A5.51 Atlantic maerl beds

Summary

Maerl produces complex habitats that are biodiversity hotspots, that provide important nursery areas for fish and shellfish species such as cod and edible crustaceans, as well as brood stock areas for a range of other species including commercially important bivalves such as scallops and clams. Three hundred and forty nine macroalgal species have been recorded on North East Atlantic maerl beds, which is 30% of the total seaweed diversity in this region. Similarly, over 2,500 macrobenthic species have been found associated with North East Atlantic maerl beds which coincidentally constitute around 30% of the total number of coastal invertebrate species in the area.

In Europe, maerl has been dredged from both living beds and fossilised deposits for use as an agricultural soil conditioner as well as for use in animal and human food additives, water filtration systems, pharmaceutical and cosmetic products. Although quantities were initially small, by the 1970s a peak of around 600 000 tonnes were extracted per year in France. Due to the very slow rate of growth, maerl is considered to be a non-renewable resource and, even if the proportion of living maerl in commercially collected material is low, extraction has major effects on the wide range of species present in both live and dead maerl deposits. Other impacts associated with dredging activity are muddy plumes which later settle out and smother associated and surrounding communities. Damage to the surface of beds is also caused by heavy demersal fishing gear, from pollution by finfish and shellfish aquaculture operations in inshore waters, and suction dredging for bivalves. Coastal construction and increases in agricultural and sewage discharges may also have some impact if they increase sediment loads or result in benthic eutrophication through the excessive growth of ephemeral species of macroalgae around maerl beds. Prohibiting the direct extraction of maerl would be of immediate benefit to this habitat. Other important conservation and management measures would be to stop the use of mobile demersal gears and other types of fishing activity where this habitat occurs and ensure sufficient distance between maerl beds and aquaculture facilities.

Synthesis

Maerl beds have declined in both extent and quality in the North East Atlantic. Recorded maerl bed declines include off the west coast of Scotland, related to the expansion of the scallop fishing industry, and a similar situation in Ireland. Extraction of both living and fossil deposits has depleted beds in the Fal Estuary in England and at least four maerl beds in Brittany (France) have been completely destroyed by this activity. In Galicia (north west Spain), mussel farming is implicated in the deterioration of maerl bed complexity and biodiversity through increased sedimentation. A further decline in the condition of this habitat is expected in the next decade due primarily to commercial extraction, mariculture and demersal fishing activities. Because of the slow growth rate of maerl, recovery of areas where maerl has been removed is not considered possible. Recovery of damaged maerl beds is also very slow and likely to take centuries replenish to themselves. Consequently, if damaging activities continue there is a high likelihood of collapse of this habitat.

This habitat does not have a restricted geographical distribution or occur in a few locations but it has been assessed as Vulnerable in the EU 28 and EU 28 + because of current and likely future continuing declines in quality and quantity.

Overall Category & Criteria			
EU 28		EU 28+	
Red List Category	Red List Criteria	Red List Category	Red List Criteria

Overall Category & Criteria			
Vulnerable	A1, C/D1	Vulnerable	A1, C/D1

Sub-habitat types that may require further examination

Lithophyllum maerl beds (assessed separately). The taxonomy of *Lithophyllum* forming maerl is unclear, but it is known to be an extremely rare and unusual subtype of Atlantic maerl beds. In the Bay of Brest, *Lithophyllum* beds are severely threatened, possibly in danger of extinction because of a recent increase in clam dredging activity.

Phymatolithon calcareum and *Mesophyllum sphaericum* maerl bed. *Mesophyllum sphaericum* occurs in the Mediterranean, but has been recorded in only one North East Atlantic location in Galicia, where it forms a significant maerl-forming component, reaching 10 cm in diameter in a single bed found in 3 – 5 m depth. The bed is currently surrounded by mussel farms.

Habitat Type

Code and name

A5.51 Atlantic maerl beds

A bed of *Lithothamnion glaciale* surrounded by brittlestars in Loch Sween, Scotland (© G.Saunders).

A bed of *Lithothamnion corallioides* with flat oyster, queen scallop, serpulid worms and a wide variety of sponges. Keraliou bank, Bay of Brest, France (© Y.Gladu).

