Scottish MPA Project

Assessment against the MPA Selection Guidelines

FETLAR TO HAROLDSWICK
POSSIBLE NATURE CONSERVATION MPA

Document version control			
Version	**Date**	**Author**	**Reason / Comments**
Version 1	07/02/2013	Siobhan Mannion, Lisa Kamphausen, Laura Clark and Andy Douse	Revised protected feature / possible MPA format, updating original MPA search location format (ver. 4).
Version 2	10/05/2013	Lisa Kamphausen	Added detail / updated to reflect 2012 survey work.
Version 3	10/06/2013	Ben James	Initial review and insertion of refined map following application of boundary setting principles.
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Purpose

This document provides details of the assessment of the Fetlar to Haroldswick possible Nature Conservation MPA against the Scottish MPA Selection Guidelines. It presents the assessment for each of the proposed protected features.

We have used the terminology set out in the Selection Guidelines to describe the five main stages in the assessment process from the identification of MPA search locations through to the development of MPA proposals. This area has now become a possible Nature Conservation MPA because, following advice from SNH and/or JNCC, Scottish Ministers have decided to consult on whether it should be formally designated.

The main terms used are described below.

MPA search location - this describes a location identified at stage 1 until it passes the assessment at stage 4.

Potential area for an MPA - if an MPA search location passes the assessment at stage 4 it goes on to become a potential area for an MPA for consideration at stage 5.

MPA proposal - a potential area for an MPA that has passed the assessment at stage 5 and which has been formally recommended for designation by SNH and/or JNCC to Scottish Ministers.

Possible MPA - an MPA proposal approved by Scottish Ministers for public consultation. From this time the location is given policy protection as if it were designated.

MPA search features - specified marine habitats, species and large-scale features that underpin the selection of Nature Conservation MPAs.

Geodiversity features - specified geodiversity interests of the Scottish seabed categorised under themed 'blocks' that are analogous to the MPA search features for biodiversity.

Representative features - habitats and/or species which are not MPA search features or key geodiversity features. They have been assessed to determine whether they would add to the broader representativity of the network.

Proposed protected feature - any feature (habitats, species, large-scale features and/or geodiversity features) which has been proposed by SNH and/or JNCC for designation as part of a Nature Conservation MPA.

History of development

The Fetlar to Haroldswick possible Nature Conservation MPA was identified for five MPA search features (black guillemot; horse mussel beds; kelp and seaweed communities on sublittoral sediment; maerl beds; and shallow tide-swept coarse sands with burrowing bivalves) and one geodiversity feature (Marine Geomorphology of the Scottish Shelf Seabed). Circalittoral sand and coarse sediment communities is not an MPA search feature but has been recommended as a proposed protected feature because we consider that it would add to the broader representativity of the Scottish MPA network (i.e. a representative feature).

Details of supporting evidence are provided in the Fetlar to Haroldswick data confidence assessment.

FETLAR TO HAROLDSWICK POSSIBLE NATURE CONSERVATION MPA - APPLICATION OF THE MPA SELECTION GUIDELINES

Stage 1 - Identifying search locations that would address any significant gaps in the conservation of MPA search features[1]

Summary of assessment	The Fetlar to Haroldswick possible MPA encompasses a range of MPA search features, including a number considered to be under threat and / or declining in Scottish waters. Sedimentary seabed habitats include beds of maerl (a coralline seaweed) and horse mussels, amongst more widely distributed coarse sandy substrates with kelps and infaunal burrowing bivalve communities. These biogenic habitats provide representation of the Marine Geomorphology of the Scottish Shelf Seabed geodiversity feature. The proposed protected features also include a nationally important proportion (ca. 5.2 %; Mitchell *et al*., 2004) of the British breeding black guillemot population which forage amongst fringing kelp habitats in the clear nearshore waters.

Detailed assessment

Proposed protected features	**Guideline 1a** *Presence of key features* [MPA search features and geodiversity equivalents]	**Guideline 1b** *Presence of features under threat and/or subject to rapid decline*	**Guideline 1c** *Functional significance for the overall health and diversity of Scottish seas*
Biodiversity			
Black guillemot	✓		
Circalittoral sand and coarse sediment communities[2]	*Representative feature*		
Horse mussel beds	✓	✓ **OSPAR T&D**[3]	
Kelp and seaweed communities on sublittoral sediment	✓	✓ **T&D**[4]	
Maerl beds	✓	✓ **OSPAR T&D**[3]	
Shallow tide-swept coarse sands with burrowing bivalves	✓	✓ **T&D**[4]	
Geodiversity			
Marine Geomorphology of the Scottish Shelf Seabed	✓		

1 All proposed protected features of the possible MPA are listed in the stage 1 detailed assessment table and subsequently assessed against the MPA Selection Guidelines (wherever practicable) to facilitate read across to SNH and JNCC's formal 2012 MPA network advice (SNH and JNCC, 2012).

