

CASE STUDY 1

LoVe Observatory (Norway)

COLLABORATORS: NIOZ*, Statoil, UEDIN

Focus ecosystems: Cold-water coral (CWC) reefs, sponges

Due to its narrow continental shelf, this area is described as the gateway to the Barents Sea. It is an important habitat and spawning ground for key species such as Northeast Atlantic cod and the cold-water coral *Lophelia pertusa*, which forms substantial framework reefs in this area.



The reef building deep water coral *Lophelia pertusa* ©Solvin Zankl, GEOMAR

CASE STUDY 2

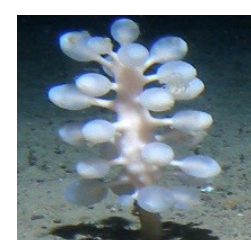
Faroe-Shetland Channel (UK)

COLLABORATORS: UEDIN*, BP, OGUUK*, MSS

Focus ecosystems: Sponge grounds

This area's seafloor morphology leads to different benthic communities: stalked sponges occupy deep-water sandy sediments, brittle star beds are found on gravel, sponges and soft corals colonise mixed gravel-cobble-boulder bottoms, and well-developed communities inhabit coarse sediments. A distinct sponge belt occurs between depths of 400–600 m.

*Oil & Gas UK



Giant carnivorous club sponge (*Chondrocladia* sp.) ©SERPENT project

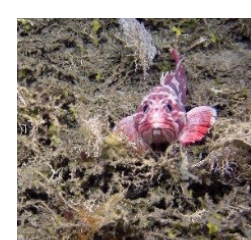
CASE STUDY 3

Rockall Bank (UK - Ireland)

COLLABORATORS: MSS, IEO, UOX

Focus ecosystems: CWC reefs, coral gardens, carbonate mounds, sponge grounds, cold seeps

Enhanced oceanographic circulation around the Rockall Bank may give rise to highly localised and specialised biological communities such as sponge aggregations, coral reefs and gardens. Large and productive fish stocks are supported, some of which may be endemic. It has been proposed as an Ecologically or Biologically Significant Area under the Convention on Biological Diversity.



Blackbelly rosefish (*Helicolenus dactylopterus*) ©J Murray Roberts

CASE STUDY 4

Mingulay Reef Complex (UK)

COLLABORATORS: UEDIN, MSS

Focus ecosystems: CWC reefs

This rare inshore ecosystem at 100-200 m depth has distinctive mounds formed by the stony coral *L. pertusa* over the last 7000 years. It is an ideal site to study the vulnerability of cold-water corals to ocean warming and acidification. Sharks use the reefs for egg-laying and resting. It is part of a Special Area of Conservation under the European Commission's Birds and Habitats Directive.



Pandalid shrimp (*Pandalina brevivirostris*) ©Henry et al. 2013, doi:10.5194/bg-10-2737-2013

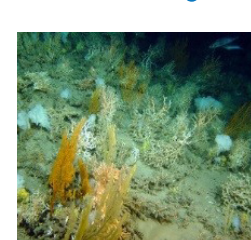
CASE STUDY 5

Porcupine Seabight (Ireland)

COLLABORATORS: NUIG, Woodside

Focus ecosystems: CWC reefs, coral gardens, carbonate mounds, sponge grounds

The intensely researched cold-water corals in this area form part of the Belgica Mound province, a Special Area of Conservation. With different stakeholders involved in fishing, telecommunications, oil and gas exploration, research and conservation, this area is ideal to develop maritime spatial planning approaches.



Deep-sea corals ©AWI and Ifremer

CASE STUDY 6

Bay of Biscay (France)

COLLABORATOR: Ifremer

Focus ecosystems: CWC on slope and in canyon settings

Recent studies have confirmed the occurrence of coldwater coral habitats in this Bay. The genetic continuum of coral reef populations between Iceland and the Mediterranean Sea shows *L. pertusa* have genetically homogeneous populations, whereas *Madrepora oculata*, also called zigzag coral, are genetically distinct. A Natura 2000 network has been proposed for reefs in this area.

