European Community Directive
on the Conservation of Natural Habitats
and of Wild Fauna and Flora
(92/43/EEC)

Second Report by the United Kingdom under Article 17

on the implementation of the Directive from January 2001 to December 2006

Conservation status assessment for :

S1377: *Phymatholithon calcareum* - Mearl

Please note that this is a section of the report. For the complete report visit http://www.jncc.gov.uk/article17

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S1376 *Lithothamnion corallioides and* S1377 *Phymatolithon calcareum* Maerl

Audit trail compiled and edited by JNCC, Scottish Natural Heritage, Queens University, the Plymouth Marine Institute, the University Marine Biological Station Millport

This document is an audit of the data and judgements on conservation status in the UK's report on the implementation of the Habitats Directive (January 2001 to December 2006) for this species. Superscript numbers accompanying the headings below, cross-reference to headings in the corresponding Annex B reporting form. This supporting information should be read in conjunction with the UK approach for species (see 'Assessing Conservation Status: UK Approach').

Phymatolithon calcareum and *Lithothamnion corallioides* are two of the more common maerl-forming species. It is for this reason that: a) they were listed under the Habitat Directive; and b) it would not be appropriate to assess them as separate species. Furthermore, data available would generally be insufficient to support meaningful assessment as separate species. They have, therefore, been considered under a joint assessment, which focuses on the wider issues relevant to maerl, for the purpose of the reporting process.

Maerl is a collective term used to describe living and dead accumulations of several species of calcified red seaweed which grow as unattached nodules or 'rhodoliths' on the seabed and can form extensive beds in Favourable conditions.

Dead thalli can accumulate over long periods of time, to form large beds, ripples or banks, often with living material in places, and can represent up to several thousands of years from the Holocene (Freiwald, 1995). Maerl thalli from beds in Strangford Lough and Milford Haven have been radiocarbon dated to about 4000 and 2000 years old respectively (dates calibrated and corrected for marine reservoir effect; Blake, 2005). These old maerl beds are termed subfossil, and can occur in deeper water than live maerl. In general, subfossil maerl deposits are more extensive than live maerl beds. Dead maerl deposits nevertheless have been shown to harbour a greater diversity and abundance of associated organisms than surrounding habitats (Birkett *et al.*, 1998, Steller *et al.*, 2003).for the context of this report 'dead maerl' will be referred to as 'maerl derived gravel'.

Since the legislation definition associated with Annex V states '….specimen means any animal or plant , whether alive or dead, of the species listed in IV or V…' this assessment will also include maerl derived gravel. Furthermore the distinction between maerl derived gravel and live maerl is necessary to ensure the assessment is a true reflection of the current status of live maerl.

Maerl-forming species include *Phymatolithon calcareum*, *Lithothamnion glaciale*, *Lithothamnion corallioides* and *Lithophyllum fasciculatum*. The main beds in the UK consist of *Phymatolithon calcareum, Lithothamnion glaciale* and *Lithothamnion corallioides.* The proportions in which each of these species is present may vary widely between adjacent sites. Maerl beds consist of a mixture of living and dead thalli or of dead material only; the requirements for living and maerl derived gravel differ significantly.

1. Range Information[2.3]

Maerl beds are patchily distributed around the coasts of the UK, with the majority occurring on exposed west coasts of Britain, southern coasts and north to Shetland. However, the distribution pattern of the individual species varies; *P. calcareum* is found along the west coast of Scotland and the Orkney islands, and along the south west coasts of Britain and in Northern Ireland, whereas *L. corallioides* is restricted to England and Western Ireland.

Maerl beds are absent from eastern coasts in the UK and rare in both Wales and England.