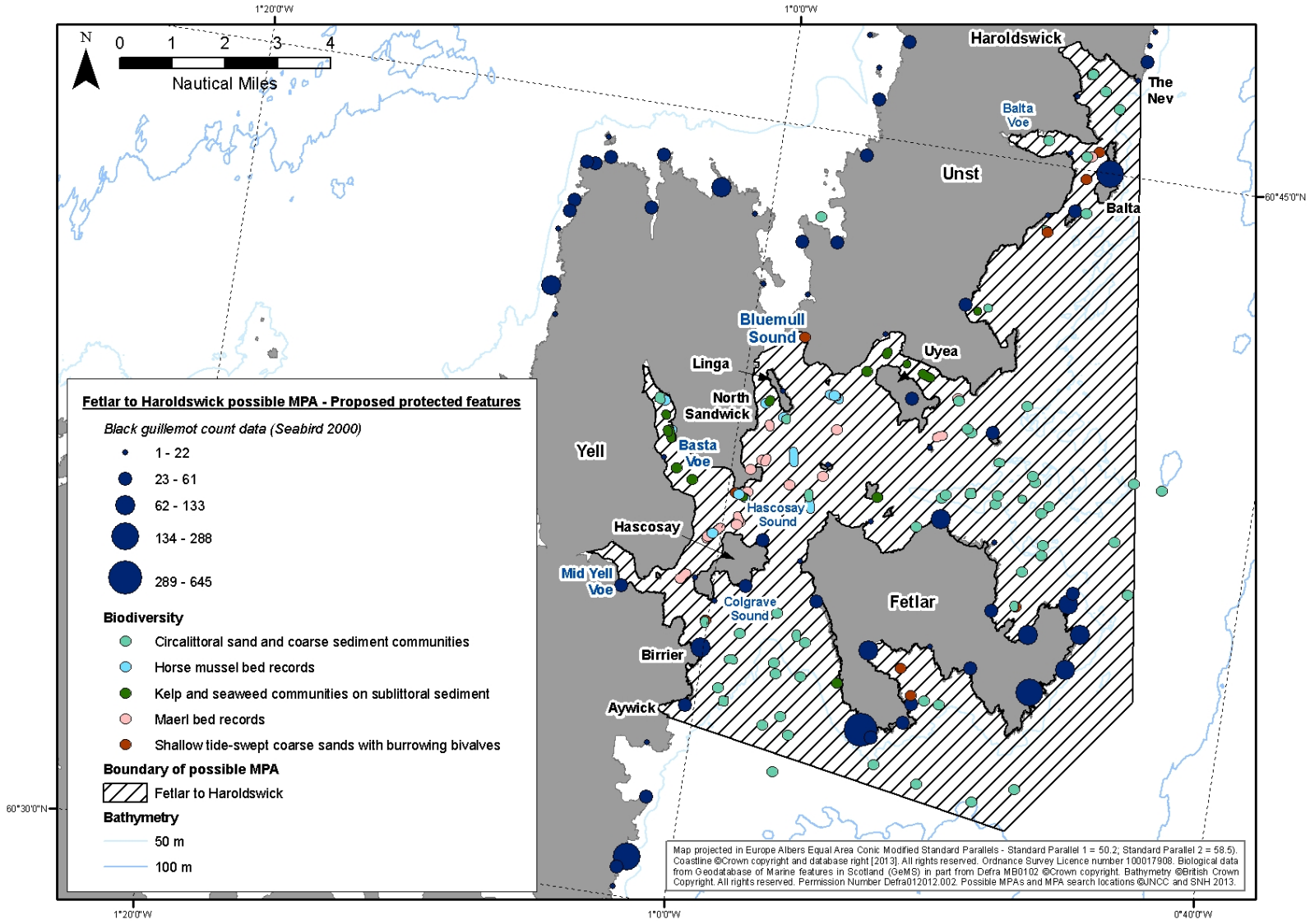
2 Comprising 'Circalittoral coarse sediment' (SS.SCS.CCS) and in particular '*Mediomastus fragilis*, *Lumbrineris* spp. and venerid bivalves in circalittoral coarse sand or gravel' (SS.SCS.CCS[.MedLumVen] - A5.14[2]), and 'Circalittoral fine sand' (SS.SSa.CFiSa - A5.25).

3 OSPAR list of Threatened and/or Declining species and habitats (see OSPAR, 2008 a & b).

4 Feature considered to be under threat and/or in decline in Scottish waters (see http://www.snh.org.uk/pdfs/publications/commissioned_reports/388.pdf for further details).

Map of the Fetlar to Haroldswick possible MPA showing the known distribution of proposed protected features

The possible MPA lies fully within the Shetland Carbonate Production Area, a key geodiversity area that represents the Marine Geomorphology of the Scottish Shelf Seabed feature (Brooks *et al*., 2012).



Stage 2 - Prioritisation of search locations according to the qualities of the MPA search features they contain

Summary of assessment	The Fetlar to Haroldswick possible MPA encompasses a diverse range of proposed protected features distributed within a varied geological setting. The features are integrally linked and many of the seabed habitats exhibit a moderately high level of natural biological diversity. The features differ in their spatial distribution and extent. The black guillemots and circalittoral sand and coarse sediment communities are distributed widely. Kelp and seaweed communities on sublittoral sediment and the maerl and horse mussel beds have a more restricted distribution. The proposed protected features are considered sensitive to a range of pressures and at a regional level are considered to be at medium risk of significant future damage by human activity. On the basis of current evidence, most of the features present within the possible MPA are thought to be in a natural state and largely undisturbed. **Four of the five Stage 2 guidelines have been met** (2a - 2c, and 2e). *Guideline 2d is considered to have been partially met* - there are examples of maerl beds and horse mussel beds within the possible MPA that have been heavily modified and / or lost as a result of human activity and other examples of these same features that could be considered least damaged / more natural.

Detailed assessment

Guideline 2a **The search location contains combinations of features, rather than single isolated features, especially if those features are functionally linked**

The possible MPA encompasses seven proposed protected features; comprising five MPA search features (at a range of scales), multiple interests under the Marine Geomorphology of the Scottish Shelf Seabed geodiversity feature and one representative seabed habitat feature. This diversity is a result of the complex morphology of the island grouping situated on the north-east coast of Shetland. Areas of open coastline, sheltered voes and tide-swept channels give rise to a wide range of environmental conditions and resultant seabed habitats (Howson 1988). The area is subject to grades of wave exposure and moderate tidal streams. Several of the proposed protected features in the area are linked[5].

- Breeding black guillemots are distributed along most of the coastline within the possible MPA and it is likely that there is a close association between this species and sublittoral kelp beds, where black guillemots forage (BirdLife International, 2012).
- The seabed habitats that thrive in tide-swept conditions form a mosaic, with maerl beds, horse mussel beds and kelp and seaweed communities on sublittoral sediments merging into one another. Horse mussel byssus threads and kelp holdfasts can stabilise maerl fragments and conversely the maerl beds can offer attachment points for kelp and horse mussel larvae (Birkett *et al*., 1998). Maerl beds occur in close proximity to records of shallow tide-swept coarse sands with burrowing bivalves and infaunal species such as burrowing bivalves are common to both habitats (Hiscock, 1986; Dixon, 1987; Howson, 1988).
- These biodiversity features are considered an integral functional part of the Shetland carbonate production system (due to their biological production of marine sediments with a high calcium carbonate content) - representing the Marine Geomorphology of the Scottish Shelf Seabed geodiversity feature (see Brooks *et al*., 2012).

Guideline met.

[5] This term refers to linkages between features and also the wider marine ecosystem in Scottish waters and is not the same as functional significance used in relation to Guideline 1c.