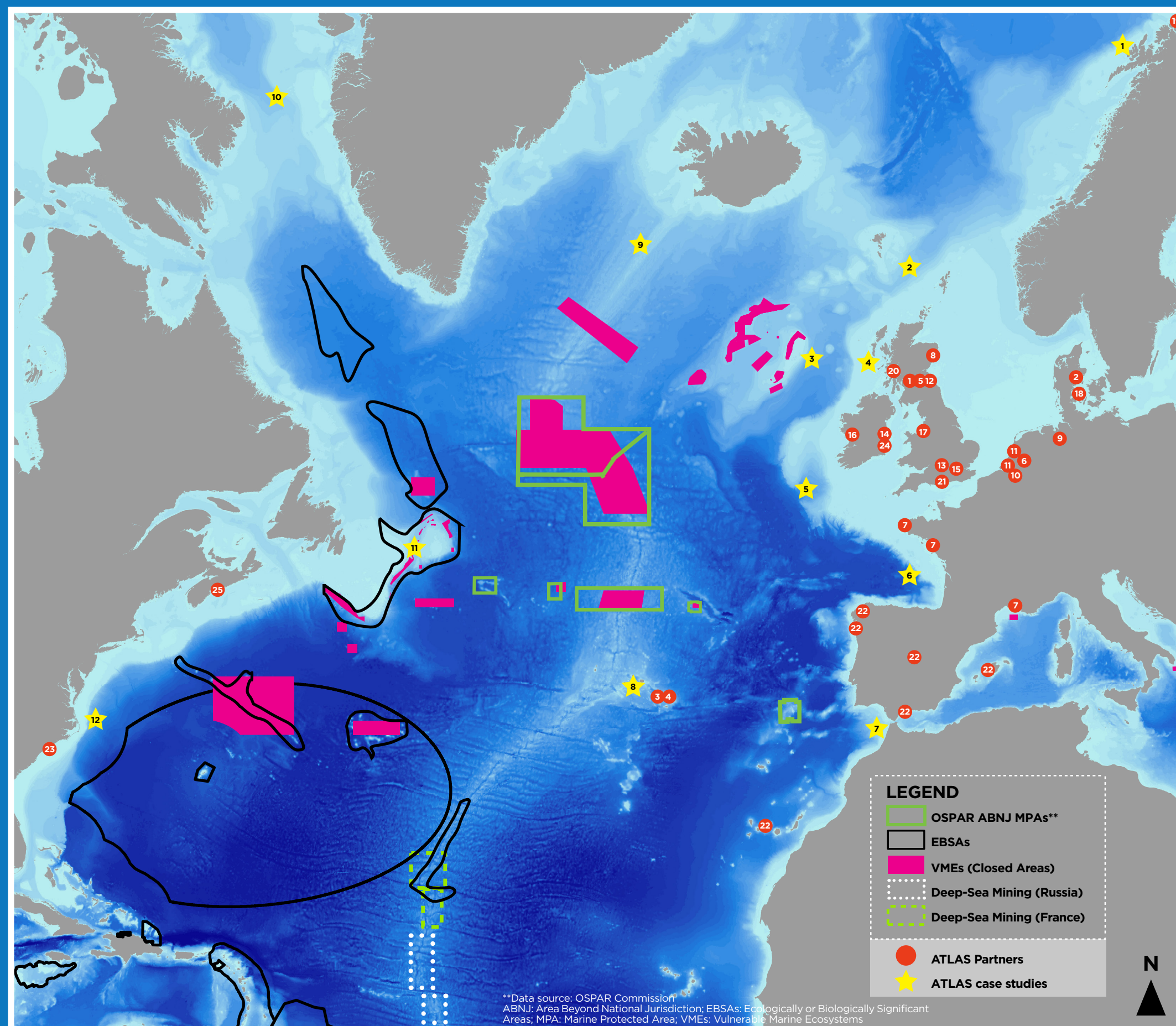


Small coral reefs 1.545 m deep in the Lampaul canyon ©Ifremer, campagne BobEco 2011



ATLAS has assembled 12 cross-cutting case studies to provide the first coherent, integrated basin-scale assessment of Atlantic deep-water ecosystems and their Blue Growth potential. These all lie along critical paths of major Atlantic current patterns, with some case study areas currently proposed or classified as Vulnerable Marine Ecosystems (VMEs) or Ecologically or Biologically Significant Areas (EBSAs). The case studies give the biogeographic, regulatory and jurisdictional range needed to meet ATLAS' objectives.