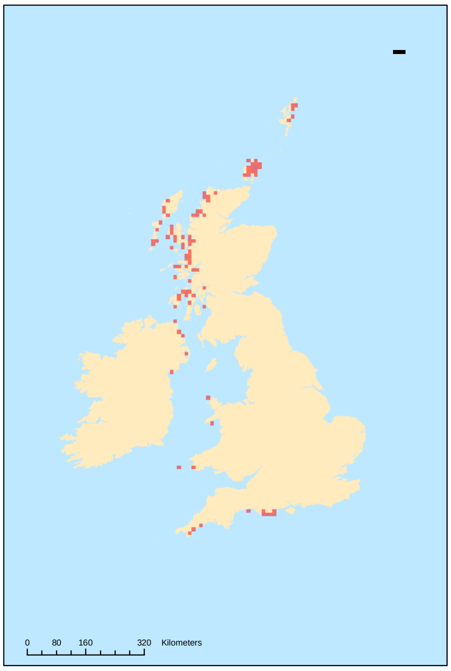
1.1 Surface area of range[2.3.1]

Unknown

Maps 1.1 and 1.2 show occupied 10 km-squares for *P. calcareum* and maerl (unspecified) respectively. Both maps have been derived from recorded survey data that has been subsequently stored within the NBN database, held at JNCC. However, since, Hall-Spencer (1995) notes *L. glaciale* has often been misidentified in Scotland as *L. corallioides*. Due to this mis-identification (C.Maggs, 2007, *pers comms*) existing databases, such as NBN hold erroneous data. Hence, no correct map of *L corallioides* is available, but a 'maerl unspecified' map provides some indication of where maerl is present.)

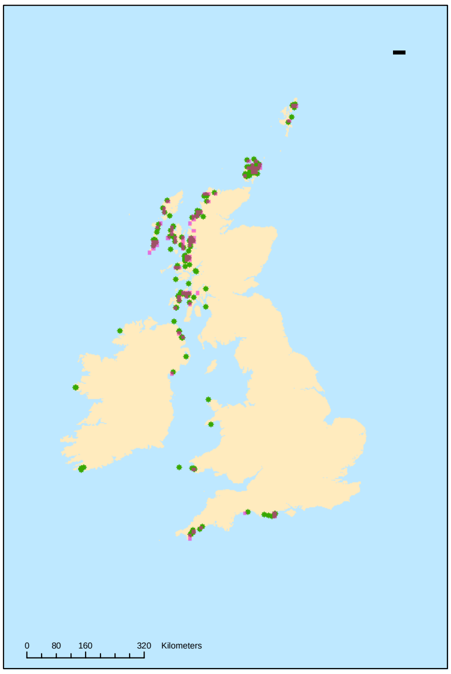
Based on these records, area of occurrence (occupied 10-km squares) has been estimated at 112,000 km^2 within GIS. However, extent is not known; for most sites, point information only is available, from areas where benthic mapping has been carried out (for examples in SACs). For this reason, range has been reported as unknown.

Map 1.1. *Phymatolithon calcareum* (2007)



Data sources provided in Section 6

Map 1.2. Maerl – unspecified. Historic extent of occurrence and occupied 10 km-squares (2007)



Data sources provided in Section 6

Maps 1.1 and 1.2 indicates the point distribution of a given maerl species that has been recorded within a marine survey.

1.2 Date of range determination[2.3.2]

Not applicable

1.3 Quality of range data[2.3.3]

Moderate

The data (derived from JNCC's NBN database) is generally of a good quality. However, maerl beds can be a composite of different maerl species. *P. calcareum* is the species present in the greatest abundance but is not necessarily the sole contributor to that bed. The current estimate has therefore been derived from a general maerl map (see Map 1.2), and thus data quality is reported as moderate, rather than good.

1.4 Range trend[2.3.4] and range trend magnitude[2.3.5]

Stable

At a10-km square resolution, both maerl derive gravel and live maerl beds are considered stable in the UK.

Maerl derived gravel:

No increase in range can occur as these beds are occupied by maerl derived gravel. Furthermore, there has been no decline in maerl derived gravel since the harvesting of sub-fossil in the Fal was revoked in 2004 (Brockington 2006 pers comms, Maggs 2007 *pers comms*), which, due to the nature of the extraction process, would not have had notable impact on UK range at the 10km scale.

