

# PRIORITY MARINE FEATURE (PMF) - FISHERIES MANAGEMENT REVIEW

## Feature

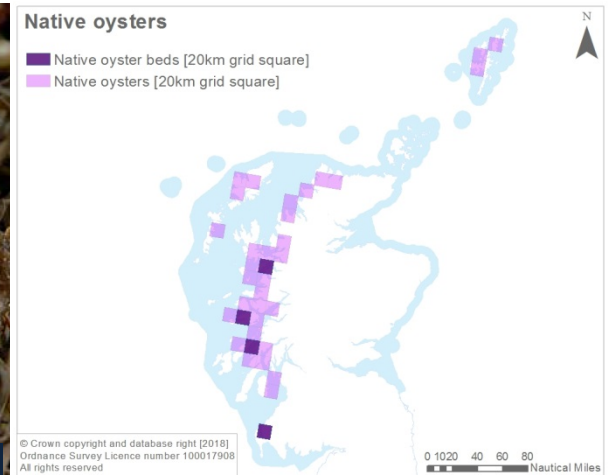
### NATIVE OYSTERS / EUROPEAN FLAT OYSTERS [*OSTREA EDULIS*]

#### Image



Image: SNH

#### Map



#### Description

**Characteristics** - The native oyster *Ostrea edulis* is a bivalve mollusc that has an oval or pear-shaped shell with a rough, scaly surface. Native oysters grow up to 110 mm long (Philpots, 1890) and are found in highly productive, shallow, estuarine and coastal waters. Where conditions are suitable, native oysters may form dense beds, substantially increasing the biodiversity of an area (Barnes, 1973) by stabilising sediments, providing a solid surface for settlement and creating a complex three-dimensional structure that serves as a nursery ground for small fish and other species (OSPAR, 2009).

The sediments below an oyster bed are enriched by organic deposits that provide a rich food source for other animals. Dense beds can contribute to nutrient cycling in estuarine and coastal ecosystems, transferring phytoplankton primary production and nutrients to benthic secondary production (benthic-pelagic coupling) (Dame *et al.*, 1984).

**Definition** - Beds of native oysters can occur on muddy fine sand or mixed sandy muds. Typical oyster densities range from between 0.2 - 3.5 individuals per m<sup>2</sup>. A minimum area of 5 m x 5 m of habitat is required to qualify as a bed. Dead oyster shells may make up a substantial portion of the substratum (Lancaster *et al.*, 2014).

**Environmental preferences** - Native oysters are found on sheltered coasts from the intertidal zone down to 5 m depth and occasionally to 20 m. They are associated with firm mud, muddy sand and muddy gravel with shells and stones. Oyster larvae settle on hard substrates (with a preference for live settled oysters, recently dead oysters and oyster shell debris - Perry & Tyler-Walters, 2016).

#### Distribution

**Scottish distribution** - On the basis of existing information, the native oyster range in Scotland is reduced compared to historical accounts and is currently confined to the west coast and islands (University Marine Biological Station Millport, 2007). Most contemporary records for native oysters are species records, with oyster beds only recorded in Loch Ryan, Loch Sween, Loch Scridain and Loch Eishort.

**Estimated known Scottish extent** - Scottish beds of native oysters may be large (up to 15 km<sup>2</sup>) or occur in small fragmented clumps around the edges of sheltered lochs. The largest extant population in Scotland is in Loch Ryan (an actively managed fishery), with population estimates of over 5 million adults and 52 million spat in the Lefnoll area alone, which covers an area of just 1.6 km<sup>2</sup>, i.e. over 3 adults and 30 spat per m<sup>2</sup> (University Marine Biological Station Millport, 2007).

**Wider distribution** - Native oysters have a confirmed sparse distribution around Ireland, western and southern England and Wales, and northern France. Native oyster beds have also been recorded in Norway, Denmark, Germany, Belgium, the Netherlands and Spain.