Guideline 2b	The search location contains example(s) of features with a high natural biological diversity (applies to seabed habitats only)
Circalittoral sand and coarse sediment communities	The proposed protected feature comprises two biotope[6] complexes: circalittoral fine sands (**SS.SSa.CFiSa**) and circalittoral coarse sediment (**SS.SCS.CCS** - with a particular focus on the finer resolution **SS.SCS.CCS.MedLumVen** biotope - *Mediomastus fragilis, Lumbrineris* spp. and venerid bivalves in circalittoral coarse sand or gravel). The majority of records of circalittoral fine sands were derived from remote video sampling undertaken in 2011 (Moore, 2012). In Colgrave Sound to the west of Fetlar shelly medium sand predominated below 50 m, supporting a fairly sparse visible fauna dominated by hermit crabs. At one station the rarely recorded night anemone, *Halcampoides elongatus*, was recorded as Frequent[7]. To the north, east and south of Fetlar a mix of biotopes was recorded at most sites, principally consisting of rock supporting faunal crust communities, waves of coarse sand (**SS.SCS.CCS**) and rippled fine sand (**SS.SSa.CFiSa**), with sharp boundaries often in evidence between coarse and fine sand biotopes. The coarse sand generally supported a sparse visible fauna, although two sites to the north-east of Fetlar exhibited abundant populations of the small scallop, *Palliolum* sp. Rippled fine sand also displayed little evidence of an infaunal community apart from the presence of bivalve siphons, whilst the epifauna was dominated by hermit crabs, small teleosts and occasional asteroids, particularly *Luidia ciliaris*. As the channel narrows and shallows between Fetlar and Hascosay the substrate coarsened to a medium - coarse sand with scattered and probably mobile *Spirobranchus*-encrusted stones (**SS.SCS.CCS.PomB**). Lack of detailed infaunal data and the sparse visual signs of the nature of the infaunal community necessitated ascription of sedimentary biotopes at a coarse level of resolution (Moore, 2012). Little visible fauna was evident on the 2012 video footage (Hirst *et al.,* 2013), but this is fairly typical for these sediment communities. No species were present at all stations, but the sand mason worm *Lanice conchilega,* hermit crabs *Pagurus bernhardus* and gobies *Pomatoschistus* sp. were recorded at several. Some areas of the **SS.SCS.CCS** biotope complex supported high abundances of ascidians, in particular *Molgula occulta*. The infaunal communities associated with **SS.SCS.CCS.MedLumVen** were seen to support several different sets of bivalve species depending on location, such as *Moerella pygmaea, Cochlodesma praetenue, Spisula* spp., *Crenella decussata*, *Abra* spp., together with pea urchins *Echinocyamus pusillus*, amphipods *Ampelisca* spp. and a range of polychaete worms *Owenia fusiformis*, *Glycera* spp., *Nephtys* spp., *Spio* spp., *Spiophanes* spp. and *L. conchilega*. Another circalittoral sand biotope, **SS.SCS.CCS.Pkef** (*Protodorvillea kefersteini* and other polychaetes in impoverished circalittoral mixed gravelly sand), was assigned to three records in 2012 on the basis of infaunal and particle size composition analyses. This biotope supported the polychaetes *Glycera* spp., *Hesionura elongata* and *Scoloplos armiger*.

[6] Further details on the UK marine habitat classification are available online at http://jncc.defra.gov.uk/page-5931

[7] For details of the SACFOR scale used for reporting the abundance of marine benthic flora and fauna in biological surveys see Hiscock (1996).

Guideline 2b	**The search location contains example(s) of features with a high natural biological diversity (applies to seabed habitats only)**
Horse mussel beds	Tide-swept horse mussel beds (**SS.SBR.SMus.ModT**) were recorded at six discrete locations in 2012 using drop-down video equipment with subsequent detailed *in situ* diver sampling undertaken at three of these beds. The beds are interspersed with other circalittoral mixed sediment habitats (**SS.SMx.CMx**) including brittlestar beds (**SS.SMx.CMx.OphMx** - *Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment), which often support horse mussels at densities too low to qualify as a 'bed' (Hirst *et al.,* 2013). The composition of the biological community associated with the horse mussel beds varies across the possible MPA. Brittlestars are present at high densities on some beds but largely absent on others. Other routinely encountered echinoderms include the common sunstar *Crossaster papposus,* edible urchin *Echinus esculentus*, cushion star *Porania pulvillus* and common starfish *Asterias rubens*. The herringbone hydroid *Halecium halecinum*, tubeworms *Pomatoceros triqueter*, encrusting bryozons and the queen scallop *Aequipecten opercularis* (often sporting a growth of *Suberites* sp. sponge) are present on most beds (Hirst *et al.,* 2013). Dead man's fingers *Alcyonium digitatum,* the feather star *Antedon bifida* and the northern sea urchin *Strongylocentrotus droebachiensis w*ere recorded as Abundant on individual beds but were absent from others surveyed in 2012. In an area of strong tidal streams and moderate wave exposure to the south of Linga in Bluemull Sound, another horse mussel bed biotope **SS.SBR.SMus.Mod.Cvar** (*Modiolus modiolus* beds with *Chlamys varia*, sponges, hydroids and bryozoans on slightly tide-swept very sheltered circalittoral mixed substrata) has been recorded previously (Howson, 1988). At two locations here the substrates comprised mixed cobbles and bedrock with *M. modiolus* and *A. digitatum* the dominant species and the sea cucumber *Cucumaria frondosa* recorded with Occasional abundance. Attempts to relocate these records in 2012 were hampered by vast numbers of brittlestars that may have concealed horse mussels during preliminary video sampling (Hirst *et al.,* 2013). The survey work undertaken in the late 1980s also recorded a horse mussel bed towards the head of Basta Voe at 12 - 14 m on soft muddy sediments, supporting large numbers of brittlestars *O. fragilis*, *O. nigra* and *O. aculeata*, and the slender seapen *Virgularia miriablis* (Howson, 1988, 1999). Coarser sediments in slightly deeper water further down the voe supported a bed that included the lugworm *Arenicola marina*, razor shells *Ensis* spp., the sand star *Astropecten irregularis*, sea cucumbers *Leptopentacta elongata* and the sand burrowing brittlestar *Acrocnida brachiata* (Hiscock, 1986). Loose lying mats of algae, especially bands of *Phyllophora crispa, Enteromorpha, Trailliella intricata, C. filum* and Occasional records of the green urchin *Psammechinus miliaris* were also recorded (Hiscock, 1986). Video sampling undertaken in 2012 did not validate either of these horse mussel bed records despite intensive targeted sampling in this part of the voe. The exact position of one of the previous records could not be sampled because a mussel farm is currently situated in this location (Hirst *et al.,* 2013). Infaunal samples collected from the three horse mussel beds surveyed by divers in 2012 exhibited moderate biological diversity with up to 79 taxa recorded from a single core (range = 36 - 79 and a mean S of 58) and diversity indices calculated ranging from 2.09 to 3.74 (Shannon-Wiener H'). These values are comparable with *Modiolus* clump samples analysed from other beds in Shetland (e.g. Busta Voe S = 65; H' = 3.5 reported in Mair *et al*. (2000)) but are lower than beds on the west coast of Scotland (e.g. Loch Alsh S = 100; H' = 4.5). In light of the differences observed between the multiple examples of the feature within the possible MPA the horse mussel beds are collectively considered to represent seabed habitats of high biological diversity.