Live maerl:

Maerl is still present in Scotland, Wales and along Cornish, Devon and Dorset coasts. The Biodiversity Action Reporting System (BARS) states that over the last three years maerl can be classed as 'stable'.

The range of live maerl is reported to be declining in Scotland (Hall-Spencer *et al*. 2006) and also off the Dorset coast (K. Collins 2007, pers comms); in Milford Haven there has been construction over part of the live maerl bed (M. Camplin 2007, *pers comms*). However, there is no evidence to suggest that this has impacted range at the 10km scale in recent years.

Hence, overall, range trends are reported as stable. However, information is supplied with a caveat stating that this conclusion is based on inadequate information.

1.5 Range trend period [2.3.6]

2002 – 2005

Post-1994 range trend information was not available at the time of assessment. The most recent alternative - the 2002 to 2005 BARS data - has therefore been reported.

1.6 Reasons for reported trend in range[2.3.7]

Not applicable

Trend is stable due to the scale at which this assessment was undertaken i.e. 100 square km, and the short time period across which information is available.

1.7 Favourable reference range[2.7.1]

Unknown

Although a quantitative area estimate cannot be provided, based on best expert judgement, current range is sufficiently large to be considered suitable for the survival of mearl for the foreseeable future.

1.8 Range conclusion[2.8]

Favourable

There has been no evidence of decline in range, and the current range (although not quantified in km2) is considered equivalent the favourable reference range based on best available information and expert judgement. Therefore, the conclusion for this parameter is Favourable.

2. Population of the Species[2.4]

L. corallioides has a much more limited distribution than *P. calcareum*.

L. corallioides is restricted to England and Western Ireland. In England the largest known area of maerl (which includes *L. corallioides)* is found on the St. Mawes Bank in the Fal Estuary (Birkett *et al*. 1998).

P. calcareum is sparsely distributed along the south west coasts of Britain and in Northern Ireland, though it has a denser distribution along the west coast of Scotland and the Orkney islands. *P. calcareum* has been described as both the most widely distributed and the most abundant maerl species in the UK (Birkett *et al*. 1998).

2.1 Population estimate[2.4.1]

>157 sites

Table 2.1, from which the current estimate is derived, is sourced from the public domain (www.ukbap-reporting.org.uk 'National Biodiversity Action Plan - Trend'); the trend and status of individual maerl beds has been submitted at a country level. This table is a good indication of the maerl beds reported across the UK, but may not be entirely inclusive. Hence, this is considered a minimum, rather than absolute, site estimate.

Table 2.1. Number of maerl beds quantified around the UK

Area	Value	Unit	Accuracy
UK	157	Site(s)	Partial survey
England	12	Site(s)	Partial survey
Northern Ireland	16	Site(s)	Sample or full survey
Scotland	128	Site(s)	Sample or full survey
Wales	1	Site	Sample or full survey

Source www.ukbap.org.uk/GenPageText.aspx?id=105

2.2 Date of population estimate[2.4.2]

2005

The estimate has been derived from the UK Biodiversity Action Plan reporting round 2002-2005, made publicly available in 2006.

2.3 Method of population estimate[2.4.3]

2 = Extrapolation from surveys of part of the population, sampling

2.4 Quality of population data[2.4.4]

Moderate

Records of the number and location of known maerl beds is derived from NBN/ recorder. In most cases this information is individual survey points. Information about the extent of maerl beds tends to be best in relevant SACs where broad scale mapping and site condition monitoring (Common Standard Monitoring) has been carried out. Thus, the identified sites from the Biodiversity Action Reporting System, Table 2.1 above, give a good indication, but not a full indication of maerl beds around the UK.

2.5 Population trend[2.4.5] and population trend magnitude[2.4.6]

Unknown

Maerl derived gravel:

In the absence of an alternative, the current estimate has been reported as number of sites; although maerl derived gravel maerl has been lost as a result of extraction processes since the Habitat Directive came into force (e.g. at the Fal estuary 1975-2004), there is insufficient evidence to report whether this ‘site number’ has decreased. Further there is no means to quantify within site losses.