Habitat description

Maerl is a collective term for various species of non-jointed coralline red algae (*Corallinophycidae*) that live unattached to the seabed. These species can form extensive beds, mostly on coarse clean gravel and clean sand or on muddy mixed sediments, either on the open coast, in tide-swept channels or in sheltered areas of marine inlets with weak current. Wave and current-exposed maerl beds, where thicker depths of maerl accumulate, frequently appear as waves and ridge-and-furrows arrangements. As maerl requires light to photosynthesize, the depth of live beds is determined by water turbidity, being recorded from the lower shore to depths of 40 m or more. Water movement also appears to be a key physical environmental factor affecting the distribution of maerl and hence the formation of maerl beds.

North East Atlantic maerl beds are typically composed of both living and dead maerl of varying proportions. Extensive maerl beds formed during the late Holocene sea level rise on the west facing Atlantic coastlines of the British Isles, Scandinavia, France and Spain. Some are believed to have been tens of kilometres across and several meters in thick. Maerl is slow growing with growth rates for presently existing free living maerl in northwest Spain and western Ireland have been calculated to vary from 0.10-1.00 mm/yr and in Norway from 0.05 - 0.15 mm/yr or up to 1.0 mm/yr.

The fauna and flora associated with maerl beds often constitute highly diverse communities, which may be attached to the surface of the maerl, on areas of exposed sediment, between the interstices of both living

and dead maerl, and within the underlying sediment. They include foliose and filamentous seaweeds, hydroids, bryozoans, gastropod and bivalve molluscs, anemones, echinoderms and polychaete worms. Beds typically support high numbers of macroalgal species, with 349 species recorded, representing around 30% of the total seaweed diversity of the NE Atlantic. Similarly, over 2,500 macrobenthic species have been found associated with NE Atlantic maerl beds which coincidentally constitute around 30% of the total number of coastal invertebrate species in the area.

The structural complexity of maerl beds are known to provide important nursery areas for fish and shellfish species such as cod and edible crustaceans at a critical phase in their life histories, as well as a refuge and feeding area for commercially important shellfish brood stock (e.g. *Ensis* spp, *Pecten maximus* and *Venus verrucosa*). There is some evidence to suggest that coralline algae produce physical and chemical cues that encourage the settlement and recruitment of planktonic juvenile stages of many invertebrate species, while providing the prospect of higher growth potential.

Indicators of quality:

Both biotic and abiotic indicators have been used to describe marine habitat quality. These include: the presence of characteristic species as well as those which are sensitive to the pressures the habitat may face; water quality parameters; levels of exposure to particular pressure, and more integrated indices which describe habitat structure and function, such as trophic index, or successional stages of development in habitats that have a natural cycle of change over time.

There are no commonly agreed indicators of quality for this habitat, although particular parameters may have been set in certain situations e.g. protected features within *Natura* 2000 sites, where reference values have been determined and applied on a location-specific basis. The overall quality and continued occurrence of this habitat is, however, largely dependent on the presence of coralline red algae which creates the biogenic structural complexity on which the characteristic associated communities depend. In the UK and France the proportion (%) of live maerl coverage is routinely used as a quality indicator for selected beds. The density and the maintenance of a viable population of maerl-forming species is a key indicator of habitat quality, together with the visual evidence of presence or absence of physical damage.

Other quality indicators currently being developed specifically for maerl beds include the detection of community shifts associated with quality decline (e.g. from clean maerl gravel with low silt and abundant suspension-feeding bivalves, to muddy sand dominated by deposit feeders and omnivores), the reduction in the thickness of live maerl cover, opportunist species dominance and overgrowth by the slipper limpet *Crepidula fornicata*.

Characteristic species:

Different maerl species dominate, depending on the conditions. In fully marine conditions the dominant maerl is typically *Phymatolithon calcareum*, under variable salinity conditions, such as in some sea lochs, it can be *Lithothamnion glaciale,* while under sheltered silty conditions *Lithothamnion corallioides* may dominate. In more muddy, sheltered and shallow conditions rare *Lithophyllum* spp. beds may form. An even rarer bed-forming occurrence of *Mesophyllum sphaericum* has been recorded in a single location in Galicia.