Guideline 2b	**The search location contains example(s) of features with a high natural biological diversity (applies to seabed habitats only)**
Kelp and seaweed communities on sublittoral sediment	Different kelp and seaweed communities on sublittoral sediment have been recorded within the possible MPA (at 11 stations sampled in 2012), dominated primarily by conspicuous sugar kelp *Saccharina latissima* (Occasional to Common at different sampling stations) but also by loose lying mats of the red algae *Phyllophora crispa* and some tangle *Laminaria hyperborea*. Five component sub-biotopes have been recognised **SS.SMp.KSwSS.LsacR.CbPb**, **SS.SMp.KSwSS.LsacR.Gv**, **SS.SMp.KSwSS.LsacR.Sa**, **SS.SMp.KSwSS.LsacR.Mu** and **SS.SMp.KSwSS.Pcri** (Dixon 1986; Hiscock, 1986; Howson, 1988; Hirst *et al.,* 2013), depending largely on the seabed substrates present (i.e. whether cobbles and pebbles, gravels, sands or mud). Records of this feature in 2012 were concentrated in the tide-swept area between Unst and Uyea and at the entrance to Balta Sound. Although not prolific and with kelp densities mostly on the low side (Hirst *et al.,* 2013), the feature was recorded at widely dispersed locations. The lower energy *Phyllophora* biotope (**.Pcri**) was recorded towards the head of Basta Voe. Kelp and seaweed communities are typically made up of a high diversity of species, but no quantitative faunal data exist with which to compare indices of biological diversity within this habitat.
Maerl beds	Maerl is the collective term for several species of calcified red seaweed, which in their free living form and under favourable conditions can create extensive beds. The predominant maerl species within the Fetlar to Haroldswick possible MPA is *Phymatolithon calcareum*, and the beds here are classified as '*P. calcareum* maerl beds in infralittoral clean gravel or coarse sand' (assigned to the **SS.SMp.Mrl.Pcal** biotope and in places to the **SS.SMp.Mrl.Pcal.R** and **SS.SMp.Mrl.Pcal.Nmix** sub-biotopes reflecting the presence of a higher abundance of red algal species on the surface of the bed and the presence of the burrowing sea cucumber *Neopendactyla mixta* respectively) (Hiscock, 1986; Howson, 1988; Hirst *et al.,* 2013). The maerl beds consist of dense carpets of large live maerl fragments (40 - 79 % cover, Hirst *et al.,* 2013), often shaped into waves, with scattered dead shell collecting in the troughs. The brown alga *Dichtyota dichotoma* was present at all stations where maerl was recorded in 2012 (Hirst *et al*., 2013). *A. rubens*, *E. esculentus*, *S. latissima*, *P. triqueter*, the sea mat *Membranipora membranacea*, *P. bernhardus* and the painted goby *Pomatoschistus pictus* were all present in at least half the surveyed stations. Quantitative comparison with other Scottish maerl beds is complicated by methodological differences, but some context is provided by studies of beds using similar techniques in the Sound of Arisaig (Moore *et al*., 2004), Loch nam Madadh (Moore *et al*., 2006) and in Loch Laxford (Moore *et al*., 2010). Epibenthic taxon richness at these sites ranged from 33 to 109 species per sample. The Fetlar to Haroldswick beds rank towards the lower end of this scale with 44 and 54 species recorded respectively from pooled core samples collected from two distinct beds. Infaunal taxon richness from the beds ranged from 37 - 73 species with mean values of 53 and 55 species per bed. The total number of infaunal taxa present in each bed was consistently high with values of 110 and 115 species recorded. These values are at the high end of infaunal richness compared with the beds on the west coast of Scotland which ranged from 56 - 122. The values recorded from beds around Ullapool in 2010 had a maximum total of 109 species (Moore *et al*., 2011). Mean infaunal abundances at these west coast sites ranged from 72 to 453 individuals 0.01 m^{-2}, with the Fetlar to Haroldswick beds in mid range (252) (Hirst *et al.,* 2013). Diversity indices in Fetlar to Haroldswick were between H' 2.9 - 3.5 (Shannon-Wiener) and J' 0.73 - 0.89 (Pilou's evenness) for individual beds which is slightly lower than the mainland beds (H' 4.04 - 5.43 and J' 0.79 - 0.96, Moore *et al*., 2011). There are differences in the community composition of different individual maerl bed patches in the Fetlar to Haroldswick possible MPA and several component biotopes are represented. Overall the biodiversity of beds is considered to be high, and the beds appear in good condition.

Guideline 2b	**The search location contains example(s) of features with a high natural biological diversity (applies to seabed habitats only)**
Shallow tide-swept coarse sands with burrowing bivalves	This proposed protected feature comprises the biotope **SS.SCS.ICS.MoeVen** (*Moerella* spp. with venerid bivalves in infralittoral gravelly sand). Associated species vary according to location within the possible MPA and include *Moerella pygmaea* (now *Tellina*) in the majority of samples, as well as maerl *P. calcareum* at a few stations, together with the bivalve *Spisula elliptica,* the razor shell *Ensis arcuatus*, and the polychaetes *L. conchilega, Glycera* spp., *Spio* spp., *Spiophanes* spp. and *Aonides paucibranchiata* (Howson, 1988; Hirst *et al.,* 2013). The feature is often situated adjacent to records of the related but deeper **SS.SCS.CCS.MedLumVen** biotope (included within the proposed protected feature circalittoral coarse sediment communities). As with that biotope, the exact species composition varies across the possible MPA. Infaunal diversity indices are only available from one area of **SS.SCS.ICS.MoeVen** sampled in 2012. Nineteen species were recorded from single grab sample and the samples was assigned a fairly low Shannon-Wiener diversity index of H' = 2.84. There are not enough data to determine if the proposed protected feature is of high biological diversity throughout the possible MPA (it is naturally less diverse than other seabed habitats because of the mobile substrates), though the habitat does appear to be in good condition (Hirst *et al.,* 2013).
2b - Result	**Guideline met**. Though data are insufficient to make formal comparisons of diversity indices for some proposed protected features, overall natural biological diversity is high.