ATLAS BLUE GROWTH SECTORS



**Data source: OSPAR Commission
ABNJ: Area Beyond National Jurisdiction; EBSAs: Ecologically or Biologically Significant Areas; MPA: Marine Protected Area; VMEs: Vulnerable Marine Ecosystems

ATLAS PARTNERS:

1. THE UNIVERSITY OF EDINBURGH (UEDIN)
2. AARHUS UNIVERSITY (AU)
3. IMAR - INSTITUTO DO MAR (IMAR-UAz)
4. SECRETARIA REGIONAL DO MAR, CIENCIA E TECNOLOGIA (DRAM)
5. BRITISH GEOLOGICAL SURVEY (BGS/NERC)
6. GIANNI CONSULTANCY (GC)
7. INSTITUT FRANCAIS DE RECHERCHE POUR L'EXPLOITATION DE LA MER (Ifremer)
8. MARINE SCOTLAND SCIENCE (MSS)
9. UNIVERSITY OF BREMEN (UniHB)
10. IODINE (IODINE)
11. ROYAL NETHERLANDS INSTITUTE FOR SEA RESEARCH (NIOZ)
12. DYNAMIC EARTH (DE)
13. OXFORD UNIVERSITY (UOX)
14. UNIVERSITY COLLEGE DUBLIN (UCD)
15. UNIVERSITY COLLEGE LONDON (UCL)
16. NATIONAL UNIVERSITY OF IRELAND, GALWAY (NUIG)
17. UNIVERSITY OF LIVERPOOL (ULIV)
18. UNIVERSITY OF SOUTHERN DENMARK (USD)
19. THE ARCTIC UNIVERSITY OF NORWAY (UiT)
20. THE SCOTTISH ASSOCIATION FOR MARINE SCIENCE (SAMS)
21. SEASCAPE CONSULTANTS (SC)
22. INSTITUTO ESPAÑOL DE OCEANOGRAFÍA (IEO)
23. UNIVERSITY OF NORTH CAROLINA WILMINGTON (UNCW)
24. AquaTT UETP CLG (AQUATT)
25. FISHERIES AND OCEANS CANADA (DFO)

CASE STUDY 7

Gulf of Cádiz, Strait of Gibraltar, Alborán Sea (Spain - Portugal)

COLLABORATORS: IEO, Ifremer, IMAR-UAz

Focus ecosystems: CWC reefs, coral gardens, sponge grounds

The interconnection and interdependency of many deep-sea species found in both the Atlantic Ocean and the Mediterranean is unknown. Focus on Atlantic-Mediterranean biodiversity and connectivity will address the role of these waters in supporting intensive human activity.



Sponges of the species *Pheronema carpenteri* ©IEO-MEDWAVES/ATLAS

CASE STUDY 8

Azores (Portugal)

COLLABORATORS: IMAR-UAz, IEO

Focus ecosystems: Hydrothermal vents, seamounts, coral gardens, sponge grounds

The seafloor of this volcanic archipelago comprises various open ocean deep-sea habitats, from seamounts to hydrothermal vents and abyssal plains. Prominent cold-water corals support commercially important fishes, while little is known about the extensive sponge aggregations. These Vulnerable Marine Ecosystems are included in the OSPAR network of Marine Protected Areas.



Menez Gwen hydrothermal vent field, Azores ©DEEPFUN project (PTDC/MAR/111749/2009, FCOMP-01-0124-FEDER-015402)

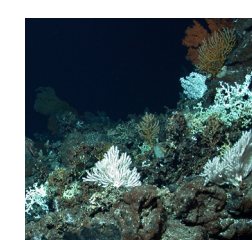
CASE STUDY 9

Reykjanes Ridge (Iceland)

COLLABORATORS: UCD

Focus ecosystems: Hydrothermal vents, CWC reefs, coral gardens, sponge grounds

Our understanding of the effects of ridges on the composition and distribution of pelagic and benthic fauna is limited. Ridge communities may be endemic to that area and may also influence the processes affecting the slope and shelf biota. Coral and sponge gardens are associated with V-shaped ridges in the Mid-Atlantic Ocean and can be found on both sides of the Reykjanes Ridge.



CWC garden ©MARUM - Center for Marine Environmental Sciences, University of Bremen

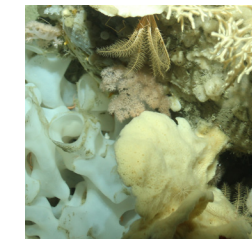
CASE STUDY 10

Davis Strait (Canada and Greenland), Labrador Sea

COLLABORATOR: DFO

Focus ecosystems: CWC reefs, coral gardens, sponge grounds

The Davis Strait is known for its complex hydrography. A ridge along the Labrador Sea slopes to 2,500 m, supporting corals and sponges, including the only known *L. pertusa* reef in Greenlandic waters. These waters support high phytoplankton biomass and copepod grazers, a valuable food source in the pelagic and the benthic environment.