A number of species are known to form maerl (or rhodoliths) in the Macaronesian region. *Neogoniolithon brassica-florida* is present in sparse aggregations, but may constitute the dominant maerl species in current-swept coarse sands and fine gravels in the Azores, while *Lithophyllum crouaniorum* can be found on shallow infralittoral sands between 2 m and 5 m depth. Beds of *Lithothamnion corallioides* are present in the Canary Islands and Madeira from 20m down to 60 m and 50 m respectively, with the Madeira beds also characterized by the presence of *Spongites fruticulosa*.

The particular mix of species present will be influenced by the sediment characteristics and degree of

shelter of the maerl bed. A particular characteristic of maerl is the presence of a mixture of hard- and soft substrata-associated assemblages including shells and gravels or varous anchored algal species such as *Gelidiella calcicola, Cruoria cruoriaeformis* (mostly excusive to maerl)*, Dictyota dichotoma*, *Halarachnion ligulatum*, *Ulva* spp. *Callophyllis laciniata*, *Cryptopleura ramosa*, *Brongniartella byssoides*, *Phycodrys rubens* and *Plocamium cartilagineum*. Other organisms such as the anemones (*Anemonia viridis* and *Cerianthus lloydii)*; the polychaetes, (*Chaetopterus variopedatus*, *Lanice conchilega*, *Kefersteinia cirrata*, *Hesione pantherina*, *Pilargis verrucosa*, *Psammolyce arenosa*, *Mediomastus fragilis*, C*hone duneri*, *Parametaphoxus fultoni*, *Notomastus latericeus*, *Caulleriella alata* and *Grania)*; the gastropods (*Gibbula cineraria*, *Gibbula magus*, *Calyptraea chinensis, Alvania beani, Alvania cimicoides, Dikoleps pusilla* and *Onoba aculeus)*; and crustaceans (*Liocarcinus depurator* and *Liocarcinus corrugatus)* may be present together with numerous melitid amphipod species and often large numbers of *Galathea intermedia* and/or *Pisidia longicornis*. A diverse assemblage of crustaceans are also commonly present.

In tide-swept conditions with variability salinity, the associated fauna and flora may also include species that reflect the slightly reduced salinity conditions. For example *Psammechinus miliaris* is often present in high numbers along with other grazers such as chitons and *Tectura* spp. *Hyas araneus*, *Ophiothrix fragilis* and *Ophiocomina nigra* In more sheltered conditions, anemones typical of sheltered conditions may be found in close association with maerl, these may include; *Anthopleura ballii*, *Cereus pedunculatus* and *Sagartiogeton undatus*. Polychaetes such as *Myxicola infundibulum* and terebellids, also characteristic of sheltered conditions, may be present as may hydroids such as *Kirchenpaueria pinnata*. Occasional *Chlamys varia* and *Thyone fusus* are present in many habitat records together with red seaweeds such as *Plocamium cartilagineum*, *Calliblepharis jubata* and *Chylocladia verticillata*. In the Kattegat, fauna associated with maerl beds include crustaceans such as *Corystes cassivelaunus* and *Thia scutellata*, and echinoderms such as *Ophiothrix fragilis* and *Ophiocomina nigra*.

Classification

EUNIS (v1405):

Level 4. A sub-habitat of ‘Atlantic shallow/infralittoral coarse sediment’ (A5.5).

Annex 1:

1110 Sandbanks which are slightly covered by seawater all the time

MAES:

Marine – Marine inlets and transitional waters

Marine - Coastal

MSFD:

Shallow sublittoral mixed sediment

EUSeaMap:

Shallow coarse or mixed sediments

IUCN:

9.3 Subtidal loose rock/pebble/gravel

9.4 Subtidal sandy

9.5 Subtidal sandy-mud

Other relationships:

HELCOM HUB:

AA.D, AB.D. Baltic photic and aphotic maerl beds

French classification:

III.3.2.1. Faciès du Maerl (= Association à *Lithothamnion corallioides* et *Phymatolithon calcareum)* (peut aussi se rencontrer comme faciès de la biocénose du détritique côtier)

IV.2.2.2. Faciès du Maerl (*Lithothamnion corallioides* et *Phymatholithon calcareum*).