### Status

The native oyster has been a popular food in the UK for centuries and dense beds were once common along the coast of Scotland, including Orkney, Shetland (see Shelmerdine & Leslie, 2009) and the Firth of Forth. However, overfishing in the late 1800s and early 1900s, together with pollution, disease and pests resulted in significant declines. Beds in the Firth of Forth covering 129 km<sup>2</sup> landed 59 million oysters in 1834-36, but by 1957 they were extinct. Beds have been cultivated in some areas on a relatively small scale. The only active oyster fishery left in Scottish waters is in Loch Ryan, which appears to have a large, self-sustaining population. A detailed report on native oysters in Scotland (University Marine Biological Station Millport, 2007) indicates a wide distribution on the west coast and islands, however these are characteristically of moderate to low population size and geographically scattered.

Native oysters (as a species) and beds of the species (as a habitat) are both recognised as threatened and/or declining (T&D) under OSPAR (OSPAR, 2008). The species is considered to be under threat and/or in decline in the Greater North Sea (Region II), with native oyster beds under threat in all regions where they occur. There is evidence of unlawful gathering of oysters on a wide scale having a severe impact on native oyster populations in Scotland (Lancaster *et al.*, 2014).

### Sensitivity (including recovery)

[Key source: [FEAST](#); [Fisheries Management Guidance](#)]

Native oysters are considered sensitive or highly sensitive to: changes in water quality; organic enrichment; change or loss of substratum (including siltation); changes in wave exposure/disturbance; pathogens and, non-indigenous species (including pests or predators of oysters). The species is moderately sensitive to changes in: local water flow; temperature; surface abrasion; and, genetic modification. Projected changes to sea level, water temperatures, seawater chemistry (ocean acidification - see OARUG, 2009; Birchenough *et al.*, 2017; Lemasson *et al.*, 2017) and the frequency and strength of storm events associated with climate change also pose threats to native oysters.

Towed bottom-contacting fishing activity has the potential for significant negative impacts on native oysters, both directly through the removal of the species and indirectly by altering the habitat or smothering with sediment. However, exposure of native oysters to towed bottom-contacting gears is likely to be relatively low. Currently, the most significant pressure affecting native oysters in Scotland is unlawful gathering. Small, isolated populations are particularly vulnerable to over-exploitation.

Three factors have been identified that limit recoverability in this species: 1) diminished brood stock; 2) shortages of high value settlement surfaces; and 3) high adult mortality (disease, pests and targeted exploitation). There is a substantial and growing knowledge-base with respect to these bottlenecks and the potential for recovery of native oysters is high (in terms of abundance and restoration to former range) (Mazik *et al.*, 2015).

Relevant techniques for oyster restoration have been developed through recent experience and research arising from international oyster restoration projects (especially in the United States and Australia). There is considerable public and private sector interest in oyster restoration in Europe including a proposal for the Dornoch Firth MPA ([Dornoch Environmental Enhancement Project](#) - see also Fariñas-Franco *et al.*, 2018).

The time-span for native oyster restoration projects like that proposed in the Dornoch Firth depends on: (i) the availability of spat or translocated brood-stock; (ii) the extent of the restoration area; (iii) the required restoration density (and additional biodiversity indicators) specified by the recovery reference range; and, (iv) the intensity of processes influencing growth, reproduction and mortality. Given ideal conditions, site-scale recovery should be possible within 6 - 12 years (Mazik *et al.*, 2015).

Ensuring robust security measures for stock used for restoration (for both disease and invasive non-native species) is a significant challenge for restoration projects.

### Connectivity

**Between native oyster beds** - Native oysters spawn in summer and the pelagic larval dispersal phase lasts for 10-30 days. This relatively long dispersal phase, combined with larval behaviour and local hydrographic conditions, determines transport distances and potential connectivity between populations (Gallego *et al.*, 2013). However, it may be that within Scottish native oyster populations recruitment is limited as a result of low population densities. Selective removal of sexually mature oysters by unlawful gathering may further suppress recruitment (University Marine Biological Station Millport, 2007). Additional management could help provide connectivity between beds, including those within the MPA network.

**With other PMFs** - Native oyster beds are often associated with other PMFs, particularly *blue mussel beds* and *intertidal mudflats* (Lancaster *et al.*, 2014). Native oysters are also known from shallow *seagrass beds* and *maerl beds* (e.g. in Loch Sween - Moore *et al.*, 2013).

