

PRIORITY MARINE FEATURE (PMF) - FISHERIES MANAGEMENT REVIEW

Feature

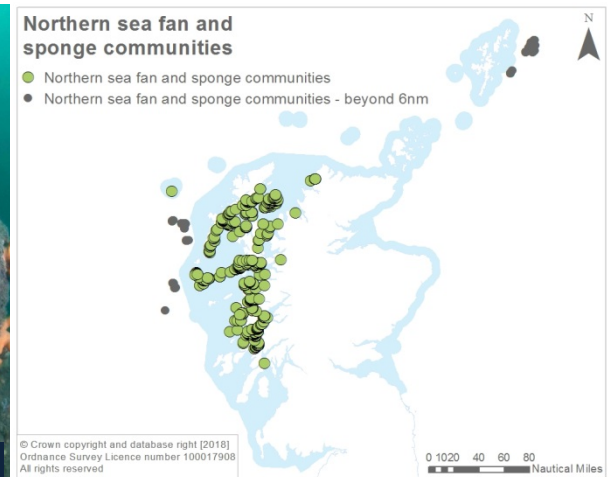
NORTHERN SEA FAN AND SPONGE COMMUNITIES

Image



Image: SNH

Map



Description

Characteristics - Northern sea fan and sponge communities occur on upward-facing and vertical bedrock, boulders and cobbles. The northern sea fan (*Swiftia pallida*) and cup corals (*Caryophyllia smithii*) characterise the habitat between ~20-50 m. In deeper waters, sea fan numbers are lower or the species may be absent and a varied sponge community is conspicuous alongside aggregations of cup corals. The rocky substrates are typically also colonised by bryozoans, sea fans, soft corals (e.g. dead man's fingers), featherstars, starfish and sea squirts; with crevices providing shelter for squat lobsters and wrasse. The northern sea fan can host the nationally rare sea fan anemone (*Amphianthus dohrnii*).

Definition - The northern sea fan habitat is defined by the presence of frequent *S. pallida* (ca. 1-9 per 100 m²) and locally abundant cup corals. The associated biological community varies depending on the physical setting (depth, degree of wave exposure and the strength of tidal currents). Moderately tide-swept conditions support the most diverse fauna with large solitary sea squirts (e.g. *Corella parallelogramma* and *Ascidia mentula*), the colonial football sea squirt (*Diazona violacea*), a varied hydroid turf, erect bryozoans such as *Porella compressa* and sponges. Areas of vertical and overhanging rock may support the white cluster anemone *Parazoanthus anguicomus*. In very wave sheltered conditions with little tidal flow, the rocky substrates can be heavily silted. The rich community associated with the sea fans here can include a number of different sponges including *Suberites carnosus* and *Polymastia boletiformis*, with the cotton spinner sea cucumber *Holothuria forskali* on rocky ledges and occasionally, red sea fingers *Alcyonium glomeratum*.

The deeper sponge communities are fairly distinct, being dominated by cup-shaped (e.g. *Phakellia ventilabrum* and *Axinella infundibuliformis*) and branching sponges (e.g. *Axinella dissimilis* and *Stelligera stuposa*) with few or no northern sea fans, in depths typically below 50 m. [Note - this habitat is not the same as the **Deep sea sponge aggregations PMF** which is restricted to offshore waters around Scotland in water depths >250 m]

Environmental preferences - Circalittoral bedrock, boulders and cobbles in wave-exposed to wave sheltered areas, in fully marine conditions at depths of 20-220 m (Connor *et al.*, 2004; Howson *et al.*, 2012). The northern sea fan is most commonly recorded from depths between 18-60 m but has also been reported from up to 1200 m off the coast of Ireland (Wilson, 2007).

Distribution

Scottish distribution - Northern sea fan communities are restricted to the west coast; from Shiant East Bank in the north (Moore, 2014) to the Sound of Jura in the south; across the Minch and down the east coast of the Outer Hebrides. Records of the northern sea fan as a species occurring in low numbers in other habitats, extend this distribution to Loch Laxford in the north (Moore *et al.*, 2010), St Kilda in the west and the Isle of Bute in the Firth of Clyde, to the south (Wilson, 2007). Deep sponge communities have been recorded from the Firth of Lorn, the Sea of the Hebrides off Mingulay and the Small Isles (Moore & Roberts, 2011), the Inner Sound (the strait separating the Inner Hebridean islands of Skye, Raasay and South Rona from the Applecross peninsula on the Scottish mainland) and on the Shiant East Bank. In offshore waters, deep sponge communities are known from west of the Outer Hebrides, the north of Scotland and east of Shetland.

Estimated known Scottish extent - Known examples of northern sea fan and sponge communities vary considerably in the area of seabed covered, from isolated 2-3 ha patches on mixed coarse sediments surrounded by burrowed mud in the Sound of Canna (Howson *et al.*, 2012; Envision Mapping, 2014) through to extensive bedrock plateaus and steep vertical cliffs with a predicted extent of several 1000's of hectares in the Firth of Lorn and Shiant East Bank (Miller *et al.*, 2017). Large areas of potentially suitable habitat (Brown *et al.*, 2017) have yet to be surveyed so new examples of these habitats are anticipated.

