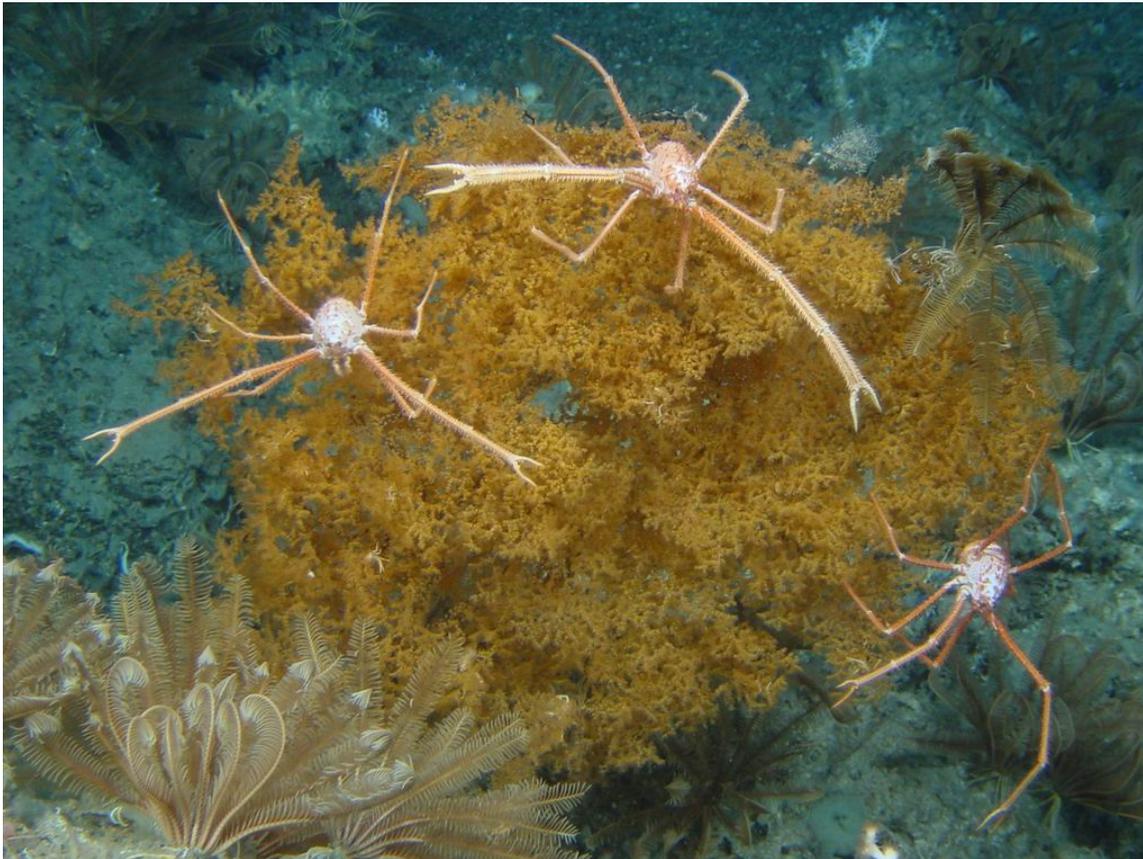


TRACES

Prospectus for a Trans-Atlantic Coral Ecosystem Study

This Prospectus describes an international Trans-Atlantic Coral Ecosystem Study (TRACES) to investigate cold-water coral communities found along the continental shelf break and slope, and in association with canyons and seamounts in the North Atlantic Ocean. The success of TRACES relies on scientific cooperation between Canada, the European Union, and the United States.



Three 'squat lobsters' on a large Atlantic black coral in the Porcupine Seabight (SW Ireland). Recent work shows that cold-water black corals may live over 2000 years and record a unique environmental archive in their skeletons. Photo: AWI & Ifremer (2003)

BACKGROUND

Coral ecosystems evoke images of warm, tropical waters, not the deep, dark depths of the sea. Yet in the cold recesses of the ocean, there are coral ecosystems as biologically complex and diverse as their tropical counterparts. Cold-water corals are found worldwide and vary from reefs made by hard scleractinian corals to vast thickets of softer gorgonian corals.

