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

## Fourth Report by the United Kingdom under Article 17

on the implementation of the Directive
from January 2013 to December 2018

Supporting documentation for the
conservation status assessment for the species:

**S1377 - Maerl (*Phymatolithon calcareum*)**

WALES

## IMPORTANT NOTE - PLEASE READ

- The information in this document is a country-level contribution to the UK Report on the conservation status of this species, submitted to the European Commission as part of the 2019 UK Reporting under Article 17 of the EU Habitats Directive.
- The 2019 Article 17 UK Approach document provides details on how this supporting information was used to produce the UK Report.
- The UK Report on the conservation status of this species is provided in a separate document.
- The reporting fields and options used are aligned to those set out in the European Commission guidance.
- Explanatory notes (where provided) by the country are included at the end. These provide an audit trail of relevant supporting information.
- Some of the reporting fields have been left blank because either: (i) there was insufficient information to complete the field; (ii) completion of the field was not obligatory; (iii) the field was not relevant to this species (section 12 Natura 2000 coverage for Annex II species) and/or (iv) the field was only relevant at UK-level (sections 9 Future prospects and 10 Conclusions).
- For technical reasons, the country-level future trends for Range, Population and Habitat for the species are only available in a separate spreadsheet that contains all the country-level supporting information.
- The country-level reporting information for all habitats and species is also available in spreadsheet format.

Visit the JNCC website, https://jncc.gov.uk/article17, for further information on UK Article 17 reporting.

# Report on the main results of the surveillance under Article 11 for Annex II, IV and V species (Annex B)

## NATIONAL LEVEL

## 1. General information

| | |
|---|---|
| 1.1 Member State | **UK (Wales information only)** |
| 1.2 Species code | **1377** |
| 1.3 Species scientific name | **Phymatolithon calcareum** |
| 1.4 Alternative species scientific name | |
| 1.5 Common name (in national language) | Maerl Phymatolithon |

## 2. Maps

| | |
|---|---|
| 2.1 Sensitive species | No |
| 2.2 Year or period | 1995-2017 |
| 2.3 Distribution map | Yes |
| 2.4 Distribution map Method used | Complete survey or a statistically robust estimate |
| 2.5 Additional maps | No |

## 3. Information related to Annex V Species (Art. 14)

| | | |
|---|---|---|
| 3.1 Is the species taken in the wild/exploited? | No | |
| 3.2 Which of the measures in Art. 14 have been taken? | a) regulations regarding access to property | No |
| | b) temporary or local prohibition of the taking of specimens in the wild and exploitation | No |
| | c) regulation of the periods and/or methods of taking specimens | No |
| | d) application of hunting and fishing rules which take account of the conservation of such populations | No |
| | e) establishment of a system of licences for taking specimens or of quotas | No |
| | f) regulation of the purchase, sale, offering for sale, keeping for sale or transport for sale of specimens | No |
| | g) breeding in captivity of animal species as well as artificial propagation of plant species | No |
| | h) other measures | No |

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3.3 Hunting bag or quantity taken in the wild for Mammals and Acipenseridae (Fish)

a) Unit

| b) Statistics/ quantity taken | Provide statistics/quantity per hunting season or per year (where season is not used) over the reporting period | | | | | |
|---|---|---|---|---|---|---|
| | Season/ year 1 | Season/ year 2 | Season/ year 3 | Season/ year 4 | Season/ year 5 | Season/ year 6 |
| Min. (raw, ie. not rounded) | | | | | | |
| Max. (raw, ie. not rounded) | | | | | | |
| Unknown | No | No | No | No | No | No |

3.4. Hunting bag or quantity taken in the wild Method used

3.5. Additional information

## BIOGEOGRAPHICAL LEVEL

## 4. Biogeographical and marine regions

4.1 Biogeographical or marine region where the species occurs

**Marine Atlantic (MATL)**

4.2 Sources of information

Barbera, C., Bordehore, C., Borg, J.A., Glemarec, M., Grall, J., Hall-, J. M., De La Huz, Ch., Lanfranco, E., Lastra, M., Mooree, P.G., Mora, J., Pita, M.E., Ramos-Espla, A.A., Rizzo, M., Sanchez-Mata, A., Seva, A., Schembri, P.J., and Valle, C. 2003. Conservation and management of northeast Atlantic and Mediterranean maerl beds. Aquatic Conserv: Mar. Freshw. Ecosyst. 13: S65-S76

Barnes, R.S.K., Coughlan, J. and Holmes, N.J. 1973. A preliminary survey of the macroscopic bottom fauna of the Solent, with particular reference to Crepidula fornicata and Ostrea edulis. Proc Malacol Soc Lond 40 253-275.

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Bosence, D. & Wilson, J. (2003). Maerl growth, carbonate production rates and accumulation rates in the northeast Atlantic. Aquatic Conservation: Marine and Freshwater Ecosystems, 13, S21-S31.

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Manac'h, N. 1995. La biodeposition de la crepidule (Crepidula fornicata). lmpact sur l'ecosysteme de la rade de Brest. Rapport IFREMER-DEL no. 95-15.
Milford Haven Port Authority Dredging Strategy Document (Revision 2), June 2016, Anthony D. Bates Partnership LLP
MCCIP. 2017. Marine Climate Change Impacts: 10 years' experience of science to policy reporting. (Eds. Frost M, Baxter J, Buckley P, Dye S and Stoker B) Summary Report, MCCIP, Lowestoft, 12pp.doi: 10.14465/2017.arc10.000-arc
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RPS PTE. 2006. ROV Maerl Survey. South Hook. For Besix-Kier J.V. JER2580R200905JEv1.1. 20th September 2005.
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## 5. Range

| | | |
|---|---|---|
| 5.1 Surface area (km²) | 700 | |
| 5.2 Short-term trend Period | | |
| 5.3 Short-term trend Direction | | |
| 5.4 Short-term trend Magnitude | a) Minimum | b) Maximum |
| 5.5 Short-term trend Method used | | |
| 5.6 Long-term trend Period | | |
| 5.7 Long-term trend Direction | | |
| 5.8 Long-term trend Magnitude | a) Minimum | b) Maximum |
| 5.9 Long-term trend Method used | | |
| 5.10 Favourable reference range | a) Area (km²)<br>b) Operator<br>c) Unknown<br>d) Method | |
| 5.11 Change and reason for change in surface area of range | Improved knowledge/more accurate data<br>The change is mainly due to: | Improved knowledge/more accurate data |
| 5.12 Additional information | | |