### Ecosystem services

- |   |   |
|---|---|
| <ul style="list-style-type: none"> <li>• Larval / gamete supply (supporting connectivity)</li> <li>• Nutrient cycling</li> <li>• Formation of habitat for other species (supporting biodiversity)</li> <li>• Resilience to INNS &amp; disease</li> <li>• Coastal protection</li> <li>• Waste breakdown &amp; detoxification of water and sediments</li> </ul> | <ul style="list-style-type: none"> <li>• Sediment stabilisation</li> <li>• Carbon storage and climate regulation</li> <li>• Shellfish</li> <li>• Ornamental materials (commercial &amp; personal)</li> <li>• Genetic resources</li> <li>• Socially valued places</li> <li>• Watching/studying nature</li> </ul> |
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### Existing Marine Protected Areas

Native oyster beds are a protected feature of Loch Sween MPA.

### Existing and proposed fisheries measures providing PMF protection

Details of existing fisheries measures associated with Loch Sween MPA are provided on Marine Scotland's web pages (<http://www.gov.scot/Topics/marine/marine-environment/mpanetwork/MPAMGT/protectedareasmgt>).

Native oysters are afforded protection by virtue of existing or proposed fisheries measures associated with other designated features in a further 9 MPAs (South Arran; Upper Loch Fyne and Goil; Loch Sunart to the Sound of Jura; Loch Creran; Loch Sunart; Sound of Arisaig; Loch Carron; Wester Ross; and, Loch Laxford).

Existing fisheries management measures (a prohibition on bottom trawl only) are considered to provide protection to the native oyster beds in Loch Ryan [CA51]. Prohibitions on trawling and dredging also provide protection to records of native oysters in Loch Roag [CA67] and Loch Torridon (through the Loch Torridon and the Northern Inner Sound measures - CA56).

### Examples of PMFs that have no or partial coverage by fisheries measures

- Native oyster beds - Loch Scridain and Loch Eishort.
- Native oysters - Loch Eriboll, South Skye, Sound of Arisaig, west coast of Mull, West Loch Tarbert and Loch Tarbert (Jura).

### Assessment against National Marine Plan General Policy 9:

Development and use of the marine environment must not result in significant impact on the national status of Priority Marine Features.

**Native oysters are an OSPAR T&D species and habitat of socio-economic and ecological value with evidence of decline in Scotland. Therefore any activities that lead to the loss of entire beds or damage beds to the extent that function or provision of ecosystem services cannot be maintained should be considered a significant impact on national status.**

**Existing licensing and consenting processes will continue to consider the potential for significant impacts on the national status of development proposals on native oyster beds. The following assessment relates to fishing using towed bottom-contacting gear only but is consistent with the approach taken for assessing proposed developments. Please refer to the *consultation overview* for further details.**

The distribution of native oysters in the wild in Scotland is generally confined to the west coast (Donnan *et al.*, 2016). In a fisheries context, additional measures to protect native oyster beds from pressures associated with towed bottom-contacting gears are recommended off the **West coast of Mull and Ulva**. The recommendation for native oyster beds needs to be considered alongside the recommendations for the other 10 PMFs considered as part of this review. The area identified provides a starting point for discussions regarding future fisheries management. These discussions will be led by Marine Scotland.

There are reports that oysters are present in depths of 10-15 m in Loch Scridain and also of deeper populations in Loch a' Chumhainn (University Marine Biological Station Millport, 2007). There are multiple records of individual native oysters around other parts of this coastline (e.g. Dipper, 2016) and there may be further beds which would benefit from protection from towed bottom-contacting fishing gears (within a relatively narrow band out from the shoreline). Although management measures will not protect native oysters from unlawful gathering, they would increase the likelihood that a significant impact on national status is avoided.

### Knowledge gaps and other records

**Other records** - While we have used the best available data, there is a general need to improve understanding of the current status of native oyster populations throughout the west coast and islands. The paucity of data in relation to oyster abundance and distribution in the shallow subtidal currently limits further recommendations in relation to towed bottom-contacting fishing activities.

Native oyster information is currently dominated by isolated presence / absence records and there is a lack of data from quantitative surveys that would enable confident identification of 'beds'. Available records of 'beds' exist in only four sea lochs. It is not suggested that native oyster populations are limited to these locations.