Live maerl:

Live maerl has been directly and indirectly affected by a range of pressures (see section 2.9), which, according to expert opinion, has increased the vulnerability of this feature. However, currently there are no trend data at the site/population level.

Overall, therefore, it is most appropriate to report the current population trend as Unknown, on the basis of insufficient information.

2.6 Population trend period[2.4.7]

1994 – 2006

2.7 Reasons for reported trend in population[2.4.8]

Not Applicable

2.8 Justification of % thresholds for trends[2.4.9]

Not Applicable

2.9 Main pressures[2.4.10]

The main pressures affecting this species are ranked in order of importance below:

290 Hunting, fishing or collecting activities not referred to above - Scallop dredging, Hydraulic dredging of bivalves

390 Mining and extraction activities not referred to above - Extraction

200 Fish and Shellfish Aquaculture - Fish farms

871 Sea defense or coast protection works - Civil engineering

820 Removal of sediments (mud...) - Maintenance of navigation channels

750 Other pollution or human impacts/activities - Industrial, agricultural and sewage discharges
860 Dumping, depositing of dredged deposits - Scallop dredging, Hydraulic dredging of bivalves, Maintenance of navigation channels
952 Eutrophication- Industrial, agricultural and sewage discharges
There have been several records from marine scientists describing the loss of maerl throughout the UK as detailed below.

In Europe maerl develops when crustose forms fragment and continue to grow clonally as free-living balls, branched twigs or rosettes, reproducing almost entirely by fragmentation (Freiwald 1995). In brief, sexual reproductive events are believed to be rare. Maerl has a very slow growth rate, approximately 1 mm per year (Bosence and Wilson 2003). More specifically the three most abundant maerl species in Europe, *P. calcareum, L. corallioides* and *L. glaciale*, grow about 0.5-1.5 mm per tip per year under a wide range of field and artificial conditions (Blake and Maggs 2003). As a result of its slow growth rates, even under favourable conditions maerl beds take a considerable period of time to accumulate. Indeed, Friewald *et al.* (1991), state that extensive beds of live and dead thalli take thousands of years to accumulate (under favourable conditions at rates of up to 2.6 m per ka).

These factors lead to a low potential for recovery from impact and thus maerl is often considered a non-renewable resource when considering exploitation proposals.

a) 290 Hunting, fishing or collecting activities not referred to above – Scallop dredging
Major changes have been reported from areas where scallops are dredged from maerl beds (Hily *et al*. 1992; Hall-Spencer and Moore 2000) such as the removal of the living maerl from the biotope surface, the loss of the stabilising algae and the disruption of the structure of both the physical habitat and the community structure.

A number of studies indicate that maerl beds have declined in both extent and quality in the UK. Hall-Spencer & Moore (2000), recorded declines on a maerl bed off the west coast of Scotland, related to the expansion of the scallop fishing industry there. Furthermore they state that maerl beds subject to scallop dredging over the past century consist of significantly smaller thalli than adjacent control beds (Hall-Spencer and Moore 2000).

In a simulated study, Hall-Spencer and Moore (2000) investigated the long-term impacts of scallop dredging on maerl (at test sites) in the Firth of Clyde. The results showed that the impacts of such dredging included the burial of maerl up to 8 cm below the sediment surface and the crushing and compacting of biogenic carbonate structures e.g. maerl thalli and bivalve shells. Indeed, dredging reduced the number of live thalli by 70%, with no sign of recovery for four years after the event. In addition the dredging resulted in sculptured ridges and troughs of the dredge tracks and these remained visible for up to 2.5 years after the experiment.

