Greenland's first living deep-water coral reef

A joint team from Denmark and Canada look at the discovery of the first live eye-coral found in Greenland

Photo: Fisheries and Oceans Canada

Until 2012, living colonial stone corals had not been recorded in Greenland. However, in that year two Canadian expeditions found living specimens of *Lophelia pertusa*, the eye-coral, and showed the presence of reef-like structures at about 800 m depth off southwest Greenland. The considerable extension of the known geographic range of these corals raises questions of fishery regulations and of the creation of MPAs in Greenland territorial waters.

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Cold-water coral reefs

Cold-water corals, both solitary and colonial, are found in most regions of the world's oceans. In contrast to the more well-known tropical relatives, they live in the darkness of deep waters and feed by catching minute animals with their tentacles. The best known species, although not the one with the widest geographical distribution, is *Lophelia pertusa*, the eye coral, which is the dominant colonial form in the Atlantic.

Biology of *Lophelia*

Dredging, trawling, photography, video-recording and multibeam bathymetry have demonstrated an extreme variation in *Lophelia* colony-size, the largest single formation known being the Sula Reef at 300 m depth off mid-Norway. It is 13 km long, about 400 m wide and up to 35 m high in places. The largest known *Lophelia* reef complex is further to the north, in depths between 300 and 400 m, west of Røst Island in the Lofoten archipelago. It covers an area approximately 40 km long by 3 km wide. Most localities reported are hard substrate of slopes, ridges, banks, seamounts and thresholds of fjords, in other words places where local current is intensified, and food conditions therefore improved. *Lophelia* reproduces both a sexually and sexually, but while the budding is well described, there is poor knowledge of the formation of sexual elements and larvae. The reefs are supposed to grow mainly through budding, and the growth rate is estimated to be on average about 1 cm per year. The growth must compensate for an appreciable degradation of the dead, lower parts of the reef, mainly caused by weakening of the calcium carbonate skeleton through the activity of boring organisms in combination with water movements.

The reef community

The living corals seem to have few predators. The reef itself, however, offers numerous different spatial possibilities for species to find suitable habitats and is the basis for a fauna of high diversity. While only the superficial 10–20 cm of the reef is occupied by living corals, the major part constitutes a framework of dead coral branches combined with living and dead skeletal structures from other kinds of animals, especially sponges, stylasterids, polychaetes and bryozoans. In the framework, all degrees of both current-exposed surfaces and more or less protected sediment-filled crevices and pockets can be found. A full taxonomic analysis of the reef fauna is a comprehensive and demanding task, listing in each case several hundred species that represent nearly all phyla. The overall picture resulting from such work is that the associated fauna is different in composition between regions (e.g. Norway, the Faroes, Bay of Biscay) with only few species in common, and that the majority of the species in each case is from the local area.

Lophelia in Greenland

From time to time, there have been claims of *Lophelia* occurring in Greenland waters, but all samples checked turned out to represent either dead fragments of other corals, or old worn skeletons from stylasterids. However, during an international multidisciplinary cruise onboard the Canadian "CCGS Henry Larsen" in September–October 2012, staff from the Bedford Institute of Oceanography, Dartmouth, secured *in situ* photographs of parts of a reef between 670 and 1050 m depth off southwest Greenland. The area is a current-swept steep part of the continental slope. The locality of the reef seems to be a rocky outcrop, where hexactinellids, demosponges, and octocorals also find a habitat. The temperature was 4.86 °C, the water mass being of Atlantic origin. The site was located when a 25 cm large fragment of a living *Lophelia* colony was entangled in CTD wire while working in the area during the Fisheries and Oceans Canada cruise for the Atlantic Zone Off-Shelf Monitoring Program (AZOMP) the previous June. The associated fauna is represented by sponges, hydroids, polychaetes, crustaceans, bryozoans, and echinoderms. The area is characterized by sustained inflow of relatively warm and saline waters from the Irminger Sea by the Current Water, representing the northwestern branch of the North Atlantic Current, carrying modified water of subtropical origin.