Wider distribution - Outside of Scotland, northern sea fan communities have only been recorded at two locations off the west coast of Ireland, at Donegal in 2010 and from the Kenmare River since 1985 (Minchin, 1987; MERC Consultants, 2009). The northern sea fan has a wider 'species only' distribution including Norway, Sweden and deep waters off Ireland. A tentative record of a *Swiftia* species (provisionally thought to be *S. pallida*) was made from the Haig Fras SAC situated approx. 95 km north-west of the Isles of Scilly in the Celtic Sea in 2015 (Callaway, 2015). There is some doubt whether records from more southerly climes, including off north-west Africa, Madeira, Bay of Biscay and in the Mediterranean are of the same species (Wilson, 2007). Deep sponge communities are broadly distributed and can be found off Northern Ireland, the west coast of Ireland, Pembrokeshire, south-west England and the English Channel. The sponge community composition varies with latitude. Southern examples lack *Phakellia ventilabrum* and have a greater diversity of axinellid sponges together with the pink sea fan *Eunicella verrucosa* which is not currently known in Scottish waters (Readman, 2018).

Status

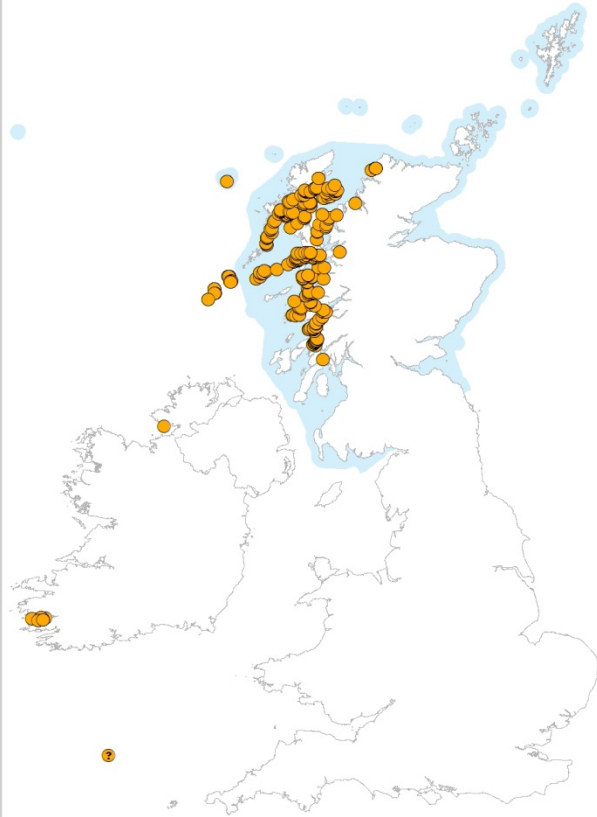
Scottish northern sea fan and sponge communities are of global importance. All British records of northern sea fan habitats are from Scotland. *Swiftia pallida* is believed to be towards the southern limit of its range in Scotland and at the two locations where known from SW Ireland (although the uncertain record from Haig Fras may change this thinking). Northern sea fan and sponge communities are encompassed by Annex I 'reefs' on the EU Habitats Directive (European Commission, 2013).

These diverse and functionally important communities are highly characteristic of moderately exposed reefs on the Scottish west coast. Examples of the habitat on low relief bedrock, cobbles or mixed substrates are considered at greater risk to towed bottom-contacting fishing gears. Picton & Goodwin (2007) attribute deterioration in the condition of an area of diverse sponge and rare hydroid communities on boulders on the east coast of Rathlin Island (NI) to scallop dredging activity. Large *Axinella infundibuliformis* cup sponges recorded on boulders in 1984 were thought to be over 50 years old. Scallop dredging started in the area in 1989 and subsequently, boulders were observed to have been turned or disappeared and the previously abundant sponges and hydroids were greatly reduced. A fan mussel *Atrina fragilis* was also lost from this area with a dredger observed working close to the previously recorded position during diving survey work in 2010 (Goodwin *et al.*, 2011).

