



<b>Scottish MPA Project</b> <b>Assessment against the MPA Selection Guidelines</b>
<b>NORTH-EAST FAROE-SHETLAND CHANNEL NATURE CONSERVATION MPA</b>
<i>JULY 2014</i>

The following documents provide further information about the North-east Faroe-Shetland Channel Marine Protected Area (MPA):

- Site Summary Document
- Data Confidence Assessment
- Management Options Paper

The documents are all available at [www.jncc.defra.gov.uk/page-6483](http://www.jncc.defra.gov.uk/page-6483)

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## Background

This document provides details of JNCC's assessment of the North-east Faroe-Shetland Channel Nature Conservation MPA (herein referred to as 'MPA') against the [Scottish MPA Selection Guidelines](#). It presents an assessment for each of the 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 an MPA.

*The main terms used are described below.*

MPA search feature - specified marine habitats, species and large-scale features which 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.

Protected feature - any feature (habitats, species, large-scale features and/or geodiversity features) which are specified in the MPA Designation Order.

MPA search location - this describes a location identified at stage 1 [of the Selection Guidelines] until it passes the assessment against stage 4.

Potential area for an MPA - if an MPA search location passes assessment against stage 4 it goes on to be considered at stage 5 as a potential area for an MPA.

Nature Conservation MPA – a location that has been approved by Ministers for designation.

Details of evidence supporting the designation of the North-east Faroe-Shetland Channel MPA are provided in the Data Confidence Assessment document.

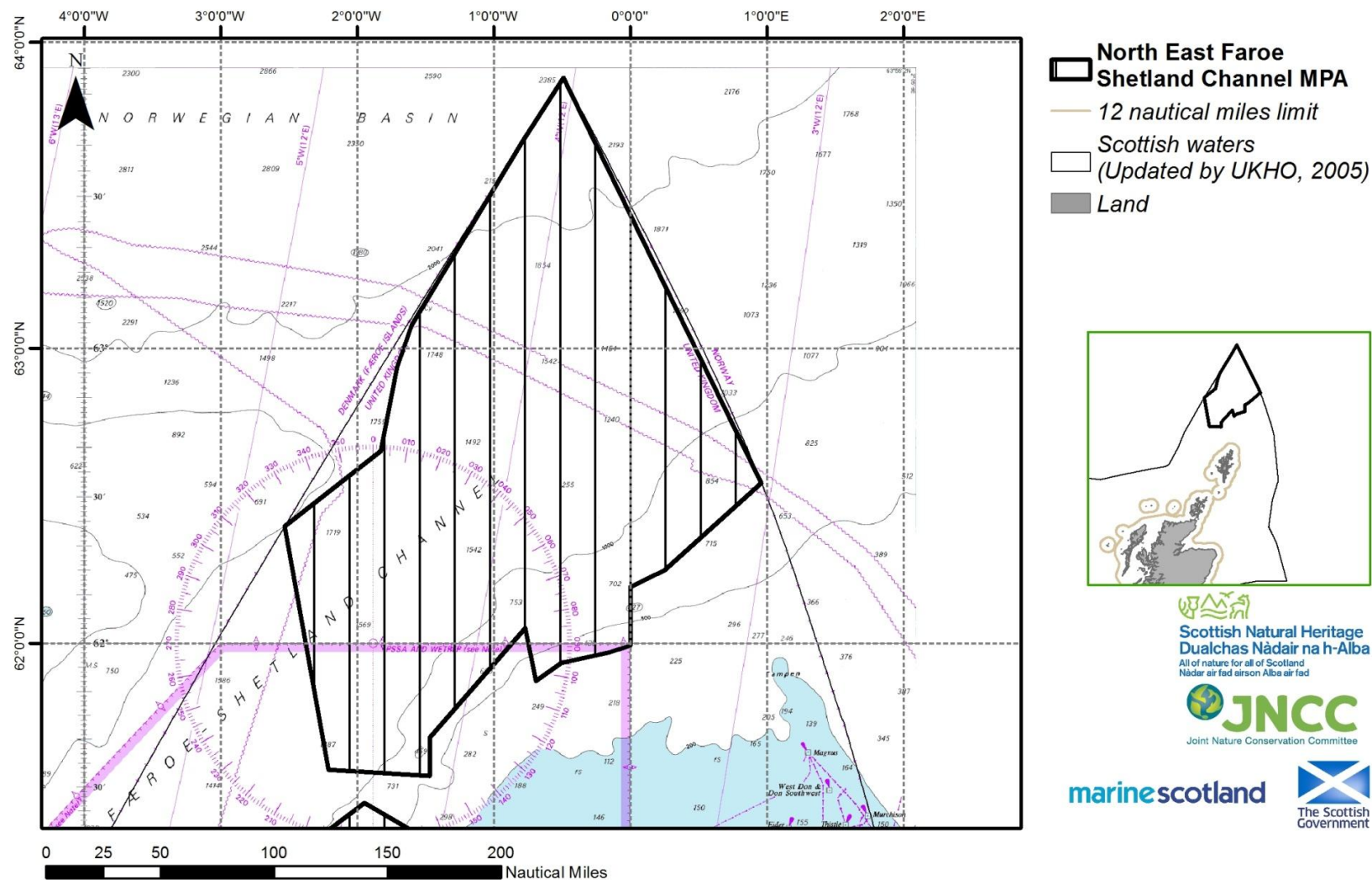
## NORTH-EAST FAROE-SHETLAND CHANNEL MPA - APPLICATION OF THE MPA SELECTION GUIDELINES