In the North Atlantic Ocean cold-water corals were first recorded in the 18th century but only in the last two decades have improved deep-ocean technologies allowed an exponential increase in scientific research on cold-water coral ecosystems. These studies have shown that cold-water corals support high biodiversity, are long-lived and slow-growing making them susceptible to physical disturbance by human activities (especially bottom trawling). They have also highlighted the importance of cold-water corals as habitat

for deep-water fishes, indicators of past ocean climate regimes and sources of novel bio-compounds. Finally, recent studies have shown that anthropogenic carbon dioxide is altering the chemistry of the seas and Atlantic corals may be among the most vulnerable marine ecosystems to this ocean 'acidification'.

BASIN-SCALE STUDY

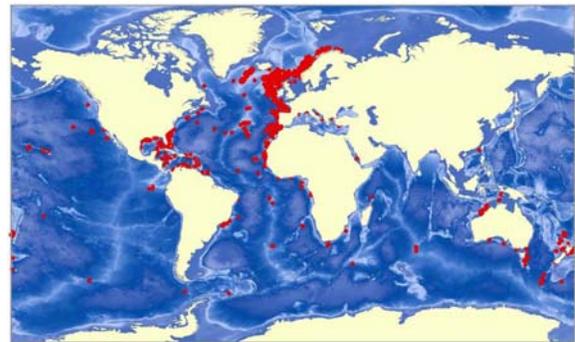
Though cold-water coral ecosystems support high biodiversity, provide important palaeo-climatic archives and are widespread on both sides of the North Atlantic Ocean, they have not been studied at a basin-scale. Most research to date has been relatively small-scale and focused on specific sites or topics. This means our understanding of genetic links between coral ecosystems and their significance as potential centres of endemism and speciation have not yet been realized. Without this type of information, conservation strategies (including networks of marine protected areas) cannot be developed for cold-water coral ecosystems, as our knowledge of how deep-water communities are connected is minimal. As resource management moves towards a basin-wide approach, so must the research supporting it.



Animals from an Atlantic carbonate mound where ten new species were discovered. So far over 1300 species have been found with NE Atlantic coral reefs.

HISTORY

The concept behind TRACES was first discussed at a collaborative planning workshop organized by the US National Oceanic and Atmospheric Administration in Galway, Ireland (January 2003). The workshop provided participants from eight nations a structured forum to identify critical gaps in our knowledge of cold-water coral ecosystems and to identify specific activities to fill those gaps. The potential for an international expedition focusing on cold-water corals was discussed and next steps were identified, but not executed.

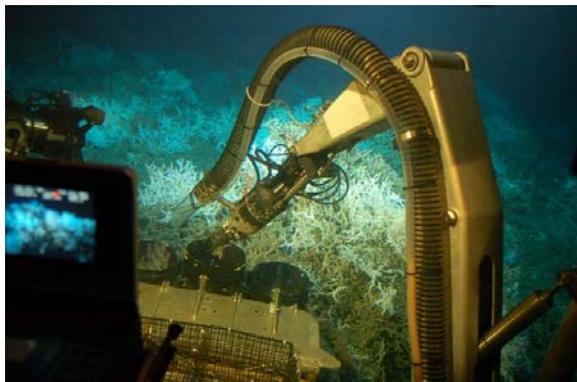


Global distribution of reef framework-forming cold-water corals showing concentration of records in the North Atlantic Ocean.

Following the Galway workshop research on cold-water coral ecosystems continued at national (US and Canada) and European Community levels. The European Community funded a series of large, interdisciplinary projects on cold-water coral ecosystems and carbonate mounds through both the 5th and 6th funding frameworks. This support continues through the current 'HERMES' project (2005-09).

Following a successful proposal to the EC's Marie Curie International Fellowship scheme, the TRACES programme entered a two year development period co-ordinated by Dr J. Murray Roberts of the Scottish Association for Marine Science (UK) and the University of North Carolina Wilmington (US). Work began in August 2007 with the initial priorities to

produce a clear conceptual framework for TRACES and to liaise with funding agencies in Canada, the EC and US.



Submersibles and experienced crew in Europe and North America allow precise controlled sampling and experimentation in delicate coral ecosystems.

OBJECTIVES

TRACES will consist of integrated, multi-disciplinary research cruises with one or two 'signature expeditions'. TRACES research cruises will use standardised protocols and multiple partners at targeted sites in the North Atlantic Ocean. Advantages of this approach address the realities and expectations of today's funding environment – 'do more with less' and 'capture the public's attention'.