## 6. Population

| | | |
|---|---|---|
| 6.1 Year or period | 2005-2017 | |
| 6.2 Population size (in reporting unit) | a) Unit | number of map 1x1 km grid cells (grids1x1) |
| | b) Minimum | 14 |
| | c) Maximum | 14 |
| | d) Best single value | 14 |
| 6.3 Type of estimate | Best estimate | |
| 6.4 Additional population size (using population unit other than reporting unit) | a) Unit | area covered by population in m2 (area) |
| | b) Minimum | |
| | c) Maximum | |
| | d) Best single value | 3690 |
| 6.5 Type of estimate | Best estimate | |
| 6.6 Population size Method used | Complete survey or a statistically robust estimate | |
| 6.7 Short-term trend Period | 2005-2018 | |
| 6.8 Short-term trend Direction | Decreasing (-) | |

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| | | |
|---|---|---|
| 6.9 Short-term trend Magnitude | a) Minimum | 91.7 |
| | b) Maximum | 91.7 |
| | c) Confidence interval | |
| 6.10 Short-term trend Method used | Complete survey or a statistically robust estimate | |
| 6.11 Long-term trend Period | | |
| 6.12 Long-term trend Direction | | |
| 6.13 Long-term trend Magnitude | a) Minimum | |
| | b) Maximum | |
| | c) Confidence interval | |
| 6.14 Long-term trend Method used | | |
| 6.15 Favourable reference population (using the unit in 6.2 or 6.4) | a) Population size<br>b) Operator<br>c) Unknown<br>d) Method | |
| 6.16 Change and reason for change in population size | Genuine change<br>Improved knowledge/more accurate data<br>The change is mainly due to: Genuine change | |
| 6.17 Additional information | | |

## 7. Habitat for the species

| | | |
|---|---|---|
| 7.1 Sufficiency of area and quality of occupied habitat | a) Are area and quality of occupied habitat sufficient (to maintain the species at FCS)? | No |
| | b) Is there a sufficiently large area of occupied AND unoccupied habitat of suitable quality (to maintain the species at FCS)? | No |
| 7.2 Sufficiency of area and quality of occupied habitat Method used | Complete survey or a statistically robust estimate | |
| 7.3 Short-term trend Period | 2005-2017 | |
| 7.4 Short-term trend Direction | Decreasing (-) | |
| 7.5 Short-term trend Method used | Complete survey or a statistically robust estimate | |
| 7.6 Long-term trend Period | 1978-2018 | |
| 7.7 Long-term trend Direction | Decreasing (-) | |
| 7.8 Long-term trend Method used | | |
| 7.9 Additional information | The maerl bed is ancient with a sample of fossil maerl collected from Stack Rock dating back to between 184 BC to 12 AD (Blake, 2005). The earliest records on marine recorder of maerl in the Milford Haven are from 1978 (South West Britain Sublittoral Survey) and then in 1985 (Oil Pollution Research Unit survey) Both these surveys recorded live maerl bed as being present in the wider bed area that is now dominated by dead maerl gravel. The cause of the loss in recent years is unclear and is thought to be a because of a combination of factors as discussed earlier (Section 7.1). | |

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## 8. Main pressures and threats

### 8.1 Characterisation of pressures/threats

| Pressure | Ranking |
|---|---|
| Other invasive alien species (other then species of Union concern) (I02) | H |
| Shipping lanes, ferry lanes and anchorage infrastructure (e.g. canalisation, dredging) (E03) | H |
| Agricultural activities generating marine pollution (A28) | H |
| Sports, tourism and leisure activities (F07) | M |
| Development and operation of energy production plants (including bioenergy plants, fossil and nuclear energy plants) (D05) | M |
| Industrial or commercial activities and structures generating marine pollution (excluding marine macro- and micro-particular pollution) (F21) | M |
| Land, water and air transport activities generating marine pollution (E07) | M |
| Mixed source marine water pollution (marine and coastal) (J02) | M |
| Residential or recreational activities and structures generating marine pollution (excl. marine macro- and micro-particular pollution) (F20) | M |

| Threat | Ranking |
|---|---|
| Other invasive alien species (other then species of Union concern) (I02) | H |
| Shipping lanes, ferry lanes and anchorage infrastructure (e.g. canalisation, dredging) (E03) | H |
| Sports, tourism and leisure activities (F07) | M |
| Development and operation of energy production plants (including bioenergy plants, fossil and nuclear energy plants) (D05) | M |
| Industrial or commercial activities and structures generating marine pollution (excluding marine macro- and micro-particular pollution) (F21) | M |
| Land, water and air transport activities generating marine pollution (E07) | M |
| Mixed source marine water pollution (marine and coastal) (J02) | M |
| Temperature changes (e.g. rise of temperature & extremes) due to climate change (N01) | M |
| Residential or recreational activities and structures generating marine pollution (excl. marine macro- and micro-particular pollution) (F20) | M |

### 8.2 Sources of information

### 8.3 Additional information

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## 9. Conservation measures

| | | |
|---|---|---|
| 9.1 Status of measures | a) Are measures needed? | Yes |
| | b) Indicate the status of measures | Measures needed but cannot be identified |
| 9.2 Main purpose of the measures taken | | |
| 9.3 Location of the measures taken | | |
| 9.4 Response to the measures | Long-term results (after 2030) | |
| 9.5 List of main conservation measures | | |

Management of professional/commercial fishing (including shellfish and seaweed harvesting) (CG01)

Other measures related to residential, commercial, industrial and recreational infrastructures, operations and activities (CF12)

Reduce impact of outdoor sports, leisure and recreational activities (CF03)

Reduce/eliminate marine pollution from agricultural activities (CA13)

Reduce/eliminate marine pollution from industrial, commercial, residential and recreational areas and activities (CF07)

