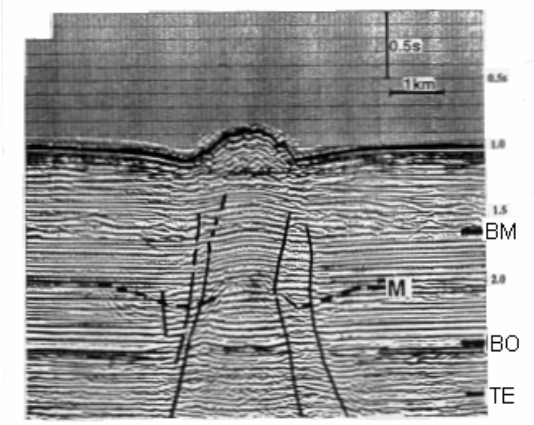
Nomination

Carbonate mounds
EUNIS code: A6.75
National Marine Habitat Classification for UK & Ireland code: Not defined



Seismic profile of carbonate mounds and sub-surface fault traces (from Hovland *et al.,* 1994).

Definition for habitat mapping

Carbonate mounds are distinct elevations of various shapes, which may be up to 350m high and 2km wide at their base (Weering *et al*, 2003). They occur offshore in water depths of 500-1100m with examples present in the Porcupine Seabight and Rockall Trough (Kenyon *et al,* 2003). Carbonate mounds may have a sediment veneer, typically composed of carbonate sands, muds and silts. The cold-water reef-building corals *Lophelia pertusa* and *Madrepora oculata*, as well as echiuran worms are characteristic fauna of carbonate mounds. Where cold-water corals (such as *Lophelia*) are present on the mound summit, coral debris may form a significant component of the overlying substratum.
There is currently speculation on the origin of carbonate mounds, with possible associations with fault-controlled methane seepage from deep hydrocarbon reservoirs, or gas-hydrate dissociation (Henriet *et al*, 1998) through to the debris from 'cold-water' coral colonies such as *Lophelia*.

Geographical extent

OSPAR Regions; I, V
Biogeographic zones: 21, 23, 35
Region & Biogeographic zones specified for decline and/or threat: V, 23 & 25

In recent years large clusters of giant carbonate mud mounds, some more than 300m high, have been discovered off the continental margins of Europe. They are biogenic accumulations, which generally occur, in localised clusters and which vary in size and shape, being conical, ridged and ring shaped and, in some cases, having very steep sides. Large and small dome-shaped knolls, which lie on the surface of the seabed, have been described as well as complex knolls and pinnacle knolls (Hovland *et al*., 1994). The examples in the Porcupine Basin are up to 2km long and 350m high (Kenyon *et al.,* 1998). Seismic profiles have also revealed buried mounds in the Porcupine Basin (the Magellan reefs) some 50-100m high, but covered by tens of metres of sediment (Henriet *et al.,* 1998).

Application of the Texel-Faial criteria

Carbonate mounds were nominated in a joint submission by three Contracting Parties citing decline, rarity, sensitivity, and ecological significance with information also provided on threat. The nomination was for Region V.

Decline
The occurrence of carbonate mounds in the OSPAR Maritime Area is not fully known. Because of this there is little information on any changes in the extent of the habitat and associated species. If mounds occur in areas targeted by demersal fisheries the habitat and associated epifauna may suffer physical damage.

Rarity

Carbonate mounds are widely distributed on the eastern margin of the North Atlantic from the Iberian Peninsula to offshore Norway in water depths of 50m to perhaps 2,000m, (Masson *et al.,* 1998). They generally occur in small, localised clusters. The findings of deep sea surveys undertaken in the last few years suggest that the European slopes of the Rockall and Porcupine Basins may be the most prolific area for the formation of carbonate mounds in the world (Anon, 1999). Recent discoveries include a giant cluster of reefs including hundreds of buried mounds off south-west Ireland (Kenyon *et al.,* 1998) and a new field of seafloor mounds in 1000m of water in the northern Rockall Trough (Masson *et al.,* 1998). The full extent of these features in the OSPAR Maritime Area is not known at the present time.

Sensitivity

Sampling of the biological communities associated with carbonate mounds have revealed that they are often dominated by suspension feeders and can support rich deepwater coral communities. Living corals have colonised some of these mounds and

debris from the deep-water colonial coral (*Lophelia* sp.) have been recovered from cores as well as the surface of mounds (Kenyon *et al.,* 1998).

As the biological communities on carbonate mounds are dominated by filter feeding communities they are likely to be sensitive to siltation. Physical damage by fishing gear is known to break up corals that colonise this habitat. The delicate structure and slow growth rate of *Lophelia* makes this coral particularly vulnerable to physical damage. The growth rate is thought to be about 6mm per year implying that normal sized colonies of around 1.5m high are about 250 years old, and the reef structures seem to be relatively stable within a time scale of hundreds of years (ICES, 1999). The potential for *Lophelia* to recover after physical damage is uncertain but is probably dependent on the severity of damage and the size of the surviving coral fragments.