Ruiz-Frau *et al.* (2007) investigated the presence of maerl Falmouth Bay which adjoins both the Fal and Helford estuaries for the presence of maerl. Maerl was found in the bay where both scallop dredging and the anchoring of ships occurs. However, whether the maerl was present in sufficient quantities to qualify for designation under UK and EU conservation laws was unclear

b) 290 Hunting, fishing or collecting activities not referred to above - Hydraulic dredging of bivalves
A significant threat to live and maerl derived gravel maerl beds is hydraulic dredging for large burrowing bivalves such as *Ensis* and *Venerupis* species. Sublittoral harvesting of *Venerupis* and *Ensis* is widespread on the west coast of Scotland, ranging from the Clyde Sea to the Northern Isles. Hydraulic dredging not only has major impacts on the target species, but causes structural damage to the community from which they are being extracted. The detrimental effects on maerl beds can include: impacts of re-suspended sediment settling out over the maerl and resulting in death of thalli (Wilson *et al* 2004 and Birkett *et al*. 1998). Indeed, a fairly recent study in the Clyde Sea area, west coast of Scotland (Hauton *et al.* 2003) demonstrated that not only does hydraulic dredging remove maerl it also suspends sediment in to the water column, which settles out and blankets the seabed to a distance of at least 8 m either side of the dredge track. The paper makes a case for protecting all maerl grounds from hydraulic dredging and establishing them as reservoirs to allow for the recruitment of commercial bivalve populations at adjacent fished sites.

c) 390 Mining and extraction activities not referred to above - Extraction
Extraction of maerl, whether from beds where live thalli are present or where the maerl is dead or semi-fossil, has been carried out in Europe for hundreds of years (Birkett *et al*. 1998). Commercial dredging of maerl deposits is particularly destructive since it removes the productive surface layer and dumps sediment on any plants that escape dredging, thus inhibiting habitat recovery (Hall-Spencer 1998). Dredging for maerl derived gravel was undertaken by the Cornish Calcified Seaweed Co. in the Fal Estuary from 1975 (now discontinued).

Extraction of both living and fossil deposits has depleted beds in the Fal Estuary, notably St. Mawes Bank, including the reduction of other fauna and flora (Rostron 1988). Now, the beds at Lyme Bay are of more concern since they have almost been destroyed through the use of towed gears (*pers comms*, Brockington 2006). Additionally, maerl beds located off West Poole Bay are thought to be under threat since they do not have adequate protection.

Only one licence for maerl extraction has been issued in Scotland. This was for a site in Orkney in the mid-nineties. There was limited dredging (<500 tonnes) in the first two years of the licence and then the operation ceased. The licence has been revoked and no other licences have been issued (Birkett *et al*. 1998).

d) 200 Fish and Shellfish Aquaculture - Fish farms
The positioning of cages over a maerl bed is likely to lead to fish faeces and partly consumed food pellets contaminating the maerl bed and resulting in anaerobiosis (due to the oxygen demand of the decomposing material). The detrital rain from cages could act in a similar way to terrigenous silt, reducing light penetration through the water column and smothering the maerl surface so that the stabilizing epiphytic algae could no longer establish themselves. As a minimum impact the increase in nutrient levels might produce local eutrophication effects. Indeed, Maggs and Guiry (1987a) noted that maerl below fish cages was covered with *Beggiatoa sp*, which had a detrimental impact on this habitat

More recently, studies (Hall-Spencer *et al*. 2006) have demonstrated the impacts of Scottish salmon fish farms on maerl and revealed significant reductions in live maerl cover. Indeed visible waste was noted up to 100 m from cage edges and near-cage infaunal samples showed significant reductions in biodiversity, with small Crustacea (ostracods, isopods, tanaids and cumaceans) being particularly impoverished in the vicinity of the cages and significant increases in the abundance of species tolerant of organic enrichment (e.g. *Capitella* spp. complex, *Ophryotrocha hartmanni*). Maerl is particularly sensitive to hydrogen sulphide, as that generated by fish farm waste (Wilson *et al.* 2004).

e) 871 Sea defence or coast protection works -Civil engineering
Construction of certain civil engineering developments may affect tidal water movement and as a result maerl beds, e.g. the construction of causeways in Western Isles between islands has restricted or in some cases cut off the tidal flow(Birkett *et al*., 1998). Coastal construction operations may result in increased sediment load, reducing light levels and potentially smothering maerl when it is deposited. Currently there is evidence that construction within Milford Haven, in the vicinity of the LNG (liquidified natural gas) terminal jetty, has resulted in smothering of some maerl (Mike Camplin, 2006, pers comm). Indeed, there is evidence to suggest that there has been a loss of maerl and available maerl habitat in Milford Haven, west Wales. As yet the exact area of loss and the long term implications are not known (*pers comm* Mike Camplin, CCW). These beds have shown a degradation in quality which has also been reflected in the quality of the infaunal community.

