

The Sula Ridge - A Potential MPA

Location

The Sula Ridge, comprising the Sula Reef, is situated off the west coast of mid-Norway, in a trough between the Frøya Bank to the southwest and the Halten Bank to the northeast at ca. 64° N and 8° E.

Potential Reasons for Selection

The Sula Reef consists of numerous closely neighboured coral banks built by the ahermatypic stone (scleractinian) cold water coral *Lophelia pertusa* at a depth of 280-300 m. It is probably the best developed deep-water coral area in the North-East Atlantic. Owing to their structured hard surface, cold water reefs are "paradise islands" of species richness, and function as important nursery grounds for commercially exploited fish stocks.

Site Description

Glaciers formed the trough between Frøya Bank and Halten Bank and left behind erratic boulders which may have served as substratum for the cold water corals. The ridge descends from the banks to 400 m depth. Here, Atlantic Water with a salinity of around 35 ‰ (PSU), and a year round temperature of ca. 6-7 °C underlays the eutrophic band of Norwegian Coastal Water. Seabed topography and the wind driven surface current enhance the current velocities on the slopes and ridges of the continental shelf. Part of the considerable annual surface

pelagic production is transported to the bottom, providing ample food conditions for sedentary filter feeders. The Sula reef complex has an age probably of more than 8000 years. It is about 13 km long, the single reefs being of up to 1 km size. It is up to 35 m high and 700 m wide. The topography of the reef leads to a local reduction of the current velocity on the leeward side from the direction of the current providing perfect sedimentation and thus feeding conditions.

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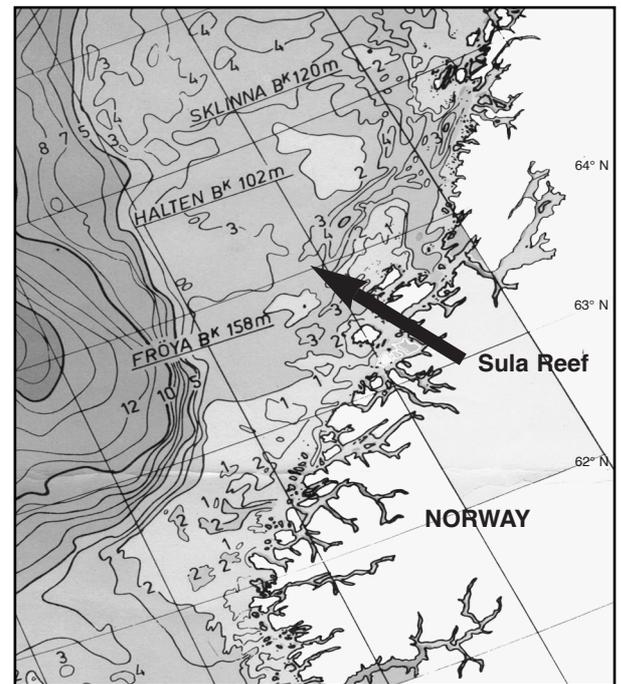


Fig. 1: The Sula Reef off the west coast of Norway. The area where bottom trawling is prohibited extends from 64°18'N 7°53'E and 64°10'N 8°17'E to 63°52'N 7°51'E and 64°N 7°26'E.

Biological Features

The reef, made up of dead and alive stone corals (mainly *Lophelia pertusa*) is colonised by a large number of living soft corals and other sessile invertebrates. It provides shelter and nursery for key commercial fish species such as Atlantic redfish. In total, more than 860 species have been estimated to live associated with the cold water corals in the North-East Atlantic. More than 300 different species have been recorded on single reefs. The diversity of some groups of animals can even approach that found in tropical shallow water coral reefs. Amongst the coral branches occur fish (redfish, saithe, cod, ling and tusk), squat lobsters and other crustaceans, molluscs, starfish, brittlestars, sea pens, and sea urchins. A wide variety of plant-like animals grow attached to the coral, including sponges, bryozoans, hydroids and other coral species.

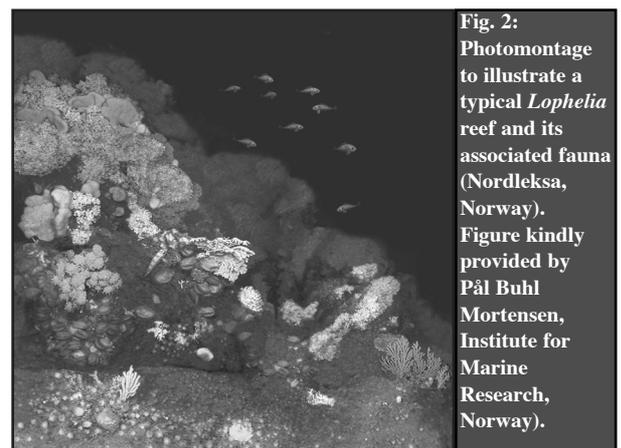


Fig. 2: Photomontage to illustrate a typical *Lophelia* reef and its associated fauna (Nordleksa, Norway). Figure kindly provided by Pål Buhl Mortensen, Institute for Marine Research, Norway).