Reduce/eliminate marine contamination with litter (CF08)

Management, control or eradication of other invasive alien species (CI03)

Adapt/manage fossil energy installation, facilities and operation (CC05)

9.6 Additional information

## 10. Future prospects

| | |
|---|---|
| 10.1 Future prospects of parameters | a) Range<br>b) Population<br>c) Habitat of the species |
| 10.2 Additional information | |

## 11. Conclusions

| | |
|---|---|
| 11.1. Range | |
| 11.2. Population | |
| 11.3. Habitat for the species | |
| 11.4. Future prospects | |
| 11.5 Overall assessment of Conservation Status | |
| 11.6 Overall trend in Conservation Status | |
| 11.7 Change and reasons for change in conservation status and conservation status trend | a) Overall assessment of conservation status<br>No change<br>The change is mainly due to: |

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b) Overall trend in conservation status

No change

The change is mainly due to:

11.8 Additional information

## 12. Natura 2000 (pSCIs, SCIs and SACs) coverage for Annex II species

12.1 Population size inside the pSCIs, SCIs and SACs network (on the biogeographical/marine level including all sites where the species is present)

a) Unit

b) Minimum

c) Maximum

d) Best single value

12.2 Type of estimate

12.3 Population size inside the network Method used

12.4 Short-term trend of population size within the network Direction

12.5 Short-term trend of population size within the network Method used

12.6 Additional information

## 13. Complementary information

13.1 Justification of % thresholds for trends

13.2 Trans-boundary assessment

13.3 Other relevant Information

# Distribution Map

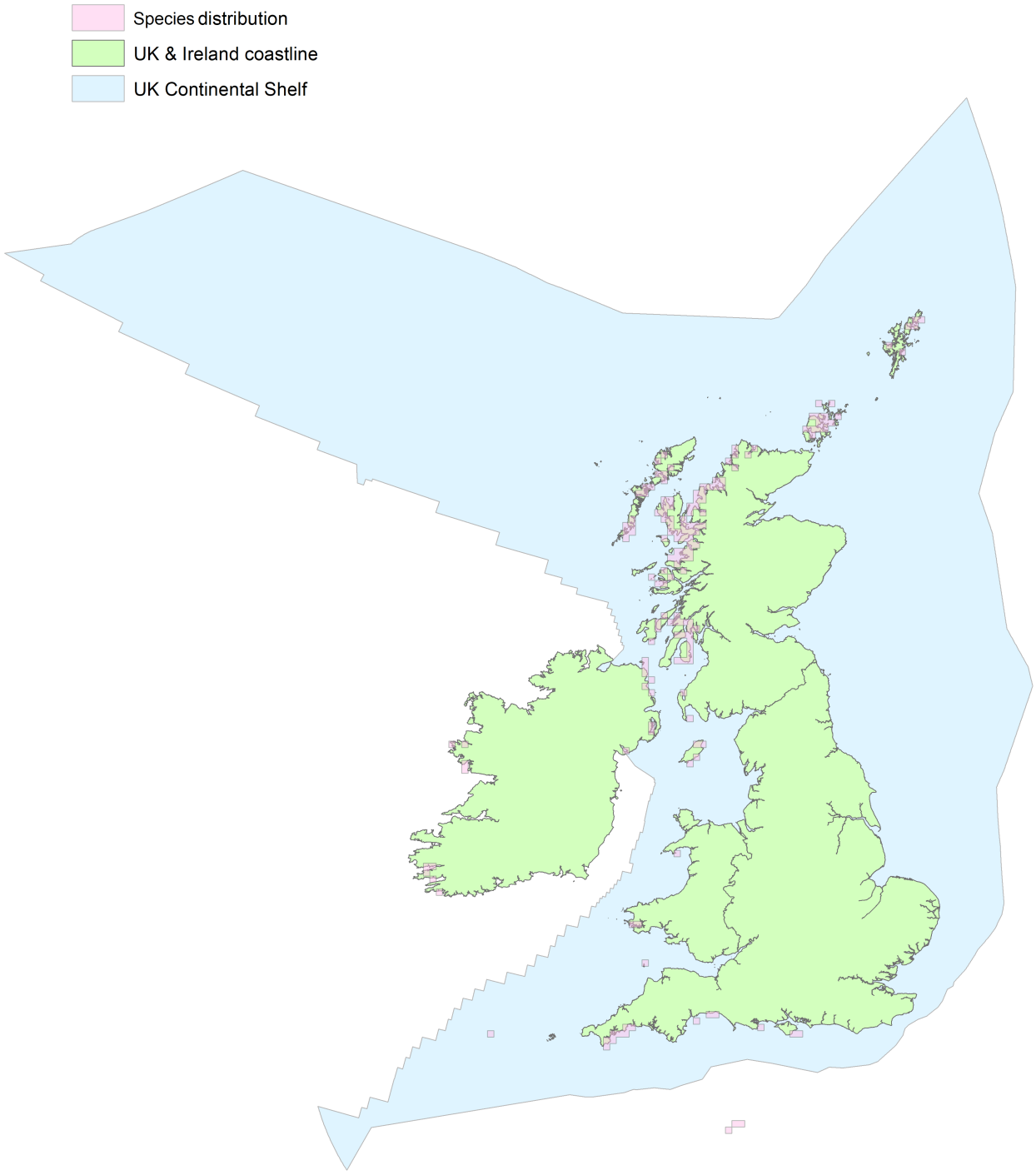


Figure 1: UK distribution map for S1377 - Maerl (*Phymatolithon calcareum*).

The 10km grid square distribution map is based on available species records within the current reporting period. For further details see the 2019 Article 17 UK Approach document.