TRACES will examine key gaps in our understanding of cold-water coral ecosystems and focus on questions that benefit from a basin-scale study, such as: How are cold-water coral ecosystems linked genetically and biogeographically? Can we develop clear models of larval dispersal potential throughout the North Atlantic Ocean? Can we decipher palaeo-oceanographic archives both at high temporal resolution using individual corals and at longer timescales through coral-built reefs and mounds? Can these archives allow us to reconstruct glacial-interglacial cycle changes in major North Atlantic hydrography (notably those related to the Gulf Stream and North Atlantic Drift currents)? What physical and biological factors are important in controlling cold-water coral occurrence? Can we develop

predictive models of coral occurrence at local, regional and eventually global scales?

DEVELOPMENT

The first step in the development of TRACES will be to prepare a Science Plan outlining the programme's vision, objectives, and sampling protocols. This requires an interdisciplinary team of scientists in Canada, Europe and the US and will begin with two workshops in early 2008 (see www.lophelia.org/traces for details). The two workshops will identify major scientific questions, develop an outline, and divide writing sections by participant expertise areas.

In parallel with the Science Plan development, discussions will begin with potential funding sources. Our intention is to obtain support from the three international partners in the programme:

- Canada (Department of Fisheries and Oceans & Natural Sciences and Engineering Research Council).
- European Union (European Commission with national funding applications by individual European research teams).
- US (National Oceanographic and Atmospheric Administration & National Science Foundation).

Key Steps

2008

- Develop Science Plan
 - North American Workshop
 - European Workshop
- Identify and communicate with potential funding sources

2009

- Call for proposals
- Proposals submitted and reviewed

2010

- First research activities

We hope for full programme support co-ordinated in its timing so that grant applications for the TRACES programme can be made in 2009 with the first research activities commencing in 2010.

BENEFITS

Advance Scientific Understanding. The TRACES programme is happening now because scientific developments on several fronts make this the right time. Baseline mapping on both sides of the Atlantic has characterised discrete cold-water coral ecosystems from the US South Atlantic Bight, Atlantic Canada and across the mid-Atlantic Ridge to the Norwegian continental shelf. Genetic markers, including several microsatellites, were recently isolated from cold-water corals making it possible to design studies on their linkage and connectivity. Cold-water coral skeletons have given palaeo-oceanographers new geochemical proxies to unravel climate history and ocean temperature regimes. Finally, TRACES will mobilise the ships and expertise to tackle the fundamental biological questions we need to answer to understand how cold-water coral ecosystems will respond to the predicted stresses of ocean acidification.

Address Legislation and Management Needs. TRACES will contribute to critical information gaps in the way we understand and manage deep-ocean ecosystems both in national waters and on the High Seas. Better understanding of the linkages and connectivity between spatially discrete cold-water coral ecosystems is needed if Regional Fishery Management Organizations are to protect vulnerable marine ecosystems. Notable among the international drivers is the United Nations declaration that areas where seamounts, hydrothermal vents and cold-water corals are known or are likely to occur based on scientific information should be closed (UN General Assembly A/61/L.38, 2006). TRACES will contribute to Canada's *Healthy*

Oceans Network, the European Union's 6th *Environmental Action Programme*, and the United States' *Deep-Sea Coral Research and Technology Programme* authorised by the Magnuson-Stevens Reauthorization Act (2006).

Build International Partnerships. The international aspects of TRACES will foster existing and develop new international partnerships. Research personnel exchange and shared ship time will be central components to the programme. By co-ordinating access to research vessel and submersible infrastructure, TRACES will provide a cost-effective mechanism for interdisciplinary research between the US, Canada and the European Union.

Raise Public Awareness. Ensuring long-term conservation and sustainable use of marine resources means raising awareness of marine ecosystems across nations, social groups and generations. Policy makers and non-governmental organizations will be involved from the start of the programme and we will ensure that educators and students are prominently involved in TRACES research cruises.

SPONSORSHIP

TRACES programme development is funded by the Royal Society of Edinburgh and a Marie Curie international fellowship grant from the European Commission.



FOR MORE INFORMATION

See the TRACES programme website www.lophelia.org/traces

Contact Dr J. Murray Roberts
robertsjm@uncw.edu
Tel +1-910-799-7926