Northern sea fan and sponge communities

Northern sea fan

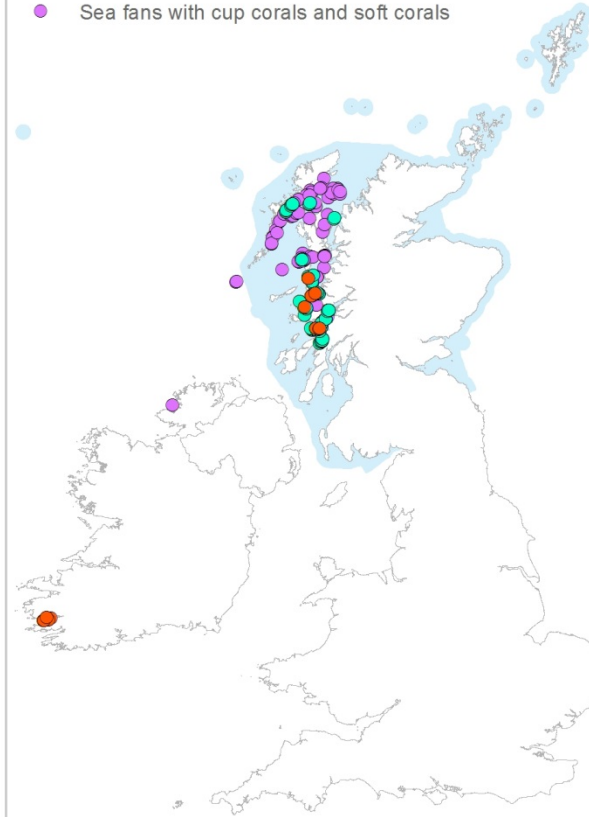
- *Swiftia pallida*



0 30 60 120 180 240
Nautical Miles

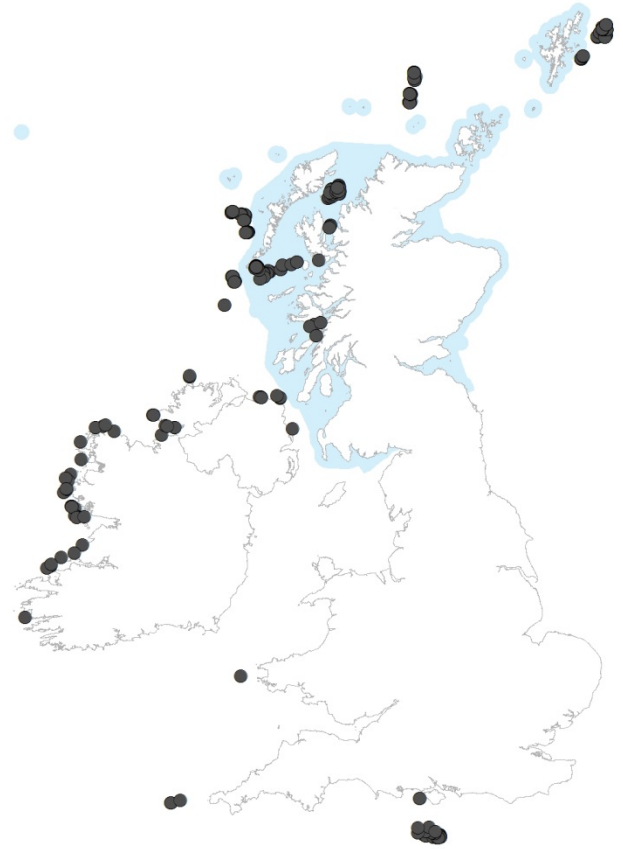
Northern sea fan and sponge communities

- Tide-swept with large sea squirts and a hydroid turf
- Sheltered conditions with sponges and red sea fingers
- Sea fans with cup corals and soft corals



Deep sponge communities

- Cup-shaped & branching sponge dominated habitats



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Observations of turned boulders and dredge marks on low relief bedrock have also been made in Scottish waters. Exploring the impacts of scallop dredging on rocky reefs was the subject of a number of studies undertaken as part of the Firth of Lorn Science Project 2006-2013 (Turrell *et al.*, 2014).

Sensitivity (including recovery)

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

Northern sea fan and sponge communities are sensitive to organic enrichment, siltation changes, abrasion and physical disturbance, synthetic and non-synthetic compound contamination and changes in water flow, wave exposure and water clarity. Activities associated with these pressures are known to include mobile demersal fishing, high levels of demersal static fishing, aquaculture and pollution.

A climate change induced increase in temperature may also lead to a reduction or loss of northern sea fans in Scottish waters (northwards retreat). It is thought that colonization of the Shetland Islands has been prevented by geographical barriers which would likely continue even in a situation of climate induced retreat (Hiscock *et al.*, 2001).

Physical damage from the use of bottom-contacting fishing gear on rocky seabed areas, such as potting, some fixed nets and trawling or dredging, may lead to the detachment of sessile species within this habitat. Where towed bottom-contacting fishing gears overlap with these communities the fragile epifauna is liable to suffer high mortality (Løkkeborg, 2005) from direct impact and from disturbance of their substrate (e.g. overturning of boulders - Freese *et al.*, 1999; Boulcott *et al.*, 2014). Boulcott & Howell (2011) demonstrate that dredging over bedrock is possible and is damaging, with low relief substrates at greater risk of exposure. Hinz *et al.* (2011) concludes that not all temperate reef fauna are affected equally by scallop dredging and that more complex stony reef habitats may provide some measure of protection at low fishing intensities.

Re-colonisation of these delicate, long-lived and slow growing suspension feeders is variable depending on intensity and frequency of disturbance (Jennings & Kaiser, 2008). Dislodged sea fans are unlikely to recover and the ability to recolonize an area following mass mortality is likely to be limited (Hiscock *et al.*, 2001). Northern sea fans have a low ability to recover from smothering though they may be tolerant to some increases in suspended sediment (Lancaster *et al.*, 2014). If lost, northern sea fan communities may take many years or decades to recover.

A study of deep (~200 m on the continental shelf) cold-water sponge species in south-eastern Alaska (at a similar latitude to the north of Scotland ~57.5°N) found that the impacts of trawling activity were much longer lasting than for warm, shallow water sponge species due to the slower growth/regeneration rates of these species (Freese, 1999; Freese *et al.*, 2001). Growth rates for branching sponges have been described as irregular, very slow, with apparent shrinkage in some years. Little or no growth and no recruitment were observed over four years of monitoring the sponges *Axinellia dissimilis* or *Axinellia infundibuliformis* at Lundy (Hiscock, 1994; Hiscock, 2003). Given the slow growth rates and long life spans of the rich, diverse fauna, it is likely to take many years for deep sponge communities to recover if adversely affected by physical damage or smothering.

Connectivity

Between northern sea fan and sponge communities - It is generally considered that populations of the northern sea fan are self-sustaining due to their short-lived larvae (3-5 days) and limited potential for larval dispersal (Hill *et al.*, 2010; Gallego *et al.*, 2013). Many sponges reproduce asexually by fragmentation and budding; however, sexual reproduction also occurs, often seasonally. The dispersal duration for sponge larvae ranges from a few hours to a few days (Hill *et al.*, 2010 - based on *Axinella* spp. sponges) so these will also be largely self-sustaining. The reproductive strategies of the other species vary widely.

Further research is required to better understand connectivity between northern sea fan and sponge communities, including the likely variation between component species.

With other PMFs - Northern sea fan and sponge communities have an association with the *cold-water coral reefs* PMF. The coral framework and adjacent hard substrates may be colonised by sponges and sea fans.