Diverse assemblage of corals, sponges and other benthic fauna in Davis Strait off Greenland ©DFO

CASE STUDY 11

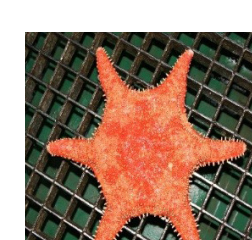
Flemish Cap (Canada)

COLLABORATORS: IEO, DFO, UOX, NAFO²

Focus ecosystems: Coral gardens, sponge grounds

Flemish Cap is an offshore Bank located in an Area Beyond National Jurisdiction within the Northwest Atlantic Fisheries Organisation regulatory area. The main focal ecosystems are sponge grounds and cold-water corals, and include important international fishing grounds.

²Northwest Atlantic Fisheries Organisation



Deep-sea starfish ©NEREIDA project

CASE STUDY 12

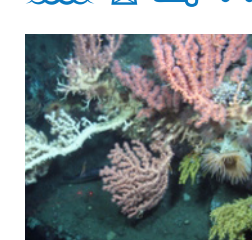
Mid Atlantic Canyons

COLLABORATORS: UNCW, TU³, NOAA⁴

Focus ecosystems: CWC reefs on slope and in canyon settings

The oceanography and geology of the sub-marine Baltimore and Norfolk canyons greatly influence the benthic community. Methane-seeps support chemosynthetic communities and many diverse organisms. Vulnerable habitats in the Middle Atlantic Bight canyons and surroundings have been given protected area status.

³Temple University, ⁴National Oceanic and Atmospheric Administration



Bubblegum coral, *Paragorgia arborea* ©Steve Ross

*Underlined collaborators are leading the investigation



- Quantification of basin-scale horizontal circulation and regional ecological systems
- Quantification of inter-annual-decadal variability in physical quantities and common forcing factors responsible for coordinated change in and between
- Identification of critical environmental tipping points of ecosystem vitality
- Integration of acquired knowledge into predictive models that can be used in the design of a management plan for the Atlantic Ocean
- A quantitative understanding of the metabolic rates of coral reefs in the Atlantic
- In-depth understanding of the food sources and food delivery pathways to sponge grounds and cold-water

1. OCEAN DYNAMICS DRIVING ECOSYSTEM RESPONSE
 Lead: Stuart Cunningham (The Scottish Association for Marine Science)

The foundation of ATLAS is improving our understanding of ocean circulation in the Atlantic. The Atlantic Ocean currents not only connect deep-sea ecosystems, but also allow us to predict how these ecosystems will adapt in a future of rapidly changing climate, carbon flux and deep ocean resource exploitation.

Understanding how ecosystems function and interact is a major goal of the ATLAS project. ATLAS is therefore providing ground-breaking new predictive models to map patterns of sensitive deep-water ecosystems and species. Forecasting changes to these ecosystems and species under future climate change scenarios will strengthen the evidence base for unlocking sustainable blue growth opportunities along with the protection of the marine environment.