Coastal alterations such as the construction of sea defences may alter the depositional patterns with the same consequences to maerl biotopes as dredging. If the underlying substratum is altered, it is unlikely that maerl will be able to re-establish itself at that site. Indirect effects such as increased shipping traffic can be a result of construction, potentially adding to sediment loading (Birkett *et al*. 1998).

f) 820 Removal of sediments (mud) - Maintenance of navigation channels
Maerl could be affected by dredging operations (directly or indirectly via resettlement of fines) or by deposit of dredge spoil. To renew or enlarge navigational channels, extensive dredging can take place. This involves removing the seabed, which results in the suspension of the fine silt and clay fractions of the sediment. This fine sediment may be deposited by the inshore currents either locally or at a considerable distance from the dredging operation (Birkett *et al*. 1998). The additional sediment loads will increase local turbidity and may also settle on maerl beds, burying the calcareous thalli, smothering other algae and animals and possibly destroying the physical stability of the habitat. Seabed removal where a maerl bed is present will of course result in the removal of the maerl itself at that site. Furthermore, given the probable method of reproduction of the species involved it is unlikely that the maerl will be able to reestablish itself (Birkett *et al.* 1998). There is historical and radiocarbon dating evidence that channel dredging in Belfast Lough was associated with the extinction of the Belfast Lough maerl bed (Blake 2005)

g) 750 Other pollution or human impacts/activities and 952 eutrophication - Industrial, agricultural and sewage discharges
Industrial, agricultural and sewage discharges (including nitrates), may impact maerl through excessive growth of ephemeral species of macroalgae and/or phytoplankton (for example via reduced light levels, contributing to hypoxic/anoxic conditions in sediment or overlying water (Birkett *et al*. 1998).

Pollution from heavy metal and organic input (from sewage discharges) has reportedly reduced the thickness of, or entirely killed, live maerl cover (Grall & Hall-Spencer 2003). However, maerl under experimental conditions was not affected by a model effluent solution (Wilson *et al.* 2004)

2.10 Threats[2.4.11]

The threats likely to affect this species are ranked in order of importance below:
290 Hunting, fishing or collecting activities not referred to above
390 Mining and extraction activities not referred to above
200 Fish and Shellfish Aquaculture
871 Sea defense or coast protection works
820 Removal of sediments (mud...)
750 Other pollution or human impacts/activities
860 Dumping, depositing of dredged deposits
952 Eutrophication
Recent studies have highlighted damaging human activities on maerl to include: fisheries (Hall- Spencer & Moore 2000; Kamenos 2006, *pers comms*); fish farm operations (Hall-Spencer *et al*. 2006); and extraction (Birkett *et al*. 1998) and concluded that there has been a decline in the extent and quality of these beds. Eutrophication is also considered to be an important threat to maerl beds (C. Maggs 2007, *pers comm*.)

2.11 Favourable reference population[2.7.2]

Unknown
It is not known whether the number of maerl sites has decreased or remained stable since the Habitats Directive came into force. However, there is evidence that maerl derived gravel has undergone some decline, at least within sites. Furthermore, live maerl has been left vulnerable by the pressures listed under section 2.9.

Based on this and expert opinion, it is possible that the current population may not be viable. However, increasing the number of sites (i.e. the current estimate) would not necessarily address this problem. Therefore, in the absence of more comprehensive information, the favourable reference population has been reported as Unknown for this reporting round.

2.12 Population conclusion[2.8]

Unknown
There is insufficient information to assess population status at present. Although it is known that maerl is sensitive and vulnerable to the impacting activities identified in sections 2.9, the extent of these pressures at site level can not be quantified (David Donnan 2006, pers. comm.). The conclusion is, therefore, Unknown.