# Range Map

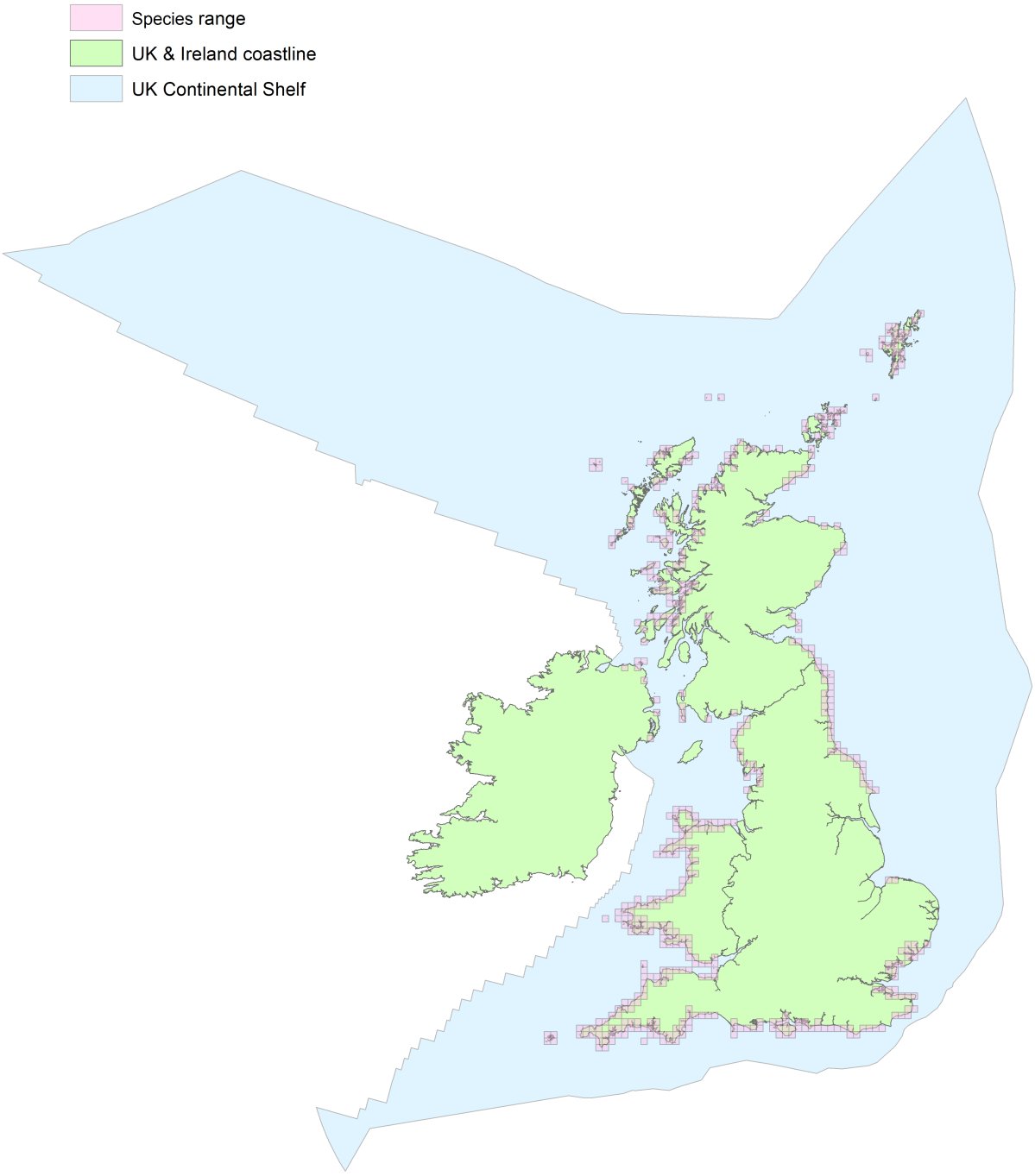


Figure 2: UK range map for S1377 - Maerl (*Phymatolithon calcareum*).

It is recognised that it is extremely difficult to distinguish maerl species without genetic testing and previous identification of UK maerl species in surveys may not be reliable. Therefore, all records of maerl species in UK waters were used to create the distribution map and range map. The number of 10x10km grid squares containing maerl records were used to calculate the range.

# Explanatory Notes

**Species name: Phymatolithon calcareum (1377)**

| Field label | Note |
|---|---|
| 2.4 Distribution map; Method used | The assessment is based on a complete survey in 2017 of the Milford Haven Maerl bed and historic data extracted from Marine Recorder. Some of the data points in Marine Recorder date back to 1995 and our confidence in these data being representative of the current situation are therefore low. Complete survey or a statistically robust estimate Systematic survey of maerl condition and distribution has only been undertaken of the maerl bed in Milford Haven. The 2017 drop down video and SCUBA diver surveys in 2016 are the best and most recent mapped distribution and therefore are used here. Records outside Milford Haven are incidental. The distribution map is based on records of live maerl from a) Marine Recorder derived point and grid layer (from JNCC) b) Drop down video (DDV) 2005 and 2017 survey (Bunker & Camplin 2007, Moore & Mercer, 2017) C) In situ SCUBA diver 2005-2008 (RPS 2006, RPS 2008), 2005 (Bunker & Camplin 2007), 2010 and 2016 (Bunker 2011, Bunker et al., in prep) |

**Species name: Phymatolithon calcareum (1377) Region code: MATL**

| Field label | Note |
|---|---|
| 5.11 Change and reason for change in surface area of range | The range and population are uncertain. The reported range is 700km2 which is a rise from the 600km2 reported in 2013. . This does not reflect a true change in range. This reporting round has included a marine recorder data point from 1995 that was missed in the previous assessment, and this has resulted in an additional 10x10km grid cell contributing towards the overall figure. Method used Surface area of Range: Estimate based on partial data with some extrapolation and/or modelling. The range is based on records of live maerl records from a) Marine Recorder derived point and grid layer (from JNCC) b) Drop down video (DDV) 2005 and 2017 survey (Bunker & Camplin 2007, Moore & Mercer, 2017) C) In situ SCUBA diver 2005-2008 (RPS 2006, RPS 2008), 2005 (Bunker & Camplin 2007), 2010 and 2016 (Bunker 2011, Bunker et al, in prep) Other Welsh records outside Milford Haven are based solely on (a). Mapping method is given in the GIS processing notes (Maerl Article17 GIS processing notes.doc). Systematic survey of maerl distribution has only been undertaken of the maerl bed in Milford Haven. |
| 6.3 Type of estimate | Method used Population size: 1km2 grid cells of maerl records based on a) Live maerl cover from DDV 2017 survey (Moore & Mercer, in prep) b) Marine Recorder data extract (1995 - 2005) The maerl biotopes used in the MR extraction were: * SS.SMp.Mrl - general maerl beds * SS.SMp.Mrl.Pcal - Phymatolithon calcareum biotope * SS.SMp.Mrl.Pcal.R - Phymatolithon calcareum subbiotope * SS.SMp.Mrl.Pcal.Nmix - Phymatolithon calcareum subbiotope * SS.SMp.Mrl.Lcor - Lithothamnion corallioides biotope * IMX.Lcor - previous classification but points still exist in Marine Recorder * IGS.Mrl - previous classification but points still exist in Marine Recorder * IGS.Phy.R - previous classification but points still exist in Marine Recorder IGS.Phy.HEc - previous classification but points still exist in Marine Recorder The two maerl species names were also included in the search conditions. |