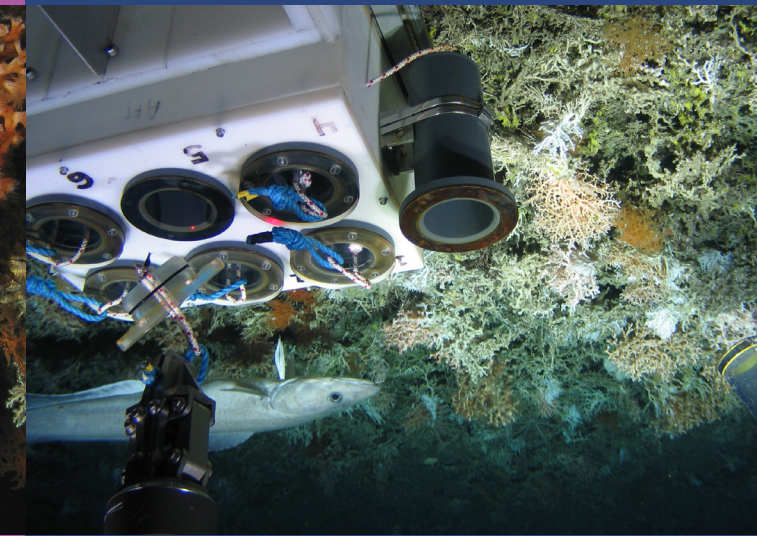


- Identification of areas in the North Atlantic that may constitute an Ecologically or Biologically Significant Area and assignment of conservation categories for Protected Area network
- Refinement of the global Open Oceans and Deep Seabed (GODS) decision-support tool, and modelling of species distribution and habitat suitability
- Validation of environmental DNA (eDNA) methods for monitoring and screening deep-sea biodiversity
- Biodiversity assessments for the Marine Strategy Framework Directive to measure Good Environmental Status indicators for a variety of ecological functions
- Identification of key areas that maintain meta-populations of Vulnerable Marine Ecosystems and other taxa and deep-sea fish species

2. FUNCTIONAL ECOSYSTEMS
 Lead: Dick van Oevelen (Royal Netherlands Institute for Sea Research)

ATLAS is studying the biodiversity and biogeographic patterns of sensitive deep-water ecosystems and species. Forecasting changes to these ecosystems and species under future climate change scenarios will strengthen the evidence base for unlocking sustainable blue growth opportunities along with the protection of the marine environment.

Understanding how ecosystems function and interact is a major goal of the ATLAS project. ATLAS is therefore providing ground-breaking new predictive models to map patterns of sensitive deep-water ecosystems and species. Forecasting changes to these ecosystems and species under future climate change scenarios will strengthen the evidence base for unlocking sustainable blue growth opportunities along with the protection of the marine environment.

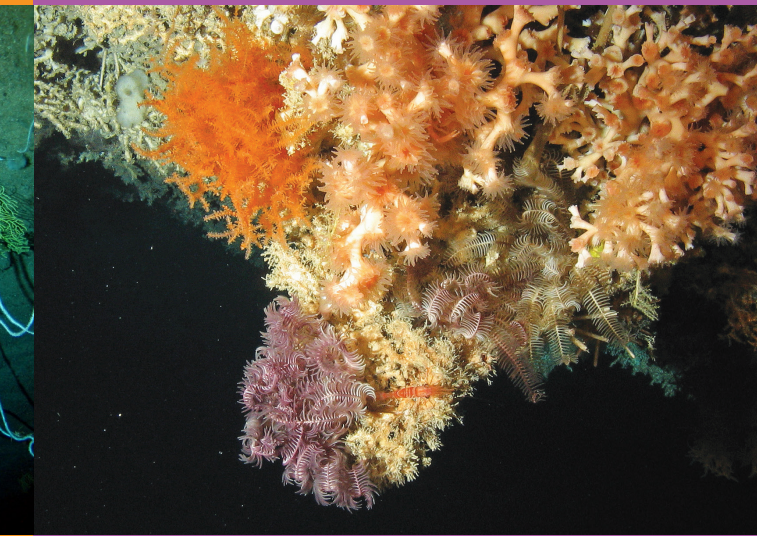


- Establishment of a new adaptive management framework that integrates meta-population genomics with boundary conditions in the North Atlantic
- Identification of key areas that maintain meta-populations of Vulnerable Marine Ecosystems and other taxa and deep-sea fish species
- Identification of whether fisheries and habitat loss have degraded exploited fish meta-populations

3. BIODIVERSITY AND BIOGEOGRAPHY
 Lead: Telmo Morato (Instituto do Mar - Centre of the University of the Azores)

ATLAS is providing new models to identify critical source areas of marine genetic resources. Exploring how these resources are connected on regional and basin scale levels will help ATLAS understand their vulnerability to climate change and human activities.

Identification of key areas that maintain meta-populations of Vulnerable Marine Ecosystems and other taxa and deep-sea fish species

