

PRIORITY MARINE FEATURE (PMF) - FISHERIES MANAGEMENT REVIEW

Feature

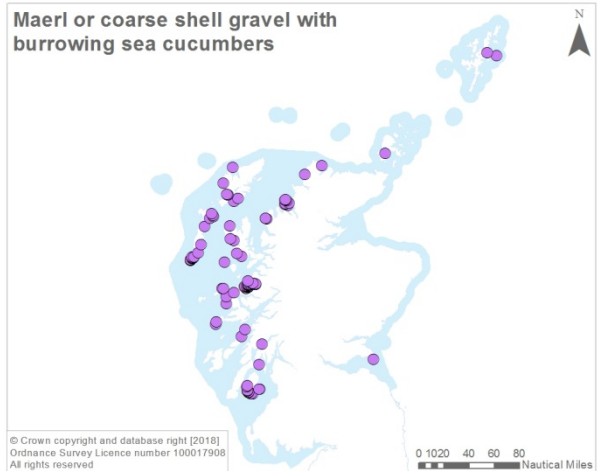
MAERL OR COARSE SHELL GRAVEL WITH BURROWING SEA CUCUMBERS

Image



Image: Graham Saunders

Map



Description

Characteristics - A species-rich sediment community characterised by the presence of the burrowing gravel sea cucumber *Neopentadactyla mixta*. Found on the margins of maerl beds in areas of dead maerl gravel, in plains of clean shell or stone gravels and occasionally coarse sands where water flow is quite strong. The sediments may be thrown into megaripples by wave action or tidal streams. **[Note - whilst often found on the edge of maerl beds, this is not a maerl bed habitat - there is a distinct and more sensitive community covered by the maerl beds PMF that also supports gravel sea cucumbers]**

Other characterising species associated with this PMF vary but often include tube-building polychaetes (e.g. sand mason worms *Lanice conchilega* and parchment worms *Chaetopterus variopedatus*) and burrowing anemones (such as *Cerianthus lloydii* or *Peachia cylindrica*). These stabilise the sediments which host an assemblage of other polychaete worms and robust bivalve molluscs including *Moerella donacina*, *Venus casina*, *Dosinia* sp., razor clams (*Ensis* spp.) and king scallops (*Pecten maximus*). Mobile fauna such as brittle stars, starfish, crabs and dragonets live on the surface of the sediments which may also support sparse hydroids and, depending on depth, red algae (Connor *et al.*, 2004). The loose structure of the sediment allows oxygen penetration to a greater depth than in finer sediments and permits a high diversity of infaunal organisms (Jackson, 2008).

Definition - The PMF is defined by the presence of frequent (ca. >1-9 per 100 m²) gravel sea cucumbers in coarse sediments. This species lives gregariously and can reach densities of > 400 per square metre in loose gravels (Smith & Keegan, 1985). The habitat is likely to be under-recorded due to the seasonal (and potentially also daily) periodicity of sea cucumber emergence (Picton, 1993). Burrowing gravel sea cucumbers are most commonly observed in the summer months (May - August).

Environmental preferences - This species-rich habitat is found in subtidal clean, gravel, maerl gravel (dead maerl) and/or coarse sands in moderately wave-exposed or tide-swept (~1 to 3 knots or 0.5 to 1.5 m/sec.), fully saline conditions at depths of 10-50 m. The burrowing sea cucumbers require a reasonable flow of water for feeding.

Distribution

Scottish distribution - Found primarily along the west coast and the Outer Hebrides, with occasional records from Orkney (Scapa Flow), Shetland (Lunna Ness and Out Skerries) and the Isle of May (outer Firth of Forth).

Estimated known Scottish extent - The habitat varies considerably in patch size from isolated single records to multiple, scattered records distributed across extensive stretches of coastline. The habitat often occurs as a mosaic with maerl beds and patches of finer sediments, with a number of diver observations from around the current-swept bases of rocky reef outcrops.

Wider distribution - The habitat is not recorded outside of the British Isles. The gravel sea cucumber itself has a wider recorded distribution, from northern Norway to the Bay of Biscay.

Status

The current status of this habitat in Scottish waters is unknown. The PMF is known to occur at the margins of maerl beds which are listed as threatened and / or declining under OSPAR (OSPAR, 2008), with evidence of decline in both extent and quality in the Celtic Seas, (OSPAR Region III - Hall-Spencer *et al.*, 2010).