| | |
|---|---|
| 6.4 Additional population size | Systematic drop down video in the Milford Haven in 2017 has enabled a robust value of 3,690km2 to be calculated for this bed. This figure can be directly compared with those reported in 2013 . This figure represents the area of live maerl (m2) within Wales' only known maerl bed (Milford Haven). It takes account of the density of live maerl on the ground - it does not represent the area within which live maerl is present. The area was calculated from DDV surveys undertaken in 2017 (Moore & Mercer, 2017), using a Voronoi/Thiessen process to assign an appropriate area to each data point. The area was then multiplied by the percentage cover of live maerl recorded at each point to provide an overall area of live maerl. Methods are given in the GIS processing notes (Maerl Article17 GIS processing notes.doc). Acknowledged problems: Problems encountered to provide population size estimation: Free-living nodules were best represented by % cover. There were some difficulties determining nodules as live maerl rather than dead maerl nodules that had been recolonised by encrusting coralline algae. In order to mitigate this problem good lighting, high resolution images and a large number of samples were collected so that a reasonable estimation of the covered by live maerl could be made. |
| 6.9 Short term trend; Magnitude | The value used here is the trend value for the Milford Haven maerl bed and is based on monitoring data (see method below 6.10). It should be noted that the deterioration of the maerl bed is supported by substantial deterioration of other monitored parameters such as infaunal diversity (number of taxa and abundance). (>7% per year since 2005) |

| | |
|---|---|
| 6.10 Short term trend; Method used | The Alternative Population (6.4) has been used to determine trends as opposed to the standard Population Size (6.2) as this alternative method is our best and most robust data. The short-term trend was determined by two separate repeat monitoring programmes. In situ fixed station monitoring data gathered by SCUBA divers between 2005 and 2016. Three spatially separate monitoring programmes cover this period: RPS monitoring during South Hook jetty refurbishments (winter of 2005 to summer 2008) (RPS 2008), CCW monitoring in 2005 and 2010 (Bunker 2011) and NRW monitoring in 2016 (Bunker et al., in prep). The monitoring programmes provide similar conclusions - declining live maerl, reductions in diversity and infauna. The CCW/NRW data covers stations widely spread throughout the bed, chosen to represent the variation in habitat, and also covers a longer temporal period. This has shown there has been a decline in the percentage cover of live maerl within the maerl bed. CCW diver monitoring between summer 2005 and summer 2010 showed that at the fixed monitoring stations there was an 83% decline in live maerl (2004-10 Maerl summary data.xls, some figures in Bunker 2011). RPS monitoring (in a limited part of the bed) showed a 46% decline between start and finish (winter 2005 to summer 2008). Removing seasonality from the RPS data by comparing winter to winter (2005-2007) and summer to summer (2006-2008) gives a loss of about 23% & 9% respectively over the two year periods. It is of note that substantial changes occurred in the maerl bed between winter 2005 and winter 2006. During this period, the refurbishment works on South Hook jetty really got underway (RPS 2008) and in 2006 there was the highest level of dredging activity (232,227 m3 volume dredged) in the Milford Haven since 1985. Almost half of this quantity is from Valero maintenance dredging (106,273 m3) with an additional 31,888 m3 from South Hook channel capital dredge campaign. It should be noted that the deterioration of the maerl bed is supported by substantial deterioration of other monitored parameters such as infaunal diversity (number of taxa and abundance).The NRW diver survey in 2016 (Bunker et al., in prep) shows that at the two sites with the most maerl, the average percentage live maerl had declined at site 478 from 36.7% to 1.1% and at site 624 from 22% to 1.9%. The in situ diver monitoring (RPS 2006, RPS 2008, Bunker & Camplin 2007, Bunker 2011, Bunker et al., in prep) represents estimated percentage cover in 50x50 cm quadrats within the maerl bed sampled in 2005, 2010 and 2016. 36 samples from 6 stations spread across the habitat variation within the bed were considered sufficient to generate a robust estimate of change in % cover of live maerl. In addition to the diving surveys, there has been a second monitoring programme using ROV/ drop down video to collect data samples of percentage cover of live and dead maerl across the whole Milford Haven bed. (RPS PTE, 2006; Bunker and Camplin, 2007 ; Moore and Mercer, in prep). The 2005/6 surveys combined DDV at mostly 50 metre intervals with ROV at mostly 10 metre intervals. Approximately 2500 data samples were gathered, providing a high level of confidence in the maerl bed extent and distribution/abundance of live maerl. Data sampling continued beyond the apparent outer extent of the bed for another 100 meters, providing a high level of confidence in the outer extent boundary. The 2017 surveys repeated the drop down video elements of this survey with sample points spaced and approximately 60 intervals with approximately 700 survey stations. For both the 2006 and 2017 surveys, the area was calculated from DDV surveys, using a Voronoi/Thiessen process. This is a standard method which partitions a surface into regions/polygons based on the distance between points. The area of each polygon was then multiplied by the percentage cover of live maerl recorded at each point and summed to provide an overall area of live maerl. Using this method, the area covered by live maerl in 2005 (figure reported in 2013) was calculated to be 44,455m2 and in 2016 is 3,690m2. This is a 91.7 percent reduction in cover. The following table does not need to be submitted into the JNCC spreadsheet. Although the area supporting live maerl (0.356km2) is similar to the area calculated in 2013 (0.360 km2), and the area containing live and dead maerl gravel (1.35km2) is similar to that calculated in 2013 value (1.30 km2), the population figures set out in section 6.4 clearly indicate that the quality of this area has |