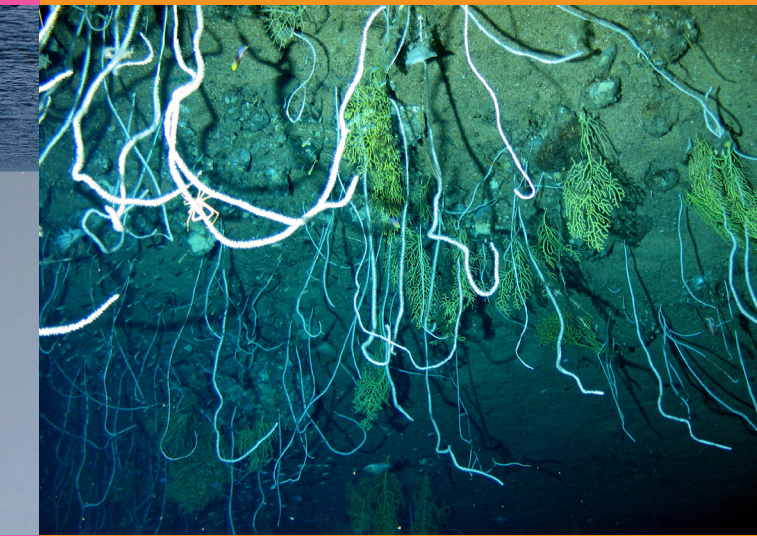


- Assessment of the validity, legitimacy and acceptability of monetary values in relation to deep-sea ecosystem services
- Expert assessment of risks in relation to ecosystem services as a result of human impacts in the Atlantic
- Harmonised approaches to mapping, habitat classification, ecosystem goods and services valuation, and impact assessment in support of the Atlantic Strategy

4. CONNECTED RESOURCES
 Lead: Sophie Arnaud-Haond (Ifremer)

ATLAS is providing new models to identify critical source areas of marine genetic resources. Exploring how these resources are connected on regional and basin scale levels will help ATLAS understand their vulnerability to climate change and human activities.

Identification of key areas that maintain meta-populations of Vulnerable Marine Ecosystems and other taxa and deep-sea fish species

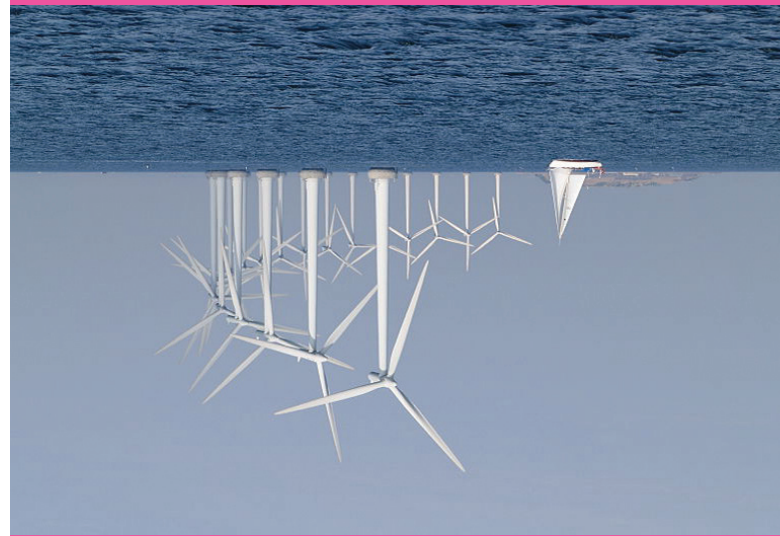


- Identification of deep-sea ecosystem services in the Atlantic
- Assessment of the validity, legitimacy and acceptability of monetary values in relation to deep-sea ecosystem services
- Harmonised approaches to mapping, habitat classification, ecosystem goods and services valuation, and impact assessment in support of the Atlantic Strategy

5. VALUING ECOSYSTEM SERVICES
 Lead: Claire Armstrong (The Arctic University of Norway)

ATLAS is providing new models to identify critical source areas of marine genetic resources. Exploring how these resources are connected on regional and basin scale levels will help ATLAS understand their vulnerability to climate change and human activities.

Identification of key areas that maintain meta-populations of Vulnerable Marine Ecosystems and other taxa and deep-sea fish species