Sensitivity (including recovery)

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

There is little direct information on the sensitivity and recovery potential of the maerl or coarse shell gravel with burrowing sea cucumbers PMF. Habitat sensitivity is defined by the sensitivity of the characterising gravel sea cucumber because a significant reduction in the abundance or loss of this defining species affects the PMF determination. The sensitivity of other characteristic infaunal species is comparable with that of the *shallow tide-swept coarse sands with burrowing bivalves* PMF.

Gravel sea cucumbers (and other characterising species of the PMF living within the sediments) are highly sensitive to physical disturbance in the form of habitat change and have a medium sensitivity to habitat structure changes, sub-surface penetration, changes in water clarity and organic enrichment (Tyler-Walters & Durkin, 2016).

There is evidence that communities on or in mobile and coarse sediments have comparatively higher resilience and recovery to high frequency disturbance (MacDonald *et al.*, 1996; Hall-Spencer, 2000; Dernie *et al.*, 2003; Hinz *et al.*, 2011). However, intensive bottom-contacting fishing activities such as scallop dredging and hydraulic dredging can modify habitats, slowing down recovery of associated fauna beyond natural capacity (Collie *et al.*, 2001; Hauton *et al.*, 2003). Sessile, long-lived bivalves are among the most severely affected fauna (Kaiser *et al.*, 2000). The net result of ongoing exposure to bottom-contacting gear is that the habitat may be maintained in a modified condition with reduced abundance (or possibly loss) of sensitive bivalve and epibenthic species. The degree of modification is likely to be dependent on the intensity of fishing (Bergman & Van Santbrink, 2000; Kaiser *et al.*, 2006), the gear type, size and weight, as well as depth of penetration into the sediment (MacDonald *et al.*, 1996).

There is little published information on larval development, recruitment and/or population dynamics in gravel sea cucumbers. As many echinoderms show sporadic and variable recruitment, a population could take from one to ten years to recruit and recolonize a habitat from which they were reduced in abundance and/or removed. However, this assessment is made by inference from the life history of members of the same phylum, so confidence is low and based on expert judgement (Tyler-Walters & Durkin, 2016).

Connectivity

Between areas supporting the PMF - the degree of connectivity between different areas supporting this PMF is unknown. Connectivity depends on the reproductive strategy and recruitment success of gravel sea cucumber populations, and on availability of suitable substrates. Due to lack of information on the basic biology of *Neopentadactyla mixta* no further assessment can be made.

For sea cucumbers in general, spawning in temperate species is restricted to spring and summer (Pawson, 1982) and breeding is assumed to occur between April and September when the population is at the substratum surface (Jackson, 2008). Most sea cucumbers are broadcast spawners (although some species brood their larvae), and larval development varies between those species where relevant information is available (Mazik *et al.*, 2015). Further research is required to understand more about connectivity between areas supporting the PMF (and links to the *maerl beds* PMF).

With other PMFs - The gravel sea cucumber also occurs within *maerl beds* (a discrete habitat encompassed by the *maerl beds* PMF). The maerl or coarse shell gravel with burrowing sea cucumbers PMF also often occurs on the margins of *maerl beds* where maerl substrates grade into coarse, non-maerl gravels. [see also relevant associations in the *maerl beds* PMF paper]

In the absence of confirmation of the presence of the gravel sea cucumber (due to sampling methodologies etc.), the infaunal community associated with the *maerl or coarse shell gravel with burrowing sea cucumbers* PMF may be comparable to that of the *shallow tide-swept coarse sands with burrowing bivalves* PMF (Connor *et al.*, 2004; Moore 2014).

Ecosystem services

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| <ul style="list-style-type: none"> • Biomass production • Larval/gamete supply (supporting connectivity) • Nutrient cycling • Formation of habitat for other species (supporting biodiversity) | <ul style="list-style-type: none"> • Formation of physical barrier • Resilience to INNS & disease • Carbon storage & climate regulation • Sediment stabilisation • Socially valued places/seascapes • Watching/studying nature |
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Existing Marine Protected Areas

Maerl or coarse shell gravel with burrowing sea cucumbers is a protected feature of 6 MPAs: Loch nam Madadh; Sound of Arisaig; Wester Ross; South Arran; Loch Laxford; and, Sound of Barra.