Does the habitat type present an outstanding example of typical characteristics of one or more biogeographic regions?

-

Justification
Maerl beds are likely to have been much more prevalent in the past, so could have been typical of the North East Atlantic region

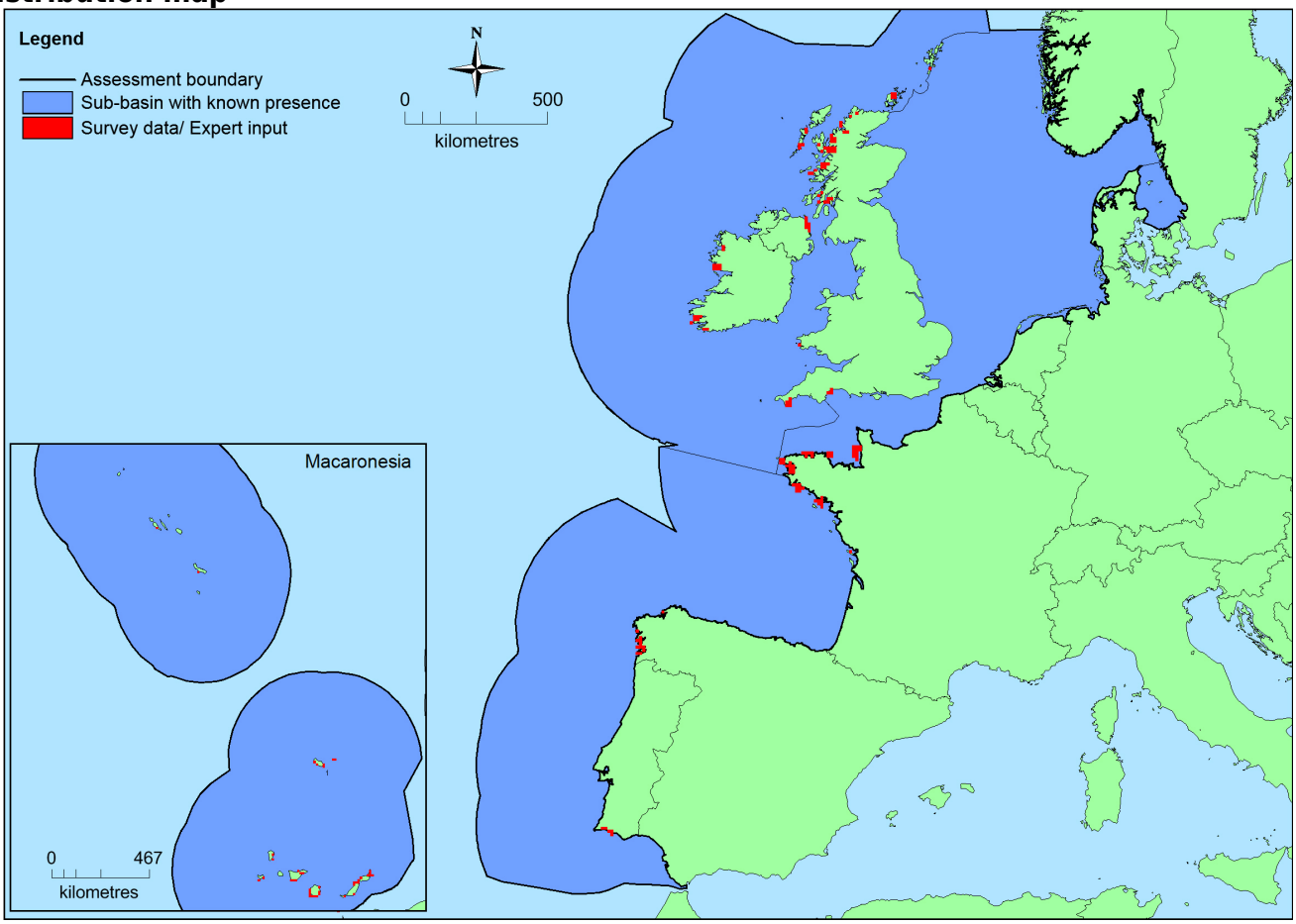
Geographic occurrence and trends

Region	Present or Presence Uncertain	Current area of habitat	Recent trend in quantity (last 50 yrs)	Recent trend in quality (last 50 yrs)
North-East Atlantic	Bay of Biscay and the Iberian Coast: Present Celtic Seas: Present Kattegat: Present Macaronesia: Present Greater North Sea: Present	Unknown Km^2	Decreasing	Decreasing