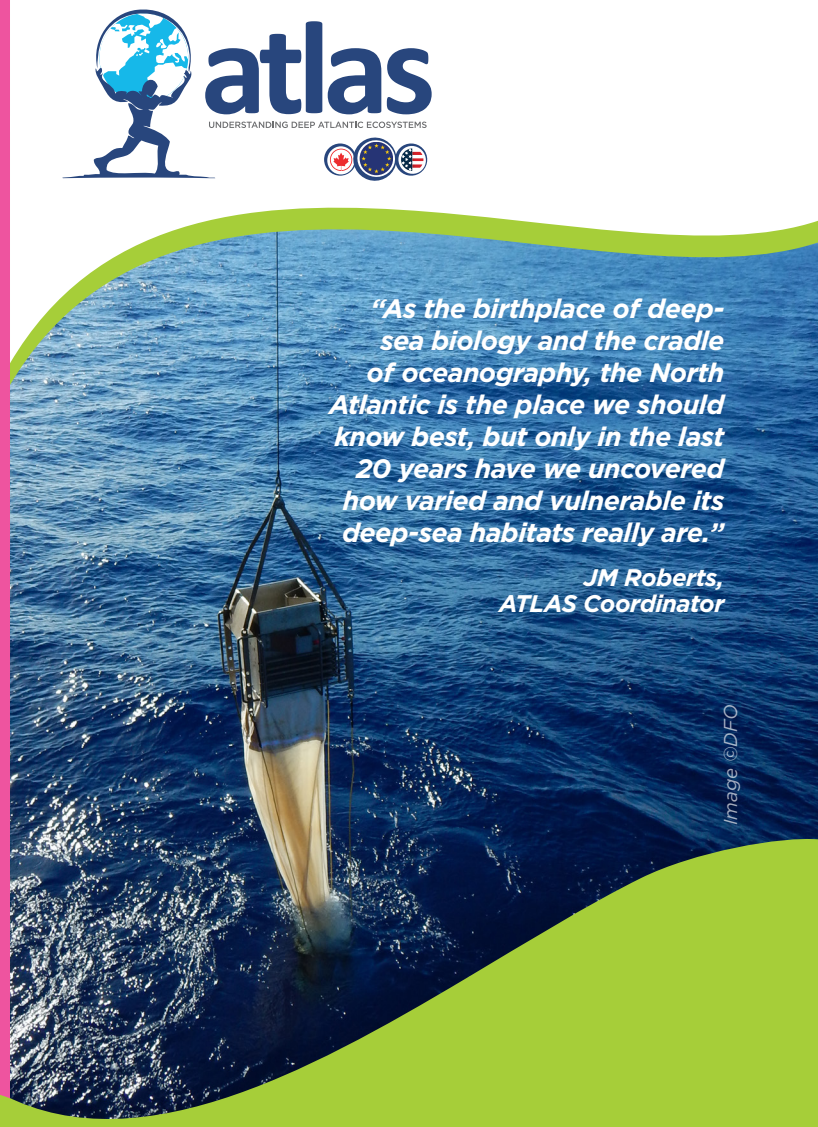


- Case Studies are used to understand the impact of different governance regimes across the Atlantic basin
- Harmonised approaches to mapping, habitat classification, ecosystem goods and services valuation, and impact assessment in support of the Atlantic Strategy
- A framework for joint public/industry data collection to ensure industry EIS/EIA (Environmental Impact Statement/Assessment) compliance is achieved in a more cost-effective manner

6. MARITIME SPATIAL PLANNING
 Lead: Anthony Grehan (National University of Ireland, Galway)

ATLAS is providing new models to identify critical source areas of marine genetic resources. Exploring how these resources are connected on regional and basin scale levels will help ATLAS understand their vulnerability to climate change and human activities.

Identification of key areas that maintain meta-populations of Vulnerable Marine Ecosystems and other taxa and deep-sea fish species



7. POLICY INTEGRATION TO INFORM KEY AGREEMENTS
 Lead: David Johnson (Seascope Consultants)

Managing cross-cutting issues in policy making requires the integration of scientific evidence into effective policy. Translating ATLAS' scientific findings to policy and practice will ultimately inform national and international agreements regarding Blue Growth and systematic conservation planning. Such agreements spanning areas across and outside of national jurisdictions are key to sustaining and managing marine resources effectively and in an equitable manner.

KEY EXPECTED RESULTS

- Suggested priorities for future evaluation of Atlantic Area-Based Marine Management Tools
- Input to a new legally binding instrument for the conservation and sustainable use of biodiversity beyond national jurisdiction
- Recommendations for the implementation of the Marine Strategy Framework Directive, the Common Fisheries Policy and Marine Spatial Planning
- Contributions to the regulation of deep-sea fisheries
- Integration of findings to implement the Sustainable Development Goals, specifically SDG 14

8. OPEN SCIENCE RESOURCES FOR STAKEHOLDERS
 Lead: Stéphane Pesant (University of Bremen)

Making research results more accessible contributes to better and more efficient science, and to innovation in the public and private sectors. ATLAS is embracing a fully open access model by participating in Europe's open research data pilot. This will allow scientific data and journal publications reporting on ATLAS Atlantic ecosystem-based research to be discovered and reused by other scientists, policy-makers and industry stakeholders.