Justification for the Potential Selection of the Sula Ridge as an Offshore Marine Protected Area

Lophelia reefs usually include three zones:

- The top of the reef mainly consists of living coral colonies. These colonies grow, often dome-shaped, up to 2 m in height before breaking apart.
- Below this zone of living coral, most of the footing consists of blocks of dead coral with some blocks of living coral in between, which had fallen down from the top. This way, the reef grows horizontally. Vertically, the dead and the living zones have about the same dimensions.
- Around the reef itself, a zone covered with fragmented coral is found. The extent of this zone varies from a few to several tens of meters.

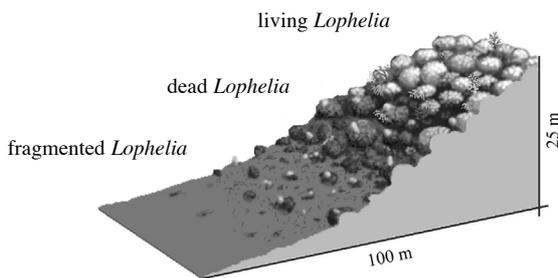


Fig. 3: Depth profile of a typical *Lophelia* reef, illustrating the zones of dead and alive corals, sponges and horn coral settlement. Figure kindly provided by Pål Buhl Mortensen, Institute for Marine Research, Norway.

Lophelia pertusa builds a hard branched skeleton of calcium carbonate. At the tips of branches tiny polyps extend their tentacles into the water to catch small animals. Living coral ranges in colour from white to orange-red. Unlike most tropical corals, the polyps are not interconnected by living tissue, and do not contain symbiotic algae (zooxanthellae) in their tissues providing them with carbohydrates produced by photosynthesis. The older coral at the base of the branches dies but continues to support the living coral. The coral is attacked by sponges, worms and other organisms which can weaken the skeleton and cause it to fragment. Detached coral can form a surface for new coral and other animals to start growing on. The coral probably reproduces by 'budding' off new polyps and by producing free-living larvae which float in the water until they find a suitable surface to attach to and grow on. Growth rates are determined by temperature and food supply, the distribution of the coral being restricted to waters with a year round steady temperature below 10 °C. Norwegian studies indicate that *Lophelia* may grow up to 6 mm per year, so reefs of 1 to 2 m high are hundreds of years old. There are two main sources of food, vertically migrating zooplankton and the seasonal „rain“ of dead plankton sedimenting out of the water column subsequent to the spring and autumn 'bloom' of phytoplankton and zooplankton.

Only recently, for the first time the human eye watched the beauties of these deep water coral reefs in the North-East

Atlantic. Therefore, our knowledge of these challenging habitats is still fragmented and incomplete, particularly regarding the associated small sized, buried and/or fast moving fauna. It is expected that the number of recorded species associated with these reefs will double, once more research is done. The importance of the reefs as a habitat for other species and consequent economic importance for fisheries, and importance in the nutrient (carbon, nitrogen, etc.) cycles of marine ecosystems, cannot be assessed with the current state of knowledge.

Human Impacts

Today, bottom trawling for fish extends down to 1500 m depth, mainly at the edge of the continental shelf. The heavy fishing gear destroys the coral and thus the habitat of the associated commercial fish and other species.

Existing/Proposed Protection

Most knowledge on the distribution of deep water coral reefs has been gathered during oil and gas exploration in recent years. Intensive studies on the biology of the reefs were only recently initiated but soon led to recommendations to the Norwegian Ministry of Fisheries to protect the reefs from further destruction. In a concerted action with other stakeholders, WWF Norway successfully advocated protection measures for the Sula Reef, and in future, further cold water reefs in Norway. Since March 1999, the Norwegian Government prohibited "all use of fishing gears that are dragged and may get in contact with the sea floor" by Norwegian and foreign vessels in the Sula Reef area as well as "all intentional destruction of coral reefs throughout Norway". The Sula Reef is the first protected *Lophelia* site in the North-East Atlantic and should become an integral part of the envisaged marine protected areas network. The network should comprise *Lophelia* sites throughout the Atlantic as one of the hot spots of biodiversity.

Text prepared by Sabine Christiansen and Thomas Torgersen

References/Further Reading

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- Rogers, A. D. (1999) The Biology of *Lophelia pertusa* (LINNAEUS 1758) and other deep-water reef-forming corals and impacts from human activities. *Internat. Rev. Hydrobiol.* 84, 315-406,

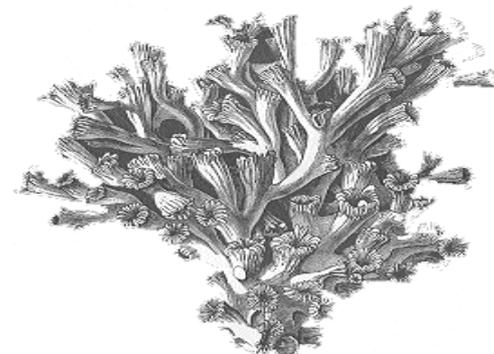


Fig. 4: Engraving of *Lophelia pertusa*. From *The Depths of the Sea* by Wyville Thomson (1874).