

Red List of Ecosystem assessment series

Produced by JNCC and NatureScot, supported by Natural Resources Wales, Natural England, and Northern Ireland Environment Agency.

This resource is one in a series/number of Ecosystem Red List assessments developed to accompany the UK Biodiversity Indicator '[Red List of Ecosystems](#)'. The assessments are available at: <https://jncc.gov.uk/resources/7b922dfc-708b-4c8c-9e6a-e2040447fb39>.

Resilient ecosystems are crucial for preventing biodiversity loss and species extinction. Maintaining healthy ecosystems safeguards the essential services they provide, which are fundamental to human well-being and a thriving economy. However, pressures and threats such as deforestation, overfishing, or climate change, can disturb the balance of ecosystems and threaten their health and functioning. Assessing the level of threat facing ecosystems is important in helping us understand the current status of the environment, and on a practical level, assessments can be used to help prioritise conservation funding decisions and where to take conservation management action on the ground.

The 'Red List of Ecosystems' (RLE) is a global assessment approach set out by the International Union on Conservation of Nature (IUCN). The approach includes consideration of a series of criteria, including change in geographic distribution through time; whether the ecosystem distribution is geographically restricted; evidence for any environmental degradation; and disruption to biotic processes or interactions. We have not carried out the quantitative analyses of the probability of ecosystem collapse necessary to assess criterion E as we do not have the data needed to carry out such analyses consistently. The IUCN methodology is widely used as a robust approach to assessing the status of ecosystems. Further details of the criteria used in these assessments are available on the [IUCN portal](#).

This assessment series sets out the RLE assessment conclusions for ecosystems found in the UK, alongside the details of how the assessment was made, including for each IUCN component criterion. The assessments have been peer-reviewed, and source data is referenced. Once complete, the series will cover the full range of natural and seminatural habitats that occur in the UK, throughout marine, terrestrial and freshwater environments.

Assessments are conducted according to the [Global Ecosystem Typology Level 3](#) (Ecosystem Functional Groups). This enables the assessments to feed into the Kunming-Montreal [Global Biodiversity Framework](#) (GBF) headline indicator A.1 Red List of Ecosystems. This indicator, which has been incorporated into the UK Biodiversity Indicator suite, is designed to measure progress against [Goal A](#) ('Protect and restore') and [Target 1](#) ('Plan and manage all areas to reduce biodiversity loss') of the GBF.

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M1.10 Rhodolith/ Maerl beds

1. Key facts

Ecosystem description: Maerl beds are formed by unusual red seaweeds with hard chalky skeletons that grow in different forms, either as small, rounded nodules or short, branched twig-like shapes (sometimes termed ‘thalli’ or ‘rhodoliths’). At high abundance, these nodules and twigs form loosely interlocking carpets which creates a complex 3D structural habitat. Maerl beds support diverse communities of burrowing infauna, especially bivalves, and invertebrates; including suspension feeding polychaetes and echinoderms.



Image credits: (Left to right) Loch Ailort, Sound of Arisaig © Graham Saunders/ NatureScot; Caol Scotnish Rapids, Loch Sween MPA, Graham Saunders © Marine Scotland; Sound of Barra © Ben James/ NatureScot.

Overall assessment conclusion: Vulnerable (VU) based on criteria B1b, C2b, and D2b.

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Corresponding habitat classifications:

The following habitats were considered in the production of this assessment:

EUNIS codes: [MB322](#), [MB421](#), [MB622](#), [MC3214](#)

UK Marine Habitat Classification:

Maerl beds [SS.SMp.Mrl](#)

Lithothamnion corallioides maerl beds on infralittoral muddy gravel [SS.SMp.Mrl.Lcor](#)

Lithophyllum fasciculatum maerl beds on infralittoral mud [SS.SMp.Mrl.Lfas](#)

Phymatolithon calcareum maerl beds with red seaweeds in shallow infralittoral clean gravel or coarse sand [SS.SMp.Mrl.Pcal.R](#)

Phymatolithon calcareum maerl beds in infralittoral clean gravel or coarse sand [SS.SMp.Mrl.Pcal](#)

Lithothamnion glaciale maerl beds in tide-swept variable salinity infralittoral gravel [SS.SMp.Mrl.Lgla](#)

Phymatolithon calcareum maerl beds with *Neopentadactyla mixta* and other echinoderms in deeper infralittoral clean gravel or coarse sand [SS.SMp.Mrl.Pcal.Nmix](#)

Neopentadactyla mixta in circalittoral shell gravel or coarse sand [SS.SCS.CCS.Nmix](#)