KEY EXPECTED RESULTS

- Engagement of ATLAS partners in Horizon 2020's Open Research Data Pilot
- A collection of outputs from thematically similar research initiatives; available through open access where possible
- Synthesis of open access ATLAS research outputs cross-linked to OpenAIRE
- Transfer of ATLAS research outputs to the European Marine Observation and Data Network (EMODnet)
- Recommendations on how to improve delivery of research outputs to EMODnet and other major platforms

9. DISSEMINATION, KNOWLEDGE TRANSFER AND OUTREACH
 Lead: David Murphy (AquaTT)

An important aspect of any research project is ensuring that the results are used by targeted stakeholders, achieving measurable impact. ATLAS will effectively communicate its research findings to all relevant stakeholders, including science, industry, policy and the public. This will ensure the knowledge generated through ATLAS can be successfully applied and exploited. As communication with the public and awareness raising are important goals of ATLAS, a suite of outreach activities and products will be developed and communicated.

KEY EXPECTED RESULTS

- Communication of the project and its objectives, partners, activities and results through: the website, social media, brochures, newsletters, videos and more
- Transfer of the knowledge gained throughout the ATLAS project to science, industry, policy and the public
- New, exciting and dynamic resources such as exhibitions and an educational and outreach programme
- An update of the Oceans gallery at Dynamic Earth with new displays that provide insight into the Atlantic deep-water environment and the ATLAS project

10. MANAGEMENT AND COORDINATION
 Lead: J Murray Roberts (The University of Edinburgh)

The ATLAS Project Office handles the administrative, legal and financial aspects of the ATLAS project. It monitors and manages the 10 work packages, 12 case studies, data handling and any ethical matters which may arise to ensure the project is successful.

ADVISORY BOARD

The Advisory Board provides expert advice to the Steering Committee (i.e. the lead scientists for work packages 1-10 and the case study coordinator) to guide and inform their decisions to further the project and to highlight opportunities to engage with policy makers, the business community and other stakeholders. The Board consists of experts in the fields of oil and gas, blue biotechnology, fisheries and marine conservation, and is chaired by Dr Jake Rice, Scientist Emeritus of the Canadian Department of Fisheries and Oceans and a leading authority on Vulnerable Marine Ecosystems and Ecologically or Biologically Significant Area policy development.

1. OCEAN DYNAMICS DRIVING ECOSYSTEM RESPONSE
 Lead: Stuart Cunningham (The Scottish Association for Marine Science)

The foundation of ATLAS is improving our understanding of ocean circulation in the Atlantic. The Atlantic Ocean currents not only connect deep-sea ecosystems, but also allow us to predict how these ecosystems will adapt in a future of rapidly changing climate, carbon flux and deep ocean resource exploitation.

Understanding how ecosystems function and interact is a major goal of the ATLAS project. ATLAS is therefore providing ground-breaking new predictive models to map patterns of sensitive deep-water ecosystems and species. Forecasting changes to these ecosystems and species under future climate change scenarios will strengthen the evidence base for unlocking sustainable blue growth opportunities along with the protection of the marine environment.

FIND OUT MORE:
www.eu-atlas.org
 @eu_ATLAS
 @EuATLAS
 in ATLAS - Deep Discoveries

CONTACT US:
 EU-Atlas@ed.ac.uk
 PROJECT COORDINATOR:
 J Murray Roberts
 murray.roberts@ed.ac.uk
 COMMUNICATION & PRESS:
 atlas@aquatt.ie

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement no. 679760 (ATLAS). The output reflects only the author's view and the European Union cannot be held responsible for any use that may be made of the information contained therein.

Designed and Developed by AquaTT

THE ATLAS PROJECT WILL PROVIDE THE FIRST COHERENT, INTEGRATED BASIN-SCALE ASSESSMENT OF ATLANTIC DEEP-WATER ECOSYSTEMS AND THEIR BLUE GROWTH POTENTIAL

www.eu-atlas.org

ATLAS members in Brussels for the project's first Science Policy Panel at the European Parliament ©ATLAS

Open data, open science, open world ©Stock image

Dynamic Earth, Edinburgh, Scotland ©Dynamic Earth

First ATLAS General Assembly, Edinburgh, Scotland ©Alex Ingle