Extent of Occurrence, Area of Occupancy and habitat area

	Extent of Occurrence (EOO)	Area of Occupancy (AOO)	Current estimated Total Area	Comment
EU 28	4,149,537 Km^2	199	unknown Km^2	EOO and AOO have been calculated on the available data. Although this data set is known to be incomplete the figures exceed the thresholds for threatened status.
EU 28+	>4,149,537 Km^2	>199	unknown Km^2	EOO and AOO have been calculated on the available data. Although this data set is known to be incomplete the figures exceed the thresholds for threatened status.

Distribution map



There are insufficient data to provide a comprehensive accurate map of the distribution of this habitat. This map has been generated using EMODnet data from modelled/surveyed records for the North East Atlantic (and supplemented with expert opinion where applicable) (EMODnet 2010). EOO and AOO have been calculated on the available data presented in this map. These should, however, be treated with caution as expert opinion is that this is not the full distribution of the habitat.

How much of the current distribution of the habitat type lies within the EU 28?

This habitat occurs in the EU 28+ (e.g. Norway). Percentage hosted by EU 28 is therefore less than 100% but there is insufficient information to establish the proportion.

Trends in quantity

Historical declining trends have been reported for maerl beds in the UK, Ireland, and France. An overall declining trend is also apparent in the recent past, although variable across beds. For example in the UK the overall decline is probably of the order of 25% but in some regions such as the Firth of Clyde the decline represents more than 80%. There has also been a serious decline in the extent of the Galician maerl beds and maerl beds have been completely eliminated from some bays in the Brittany region of France, with an estimated 30% destroyed by clam dredging in the Bay of Brest.

The total spatial area covered by maerl beds is unknown. A few locations have, however, been mapped in detail. For example, the area covered by maerl beds occurring in La Rochelle (Biscay Bay, France), Galicia and Algarve (Portugal) total cover approximately 27 km^2.

- Average current trend in quantity (extent)
  EU 28: Decreasing
  EU 28+: Unknown
- Does the habitat type have a small natural range following regression?

No

Justification

Although this habitat has declined in the last 50 years it does not have a small natural range as EOO>50,000km^2

- Does the habitat have a small natural range by reason of its intrinsically restricted area?

  No

  Justification

  Although this habitat has declined in the last 50 years it does not have a small natural range as EOO>50,000km^2

Trends in quality

There has been a historical decline in live maerl cover and maerl habitat quality in the last 50 years and probably over longer periods of time as apparent from Galician and French maerl beds, which have been studied since the 1920s and 1898 respectively. In the UK *in situ* quantitative assessment and monitoring of live maerl extent has indicated that activities such as dredging (e.g. for soil conditioner or shipping channels), destructive fishing (e.g. with dredges or trawls) and fish farming has reduced the extent, complexity and biodiversity of these habitats over the past 50 years. This declining trend is predicted to continue as damaging fishing practices such as scallop dredging, and demersal trawls continue to degrade maerl habitats. Aquaculture is also having an impact on maerl habitat through localised contamination, organic enrichment, and eutrophication. The introduction of invasive non-indigenous species can also lead to the alteration maerl habitats through activities such as the movement of live oysters into waters adjacent to maerl beds.

- Average current trend in quality

  EU 28: Decreasing

  EU 28+: Unknown

Pressures and threats

Commercial dredging in the recent past has beem a considerable threat to maerl beds. Extraction of both living and fossil deposits has severely depleted beds in the Fal Estuary in England, while commercial dredging of around 500,000 tonnes per annum from large beds in French waters, such as those off the Glénan Islands, has also caused irreversible damaged in this and other Breton maerl beds. Although dredging ceased here in 2011,at least four maerl beds in Brittany are known to have been completely destroyed by this activity.