| | |
|---|---|
| | dramatically decreased. |
| 6.11 Long term trend; Period | No long-term trend data available |
| 6.17 Additional information | The change is considered to be genuine as it is based on drop down video survey data gathered from 2005 to 2018 and supported by recent dive survey work gathered in 2016 which also shows a decline in live maerl abundance as well as substantial decreases in other maerl bed species (e.g. infauna). The reason for this change is not fully understood as the studies cannot show causality. Other studies, however, have shown that maerl is very susceptible to increased levels of suspended sediments, particularly fine organic sediments. (Wilson et al, 2004). These types of suspended sediments can be associated with resuspension from dredging activities, sewage outfalls, bottom trawling fisheries [not currently occurring in the Milford Haven], aquaculture and the presence of the Crepidula fornicata, whose faeces and pseudofaeces can have devastating effects where they exist in high densities, such as has been recorded on Breton maerl beds (Grall and Hall-Spencer, 2003). |

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| 7.1 Sufficiency of area and quality of occupied habitat | - area = No (0.356km2 with live maerl) The quality of the remaining habitat in the Milford Haven bed is unlikely to be of sufficient quality and area to maintain the species, and thus the feature, in the long-term. The surface area of habitat represents the area of sea bed within which live maerl has been recorded as present in the NRW Milford Haven maerl bed survey in 2017 (Moore and Mercer, in prep). -quality = not sufficient quality Quality of the habitat is given as insufficient in light of: - The decline in maerl abundance and substantial decline in the condition of the beds' associated species (e.g. infauna) (RPS 2008, Bunker 2011, Moore and Mercer, in prep, Bunker et al., in prep), - Diver surveys showing an increase in abundance of the non-native Slipper Limpet Crepidula fornicata. (Moore and Mercer, in prep, Bunker et al., in prep), - Diver core samplesing an increase in proportion of fine particles in the surface sediments within the areas which historically had the most live maerl. (Bunker et al., in prep) A number of factors may have influenced the quality of the maerl bed: Increase in sediment deposition, likely due to a combination of factors including: * Presence of non-native Slipper Limpet Crepidula fornicata. * Changes in weather patterns - greater flash flooding; increases in wind/storminess * Agricultural practices (Eckard et al., 2017) * Capital and maintenance dredging operations (Milford Haven Dredging Strategy (Revision 2). Milford Haven Port Authority, 2016) - A large jetty construction running through the maerl bed and impacts associated with jetty construction, refurbishment and maintenance including substantial physical impacts from marine plant and vessel prop wash, and contamination from discharges and shot blasted jetty pile coatings. - Maerl has been shown to tolerate heavy metal pollution (Wilson et al., 2004). However, the bed is within a WFD coastal water body failure Cycle 2 2015 and this could contribute to deterioration in quality, in combination with other pressures. Overall status Moderate. Failure for: * Chemistry - Fail. Annexe 10: Mercury and its compounds - Fail (Confidence - very certain). * Ecological status - Moderate. Dissolved Inorganic Nitrogen - Moderate (Confidence - very certain) Changes in estuary water quality including high levels of nutrients (nitrogen in particular) which can cause excessive growth of opportunistic macro algae leading to eutrophication. The increase in nutrients are most likely due to urbanisation in the catchment, agricultural intensification and industrialisation of the Milford Haven (Edwards, 2014). Overall = No b) If NO, is there a sufficiently large area of occupied & unoccupied habitat of suitable quality (to maintain the species at FCS)? NO No, it is unlikely that the remaining area in the Milford Haven is of suitable quality because of the reasons stated in 7.1. sufficient occupied = No (see 7.2a) sufficient unoccupied = No (0.99km2 with dead Maerl gravel(1.3459-0.356km2)) Overall = No (1.35km2- with live and dead maerl) The value represents the combined area of seabed supporting presence of live maerl and the area of maerl derived gravel, comprising the Milford Haven maerl bed, as estimated from the recent 2017 drop down video. Although it is considered that the area of 1.35km2 is of adequate size, this is not now of sufficient quality to maintain the species in the long-term. |

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| 7.2 Sufficiency of area and quality of occupied habitat; Method used | As described in Section 6.4, the surveys using ROV/drop down video to collect data samples of percentage cover of live and dead maerl across the whole Milford Haven bed can be used to show the extent of dead maerl as well as live maerl. (RPS PTE, 2006; Bunker and Camplin, 2007; Moore and Mercer, in prep). The 2005/6 surveys combined DDV at mostly 50 metre intervals with ROV at mostly 10 metre intervals. Approximately 2500 data samples were gathered, providing a high level of confidence in the live maerl and dead maerl gravel bed extent. Data sampling continued beyond the apparent outer extent of the bed for another 100 meters, providing a high level of confidence in the outer extent boundary. The 2017 surveys repeated the drop down video elements of this survey with sample points spaced at approximately 60 intervals resulting in a grid of approximately 700 survey stations in total. For both the 2006 and 2017 surveys, the area calculations were derived from DDV survey points, using a Voronoi/Thiessen process. This is a standard method which partitions a surface into regions/polygons based on the distance between points. Percentage cover of live and dead maerl was assessed at each point from the drop down video image. This was then multiplied by the area of the Voronoi polygon. It shows the overall area in which the live and dead maerl is present. The area covered with dead maerl indicates there were historically suitable conditions to support the growth and development of maerl. Presumably if conditions were perfect the hydrodynamic regime in this area would support the maerl to maintain a thriving bed. The dramatic reduction in cover of live maerl in the last 12 years is a clear indication that the conditions no longer enable the maerl to thrive.The area of seabed containing maerl derived gravel, as estimated from the recent 2017 drop down video. When this is combined with the area of live maerl it totals an area of 1.35km2. |
| 7.4 Short term trend; Direction | Although the area supporting live maerl (0.356km2) is similar to the area calculated in 2013 (0.360 km2), and the area containing live and dead maerl gravel (1.35km2) is similar to that calculated in 2013 value (1.30 km2), the population figures set out in section 6.4 clearly indicate that the quality of this area has dramatically decreased. |
| 7.5 Short term trend; Method used | The area statistics have been calculated from DDV and ROV surveys undertaken in 2004 & 2005 and a repeated survey in 2017. This has been complemented by a separate in situ survey made by SCUBA divers in 2005, 2010 and 2016 (RPS 2006, RPS 2008, Bunker 2011, Bunker et al, in prep). Together these assessed maerl cover, quality, sediment characteristics and associated species including the non-native Slipper Limpet Crepidula fornicata. |