Existing and proposed fisheries measures providing PMF protection

Details of existing fisheries measures within Wester Ross, South Arran and Loch Laxford MPAs are provided on Marine Scotland's web pages (<http://www.gov.scot/Topics/marine/marine-environment/mpanetwork/MPAMGT/protectedareasmgt>).

New fisheries management measures that will provide PMF protection in the Loch nam Madadh, Sound of Arisaig and Sound of Barra MPAs will be consulted upon later in 2018 (see - <http://www.gov.scot/Topics/marine/marine-environment/mpanetwork/inshorempas/Management>).

The PMF is afforded protection by virtue of fisheries measures associated with other designated features in a further 3 MPAs: Isle of May; Loch Carron; and, Loch Sunart to Sound of Jura.

Maerl or coarse shell gravel with burrowing sea cucumbers is also afforded protection through the Loch Roag (CA67) fisheries area.

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

There are unmanaged maerl or coarse shell gravel with burrowing sea cucumbers records scattered along the Scottish west coast and islands:

- Shetland (off Out Skerries and Lunna Holm) without associated maerl bed records.
- Sango Bay (Loch Eriboll approaches).
- Longa Island (Gairloch).
- Outer Hebrides - multiple records along south-west Lewis, Loch Seaforth, Scalpay, in the Sound of Harris and, around the Uists.

- Off Canna and around Skye.
- From Coll and Mull to Arisaig.
- Inner Clyde (Adlamont Point).

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.

Advice given for the maerl beds PMF encompasses the requirements of the maerl or coarse shell gravel with burrowing sea cucumbers PMF due to its close spatial association. Should management be put in place to avoid a significant impact on the national status of maerl beds, no further management of towed bottom-contacting fishing activity would be required for this PMF.

Existing licensing and consenting processes will continue to consider the potential for significant impacts on the national status of development proposals on maerl or coarse shell gravel with burrowing sea cucumbers. The following assessment relates to fishing with towed bottom-contacting gear only but is consistent with the approach taken for assessing proposed developments. Please refer to the *consultation overview* and the maerl beds PMF paper for further details.

In a fisheries context, further protection measures from pressures associated with towed bottom-contacting gear are most easily focussed on discrete areas that hold good examples of maerl beds. Nine out of a total of 13 areas considered of particular importance for maerl beds in a fisheries context also encompass records of the maerl or coarse shell gravel with burrowing sea cucumbers PMF. These are: **Clyde; North-west Mull; Mallaig to Mull; Inner Sound; Skye; Uists; Lewis & Harris; Kylesku to Eriboll**; and, **Orkney**. The recommendations for maerl beds and maerl or coarse shell gravel with burrowing sea cucumbers need to be considered alongside the recommendations for the other 9 PMFs considered as part of this review. The areas identified provide a starting point for discussions regarding future fisheries management. These discussions will be led by Marine Scotland.

Areas recommended for consideration of additional fisheries management of maerl beds encompass the known range of environmental conditions in which the PMF occurs (exposure, depth, geographic range, substrate, rhodolith form etc.). The areas for maerl beds encompass the habitat's inherent patchy nature, including records of the maerl or coarse shell gravel with burrowing sea cucumbers PMF, with which it forms mosaic habitats.

Knowledge gaps and other records

It is likely that the habitat is under-recorded.

The degree of association with the shallow tide-swept coarse sands and burrowing bivalves PMF requires further investigation. Additional information on the basic biology of the burrowing gravel sea cucumber is also required.

Data confidence

Available records span 1970 to 2017; though many are quite old (e.g. Howson, 1991). Surveys vary in scope from Seasearch (carried out by volunteer divers) to dedicated PMF validation surveys (e.g. SNH & MSS 2013 South Arran benthic camera survey). Records come from diving and remote video surveys.

Given that the gravel sea cucumber characterising this PMF remains burrowed in the sediment for several months each year, and even when exposed its semi-translucent, small white body is well camouflaged, it is highly likely that the feature is under-recorded. The difficulty in seeing the animals explains inconsistent recording of the PMF over time e.g. in Loch Laxford where it was recorded in 1991, not seen in monitoring work in 2010, but recorded again in 2015 (Moore *et al.*, 2017).

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

Maerl or coarse shell gravel with burrowing sea cucumbers

Neopentadactyla mixta in circalittoral shell gravel or coarse sand