2. Assessment against IUCN criteria

Criterion A: Reduction in geographic distribution

Criterion A considers reduction in geographic distribution over ANY of the defined time periods for criteria A1, A2a, A2b or A3. For details of time periods and criteria see [IUCN Red List of Ecosystems Criteria Summary Sheet 2.2 EN.pdf](#)

Five species of maerl have been recorded in UK waters (Simon-Nutbrown et al., 2020; Jenkins et al., 2021). These are extremely difficult to distinguish without genetic testing (Jenkins et al., 2021) and are therefore considered together as maerl bed habitat. Although maerl beds can be found throughout the UK waters, Scottish waters support most of the beds in the UK and account for approximately 30% of the maerl beds in north-west Europe (Hall-Spencer *et al.*, 2010; Natural England, 2019; OSPAR, 2019; Daera, 2024; NatureScot, 2025, NRW, 2025). Maerl beds develop on coarse clean sands and gravels either at the open coast or in tide-swept channels to a depth of about 25 m. There are occasional records from muddier sediments e.g. Loch Torridon and in deeper waters e.g. Shetland.

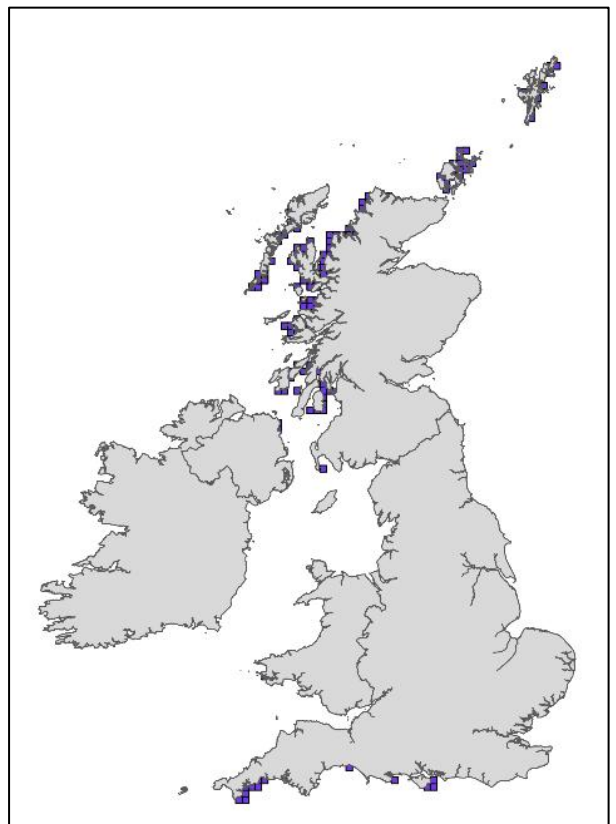
Least concern (LC) – There is no evidence to indicate there has been a decline in the geographic distribution of maerl beds in UK waters. It should be noted however that maerl beds have not been fully mapped.

Criterion B: Restricted geographic distribution

Criterion B considers restricted geographic distribution indicated by ANY of the time periods for criteria B1, B2 or B3. For details of time periods and criteria see [IUCN Red List of Ecosystems Criteria Summary Sheet 2.2 EN.pdf](#).

Maerl beds have a globally restricted distribution. The total extent in the UK is estimated to be 91 km² (Mountford et al., 2025). Accumulations of maerl are considered a bed where there is at least 20% coverage of dead or live maerl thalli. The 20% cover of maerl substrates has to extend over an area of at least 5 m x 5 m (25 m² – whether continuous or in discrete patches / rows). Areas of the seabed where the substrate is made up of broken maerl gravel may also be considered maerl beds, albeit degraded ones, when there is at least 5% cover of live maerl material >1 cm in size.

There has been a long-term decrease in the habitat extent. This is related to known declines in the some maerl beds and declines in condition due to impacts affecting the area of 'live' maerl habitat (e.g. Moore et al., 2013; Moore 2014a, 2014b; Natural England, 2019; OSPAR, 2019; Scottish Government, 2021; NatureScot, 2025; NRW, 2025). As a result, 26.3% of maerl bed extent is considered to be in a poor condition, 38.2% in a good condition and 35.5% in an unknown condition.



B1b Vulnerable (VU) – The known extent of maerl beds in UK waters is extremely restricted, with declines in extent and poor condition recorded in some beds, whilst others are in a good condition.

Criterion C: Environmental degradation

Criterion C considers environmental degradation over ANY of the time periods for criteria C1, C2a, C2b or C3. For details of time periods and criteria see [IUCN Red List of Ecosystems Criteria Summary Sheet 2.2 EN.pdf](#).