Guideline 2c	**The search location contains coherent examples of features, rather than smaller, potentially more fragmented ones**
Black guillemot	Black guillemots breed along the rocky coastline throughout the possible MPA where suitable nesting habitat exists (almost exclusively cliff nesters utilising crevices, holes under rocks and other concealed locations - SNH, 2012). There are concentrations of birds around Fetlar, along sections of the east coast of Yell such as at Birrier, and on the island of Balta to the north. The area of the existing Fetlar Special Protection Area (SPA) supports ca. 2.6 % of the British breeding population (between 950 and 1,000 individuals). The possible MPA extends beyond the SPA and encompasses 5.2 % of the British breeding population (over 2,000 birds) (Mitchell *et al.*, 2004; SNH, 2012). Large numbers of black guillemots use the possible MPA as a moult and winter foraging area, suggesting that the breeding population is largely sedentary. The Northern Isles are the British stronghold of this species (Mitchell *et al*., 2004) and the possible MPA may be one of the most important wintering areas in Shetland (Ewins and Kirk, 1988). The provisional results of survey work undertaken in 2013 suggest that numbers have remained fairly stable since the Seabird 2000 sampling, with 2,090 birds counted within the area of the possible MPA.
Circalittoral sand and coarse sediment communities	The circalittoral sand and coarse sediment communities feature is widely distributed across the possible MPA (Moore, 2012; Hirst *et al.,* 2013) and undoubtedly extends well beyond the proposed boundary. The precise area of this feature has not been calculated but is likely to exceed 65 km^2. The **SS.SSa.CFiSa** and **SS.CCS.MedLumVen** samples aligned well with the descriptions provided for these biotopes within the national classification (Connor *et al*., 2004) and are considered to represent typical examples. The deeper water sedimentary habitats are generally more stable than shallower, infralittoral equivalents and consequently support more diverse faunal communities. There is no specific information on the minimum size of an area required to ensure viability of these communities. However, the majority of species identified as being faithful and frequent residents of the feature have a larval phase in their development (Hill *et al.*, 2010) and so are capable of dispersing over large distances (providing connectivity with areas beyond the possible MPA). In the absence of significant disturbance, the feature is therefore expected to persist.

Guideline 2c	**The search location contains coherent examples of features, rather than smaller, potentially more fragmented ones**
Horse mussel beds	Horse mussel beds were recorded as a series of discrete patches within Bluemull and Colgrave Sounds and at the mouth of Basta Voe to the north and west of Hascosay (at six locations in 2012). Individual horse mussels were also recorded scattered throughout much of the intervening area in 2012 (at a further 16 video sampling stations). Because of the dispersive larval life history stage of this species, connectivity between the individual beds is therefore likely to be high. One of the beds recorded in this area in the 1980s (Hiscock, 1986; Howson, 1988) was validated in 2012 but others were not and it is currently unclear whether they are still present at their former locations (Hirst *et al.,* 2013). The abundance of *M. modiolus* where it was found as a bed varied from Frequent at one location (10 - 20 % cover - the lowest abundance considered to constitute a bed during the 2012 survey), to Common at four locations (20 - 39 %) and Abundant (40 - 79 %) at the bed off the south coast of Unst (Hirst *et al.,* 2013). The heterogeneity of the seabed habitats prevented a meaningful estimation of bed size in 2012 but the video transects assigned to the horse mussel beds feature ranged from 86 m in length to 418 m in water depths of 8 - 27 m. Horse mussels are a long-lived species, with individuals over 25 years old frequent in British populations and occasional records of up to 35 years (Hill *et al*., 2010). Maximum ages are thought likely to be in excess of 50 years (Anwar *et al*., 1990). Temporal variability of horse mussel beds has not been well studied but in the absence of regular disturbance and despite intermittent and variable recruitment, they appear to be fairly stable in the long-term with beds known from the same location for 80+ years (Anwar *et al*., 1990; Hill *et al*., 2010; Seed and Brown, 1975). The complex coastline between Fetlar and Haroldswick and the resulting range of environmental conditions manifests itself in the wide range of species seen in association with the different horse mussel beds here. The characteristic species align well with those outlined within the national biotope classification (Connor *et al*., 2004).
Kelp and seaweed communities on sublittoral sediment	The kelp and seaweed communities on sublittoral sediment proposed protected feature is naturally highly fragmented where recorded in shallow waters around Scotland's coastline, and there are several distinct and separate areas of the different component biotopes that comprise the feature across the possible MPA. The boundaries of the feature are considered fluid however; especially where maerl beds and the kelp and seaweed communities feature merge into one another. The key characterising species of this feature such as sugar kelp *Saccharina latissima* are widespread occurring in other sedimentary and rocky habitats. The species has a high dispersal potential of up to 10 km (Kinlan and Gaines, 2003), so the fragmentation observed is unlikely to affect recruitment and population maintenance - the discrete patches of the feature are likely to be connected within the possible MPA and beyond. *S. latissima* is reported to live for 2 to 4 years and grows quickly in the spring but is highly intolerant to increases in wave action or increasing shelter (White and Marshall, 2007). Records of this feature have been made over several decades (e.g. Hiscock, 1986; Hirst *et al.,* 2013) and are considered to be of sufficient longevity to allow for management as a protected feature, even though seasonal and annual variation in algal coverage will occur.
Maerl beds	Maerl was observed at 16 of the stations sampled by drop-down video in 2012. The maerl beds proposed protected feature (**SS.SMp.Mrl.Pcal / .R**]) was assigned to nine of these records. The maerl bed records are concentrated down the east side of Yell into Hascosay Sound, in the Bluemull Sound area off the south-east of Uyea and at the mouth of Balta Sound, with records of less abundant scattered maerl throughout the survey area. The level of fragmentation found within maerl beds is highly variable. The maerl bed records may represent an almost continuous bed in Hascosay Sound but in other areas smaller beds were recorded in association with other habitats, e.g. merging into and out of horse mussel beds or kelp and seaweed communities on sublittoral sediment (Hirst *et al.,* 2013). Conservative estimates of the extent of this feature are given in Hirst *et al*. (2013). The maerl beds are estimated to cover ca. 0.67km^2 off Hascosay, and 0.27km^2 further north in Bluemull Sound.

