

# 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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# M1.4 Shellfish Beds and Reef

## 1. Key facts

**Ecosystem description:** This ecosystem encompasses blue mussel beds (*Mytilus edulis*), horse mussel beds (*Modiolus modiolus*), native oyster reefs (*Ostrea edulis*) and flame shell beds (*Limaria hians*). These habitats are structurally complex, playing an important role in benthic productivity and seabed stabilisation, as well as supporting diverse benthic communities.

This assessment is compiled from individual species level RLE assessments for blue mussel beds, horse mussel beds, native oyster reefs and flame shell beds



Image credits: (Left to right) Blue mussel © JNCC; Horse mussel, Loch Creran © Graham Saunders/ Marine Scotland; Native oyster, Loch Ewe © Graham Saunders/ NatureScot; Flame shell, Loch Carron MPA © Rob Crook/ NatureScot.

**Overall assessment conclusion: Vulnerable (VU) based on criteria A2b, A3, C1, C2b, D2b, and D3.**

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### **Corresponding habitat classifications:**

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

**EUNIS codes:** [MA122](#), [MA124](#), [MA1256](#), [MA2271](#), [MA4221](#), [MB1261](#), [MB2221](#), [MB2222](#), [MB2223](#), [MC2231](#), [MC2232](#), [MC2233](#), [MC2234](#), [MC2235](#)

**UK Marine Habitat Classification:** see separate assessments for individual shellfish species assessments.

## 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](#)

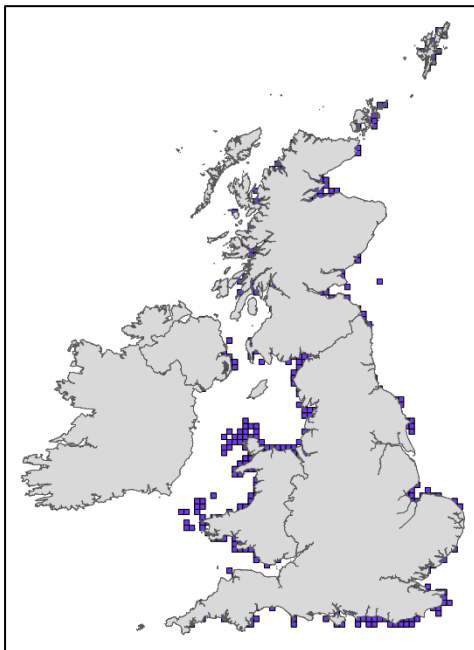
Shellfish beds, particularly native oyster, were historically widespread in UK waters. For example, Olsen (1883) noted that billions of oysters formed dense beds over wide areas of the seabed which are no longer present today (Zu Ermgassen et al., 2024). Over the last 50 years, declines of >50% for littoral blue mussel beds and >30% for sublittoral beds have been recorded (Gubbay et al., 2016; Baden et al., 2021), although this can be much higher

or lower for individual beds (Fariñas-Franco et al., 2014; Scottish Government, 2020). Whilst for horse mussels and flame shells changes in geographic distribution are less well understood.

**A2b, A3 Vulnerable (VU)** – although there has been no reduction in the overall geographic distribution of shellfish beds and reefs, significant declines have been recorded for some species both historically (e.g. native oyster) and more recently (e.g. blue mussel).

### **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](#).



The extent of shellfish beds in UK waters is estimated to be 121 km<sup>2</sup> (Mountford et al., 2025). Shellfish beds and reefs in UK waters have been impacted by human activities which have caused restrictions and fragmentation, alongside a significant decline in condition (Strong et al., 2016; Thurstan et al., 2024; West et al., in press).

**B1a-c, B2b Vulnerable (VU)** – The condition of existing shellfish beds has declined with a decrease in extent, shellfish density and continuity within the bed.

### **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](#).

Shellfish beds are sensitive to physical damage, contamination and changes in siltation, smothering, water flow and wave action (Mazik et al., 2015; Hutchison et al., 2016; Baden et al., 2021; OSPAR 2023; Smyth et al., 2023). Activities such as bottom-contacting fishing (primarily scallop dredges and demersal trawls, but also including creels), aquaculture and anchoring / moorings and infrastructure development can all impact shellfish beds through the direct mortality and damage to the shellfish or through disruption of their habitat (Minchin, 1995; Hall-Spencer & Moore, 2000; Hall-Spencer et al., 2003; Trigg & Moore, 2009; Baden et al., 2021; OSPAR, 2023).