Ecological significance

The elevation and substrate of carbonate mounds provide a suitable surface for colonisation for many species that require hard surfaces for attachment. Because of this they can be areas of high species diversity in the deep sea and therefore of particular ecological significance. Surveys of the Porcupine Bank and Rockall Bank, have indicated that the summits and upper slopes of most of carbonate mounds and knolls identified on sidescan sonar were covered by a carpet of coral debris. Living coral was also present with the most abundant species being the colonial corals *Lophelia pertusa* and *Madrepora oculata* which formed colonies up to 30cm high. The solitary coral *Desmophyllum cristagalli* and the octocoral *Stylaster* sp. were also occasionally present and nearby areas of cobbles and small boulders provided a surface for settlement of individual coral colonies (Wilson & Vina Herbon, 1998).

Sampling of the fauna from Porcupine Basin carbonate mounds revealed that although most of the animals were suspension feeders there were also deposit feeding, carnivorous or omnivorous species (SumiNa & Kennedy, 1998). The branching structure of dead coral underlying the living colonies provided a surface for settlement which was also elevated from the seabed and was extensively colonised by sponges, bryozoans, hydroids, soft corals, ascidians, calcareous tube worms, zoanthids, crinoids and bivalves. Many large eunicid worms and sipunculids were also found burrowing inside the coral material perhaps using the coral for shelter. The suspension feeding ophiuroid *Ophiactis balli* was also abundant sheltering in the dead coral material and the suspension feeding bivalve *Astarte* sp. abundant in the sediment underlying the thickets at some sites.

The area around carbonate mounds can also support an abundance of species. In the case of the Porcupine Basin there was extensive evidence of the working of the sediment apparently by echiuran worms, cerianthid anemones and caridean shrimps (Wilson & Vina Herbon, 1998). The tail-like features downstream of carbonate mounds in the northern Rockall Trough showed high densities of the xenophyophore *Syringammina fragilissima* compared to numbers in the background sediments. There was also a slight increased in the density of metazoan invertebrates on the tails and mounds relative to the background (Masson *et al.,* 1998). The reason for this clustering is unclear at the present time.

Threat

Although information about carbonate mounds and the associated communities is limited it can be expected that demersal trawling operations have a physical impact. Fishing activity is very intensive in some of the areas where mounds occur and repeated trawling does not allow time for the continual growth of coral colonies. Recovery may therefore only be possible over a long period of time, if at all.

Relevant additional considerations

Sufficiency of data

The mapping of carbonate mounds is an ongoing task and as a consequence the full extent and distribution of these features in the OSPAR Maritime Area is still to be determined. Major clusters are already known to occur in the Porcupine Basin and the Rockall Trough however, and it is these sites for which most is known. Much also remains to be learnt the biological communities found on carbonate mounds.

Changes in relation to natural variability

Some surveys have reported an extensive carpet of dead corals and only small colonies of living coral on carbonate mounds suggesting that conditions were suitable for the growth and development of the coral banks at some stage but that this is no longer the case (Kenyon *et al.,* 1998). Possible reasons put forward to explain this include natural changes in the current regime, sea temperature and food supply to the area as well as damage from deep-sea trawling.

Expert judgement

Expert judgement has played a part in putting forward this nomination. This is because there is mostly qualitative data on the extent and threat to this habitat. The main consideration is that carbonate mounds and their associated fauna are potentially threatened by certain fishing operations and should therefore be listed by OSPAR.

ICES evaluation

ICES requested that further information on the biological communities associated with carbonate mounds be cited in the nomination. (This has been provided in the section on ecological significance.) They note there is no evidence that carbonate mound substrates are at any greater risk than other reef-supporting substrates but that they may be at lower risk than other features such the sand mounds underlying the Darwin Mounds to the west of Shetland (ICES, 2002). In particular, ICES consider there is no evidence of direct "clear and present" threats to the mounds but that there is evidence of a threat to biota growing on the mounds from fishing activities.

They conclude there is insufficient evidence for the nomination. In light of this it is necessary to determine whether there is a strong enough case for the nomination on the basis of expert judgement.

Threat and link to human activities

Cross-reference to checklist of human activities in OSPAR MPA Guidelines

Relevant human activity: Fishing, hunting, harvesting; Category of effect of human activity: Biological – removal of target and non-target species.

Commercial exploitation of deepwater fish started to gain momentum in the 1960s and is now at the point where an estimated 40% of the world's trawling grounds are in water deeper than continental shelves (McAllister *et al.* in Roberts 2002). Where deep sea fishing grounds coincide with carbonate mound structures, human activity will be the principal threat to these features and their associated communities.

Management considerations

Management measures should be targeted at preventing physical damage to carbonate mound structures and the associated communities as this is believed to be the principle threat at the present time. Closed areas for particular types of fishing have been introduced in some areas and could be applied more widely to protect this habitat. This is a matter that falls within the remit fisheries organisations rather than OSPAR, although OSPAR can communicate an opinion on this to the relevant bodies and introduce any relevant supporting measures that fall within its own remit if such measures exist or are introduced in the future.

Further information

Nominated by:
Iceland, Portugal, UK

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Useful References:

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