8.1 Characterisation of pressures/ threats

The identified pressures and threats set out here relate predominantly to those affecting the maerl bed in Milford Haven, which is the main location of maerl in Welsh waters. They are based on human activities that do, and will probably continue to, interact with the maerl bed in Milford Haven and also encompas recorded and/or reported changes in environmental conditions that are relevant to maerl growth and survival in Milford Haven. All pressures identified are supported by formal record, observation, primary or grey literature. I02 Other invasive alien species (other than species of Union concern), (Pressure: H, Threat: H). The presence of Slipper Limpet Crepidula fornicata in the maerl bed has increased dramatically since 2005. It is one of the factors thought to be responsible for increased silty fine particle fraction of the seabed sediment. Crepidula 'reefs' trap silt, reduce particle resuspension and speed up sedimentation rates (Barnes et al., 1973). Active pumping during feeding leads to biodeposit sedimentation rates faster than that of other suspended matter (Haven and Morales-Alamo 1968 and Sorin, 1981 cited by Chauvaud et al. 2000). Studies by (Manac'h, 1995) showed that biodeposition by Crepidula leads to sediment organic enrichment and Chauvaud et al. (2000) discuss how the increased biodeposition leads to increased diatom production on the sediment which is food for both herbivores and surface deposit feeders. Grall and Hall-Spencer (2003) describe how live maerl thalli become covered in Crepidula and the interstices in the maerl sediments become clogged with silt, killing maerl thalli and dramatically altering the associated maerl communities. Wilson et al. (2004) demonstrated, using experimental techniques, that a major hazard for live maerl and the rich communities that depend on them is the smothering by fine sediment. Maerl is particularly sensitive to increases in siltation and therefore the presence of Crepidula in the bed is ranked as both a high pressure and and threat (due to the high likelihood of the current Crepidula population increasing in the future) E03 Shipping lanes, ferry lanes and anchorage infrastructure (e.g. canalisation, dredging), (Pressure: H, Threat: H). Milford Haven is a busy commercial deep water port. The maerl bed is subject to raised water turbidity and silt deposition which are thought to be partly due to capital and maintenance dredging operations. The maerl bed is situated adjacent to areas that have been previously dredged. The Milford Haven Dredging Strategy document (Revision 2) 2016, indicates that according to their multibeam surveys in the region of South Hook there has only been a very small build up in areas above 10m. Multibeam, however, is not a sensitive tool for measuring the sort of changes in sediment composition that would affect the survival of maerl and a small build up may be of significance. The maerl bed is bisected by a large jetty that was refurbished between 2005-2008. This resulted in impacts on the bed, some of which are evident on the CCW side scan data (2009), for example foot print depressions from jack-up barges and deposition of other construction material. Other impacts included: the deposition of contaminated material - coal tar coverings of piles were shot blasted and this highly toxic material entered the sea below the jetty - the long-term consequences of this are unknown; Large LNG vessels berth at the end of the jetty, adjacent to the bed and a small boat passage concentrates small vessel traffic in shallow water over the northern edge of the bed. The propeller wash from these vessels manoeuvring under the jetty in the shallow water has caused localised deterioration of the bed. A28 Agricultural activities generating marine pollution, (Pressure: H, Threat: H). Although there are many substantial discharges to the estuary including from sewage treatment works (F20), the petrochemical industry (F21) and energy production industry (D05), nutrient loading from agricultural runoff and inappropriate use does represent a significant input where nutrient loading is already high This can lead to algal blooms, causing a reduction in dissolved oxygen and raised levels of anoxia. This has the potential to disrupt complex food chains in the system, disrupting the delicate balance between invertebrate populations, biomass, waterfowl populations, sediment flats and salt marsh structure, function and community structure (Edwards, 2014). F07 Sports, tourism and leisure activities (Pressure: M, Threat: M). Anchoring impacts from recreational craft, largely anglers. A voluntary management