Stage 1 - Identifying search locations that would address any <u>significant</u> <u>gaps</u> in the conservation of MPA search features	
Summary of assessment	<p>The MPA includes eight protected features. There are four biodiversity features: deep-sea sponge aggregations, Atlantic and Arctic influenced offshore subtidal sands and gravels and offshore deep sea muds on the continental slope and beyond the continental shelf, and an area of the Faroe-Shetland Channel continental slope. The four proposed geodiversity features are representative of the North Sea Fan, the Miller Slide, the Pilot Whale Diapirs, and the West Shetland Margin Contourite Deposits Key Geodiversity Areas (Brooks <i>et al.</i>, 2013). Deep-sea sponge aggregations are considered to be a Threatened and/or Declining habitat by the OSPAR Commission. The Faroe-Shetland Channel slope is thought to have functional significance to the health and biodiversity of Scotland's seas in the way that it interacts with five different water masses converging in the channel leading to enhanced vertical mixing and subsequently enhanced productivity in the area (Turrell <i>et al.</i>, 1999). Such mixing and productivity serve to focus prey items (Pollock <i>et al.</i>, 2000, Weir <i>et al.</i>, 2001; Debes <i>et al.</i>, 2007) and may enhance foraging activity of top predators in the area. In addition, the Faroe-Shetland Channel is thought to be an important migratory pathway for cetaceans (Pollock <i>et al.</i>, 2000, Weir <i>et al.</i>, 2001, Swift <i>et al.</i>, 2002, Macleod <i>et al.</i>, 2003, Reid <i>et al.</i>, 2003). The MPA includes geodiversity features representative of Key Geodiversity Areas in Scotland's seas (Brooks <i>et al.</i>, 2013).</p>