As well as the direct effect of the physical removal of the maerl during extraction, there are other direct and indirect impacts from muddy plumes and sediment redistribution or suspension, caused by the dredging activity and coastal construction, which later settle out and smother associated and surrounding communities. The impact area from this pressure may extend up to 200 times the area of the extraction zone.

Eutrophication, organic enrichment and sedimentation from domestic, industrial or agricultural discharges and from aquaculture installations are an on-going threat. In the recent past in the Bay of Brest, maerl beds have been lost due to eutrophication, even if measures to reduce sewage discharges are likely to reduce this pressure in the near future. In Galicia, Spain, mussel farming has caused deterioration in maerl bed complexity and biodiversity through increased sedimentation. Eutrophication can indirectly cause further impacts, such as an increase in ephemeral algal biomass, smothering the maerl and sometimes resulting in the closure of the king scallop fishery which in turn encourages an increase in the more destructive clam fishery. Moreover, an increase in algal biomass at impacted sites may promote infestation by invasive alien species such as *Crepidula fornicata,* which can degrade associated communities through competition, and reduce abundance and diversity by building up accumulations of faeces, pseudofaeces

and shell drifts.

Maerl thalli are fragile and so inherently susceptible to physical damage from abrasion, such as that originating from mobile demersal fishing gears. Maerl beds in the Firth of Clyde, Scotland, first sampled in the 1880s, are known to have been broken up and destroyed by heavy towed fishing gear. Bivalve dredging currently remains one of the main threats to European maerl beds, with some French beds under increasing pressure from the intensification of clam (*Venus verrucosa*) fishing..

List of pressures and threats

Biological resource use other than agriculture & forestry

Marine and Freshwater Aquaculture
- Intensive fish farming, intensification
- Suspension culture

Fishing and harvesting aquatic resources
- Professional active fishing
- Benthic or demersal trawling
- Benthic dredging

Human intrusions and disturbances

Other human intrusions and disturbances
- Shallow surface abrasion/ Mechanical damage to seabed surface

Invasive, other problematic species and genes

Invasive non-native species

Natural System modifications

Human induced changes in hydraulic conditions
- Extraction of sea-floor and subsoil minerals (e.g. sand, gravel, rock, oil, gas)

Conservation and management

Prohibiting the direct extraction of maerl would be of immediate benefit to this habitat. Other important conservation and management measures would be to stop the use of mobile demersal gears and other types of fishing activity where this habitat occurs because of the damaging effects of abrasion. Sufficient distance between maerl beds and aquaculture facilities is also important. Mussel aquaculture, for example contributes large amounts of fine sediment and detritus to the bottom, causing the burial and death of the maerl thalli by reduction of gas exchange around them.

List of conservation and management needs

Measures related to wetland, freshwater and coastal habitats

Restoring/Improving water quality

Measures related to spatial planning

Establish protected areas/sites
Legal protection of habitats and species

Measures related to hunting, taking and fishing and species management

Regulation/Management of fishery in marine and brackish systems
Specific single species or species group management measures

Measures related to special resouce use

Regulating/Managing exploitation of natural resources on sea

Conservation status

Annex 1:

1110: MATL U2, MMAC U1

Maerl beds are identified as a threatened and/or declining habitat in all the OSPAR regions.

HELCOM has assessed Baltic photic maerl beds (AA.D) and Baltic aphotic maerl beds (AB.D) as EN (B1+2a(ii))

When severely damaged, does the habitat retain the capacity to recover its typical character and functionality?

No. Maerl thalli are fragile and therefore inherently susceptible to seabed abrasion, although they are resilient to natural movement by currents and waves. It is important not to change the natural disturbance regime or increase compaction of maerl as this can kill live thalli through burial in sediment or crush the brittle thalli, reducing their length and complexity. Large live thalli can range from 10s-100s of years old (and dead thalli 100s-1000s of years old) and with increasing maerl size, the three-dimensional complexity of the thalli increases which leads to increases in the diversity of associated flora and fauna. The size of maerl thalli decreases in the presence of activities that abrade or compact the seabed resulting in associated biodiversity loss.