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| | measure to exclude anchoring within the maerl bed has been established but its effectiveness is as yet unknown (lack of compliance monitoring). F20 Residential or recreational activities and structures generating marine pollution (excl. marine macro- and micro-particular pollution), (Pressure: M, Threat: M). Substantial discharge from Sewage Treatment plants elevate the levels of nutrients significantly in the Milford Haven where nutrient levels are already high. This contributes to elevated levels of eutrophication (including increased plankton and epiflora resulting in reduced light and increased siltation). D05 Development and operation of energy production plants (including bioenergy plants, fossil and nuclear energy plants), (Pressure: M, Threat: M). The effluent from the 2000 megawatt Pembroke Power Station contributes to elevated levels of eutrophication (including increased plankton and epiflora resulting in reduced light and increased siltation). This may affect species distribution as well as contributing to elevated levels of eutrophication (including increased plankton and epiflora resulting in reduced light and increased siltation). F21 Industrial or commercial activities and structures generating marine pollution (excluding marine macro- and micro-particular pollution), (Pressure: M, Threat: M). The 2000 megawatt Pembroke Power Station uses 'once through' cooling water extracted from the Milford haven, raising the ambient temperature of the discharged water by 8 degrees Celsius. This causes an increase in ambient temperature across the whole of the Milford Haven Waterway. This may affect species distribution as well as contributing to elevated levels of eutrophication (including increased plankton and epiflora resulting in reduced light and increased siltation). There has been deposition of construction material from the jetty refurbishment works directly on the maerl bed previously. Shot blasting of piles has led to contaminated material being deposited onto the maerl bed. In addition to this, there are a large number of industrial structures in the area surrounding the Milford Haven that, if left abandoned, could potentially result in a pollution incident, which contributes to the threat ranking in this assessment. E07 Land, water and air transport activities generating marine pollution, (Pressure: M, Threat: M). This pressure and threat relates to general pollution in the busy industrialised part of the Milford Haven where there are many activities operating closely together. This includes minor spills or discharge of petrochemicals and other chemicals from vessels. J02 Mixed source marine water pollution (marine and coastal), (Pressure: M, Threat: M). General mixed source pollution through general industrialisation of the area surrounding the Milford Haven. WFD chemical failure (Mercury). A threat of major oil spills such as the Sea Empress disaster (which was berthed following the spill at the head of the jetty that bisects the maerl bed) and significant oil industry catastrophic failures and leaks. Input of contaminated waste from jetty refurbishment works. N01 Temperature changes (e.g. rise of temperature & extremes) due to climate change, (Pressure: none, Threat: M). Thermal effects as a consequence of climate change are likely to be indirect (e.g. through plant growth, shading, silt deposition and anoxia). Water quality is dependent on levels of precipitation (e.g. silt and other agricultural/urban runoff and SWOs). Changes in wave energy (storminess) are likely to change the habitat suitability since the area is exposed to south west swells. Potential effects of ocean acidification on maerl is unknown, but the structure of maerl is carbonate based. Rises in sea level will reduce light levels to the maerl. |
| 9.1 Status of measures | Whilst some measures have been taken to address the issues, further interventions are needed but the mechanisms have not been resolved, and in reality, many of the issues are not yet understood. |

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| 9.5 List of main conservation measures | CG01 Management of professional/commercial fishing (including shellfish and seaweed harvesting) Dredging for scallops in Milford Haven is now banned under the Scallop Fishing (Wales) (No.2) Order 2010 but was known to occur on the maerl bed in the past (e.g. in 2008 towards the end of the jetty construction). This Order bans all scallop fishing using towed gear within 1nm of the Welsh baseline through the whole of Wales. This includes all areas with maerl records. This is a positive step and will reduce direct physical impact to any pockets of maerl that remain around the Welsh coast and particularly to the main bed in the Milford Haven. Scallop Fishing (Wales) (No.2) Order 2010 http://www.legislation.gov.uk/wsi/2010/269/made CF03 Reduce impact of outdoor sports, leisure and recreational activities A voluntary 'no anchoring' zone in the Milford Haven over the maerl bed has been agreed in order to reduce the direct physical impact that anchoring on the seabed has. This is a positive step and is supported by NRW. A Voluntary Agreement for the Protection of Sensitive Habitat Zones of Subtidal Seagrass and Maerl in Milford Haven between Milford Harbour Users Association (MHUA) and Pembrokeshire Marine Special Area of Conservation (SAC) Relevant Authorities Group (RAG) http://www.pembrokeshiremarinesac.org.uk/english/special/voluntary_sensitive_habitat_protection_zones.htm CF12 Other measures related to residential, commercial, industrial and recreational infrastructures, operations and activities CC05 Adapt/manage fossil energy installation, facilities and operation Changes to dredging methodology have been implemented in order to reduce the environmental impacts associated with dredging in the Milford Haven. There is a restricted regime in place to control overflow of hopper during dredging in place when dredging material with a fine sediment composition. This reduces the input of highly turbid water overflowing from dredging vessels. This is a positive to reduce the impact of dredging and is welcomed by NRW. Milford Haven Port Authority Dredging Strategy Document (Revision 2), June 2016, Anthony D. Bates Partnership LLP CA13 Reduce/eliminate marine pollution from agricultural activities Thematic Action Plan: Diffuse Water Pollution - Investigation, Direct Management and Management Agreements (incl Glastir) are the main mechanisms to manage diffuse water pollution: Raise the profile of breaches in cross-compliance affecting N2K habitats and features (terrestrial, freshwater and marine) and target compliance monitoring. Risk assessments to be carried out on catchments of N2K sites which have high priority diffuse pollution issues/risks and which are failing under the WFD. Examples of new or improved mechanisms may include: - Small-scale standalone capital grant scheme to address diffuse pollution issues. - Development of nutrient management initiatives. - Training for farmers/landowners regarding reducing diffuse pollution, waste management and farm nutrient budgeting. - Catchment level Rural Sustainable Drainage Systems pilot projects. CF07 Reduce/eliminate marine pollution from industrial, commercial, residential and recreational areas and activities Implementation and enforcement of water quality regulation (both marine and freshwater) is ongoing work and is making gains in improving water quality. Management of the wider countryside including the implementation of the River Basin Management Plans by NRW and EA (cross boarder catchments) is also contributing to improvements (NRW 2015). Shared multi-agency pollution response plans to deal with major incidences are in place and are regularly updated. CF08 Reduce/eliminate marine contamination with litter Implementation and enforcement of water quality regulation (both marine and freshwater) is ongoing work and is making gains in improving water quality. Evidence from the NRW Actions Database, the Priority Improvement Plans (PIPs) and Site Management Reports have been used to develop Thematic Action Plans to address a number of pressures and threats to Natura sites in Welsh waters including litter. CI03 Management, control or eradication of other invasive alien species Thematic Action Plan: Invasive Species and Pathogens - Improve awareness of, and compliance with, good biosecurity practices and training amongst NRW staff and contractors e.g. cleaning of boots/tools/vehicles at entry points to N2K sites. Ensure all NRW staff use bilingual biosecurity e-learning resource. Gather evidence on the presence and |

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| | distribution of invasive non-natives species within sites, and the activities associated with the vectors of spread. There would also be a need to investigate pathways. Marine INNS Pathway Management in Wales will help deliver the above. |
| 10.1 Future prospects of parameters | Given that there are multiple complex issues affecting this species with a lot of uncertainty surrounding the causes of its decline, and the very slow growing nature of the maerl, the opinion is that there is a significant risk that the only maerl bed in Welsh waters will ultimately be lost. As a result we consider the future prospects of Range to be very negative |