Extensive sponge communities were recorded around the Mingulay cold-water coral reef complex during survey work undertaken in 2003 (Roberts *et al.*, 2004) and subsequent Marine Scotland Science sampling in 2010 (Moore & Roberts, 2011). Sponges play a key role in carbonate recycling (Beuck *et al.*, 2007; Bell, 2008), they help to bind coral structures and facilitate lateral patch expansion (Wilson, 1979). The East Mingulay corals are characterised by encrusting sponges (Davies *et al.*, 2009). Small colonies of *Swiftia pallida* occurred at high densities in sponge dominated communities around the coral reefs at some of the 2010 Mingulay survey stations in water depths 50-120+ m (Moore & Roberts, 2011). [please refer to the *cold-water coral reefs* PMF paper for further details]

The *fan mussel* (*Atrina fragilis*) has been recorded from sublittoral sediments adjacent to bedrock, boulder and cobble habitats supporting the northern sea fan and sponge communities PMF in the Small Isles MPA (Howson *et al.*, 2012; Moore, 2012 & 2013). This relationship almost certainly only reflects the natural refuge function afforded to pockets of sediments within rough ground favoured by northern sea fans.

Tide-swept algal communities may be found above northern sea fan habitats. *Pink sea fingers* (*Alcyonium hibernicum*), *white cluster anemones* (*Parazoanthus anguicomus*), *European spiny lobsters* (*Palinurus elephas*) and *northern feather stars* (*Leptometra celtica*) can all be found within the northern sea fan and sponge communities PMF.

Ecosystem services

- | | |
|---|--|
| <ul style="list-style-type: none"> • Formation of habitat for other species (supporting biodiversity) • Waste breakdown and detoxification of water and sediments | <ul style="list-style-type: none"> • Larval/gamete supply (supporting connectivity) • Watching/studying nature |
|---|--|

Existing Marine Protected Areas

Northern sea fan and sponge communities are a protected feature of 8 MPAs in Scottish territorial waters: Small Isles; Firth of Lorn; Loch nam Madadh; St Kilda; East Mingulay; Loch Laxford; Lochs Duich, Long and Alsh; and, Sunart.

The PMF is also a protected feature of the Pobie Bank MPA in offshore waters (see <http://jncc.defra.gov.uk/page-6540> for further details).

Existing and proposed fisheries measures providing PMF protection

Details of existing fisheries measures associated with 6 of the MPAs: Firth of Lorn; St Kilda; East Mingulay; Loch Laxford; Lochs Duich, Long and Alsh; and, Sunart 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 Small Isles and Loch nam Madadh MPAs will be consulted upon later in 2018 (see - <http://www.gov.scot/Topics/marine/marine-environment/mpanetwork/inshoremipas/Management>).

Northern sea fan and sponge communities are afforded protection by virtue of existing or proposed fisheries measures with other designated features in a further 2 MPAs (Loch Sunart to Sound of Jura [multiple records]; and, Wester Ross [a single sea fan record on the outer sill in Little Loch Broom]).

The PMF is also afforded protection off the east coast of Rona through the Loch Torridon and the Northern Inner Sound measures (CA56) and a single sea fan record is encompassed by the Loch Gairloch fisheries measures (CA58).

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

There are a large number of unprotected records of northern sea fan and sponge communities across the west coast. Clusters of records are present around -

- Shiant East Bank - a submerged bank in the North Minch to the north-east of the Shiant Islands. The area has been proposed as an MPA for northern sea fan and sponge communities amongst other interests (see SNH, 2014 for more details).
- The Little Minch - two discrete clusters of records on submerged banks comprising mixed substrates and rocky outcrops in the strait between north Skye and Harris / North Uist.
- East coast of the Outer Hebrides from Loch Erisort, Lewis to Loch Boisdale, South Uist.
- South Skye - in Soay Sound, Loch Scavaig, Loch Slapin and Loch Eishort (Moore, 2015 & 2017).
- Sea of Hebrides - to the south-east of the East Mingulay SAC (Moore & Roberts, 2011); South of Eigg and Muck; and, on the west coast of Mull (Dipper, 2016).
- Sound of Jura - at the mouths of Lochs Craignish and Crinan and down the SE coast of the sound.

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.

Northern sea fan and sponge communities in Scotland are of global importance. They are functionally important, biodiverse and sensitive. If lost, they would take many years or decades to recover due to the short pelagic larval duration of characterising species and the limited potential for dispersal. Therefore any activities that lead to the loss of entire patches of feature or where they are damaged to the extent that their 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 northern sea fan and sponge communities. 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.

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 northern sea fan and sponge communities. There are four areas considered of particular importance: **Shiant East Bank; Little Minch; Sea of Hebrides (Mingulay 4)** and, **South of Eigg**. The recommendations for northern sea fan and sponge communities need to be considered alongside the recommendations for the other 10 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 where additional fisheries management should be considered to avoid significant impact on the national status of this PMF are distributed to cover a range of environmental conditions; encompassing variation in seabed topography and substrates, wave exposure, tidal currents, depth and geographic range. Areas have been designed around clusters of records in preference to isolated observations, and around more extensive areas where this information is known or may be inferred from predictive mapping. Information on existing levels of fishing pressure has also informed the recommendations.

A greater biological diversity of associated faunal and floral communities across an extensive area with a higher abundance of northern sea fans, cup corals, and sponges, are factors which increase the conservation importance of examples of this habitat. Information on these characteristics does not exist for all records in Scottish waters precluding their detailed application in this assessment. However, such information will be sought and used in development licensing and consenting processes.

There are currently no managed records of northern sea fan communities north of Loch nam Madadh on North Uist and Rona in the Inner Sound. Sparse records of the northern sea fan as a species are afforded protection through existing fisheries measures in Loch Laxford (the most northerly known record in Scottish waters but at low density from one location - see Moore *et al.*, 2010); Little Loch Broom (a single sparse occurrence on the outer sill - Moore, 2012) and in Loch Gairloch (at low abundance from one station).