Guideline 2c	**The search location contains coherent examples of features, rather than smaller, potentially more fragmented ones**
Maerl beds *cont*.	The beds are of moderate scale in a Scottish context. Very little information is available to assess the area required to ensure the viability of maerl beds. Vegetative growth is the main form of propagation so the dispersal potential of maerl is limited, probably less than 1 km, based on the dispersal of adults by water movement. Therefore, Hill *et al.* (2010) conclude an area of 1 km^2 would incorporate the complete asexual life cycle. Many maerl beds in Scottish waters are smaller than this and are considered to be largely self-sustaining due to vegetative propagation. Regardless of the size of a maerl bed it is recommended that beds are protected to their full extent. Maerl is extremely slow-growing with growth rates in Scotland in the order of tenths of millimetres to two millimetres per year. The life-span of individual plants of *P. calcareum* is estimated to be from 20 to 100 years. Thus, in the absence of disturbance or any changes in the suitability of habitat, maerl beds are likely to be long-lived and stable. Their recovery potential is low (OSPAR, 2010).
Shallow tide-swept coarse sands with burrowing bivalves	The shallow tide-swept coarse sands with burrowing bivalves (**SS.SCS.ICS.MoeVen**) feature has been confirmed from a small number of discrete and widely dispersed locations within the possible MPA. Many of the species associated with the feature are also found in the more widely distributed and closely aligned circalittoral **SS.SCS.CCS.MedLumVen** biotope. Fragmentation of the **SS.SCS.ICS.MoeVen** biotope is therefore considered less than the mapped distribution of the feature might suggest. The records of the feature are considered 'typical' of this biotope which is found on coarse, gravelly infralittoral sand (0 - 20 m) on exposed open coasts subject to moderately strong tidal water movement (Conner *et al.,* 2004). A number of the characterising species, such as venerid bivalves, were sparse in the Fetlar to Haroldswick samples - a greater number of larger samples would be required to accurately quantify their abundance and distribution within the possible MPA. Very little information is available to assess the area required to ensure the viability of this proposed protected feature, and specifically of the bivalve communities. Similarly, there are no data on the longevity of this feature, but its continued presence since initial records in the mid-1980s (e.g. Howson, 1988) infers a level of permanency. In the absence of significant disturbance, the feature is expected to persist.
2c - Result	**Guideline met**.

Guideline 2d	**The search location contains features considered least damaged / more natural, rather than those heavily modified by human activity**
Black guillemot	Areas of nesting habitat within the possible MPA are essentially unmodified. Black guillemot numbers have remained reasonably stable across the three most recent counts suggesting that the population has not been adversely affected by human activity.
Circalittoral sand and coarse sediment communities	A number of fishing vessels were observed working in areas supporting this seabed feature during the 2012 marine biological survey. The scale and significance of any modification to the component biotope complexes is unknown. The **SS.SCS.CCS.MedLumVen** biotope has a high or very high recoverability (full recovery within months to years) to the range of pressures that might be associated with fishing activity (Rayment, 2001).

Guideline 2d	**The search location contains features considered least damaged / more natural, rather than those heavily modified by human activity**
Horse mussel beds	No evidence of damage was recorded from the horse mussel beds studied in detail during the 2012 survey (Hirst *et al*., 2013). However, five horse mussel bed records from the late 1980s were re-visited as part of the 2012 work with the feature only confirmed from one of these locations (of the six small beds recorded in 2012, five represent new records). One of the previously recorded beds in Basta Voe could not be relocated in 2012 despite intensive targeted sampling and it is likely that the bed no longer exists in this location. Uncertainties exist around the continued presence of another bed within Basta Voe and at two locations in Colgrave Sound. Scattered individual horse mussels were recorded in the vicinities of these former records and it is currently unclear whether there has been a wider deterioration in feature condition and if so, whether this is related to human activity taking place within the possible MPA.
Kelp and seaweed communities on sublittoral sediment	No indicators of damage to this feature were recorded during the most recent marine biological survey which was undertaken in 2012 (Hirst *et al*., 2013). The feature is therefore considered to be in a natural state within the possible MPA.
Maerl beds	No evidence of damage was recorded from the maerl beds studied in detail during the most recent survey in 2012 (Hirst *et al*., 2013). However, evidence of damage to this feature as a result of human activity has been documented (Hall-Spencer *et al*., 2006; Haskoning Ltd, 2006). Benthic studies were undertaken to assess the impacts of a fish farm at North Sandwick situated over a maerl bed. The sampling recorded a significant reduction in live maerl with infaunal community composition shifts reflecting organic enrichment (e.g. high densities of polychaetes).
Shallow tide-swept coarse sands with burrowing bivalves	No indicators of damage to this feature were recorded during the most recent marine biological survey which was undertaken in 2012 (Hirst *et al*., 2013). The feature is therefore considered to be in a natural state within the possible MPA.
Geodiversity	The biodiversity features are considered an integral functional part of the carbonate production system in Shetland waters (representing the Marine Geomorphology of the Scottish Shelf Seabed geodiversity feature). In light of the continued presence of both maerl and horse mussel beds (the most sensitive biodiversity features present) at a number of discrete locations across the possible MPA, the wider geodiversity interests are considered to be in a natural state.
2d - Result	**Guideline <u>partially</u> met**. There are instances of localised damage to a number of the proposed protected features within the possible MPA. At least one maerl bed within the possible MPA is known to have been heavily modified by human activity and it would also appear that at least one horse mussel bed (within Basta Voe) has been lost since detailed survey work was last undertaken in the mid-1980s. The cause of this feature loss in unknown. Uncertainties exist regarding the continued presence and status of another horse mussel bed within Basta Voe and at two other former locations in Colgrave Sound. However, the 2012 survey work did record multiple new, good quality examples of both features at a number of discrete locations within the possible MPA. These examples did not show signs of modification and are considered to in a natural state.

Guideline 2e	The search location contains features considered to be at risk[8] of significant damage by human activity
Black guillemot	The Fetlar to Haroldswick possible MPA lies within the North MPA region[9]. On the basis of a risk assessment undertaken at the level of the MPA region, there is considered to be a **low** risk of significant damage to this feature arising from human activity (a cumulative assessment considering the range of activities known to be taking place in the MPA region). Within the region, black guillemot populations are at medium risk from marine energy production (wave and tidal turbines and associated infrastructure), seaweed harvesting and non-native species colonisation e.g. American mink (currently either absent or present at only very low levels but there is potential for the spread of this species from the west coast of Scotland). The risk of damage from fishing and aquaculture-related activities is considered to be low.
Circalittoral sand and coarse sediment communities	**Regional risk assessments have not been completed for representative features**. However, information is available on the likely sensitivity of this feature (based on **SS.SCS.CCS.MedLumVen** biotope) to pressures arising from human activity. The feature is considered to be moderately sensitive to substratum loss, chemical contamination and decreases in salinity. It is considered to have a low sensitivity to abrasion and physical disturbance, changes in water flow rate and increases in wave exposure (Rayment, 2001).
Horse mussel beds	On the basis of the cumulative regional risk assessment, there is considered to be a **medium-high** risk of significant damage to this feature arising from human activity. Within the region, the feature is considered at high risk from aquaculture (fin-fish farming), hydraulic dredging for bivalves, otter trawling and scallop dredging and at medium risk from seaweed harvesting, dive fisheries, set netting and shellfish farming. Infrastructure developments, tourism and shipping-related activities are considered to pose a low risk.
Kelp and seaweed communities on sublittoral sediment	On the basis of the cumulative regional risk assessment, there is considered to be at **low** risk of significant damage arising from human activity. Within the region, the feature is considered at high risk from hydraulic dredging for bivalves and at medium risk from otter trawling and scallop dredging. The risk of damage from marine energy production (wave and tidal turbines and associated infrastructure) and aquaculture-related activities is considered to be low.
Maerl beds	On the basis of the cumulative regional risk assessment, there is considered to be a **medium** risk of significant damage to this feature arising from human activity. Within the region, the feature is considered at high risk from demersal fishing activity (hydraulic dredging, otter trawling and scallop dredging) and medium risk from other fishing techniques, seaweed harvesting, aquaculture, and tourism and leisure-related activities.