Expert opinion suggests that native oysters are under-recorded and it is likely that there are more beds around the west coast of Scotland. Future targeted surveys should be guided by species distribution / habitat suitability modelling studies as well as knowledge of historic presence.

## Data confidence

Our understanding of native oyster bed distribution in Scotland is limited by current data availability. For the purposes of this review, records of individual native oysters have been included and it has been assumed that clusters of such records indicate the presence of a larger population.

Many records are from surveys undertaken in the 1970s to 1990s (including the Marine Nature Conservation Review - Hiscock, 1996). More recent records are mainly derived from dedicated native oyster research projects, SNH commissioned surveys, local records centres / biological recording groups and Seasearch (carried out by volunteer divers). Additional records for areas such as Orkney, Firth of Forth and Solway Firth exist in the NBN Atlas (<https://nbnatlas.org/>). However, not all of these are observations of live animals so the data have not been fully utilised in this review. The University Marine Biological Station Millport (2007) study reported local information suggesting that there are no extant native oyster populations around Orkney.

## References

- Barnes, R.S.K. 1973. A preliminary survey of the macroscopic bottom fauna of the Solent, with particular reference to *Crepidula fornicata* and *Ostrea edulis*. *Proceedings of Molluscan Journal*, **40**: 253-275.
- Birchenough, S., Williamson, P. & Turley, C. 2017. Future of the Sea: Ocean Acidification. *Foresight - Future of the Sea Evidence Review*. Foresight, Government Office for Science. <[https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/645500/Ocean\\_Acidification\\_final\\_v3.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/645500/Ocean_Acidification_final_v3.pdf)>
- Dame, R.F., Zingmark, R.G. & Haskin, E. 1984. Oyster reefs as processors of estuarine materials. *Journal of Experimental Marine Biology and Ecology*, **83**(3): 239-247.
- Dipper, F. 2016. (ed). *Intertidal and sublittoral survey of islands within the Staffa Island group, Inner Hebrides. September 16-20, 2016*. Porcupine Marine Natural History Society Field Trip Report. <[http://pmnhs.co.uk/wp-content/uploads/2018/04/Staffa\\_Report\\_Final\\_SNH.pdf](http://pmnhs.co.uk/wp-content/uploads/2018/04/Staffa_Report_Final_SNH.pdf)>
- Donnan, D.W., Manson, F.J. & MacDonald, I. 2016. Native Oyster. In: Gaywood, M.J., Boon, P.J., Thompson, D.B.A. & Strachan, I.M. (eds). 2016. *The Species Action Framework Handbook*. Scottish Natural Heritage, Battleby, Perth. <<https://www.nature.scot/sites/default/files/Publication%202016%20-%20Species%20Action%20Framework%20Handbook%202016.pdf>>
- Fariñas-Franco, J.M., Pearce, B., Mair, J.M., Harries, D.B., MacPherson, R.C., Porter, J.S., Reimer, P.J. & Sanderson, W.G. 2018. Missing native oyster (*Ostrea edulis* L.) beds in a European Marine Protected Area: Should there be widespread restorative management? *Biological Conservation*, **221**: 293-311. <<https://www.sciencedirect.com/science/article/pii/S0006320717308030>>
- Gallego, A., Gibb, F.M., Tulett, D. & Wright, P.J. 2013. Connectivity of benthic priority marine species within the Scottish MPA network. *Scottish Marine and Freshwater Science*, **4**(2). Edinburgh: Scottish Government, 51pp. DOI: 10.7489/1512-1. <<http://www.gov.scot/Resource/0042/00427638.pdf>>
- Hiscock, K. 1996. *Marine Nature Conservation Review: Rationale and Methods*. Peterborough, Joint Nature Conservation Committee (Coasts and seas of the United Kingdom - MNCR series). 167pp.
- Lancaster, J. (Ed.), McCallum, S., Lowe A.C., Taylor, E., Chapman A. & Pomfret, J. 2014. Development of detailed ecological guidance to support the application of the Scottish MPA selection guidelines in Scotland's seas. *Scottish Natural Heritage Commissioned Report No. 491*. Native oysters - supplementary document.