3. Habitat for the Species in the Biogeographic Region or Sea[2.5]

Both *P. calcareum and L. coralloides* form a habitat.

The ecological requirements for living maerl beds are thought to be relatively precise and the distribution of live maerl is subject to various controlling environmental factors, the most important of which are currents, wave action and the interactive effect of depth and water quality on photosynthesis (Birkett *et al.* 1998). Extensive beds typically are located in coarse clean sediments of gravels and clean sands or muddy mixed sediments, which occur either on the open coast or in tide-swept channels of marine inlets. Maerl tends to be located in areas of accelerated currents e.g. narrow straits and headlands, but bottom current speeds must not exceed a certain level as maerl thalli are sensitive to physical damage. Live maerl beds have been recorded from extreme low tide level to 30 m depth. Coupled with the high water flow, maerl requires a high water quality with a low particulate organic matter content (Kamenos, 2006, *pers.comm*.). Higher levels of prevailing turbidity will limit the maximum depth to which maerl is found.

Maerl has an open complex structure and thus forms a heterogeneous habitat for numerous fauna and flora. In fact maerl beds have been compared to seagrass beds in terms of their high biodiversity (Kamenos *et al*. 2003). Negative impacts such as dredging and storms can destroy the heterogeneity of this habitat and therefore reduce biodiversity.

3.1 Surface area of habitat[2.5.2]
Unknown

3.2 Date of estimation[2.5.3]
Not applicable

3.3 Quality of data on habitat area[2.5.4]
Poor
The only known estimates are at the coarse 10-km square resolution reported for range. At a local scale, the extent of maerl is Unknown.

3.4 Habitat trend[2.5.5]
Unknown
Based on best available information and expert judgement, habitat has suffered decline since the Habitat Directive came into force. The extent of this, however, is Unknown.

There are numerous human activities that have resulted in a loss of, maerl derived gravel, and a decline in the quality (and possibly area) of live maerl, including hydraulic dredging, aggregate extraction, fish farms, eutrophication and civil engineering. It is difficult to know the true extent of these impacts due to lack of information and surveys / monitoring being undertaken.

Apart from human activities maerl is also susceptible to natural damage resulting from storms. However, both impacts can reduce or completely compact the fragile thalli. Although, again, it is difficult to assess the exact extent of the impact, it is understood that maerl has strict water quality requirements to flourish, and pollution by anthropogenic or natural causes places stress on these species. Furthermore, maerl does not recover quickly from such impact due to its recorded slow growth rates (Blake & Maggs 2003) and sporadic recruitment.

3.5 Habitat trend period[2.5.6]
1994 – 2006

3.6 Reasons for reported trend in habitat[2.5.7]
Not applicable

3.7 Suitable habitat for the species (in km^2)[2.7.3]
Unknown

3.8 Habitat conclusion[2.8]
Unknown

Recent assessments of the quality of existing maerl beds in the UK has been described as ‘not good’’ by experts (Moore and Kamenos 2007, *pers.comms*) who state ‘although several maerl beds exist in the UK, most are heavily damaged or are fossil deposits – a limited number of maerl beds are in good condition remain in the UK’. (Information on the ecological requirements of maerl is provided at the beginning of section 3).

Recent studies have highlighted damaging human activities on maerl to include: fisheries Hall-Spencer & Moore 2000; Kamenos 2006, pers comms); fish farm operations (Hall-Spencer *et al*. 2006); and extraction (Birkett *et al*. 1998) and concluded that there has been a decline in the extent and quality of these beds. Eutrophication is also considered to be an important factor for maerl beds (C. Maggs 2007, *pers comms*). Most of these studies reflect particular sites and not a reflection for the UK as a whole. Whilst that is the case we must take note of this information since these sites form part of the suite of UK sites and the impaction is that the threat to these sites is increasing.