[8] Information on the sensitivity of the MPA search features to pressures and their associated activities was taken from Tillin *et al*. (2010). The degree to which an MPA search feature is exposed to activities / pressures to which it is sensitive in each MPA region was assessed to provide a qualitative measure of risk. Risk assessments for the various activities were examined to produce an overall qualitative risk assessment by MPA region. The conclusions may therefore not reflect the level of risk at the scale of the possible MPA. Site-specific activities and pressures are considered in further detail within the management options paper produced for this possible MPA.

[9] The seas around Scotland were split into five MPA regions (East, North, West, South-west and Far West) at the outset of the MPA Project to aid the identification of MPA search locations and the preliminary appraisal of these against the MPA Selection Guidelines (e.g. the completion of regional risk assessments). This approach provided a useful framework for the initial stages of assessment. Within SNH and JNCC's formal MPA network advice (SNH and JNCC, 2012) the MPA proposals and remaining MPA search locations were then cast within the context of broader OSPAR regions.

Guideline 2e	**The search location contains features considered to be at risk[8] of significant damage by human activity**
Shallow tide-swept coarse sands with burrowing bivalves	On the basis of the cumulative regional risk assessment, there is considered to be at **low** risk of significant damage arising from human activity. Within the region, the feature is considered at high risk from hydraulic dredging for bivalves and at medium risk from dive fisheries, otter trawling and scallop dredging. The risk of damage from other fishing activities, marine energy production (wave and tidal turbines and associated infrastructure) and aquaculture-related activities is considered to be low.
Geodiversity	**Regional risk assessments have not been completed for geodiversity features**. Information is available on the likely sensitivity of this feature to pressures arising from human activity (Brooks, 2013). The biodiversity features are considered an integral functional part of the carbonate production system and form a component of the geodiversity feature with associated risks as outlined above. The Marine Geomorphology of the Scottish Shelf Seabed geodiversity feature is primarily considered sensitive to changes in tidal flow, physical change (deposition of materials on the seabed such as concrete mattresses, rock dumping, and moorings) and physical removal (sediment extraction). These pressures may be associated with marine energy production (wave and tidal turbines and associated infrastructure) or other coastal developments. The feature is considered to have low or no sensitivity to pressures associated with fishing activities. In the vast majority of instances, most pressures associated with marine anthropogenic activities will not be sufficient to impact geological and geomorphological seabed features (Brooks, 2013).
2e - Result	**Guideline met**. This is not an assessment of activities that require management within the possible MPA. That assessment is provided in the management options paper.

Stage 3 - Assessing the appropriate scale of the search location in relation to search features[10] it contains
Assessment
The size of the search location should be adapted where necessary to ensure it is suitable for maintaining the integrity of the features for which the MPA is being considered. Account should also be taken where relevant of the need for effective management of relevant activities
The size and shape of the possible MPA reflect the known extent of the proposed biodiversity protected features. Field studies and modelling work indicate that approximately 95% of all black guillemot foraging occurs within 2 km of the coastline where they nest; and generally in waters less than 50 m deep (SNH, 2012). Building upon the existing Fetlar SPA, the boundary incorporates this black guillemot foraging area (aligned with 50 m bathymetric contour to the south and east of Fetlar) and extends up the east coast of Unst to The Nev at Haroldswick, across the bottom end of Bluemull Sound and down the east coast of Yell to Aywick to incorporate known records of shallow tide-swept coarse sands with burrowing bivalves, maerl beds and horse mussel beds. The boundary incorporates Basta Voe and Mid Yell Voe, Hascosay and Colgrave Sounds and stretches of open coastline. Black guillemots are a proposed protected feature across the whole of possible MPA which would encompass ca. 5.2 % of the British breeding population (in excess of 2,000 individuals - Mitchell *et al.*, 2004). The circalittoral sand and coarse sediment communities are widely distributed around Scotland and extend beyond the proposed boundary. The area of this feature is large and considered sufficient to maintain integrity. The possible MPA lies fully within a key geodiversity area which encompasses the whole of Shetland. The geodiversity interests did not influence boundary design and the possible MPA provides for representation only, of the Marine Geomorphology of the Scottish Shelf Seabed geodiversity feature. **Guideline met**.

[10] Assessing the size and shape of a possible MPA involves considering the distribution of both MPA search features and relevant geodiversity features. The latter, which are analogous to the biodiversity search features, were defined after the publication of the MPA Selection Guidelines (refer to Brooks *et al*., 2012).

Stage 4 - Assessing the potential effectiveness of managing features within a search location as part of a Nature Conservation MPA

Summary of assessment	**The possible MPA passed the assessment against the Stage 4 guideline**. This resulted in the original MPA search location progressing as a potential area for an MPA to Stage 5.

Detailed assessment

There is a high probability that management measures, and the ability to implement them, will deliver the objectives of the MPA

The conservation objective for all protected features except horse mussel beds within this possible MPA is to 'conserve'. The features are considered to be in good condition. The conservation objective for the horse mussel beds is to 'conserve (feature condition uncertain)'. Uncertainties remain regarding the current status of a number of former horse mussel bed records within the possible MPA.

A number of activities are considered capable of affecting the proposed protected features (see 2e above) and there is therefore a need to consider whether additional management is required.