Lophelia in adjacent regions

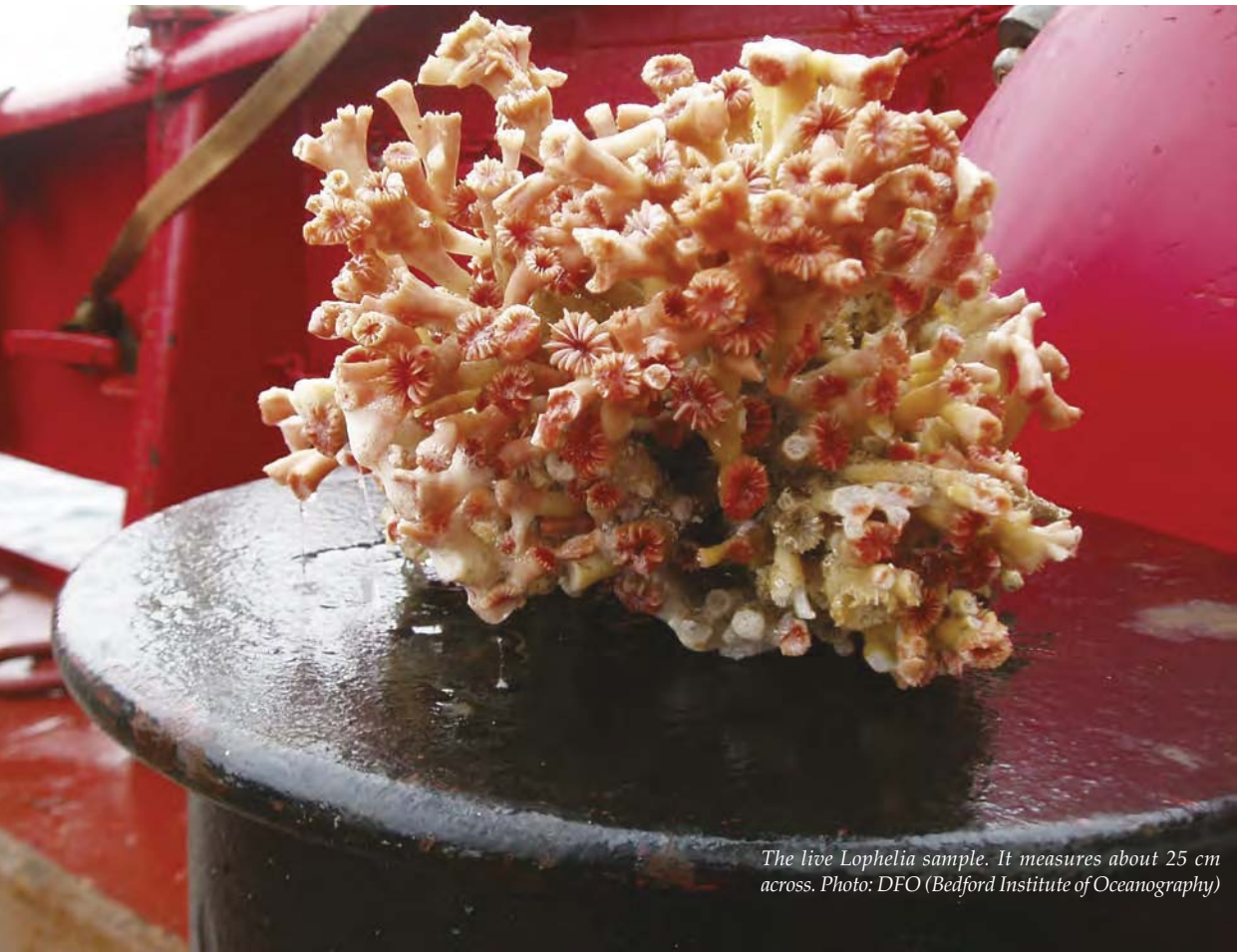
The eye-coral has been found all over the Atlantic Ocean along continental margins, on banks and on seamounts, with most recorded instances in the northern Atlantic, as that is where numerous investigations and intensive search for reefs have taken place. In the Northeast Atlantic, it is distributed from northern Norway to West Africa, and from the Faroe Islands to Iceland and the Reykjanes Ridge. In the Northwest Atlantic it is found from the Scotian Shelf to Florida.

The new Greenlandic coral reef: importance and perspectives

The record of live *Lophelia pertusa* in Greenland waters is biogeographically important, indicating connection between the eastern and western distribution areas. For future investigations, questions are raised about the distribution of the species off Greenland and eastern Canada, immigration from where to where and at what time (the age of the reef), including a possible Pacific connection in the past.

It has been proved that trawling is highly damaging to *Lophelia* reefs. Both because of great national value as an addition to the Greenlandic nature diversity and because of its scientific importance, the authors feel the reef and its nearby area should be placed under some kind of regulatory measure as soon as possible.

There is an obvious international interest as the ICES Working Group on Deep-Sea Ecology (WGDEC) through recent years made an effort to map the reefs in the NAFO and ICES areas of the North Atlantic. The mapping is part of the WGs working plan: to identify and characterize benthic vulnerable marine ecosystems (VMEs) and ecologically significant areas in the region.



The live Lophelia sample. It measures about 25 cm across. Photo: DFO (Bedford Institute of Oceanography)

Southern Greenland. The position of the site on the continental slope, where the Lophelia sample was secured. Figure by: Mr. Camille Lirette (Bedford Institute of Oceanography)

This project was funded by the Canadian International Governance Strategy Program.

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