The predicted impacts of climate change may also threaten shellfish beds and reefs. Bivalves are sensitive to changes in temperature and salinity, increased storminess and ocean acidification which can impact reproduction, larval development and settlement, and growth, as well as potentially impacting immune responses, increasing disease prevalence and interactions with non-native species (MCCIP, 2018; Seuront et al., 2019; Baden et al., 2021; Teixeira Alves et al., 2021; OSPAR, 2023; Krufft Welton et al., 2024).

**C1, C2b Vulnerable (VU)** – Demersal fishing operations are known to have a significant impact on shellfish beds and reefs, and climate change is expected to have a continued impact 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](#)

The bivalves are ecosystem engineers and key structural species of shellfish beds and reefs, creating complex and highly diverse habitat which support many other species (Magorrian & Service, 1998; Hall-Spenser & Moore, 2000; Veale et al., 2000; Trigg and Moore, 2009; Cook et al., 2013; Pinn, 2021; Kennon et al., 2023; Lee et al., 2024). Removal or damage to the bivalve shells, e.g. via fishing or other disturbance, will have an impact on the biological communities that they support (Hall-Spenser & Moore, 2000; Baden et al., 2021; OSPAR, 2023). There are elements of the biology and ecology of the shellfish (e.g. late reproductive maturity, low larval settlement success and sporadic reproductive output) which can significantly reduce the recovery potential of the beds once damaged (Mazik et al., 2015; Fariñas-Franco et al., 2018).

Competition with non-native species such as the slipper limpet (*Crepidula fornicata*) and Pacific oysters (*Magallana gigas*) will impact shellfish beds (Mainwaring et al., 2014; Cook et al., 2015; Allen, 2019; Baden et al., 2021; Smyth et al., 2023; OSPAR, 2023). There are also a number of horizon non-native species, present within the UK but not yet in Scotland, which have the potential to affect shellfish beds. These include the Asian shore crab (*Hemigrapsus sanguineus*), the veined rapa whelk (*Rapana venosa*), sea grapes (*Caulerpa racemosa*) and the Atlantic oyster drill (*Urosalpinx cinerea*) (West et al., 2021, in press).

**D2b, D3 Vulnerable (VU)** – Many sites are degraded and/or have declined in extent with non-native species presenting an ongoing risk.

### **Conservation measures in place**

Blue mussel beds (*Mytilus edulis*), horse mussel beds (*Modiolus modiolus*), native oyster reefs (*Ostrea edulis*) and flame shell beds (*Limaria hians*) are all protected as part of the UK's Marine Protected Area (MPA) network as a designated feature in over 50 sites. 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. The majority of the MPAs designated for shellfish beds are protected by fisheries measures that prohibit certain types of shellfish extraction or the use of certain towed fishing gear.

As Priority Marine Features (PMF) in Scotland's seas, shellfish beds are also protected outwith the site network via the National Marine Plan General Policy GEN 9b. This ensures that development and use of the marine environment does not have a significant effect on their national status. It is expected that additional inshore fisheries measures linked to MPA and PMF management areas for fishing gear to which shellfish beds are sensitive to will be consulted upon in 2025/26. The Scottish Biodiversity Strategy to 2045, the Scottish Biodiversity Duty and UK Marine Strategy Good Environmental Status provide further drivers to ensure biological diversity is restored, and ecosystems are safeguarded.

Blue mussels and native oysters are commercially important species, through aquaculture production and also wild caught fisheries. Many of the fisheries are governed by ancient laws; e.g. participants in the Truro Oyster Fishery must use sail or oar vessels and haul their catch aboard by hand or hand winch. No motor or mechanical power is permitted. Blue mussels are a “Royal Shellfish”, and, therefore, are the responsibility of Scottish Ministers (passed on from the Crown Estate in 2014) and can only be fished commercially when special permission is granted. Native oysters are the only marine species listed in Scotland as ‘Sensitive’. This term refers to species that are vulnerable to persecution or over-exploitation, with the designation aiming to safeguard them from deliberate or reckless harm (e.g. illegal harvesting).

Restoration projects so far are focused on native oysters, with two main aims: to protect and enhance the remaining populations and to restore the species to its natural range where it has been extirpated (Bromley and Donnan, 2022; Donnan et al., 2024; zu Ermgassen et al., 2024). The use of closed fishery zones or MPAs may be required to protect these emergent populations in the future (Smyth et al., 2023). Although active restoration of blue mussel beds is not occurring in the UK, there is potential to do so as it is being undertaken elsewhere in Europe (Banke et al., 2024).

### Overall assessment conclusion

**Shellfish Beds and Reef in the UK are assessed as being Vulnerable (VU) based on criteria A2b, A3, C1, C2b, D2b, and D3.**

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