Extensive areas of suitable habitats with comparatively recent records of northern sea fan and sponge communities are proposed in the North and Little Minch to address this current lack of protection.

Shiant East Bank was proposed as an MPA in 2014 for a range of seabed habitats including northern sea fan and sponge communities as well as for geodiversity interests (SNH, 2014). Deep sponge communities have been widely recorded across the bank in waters from ~40-90 m on bedrock, cobbles and boulders in dense fields (somewhat atypical) or scattered over sandy sediments. Northern sea fans are also present although generally at a relatively low density (Moore & Atkinson, 2012; Moore 2012, 2014).

The bank encompassed by the **Little Minch** area is more tide-swept than the Shiant East Bank and this is reflected in the sediments, with little to no burrowed mud habitat present. High densities of northern sea fans are accompanied by a moderately rich sponge fauna over a wide area. White cluster anemones *Parazoanthus anguicomus* (a PMF) are also a feature of the sea fan habitat here. Dense fields of the northern feather star (*Leptometra celtica* - another PMF) on mixed substrates were also recorded at a number of stations in 2011 (Moore, 2012). The Little Minch area extends across the Minch to the eastern margins of the Sound of Harris where multiple records of the diverse, tide-swept sea fan communities with large solitary sea squirts were recorded in 2005 (Malthus *et al.*, 2006). The focus of any management measures should be around the clusters of existing records on the bank and off the coastal margin in the Sound of Harris. Parts of the bank area around a number of the existing feature records appear to be subject to a moderate level of dredging pressure.

To the south, the **Sea of Hebrides (Mingulay 4)** area is notable for the extensive development of diverse, erect deep sponge communities with a fauna including small colonies of northern sea fans at high density on broad areas of flatter rock. This area is adjacent to the SE Mingulay SAC and was surveyed during studies to map the cold-water coral reefs feature of that site (summarised in Davies *et al.*, 2009). The possibility of cold-water corals occurring on 'Mingulay 4' was discussed in Roberts *et al.* (2004) but references to small coral colonies may have been observations of globular growths or aggregations of *Filograna implexa* tube worms which were subsequently recorded in 2010 (Moore & Roberts, 2011). Deep sponge communities are present and protected within the adjacent SAC but not in association with high densities of northern sea fans. The Sea of Hebrides area comprises comparatively low relief habitat in close proximity to moderately high intensity trawl activity.

A broad area to the **South of Eigg** has also been identified around scattered records of northern sea fan communities (including the most diverse tide-swept variant) that are also considered to be potentially exposed to pressures associated with towed bottom-contacting fishing activity (either directly or linked to smothering from disturbed sediments).

Consideration of the need for management measures should focus on the northern sea fan and sponge community records and areas of adjacent suitable habitat. The Oberon Bank is situated to the south-east of the area and appears to be fished heavily on all sides. Records of northern sea fan communities from the bank were made in 2003 by Seasearch divers looking for fan mussels (Solandt & Duncan, 2003). Other records are distributed on the Bo Fascadale reefs off the Ardnamurchan Peninsula, off the SE coast of Eigg and to the north and east of Muck. Additional information for this area may be available from Marine Scotland Science following survey work undertaken in 2014 to map the distribution of fan mussels (see Stirling, 2016). Any measures identified in relation to that PMF [see relevant paper and the proposed South-east of Muck area] could be tailored accordingly to provide protection to adjacent areas of northern sea fan habitat.

Knowledge gaps and other records

Knowledge gaps - Seven knowledge gap areas have been identified primarily on the basis of modelled habitat (i.e. records of northern sea fan and sponge communities may / may not already exist in these areas): **West of Hebrides**; **SW Barra Head**; **West of Tiree**; **East of Uists**; **NW Skye**; **West of Skye**; and, **Sound of Jura**.

On the basis of predictive rock distribution datalayers (Brown *et al.*, 2017), bathymetry and the distribution of existing records, the **West of Hebrides**, **SW Barra Head**, **West of Tiree**, **NW Skye**, and **West of Skye** areas are considered likely to support deep sponge communities. Northern sea fan communities may not occur in shallower areas due to the degree of wave exposure (for the first 3 areas) but sea fans may form a feature of the deeper sponge dominated habitats as observed at Sea of Hebrides (Mingulay 4). Similarly, the area to the **East of the Uists** is also largely un-surveyed, but there are existing records of northern sea fan and sponge communities in nearshore areas and these habitats may be more extensive in waters down to ~<50 m. As with the other knowledge gaps areas, bathymetry and predictive rock mapping suggest that sponge communities are likely to be present on suitable substrates in deeper water.

The most southerly examples of northern sea fan communities in Scottish waters are known from the **Sound of Jura**. There have been recent records of extensive, very high quality habitat from this area but it is currently unclear how the distribution of the PMF relates to the existing fisheries management area at the top of the sound (associated with the Loch Sunart to the Sound of Jura MPA). Further survey work is required in this area to determine whether the existing measures provide sufficient protection to the northern sea fan and sponge communities present in this location. Some additional information on habitat presence and distribution may be available from Marine Scotland Science-led studies undertaken to explore the impacts of scallop dredging on rocky-reef substrata (Boulcott & Howell, 2011).

Other records - There are a number of recent records of northern sea fan communities from the west coast of Mull which supplement existing observations, including an example of the more sparsely recorded low energy habitat with red sea fingers *Alcyonium glomeratum* at MacQuarrie's Rock in Loch na Keal (Dipper, 2016). Any measures developed in this location for other PMFs (including maerl and seagrass beds) could be adapted to afford protection to areas supporting northern sea fans.