Effort required

200+ years
Naturally

Red List Assessment

Criterion A: Reduction in quantity

Criterion A	A1	A2a	A2b	A3
EU 28	>30 %	unknown %	>30 %	unknown %
EU 28+	>30 %	unknown %	>30 %	unknown %

Maerl beds have undergone well-documented declines in condition and are being removed for commercial use in some parts of the regional sea area. Expert opinion indicates that an overall decline in quantity of more than 30% has occurred within the last 50 years. Historical declines have also occurred but there is insufficient information to quantify the extent. This habitat has been assessed as Vulnerable under criterion A for the EU 28 Trends in maerl beds in Norway are unknown but as the majority of the beds are likely to be within the EU 28 this habitat is also assessed as Vulnerable for the EU 28+.

Criterion B: Restricted geographic distribution

Criterion B	B1				B2				B3
	EOO	a	b	c	AOO	a	b	c	
EU 28	>50,000 Km^2	Yes	Yes	No	>50	Yes	Yes	No	No
EU 28+	>50,000 Km^2	Yes	Yes	No	>50	Yes	Yes	No	No

This habitat has a large natural range in the North East Atlantic region The precise extent is unknown however as EOO >50,000 km2 and AOO >50, this exceeds the thresholds for a threatened category on the basis of restricted geographic distribution. There is a decreasing trend in quantity and quality but the

distribution of the habitat is such that the identified threats are unlikely to affect all localities at one. This habitat has therefore been assessed as Least Concern under criteria B1, B2 & B3 for both the EU 28 and EU 28+.

Criterion C and D: Reduction in abiotic and/or biotic quality

Criteria C/D	C/D1		C/D2		C/D3	
	Extent affected	Relative severity	Extent affected	Relative severity	Extent affected	Relative severity
EU 28	30 %	severe %	unknown %	unknown %	unknown %	unknown %
EU 28+	30 %	severe %	unknown %	unknown %	unknown %	unknown %

Criterion C	C1		C2		C3	
	Extent affected	Relative severity	Extent affected	Relative severity	Extent affected	Relative severity
EU 28	unknown %	unknown %	unknown %	unknown %	unknown %	unknown %
EU 28+	unknown %	unknown %	unknown %	unknown %	unknown %	unknown %

Criterion D	D1		D2		D3	
	Extent affected	Relative severity	Extent affected	Relative severity	Extent affected	Relative severity
EU 28	unknown %	unknown%	unknown %	unknown%	unknown %	unknown%
EU 28+	unknown %	unknown%	unknown %	unknown%	unknown %	unknown%

There has been a substantial reduction in abiotic and/or biotic quality of this habitat in the last 50 years (estimated to be a severe decline affectiong more than 30% of the extent). This trend is predicted to continue unless damaging human activities are curtailed. This habitat has therefore been assessed as Vulnerable under criteria C/D for EU 28. Trends in maerl beds in Norway are unknown but as the majority of the beds are likely to be within the EU 28 this habitat is also assessed as Vulnerable for the EU 28+.

Criterion E: Quantitative analysis to evaluate risk of habitat collapse

Criterion E	Probability of collapse
EU 28	unknown
EU 28+	unknown

There is no quantitative analysis available that estimates the probability of collapse of this habitat type.

Overall assessment "Balance sheet" for EU 28 and EU 28+

	A1	A2a	A2b	A3	B1	B2	B3	C/D1	C/D2	C/D3	C1	C2	C3	D1	D2	D3	E
EU28	VU	DD	DD	DD	LC	LC	LC	VU	DD	DD	DD	DD	DD	DD	DD	DD	DD
EU28+	VU	DD	DD	DD	LC	LC	LC	VU	DD	DD	DD	DD	DD	DD	DD	DD	DD

Overall Category & Criteria			
EU 28		EU 28+	
Red List Category	Red List Criteria	Red List Category	Red List Criteria
Vulnerable	A1, C/D1	Vulnerable	A1, C/D1

Confidence in the assessment
Medium (evenly split between quantitative data/literature and uncertain data sources and assured expert knowledge)

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