Statutory mechanisms exist (e.g. Fisheries Orders or Marine Conservation Orders) to support the introduction of spatial / temporal measures to conserve the features within the possible MPA. For example, Fisheries Orders have already been used to underpin management of marine Special Areas of Conservation. There is therefore potential for management measures to be implemented successfully and the conservation objective of the MPA to be achieved. Further discussion is required with those involved in using the possible MPA to provide clarification on interactions between the protected features and known / potential activities / developments.

Additional details are provided in the management options paper produced for this possible MPA.

Stage 5 - Assessment of the contribution of the potential area to the MPA network

Summary of assessment	Guideline met - **if designated the possible MPA would make a significant contribution to the MPA network.**

Detailed assessment

The potential area contributes significantly to the coherence of the MPA network in the seas around Scotland

Assessment of biodiversity features

Feature	Representation	Replication	Linkages	Geographic range & variation	Resilience
Black guillemot	Encompasses ca. 5.2 % of the GB breeding population (2.6 % within the area of the existing SPA).	Replication of this feature in the network is proposed within and between OSPAR Regions II and III (see SNH and JNCC, 2012).	Not applicable[11]	One of the largest populations of black guillemots in Shetland and the UK, notable also for moulting and wintering concentrations. The most northerly example of the feature within the MPA network.	Additional replication within the network is proposed because the population in Scotland, particularly along the west coast (and islands), is considered to be threatened as a result of predation by introduced mammalian predators.
Circalittoral sand and coarse sediment communities	Good examples of deep sand and coarse sediment communities. [**SS.SCS.CCS** and **SS.SSa.CFiSa** biotope complexes]	Replication of the feature in the network is proposed within and between OSPAR Regions II and III (see SNH and JNCC, 2012).	Not applicable[12]	The most northerly example of the feature within the MPA network.	A representative feature. Not considered to be threatened and/or declining. Recommended to ensure representation of the range of broad-scale habitats within the Scottish MPA network.

[11] Connectivity has only been considered for black guillemots within the Clyde Sea Sill possible MPA and the provision of linkages to Irish populations of this species. This is because juvenile black guillemots tend not to move further than about 50 km from their natal colony (SNH, 2012).

[12] The linkages part of the guideline has only been assessed in situations where there is a good understanding of the relationship between features in different areas to help build connectivity into the network. There is currently little evidence on which to base assessments of linkages for seabed habitats and low or limited mobility species in Scotland's seas. Whilst there is information available for some species on dispersion distances, this cannot be readily applied to areas with complicated hydrography. For this reason, Marine Scotland Science is currently completing work on connectivity which focuses on a number of seabed habitats and low or limited mobility species (see http://www.scotland.gov.uk/Resource/0038/00389468.doc for an outline of work being undertaken to consider connectivity within the Scottish MPA network).

Assessment of biodiversity features					
Feature	**Representation**	**Replication**	**Linkages**	**Geographic range & variation**	**Resilience**
Horse mussel beds	Good examples of the feature comprising - *Modiolus modiolus* beds with hydroids and red seaweeds on tide-swept circalittoral mixed substrata [**SS.SBR.SMus.ModT** biotope]	Replication of this feature in the network is proposed within and between OSPAR Regions II and III (see SNH and JNCC, 2012).	Not applicable[12]	Nearshore tide-swept sounds. Example of a large area with a number of small discrete horse mussel beds in OSPAR Region II. The most northerly example of the feature within the MPA network.	Additional replication of this feature is proposed within the network because horse mussel beds are considered to be threatened and declining in Scottish waters. The feature is listed on the OSPAR List of Threatened and/or Declining habitats.
Kelp and seaweed communities on sublittoral sediments	Good examples of the feature. [a number of different biotopes under the **SS.SMp.KSwSS** biotope complex]	Replication of this feature in the network is proposed within and between OSPAR Regions II and III (see SNH and JNCC, 2012).	Not applicable[12]	Examples of different habitat variants (**.LSacR.CbPb**; **.LSacR.Gv**; **.LSacR.Sa**; **.LsacR.Mu**; and **.Pcri** biotopes). The most northerly example of the feature within the MPA network.	Not required to achieve adequacy because of the protection already provided by existing measures. Examples of the feature within the possible MPA are of high quality. Recommended to add to the integrity of the proposal and complement existing protection in Region II.
Maerl beds	Good examples of the feature comprising beds of - *Phymatolithon calcareum* maerl beds in infralittoral clean gravel or coarse sand. [**SS.SMp.Mrl.Pcal** biotope]	Replication of this feature in the network is proposed within and between OSPAR Regions II and III (see SNH and JNCC, 2012).	Not applicable[12]	Nearshore tide-swept sounds. Example of a large area with a number of small discrete maerl beds in OSPAR Region II. Examples of different habitat variants (**.Pcal**; **.Pcal.R** and **.Pcal.Nmix** biotopes). The most northerly example of the feature within the MPA network.	Additional replication of this feature is proposed within the network because maerl beds are considered to be threatened and declining in Scottish waters. The feature is listed on the OSPAR List of Threatened and/or Declining habitats.

Assessment of biodiversity features					
Feature	**Representation**	**Replication**	**Linkages**	**Geographic range & variation**	**Resilience**
Shallow tide-swept coarse sands with burrowing bivalves	Good examples of the feature occurring in multiple locations across the possible MPA. [**SS.SCS.ICS.MoeVen** biotope]	Replication of this feature in the network is proposed between OSPAR Regions II and III (see SNH and JNCC, 2012).	Not applicable[12]	The most northerly example of the feature within the MPA network.	Replication of the feature, which is considered to be threatened and declining in Scottish waters, would be delivered within the network through the possible MPAs.

Assessment of geodiversity features	
Geodiversity features[13]	The Fetlar to Haroldswick possible MPA lies within the Shetland Carbonate Production Area, a key geodiversity area in Scottish waters representing an internationally important example of a non-tropical shelf carbonate system (the biological production of marine sediments with high calcium carbonate content - derived from the shells of animals that live in on the seabed or from coralline algae such as maerl). The nearshore (0 - 30 m) sediment composition of the seabed around the Shetland Isles has not been investigated in detail. However, the outer shelf (30 - 50 m) is dominated by *Ditrupa*-rich sediments where as the deeper open shelf (50 - 200 m) is dominated by molluscs. These sediments supply the carbonate sands seen on sandy beaches around Shetland and they also underpin the development of small areas of coastal machair (which supports diverse grassland vegetation) - they are considered to be critical to the functioning of the wider marine and coastal ecosystem. Source: Brooks *et al*., 2012 (and references therein).

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[13] For geodiversity the stage 5 assessment primarily considers the potential contribution to the principal 'networks' of marine geodiversity interests present in Scottish waters (representation).

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