There are records of northern sea fan communities to the north of the existing Loch Torridon and Inner Sound fisheries management area (CA56), including the more diverse tide-swept faunal turf habitat. A slight extension to existing measures would provide protection in a northerly area for this component, but the extent of habitat here requires further investigation.

Sea lochs on the south coast of Skye support clusters of records; however, these were not considered particularly high quality examples of the PMF, especially when compared to examples within the adjacent Small Isles MPA, with sparse densities of northern sea fans (Moore, 2015 & 2017).

Data confidence

Available records span 1979-2017, charting the start of the Marine Nature Conservation Review survey programme (Hiscock, 1996) through to a 2016 Porcupine Marine Natural History Society field trip off west Mull (Dipper, 2016) and SNH / SEPA sampling in sea lochs at south Skye (Moore, 2017). Surveys vary in their original aims from Seasearch (carried out by volunteer divers such as the Oberon Bank 2003 survey), studies undertaken to support aquaculture development proposals, to MPA-related nature conservation assessments (e.g. SNH/MSS Little Minch and Mingulay surveys in 2011). Records primarily come from diving and remote video methodologies.

Deep sponge community records from a 2003 survey undertaken to map the distribution of cold-water corals were derived from the classification presented in Roberts *et al.* (2004). These records are not currently held within the PMF database.

There are extensive areas of potentially suitable habitat that have not been surveyed. A number of these have been identified as knowledge gaps. Northern sea fan and sponge communities are therefore considered to be under-recorded on the west coast of Scotland and further records are anticipated (although the geographical range of the different component habitats may not change significantly).