- Lemasson, A.J., Fletcher, S., Hall-Spencer, J.M. & Knights, A.M. 2017. Linking the Biological Impacts of Ocean Acidification on Oysters to Changes in Ecosystem Services: A Review. *Journal of Experimental Marine Biology and Ecology*, **492**: 49-62; doi: 10.1016/j.jembe.2017.01.019. <<https://pearl.plymouth.ac.uk/handle/10026.1/8027>>
- Mazik, K., Strong, J., Little, S., Bhatia, N., Mander, L., Barnard, S. & Elliott, M. 2015. A review of the recovery potential and influencing factors of relevance to the management of habitats and species within Marine Protected Areas around Scotland. *Scottish Natural Heritage Commissioned Report No. 771*. <<https://www.nature.scot/snh-commissioned-report-771-review-recovery-potential-and-influencing-factors-relevance-management>>
- Moore, C.G., Harries, D.B., Atkinson, R.J.A., Clark, L., Cook, R.L., Hirst, N.E., Saunders, G.R., Lyndon, A.R., Sanderson, W.G. & Porter, J.S. 2013. The distribution and condition of proposed protected features within the Loch Sween possible Nature Conservation MPA. *Scottish Natural Heritage Commissioned Report No. 621*. <<https://www.nature.scot/snh-commissioned-report-621-distribution-and-condition-proposed-protected-features-within-loch-sween>>
- Ocean Acidification Reference User Group. 2009. *Ocean Acidification: The Facts. A special introductory guide for policy advisers and decision makers*. Laffoley, D. d'A., & Baxter, J.M. (eds). European Project on Ocean Acidification (EPOCA). 12pp. <[https://www.iaea.org/ocean-acidification/download/11\\_Dissemination/OA%20The%20facts/OA.TF.English.pdf](https://www.iaea.org/ocean-acidification/download/11_Dissemination/OA%20The%20facts/OA.TF.English.pdf)>
- OSPAR. 2008. OSPAR List of Threatened and/or Declining Species and Habitats. Reference Number: 2008-6e. <[http://jncc.defra.gov.uk/pdf/08-06e\\_OSPAR%20List%20species%20and%20habitats.pdf](http://jncc.defra.gov.uk/pdf/08-06e_OSPAR%20List%20species%20and%20habitats.pdf)>
- OSPAR. 2009. *Background document for Ostrea edulis and Ostrea edulis beds*. <[https://qsr2010.ospar.org/media/assessments/Species/P00428\\_ostrea\\_edulis\\_and\\_beds.pdf](https://qsr2010.ospar.org/media/assessments/Species/P00428_ostrea_edulis_and_beds.pdf)>
- Perry, F. & Tyler-Walters, H. 2016. [Ostrea edulis] beds on shallow sublittoral muddy mixed sediment. In Tyler-Walters H. and Hiscock K. (eds) *Marine Life Information Network: Biology and Sensitivity Key Information Reviews*, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 17-01-2018]. <[http://www.marlin.ac.uk/habitats/detail/69/ostrea\\_edulis\\_beds\\_on\\_shallow\\_sublittoral\\_muddy\\_mixed\\_sediment](http://www.marlin.ac.uk/habitats/detail/69/ostrea_edulis_beds_on_shallow_sublittoral_muddy_mixed_sediment)>
- Philpots, J.R. 1890. *Oysters and all about them*. (2 volumes). London: John Richardson & Co.
- Shelmerdine, R.L. & Leslie, B. 2009. Restocking of the native oyster, Ostrea edulis, in Shetland: habitat identification study. *Scottish Natural Heritage Commissioned Report No. 396*. <<https://www.nature.scot/snh-commissioned-report-396-restocking-native-oyster-ostrea-edulis-shetland-habitat-identification>>
- University Marine Biological Station Millport. 2007. Conservation of the Native Oyster Ostrea edulis in Scotland. *Scottish Natural Heritage Commissioned Report No. 251*. <<https://www.nature.scot/snh-commissioned-report-251-conservation-native-oyster-ostrea-edulis-scotland>>

**Areas where fisheries management should be considered to avoid a significant impact on the national status of the PMF**