Maerl is an ecologically important habitat for a range of flora and fauna. Damage, death or removal of maerl is linked to the reduction of the quality of this habitat and the biodiversity of its associated fauna and flora (Kamenos 2006, *pers comms*). Indeed the loss of heterogeneity of this habitat (Hall-Spencer *et al*. 2003) is a real cause for concern. Habitats once described as clean maerl gravel with low silt content supporting abundant suspension feeding bivalves have been described as changing into a muddy sand habitat dominated by deposit feeders and omnivores (Hall-Spencer *et al*. 2003).

Although the threats and pressures have increased and there is concern about the nature and extent of the risk posed to the quality of the maerl resource, the extent of the change can not be quantified. Furthermore there is a lack of evidence to state that the surrounding environment e.g. water quality, has been degraded. On the basis of this the conclusion has to be stated as Unknown.

4. Future Prospects[2.6]

4.1 Future prospects conclusion[2.8]

Poor prospects

Species likely to struggle unless conditions change.

L. corallioides and *P. calcareum* are included in Annex V of the Habitats Directive. As part of the UK's response to the European Union Habitats Directive to protect habitats, maerl is identified in the JNCC interpretation of the EC Habitats Directive as a key habitat within the Annex I category ‘sand banks which are slightly covered by seawater at all times’ and Shallow inlets and Bays. Both are also on the long list of species in the UK Biodiversity Steering Group Report (Anon. 1995), and maerl is the subject of a Habitat Action Plan under the UK Biodiversity Action Plan.

Maerl beds also occur in three demonstration SACs within the UK, while the Fal and Helford (Cornwall) candidate SAC includes the largest maerl bed in England.

Beyond legislative protection, there is no intensive conservation action specifically aimed at maerl. Extraction activities have now been halted. However, evidence suggests that maerl continues to be under threat from damaging human activities, such as fisheries and fish farm operations. Eutrophication is also considered to be an important threat to maerl beds (see sections 2.9 and 2.10). Furthermore, 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 maerl derived gravel deposits (Hall-Spencer 1998; Barbera *et al*. 2003).

Based on this and expert opinion, over the next 12 years it can be expected that *L. corallioides* and *P. calcareum*, and the maerl beds that they comprise, will "struggle unless conditions change".

4.2 Future prospects conclusion[2.8]

Unfavourable – Inadequate and deteriorating

Prospects have been identified as poor. Furthermore, with declines of both live and maerl derived gravel continuing (the latter of which can not be replaced) prospects of long term viability are expected to worsen.

Hence, future prospects are concluded as Unfavourable - Inadequate and deteriorating.

5. Overall Conclusion [2.8]

Unfavourable – Inadequate and deteriorating

Table 5.1. Summary of conclusions

Parameter	Judgement	Grounds for Judgement (in accordance with Annex C)	Reliability*
Range	Favourable	Range is stable and not smaller than the favourable reference range.	3
Population	Unknown	Insufficient reliable information available	N/A
Habitat	Unknown	Insufficient reliable information available	N/A
Future Prospects	Unfavourable – Inadequate and deteriorating	Any combination other than those described under 'Favourable' or 'Unfavourable-Bad'. Main pressures and threats to the species are significant. Although maerl is not considered "likely to become extinct" over the next 12 years, this assessment is expected to deteriorate if conditions do not change.	1
Overall Assessment	Unfavourable – Inadequate and deteriorating	One or more Unfavourable – Inadequate; no Unfavourable – Bad	2

*1=High, 2=Moderate, 3=Low

High – Expert opinion is that the concluding judgement accurately reflects the current situation based on a professional understanding of the species. For range, population, and habitat, quality of data used to establish the current estimate has been identified as "good"; data used to inform trends is comprehensive and up to date.

Moderate – A greater understanding of the feature, or the factors affecting it, is required before a confident concluding judgement can be made by experts. For range, population, and habitat, the current estimate and/or trend are based on recent, but incomplete or limited survey data; or alternately, a comprehensive, but outdated (pre-1994) review.

Low – Judgements, and comprising estimates, are based predominately on expert opinion.

N/A – Assessment conclusion is “unknown”, on the basis of insufficient reliable information

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