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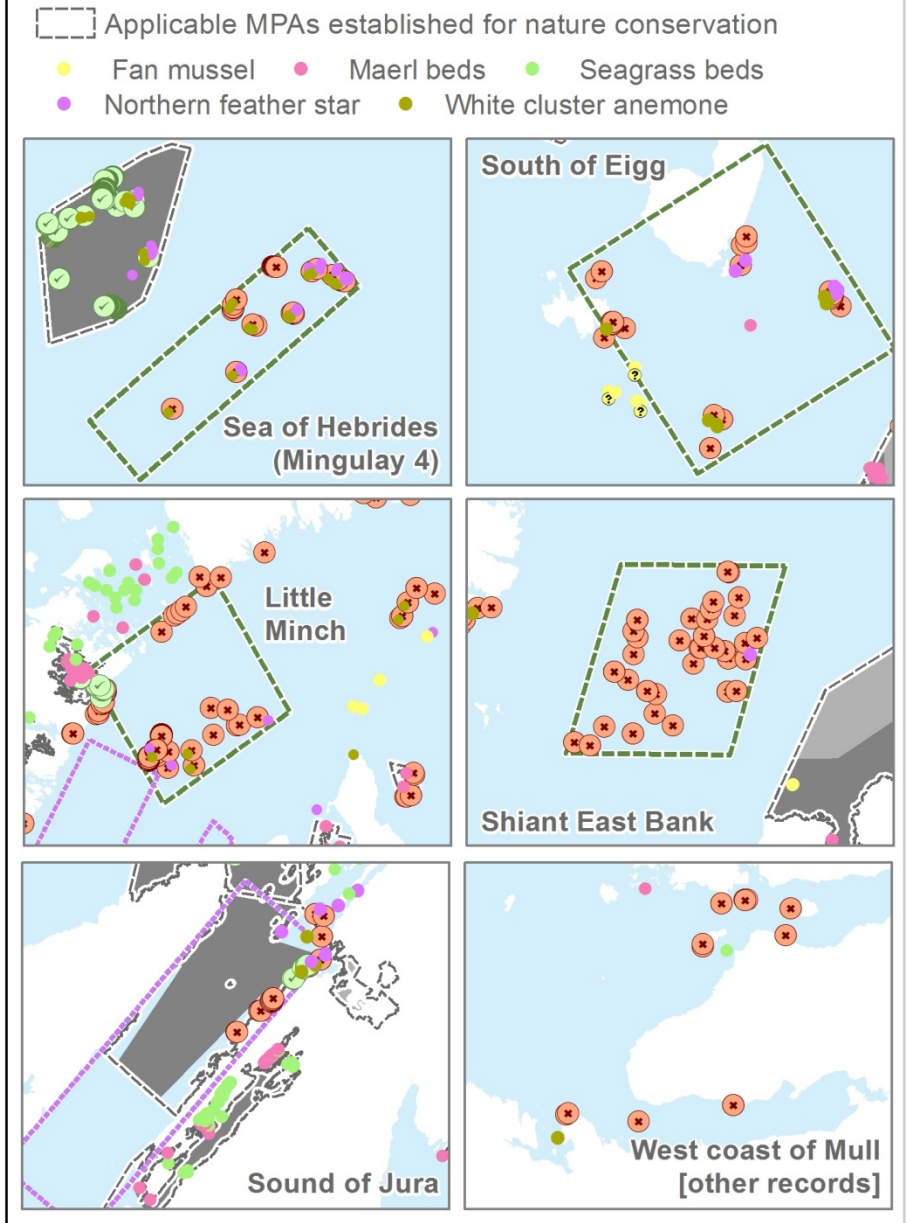
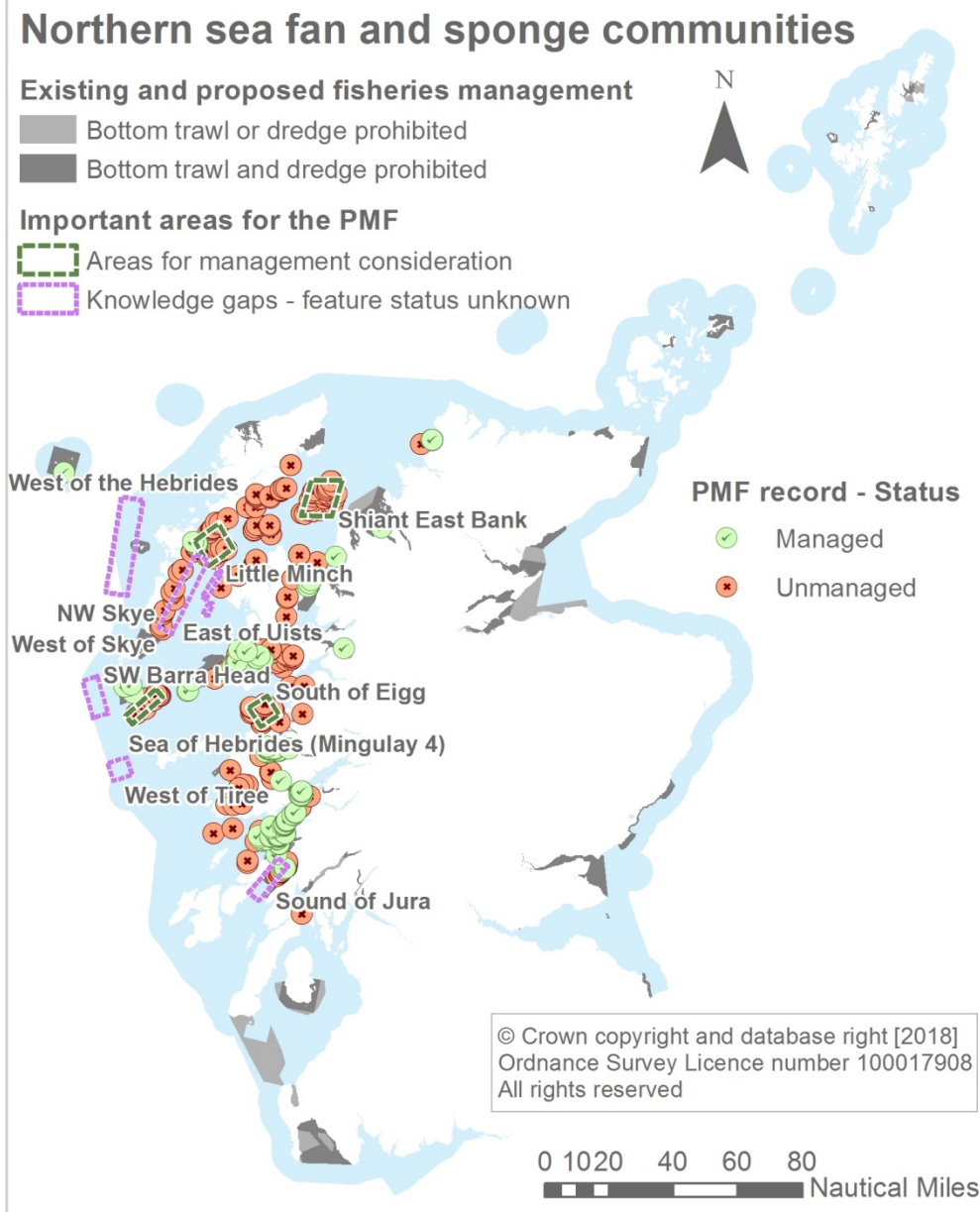
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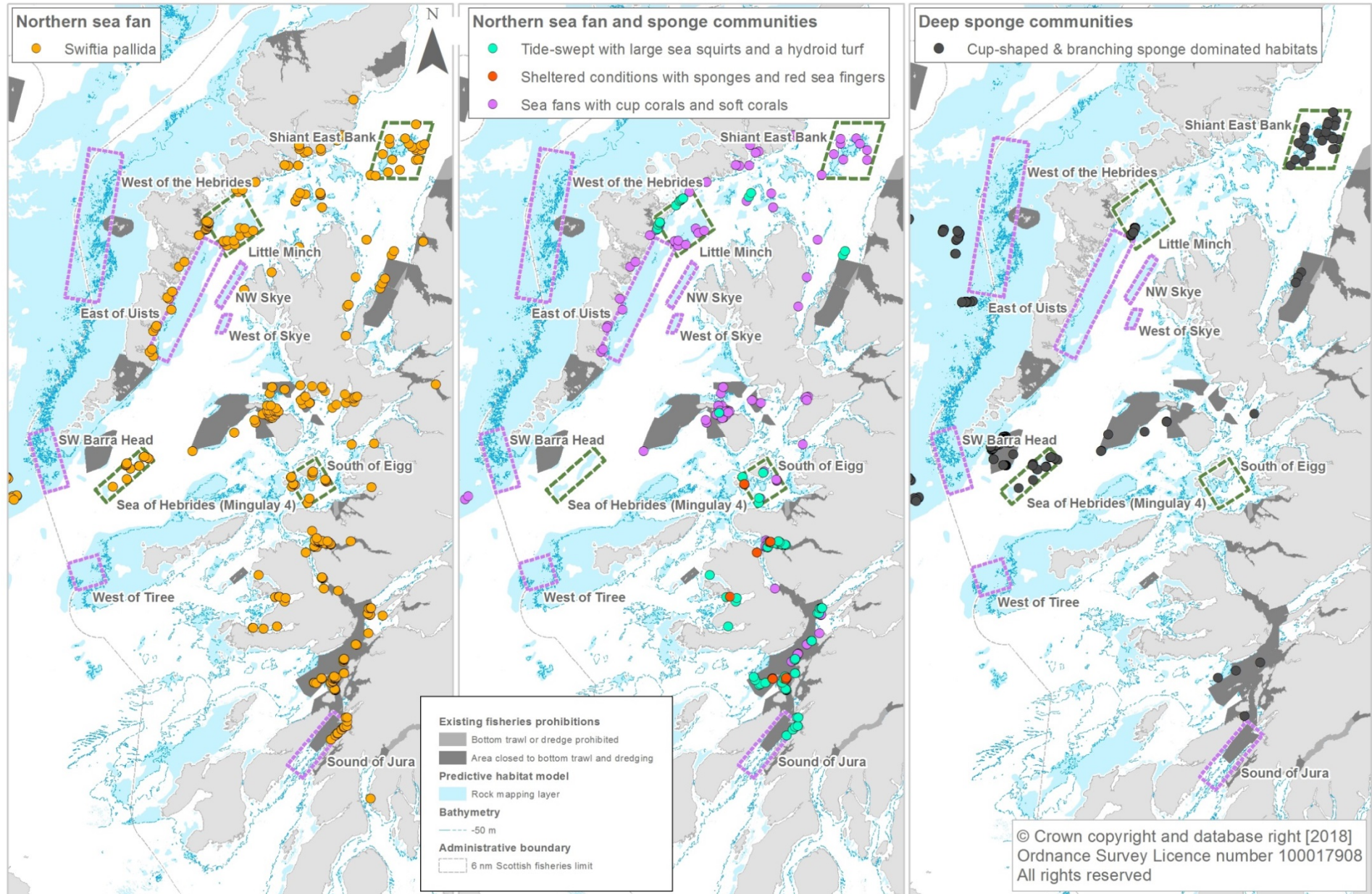
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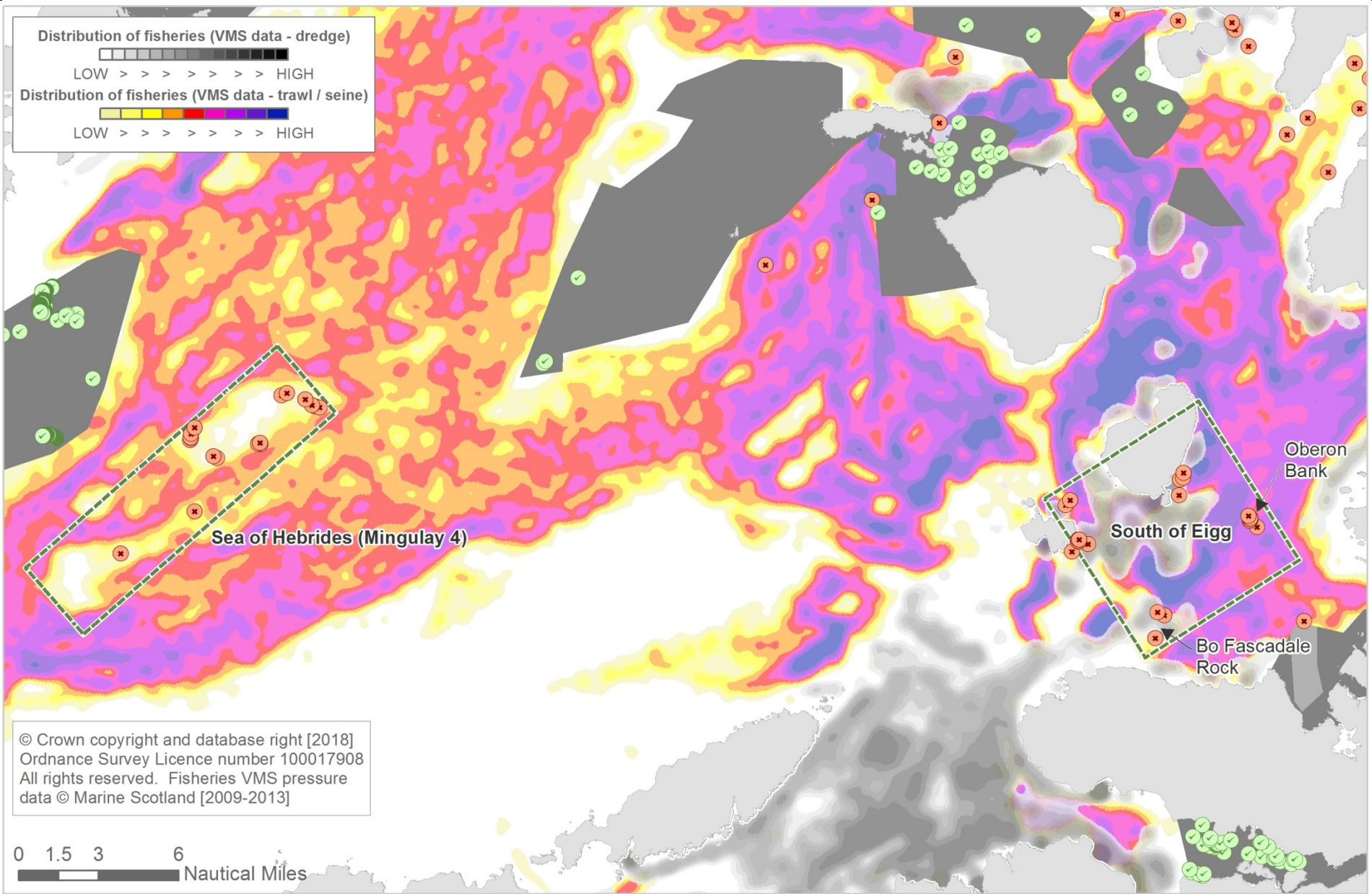
Areas where fisheries management should be considered to avoid a significant impact on the national status of the PMF



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Towed bottom-contacting fishing pressure



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