Maerl beds are extremely slow growing (0.2-1.5mm per year) and extensive beds may be 1000s of years old, and individual maerl thalli may live for >100 years (Foster, 2001; Blake and Maggs, 2003; Burdett et al., 2011; Perry et al., 2024). As a result, maerl beds are highly sensitive to physical disturbance, particularly in the form of abrasion and habitat removal / change, siltation, organic enrichment and changes in water flow (Hall-Spencer & Moore, 2000; Wilson *et al.*, 2004; OSPAR 2019; Perry et al., 2024). Activities associated with these pressures include bottom-contacting fishing, aquaculture and coastal development (Hall-Spencer *et al.*, 2006; Mazik *et al.*, 2015; OSPAR, 2019; Legrand et al., 2024). For example, a review of historic data on the west coast of Scotland revealed extensive damage to maerl beds over the last 100 years (OSPAR, 2010).

Maerl beds may also be vulnerable to future climate impacts associated with sea temperature rise, marine heatwaves, and ocean acidification, with likely knock-on effects on community composition and function (Martin & Hall-Spencer, 2017; MCCIP, 2018; Qui-Minet et al., 2019; Simon-Nutbrown et al., 2020). Changes in circulation, oxygenation, salinity, increased run-off and increased storminess may also have an impact.

C2b Vulnerable (VU) – There is evidence of extensive historical abiotic damage to maerl beds and climate change is expected to impact them in the future.

Criterion D. Disruption of biotic processes or interactions

Criterion D considers Disruption of biotic processes or interactions over ANY of the time periods for criteria D1, D2a, D2b or D3. For details of time periods and criteria see [IUCN Red List of Ecosystems Criteria Summary Sheet 2.2 EN.pdf](#)

Maerl is an ecosystem engineer, creating a complex 3D structural habitat that greatly increases the local biodiversity and provides an important habitat for key commercial species. If maerl is removed, fragmented or killed then it has almost no ability to recover (Perry & Tyler-Walters, 2018). Very little is understood about maerl reproduction, but it appears there is limited sexual reproduction and poor dispersal (Pardo et al., 2019). Where live maerl does remain, recoverability after damage is severely limited by the slow growth rates (Mazik *et al.*, 2015; Perry et al., 2024). If the maerl is killed but dead maerl substrates remain, then the associated benthic community may partially recover within 2-10 years (Perry et al., 2024; Purdue et al., 2025).

D2b Vulnerable (VU) – historically maerl beds were mined, although this practice is no longer permitted, and whilst some fisheries measures are in place to protect maerl beds from damage, further measures are required and will be consulted upon in the near future.

Conservation measures in place

Maerl beds are listed as an OSPAR threatened and/or declining habitat (OSPAR, 2008, 2019). In the UK, maerl beds are protected within the protected sites network either as a feature in their own right or as a component of 'Sandbanks which are slightly covered by sea water all the time' or 'Large shallow inlets and bays'. Currently there are 12 Marine Protected Areas (MPAs) which protect maerl. These are:

- Luce Bay and Sands Special Area of Conservation (SAC)

- Loch nam Madadh SAC
- Sound of Arisaig (Loch Ailort to Loch Ceann Traigh) SAC
- Loch Laxford SAC
- Fetlar to Haroldswick Nature Conservation MPA (NCMPA)
- Loch Sween NCMPA
- South Arran NCMPA
- Wester Ross NCMPA
- Wyre and Rousay Sounds NCMPA
- Loch Carron NCMPA
- Red Bay SAC
- Pembrokeshire Marine SAC

Site-specific Conservation Objectives, information on pressures and threats, and details of the habitats and species are contained within the Conservation and Management Advice packages. Most human activities with the potential to have adverse effects on protected sites, such as construction and dredging, are managed through a licensing and consents process. For fishing activity, management measures have been implemented in a number of protected areas with maerl habitats.

Additionally outside of MPAs, potential impacts are considered on Priority Marine Features (PMFs) which include maerl beds (<https://www.snh.scot/professional-advice/safeguarding-protected-areas-and-species/priority-marine-features-scotlands-seas>). This includes consideration through Environmental Impact Assessments. Policy GEN 9 on the *Natural Heritage* in Scotland's National Marine Plan (Marine Scotland, 2015) requires that development and use of the marine environment must not result in a significant impact on the national status of PMFs. Scotland's National Marine Plan is currently being updated. Fisheries management measures are currently being explored in Scotland for the remaining MPAs in the network, as well as a suite of proposed PMF management areas identified for maerl and other sensitive seabed habitats.

Reducing the pressures associated with human activities is considered the most effective method of increasing the resilience of maerl beds to potential climate change impacts (MCCIP, 2018).

Overall assessment conclusion

Rhodolith/ Maerl beds in the UK are assessed as being Vulnerable (VU) based on criteria B1b, C2b and D2b.

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