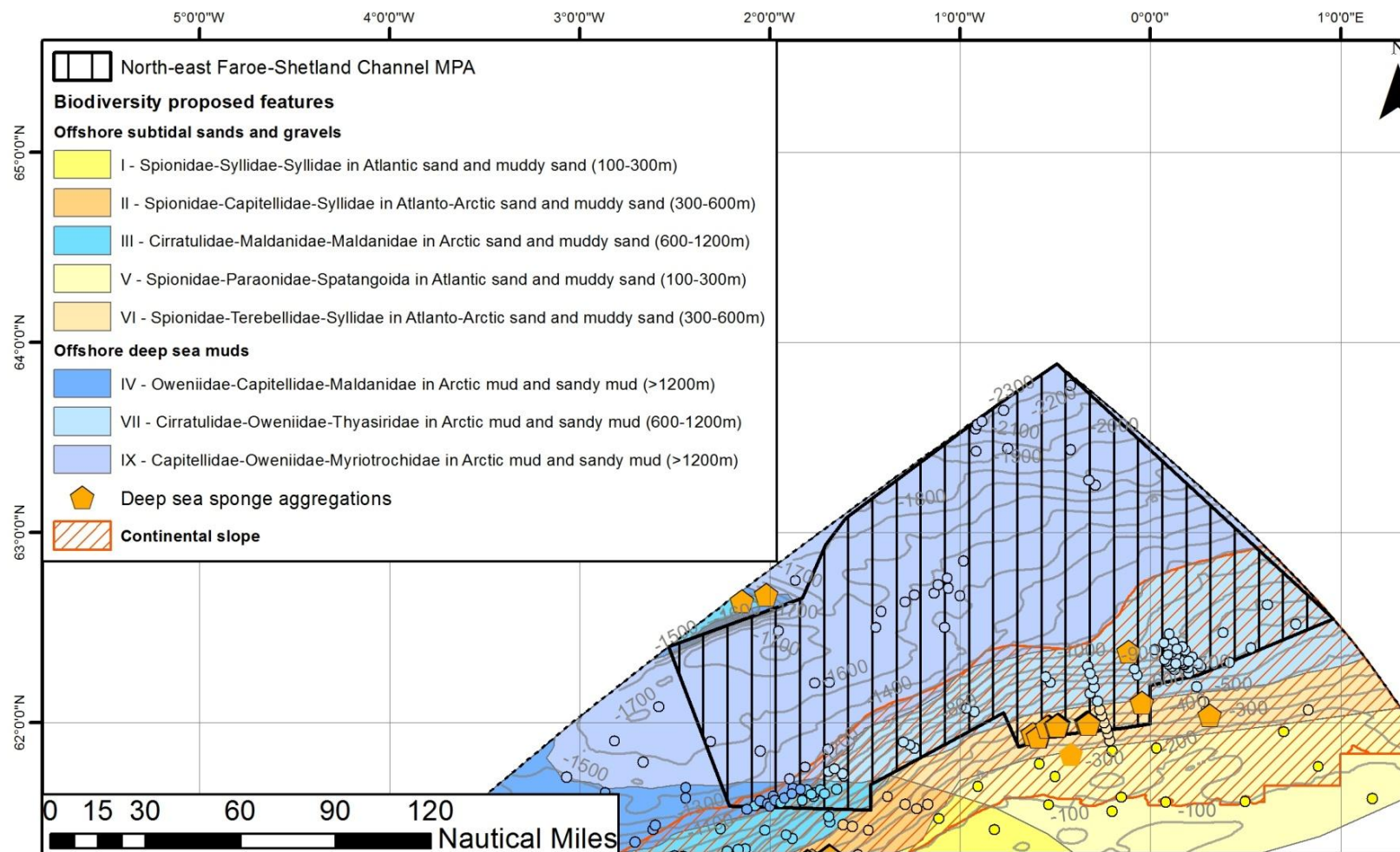
<b>Detailed assessment</b>			
<b>Protected features</b>	<b>Guideline 1a</b> <i>Presence of key features [MPA search features and geodiversity equivalents]</i>	<b>Guideline 1b</b> <i>Presence of features under threat and/or subject to rapid decline</i>	<b>Guideline 1c</b> <i>Functional significance for the overall health and diversity of Scottish seas</i>
<i>Biodiversity</i>			
Deep-sea sponge aggregations	✓	✓ OSPAR T&D <sup>1</sup>	
Offshore deep-sea muds	✓		
Offshore subtidal sands and gravels	✓		
Continental slope	✓		✓ hydrographic processes, foraging areas, migratory pathway
<i>Geodiversity</i>			
Prograding wedge (Quaternary of Scotland)	✓		
Slide deposits (Submarine Mass Movement)	✓		
Contourite sand/silt (Marine Geomorphology of the Scottish Deep Ocean Seabed)	✓		
Mud diapirs (Cenozoic Structures of the Atlantic Margin Block)	✓		

<sup>1</sup> OSPAR list of Threatened and/or Declining species and habitats (see OSPAR, 2008 a & b).

## Map showing the location of the North-east Faroe-Shetland Channel MPA

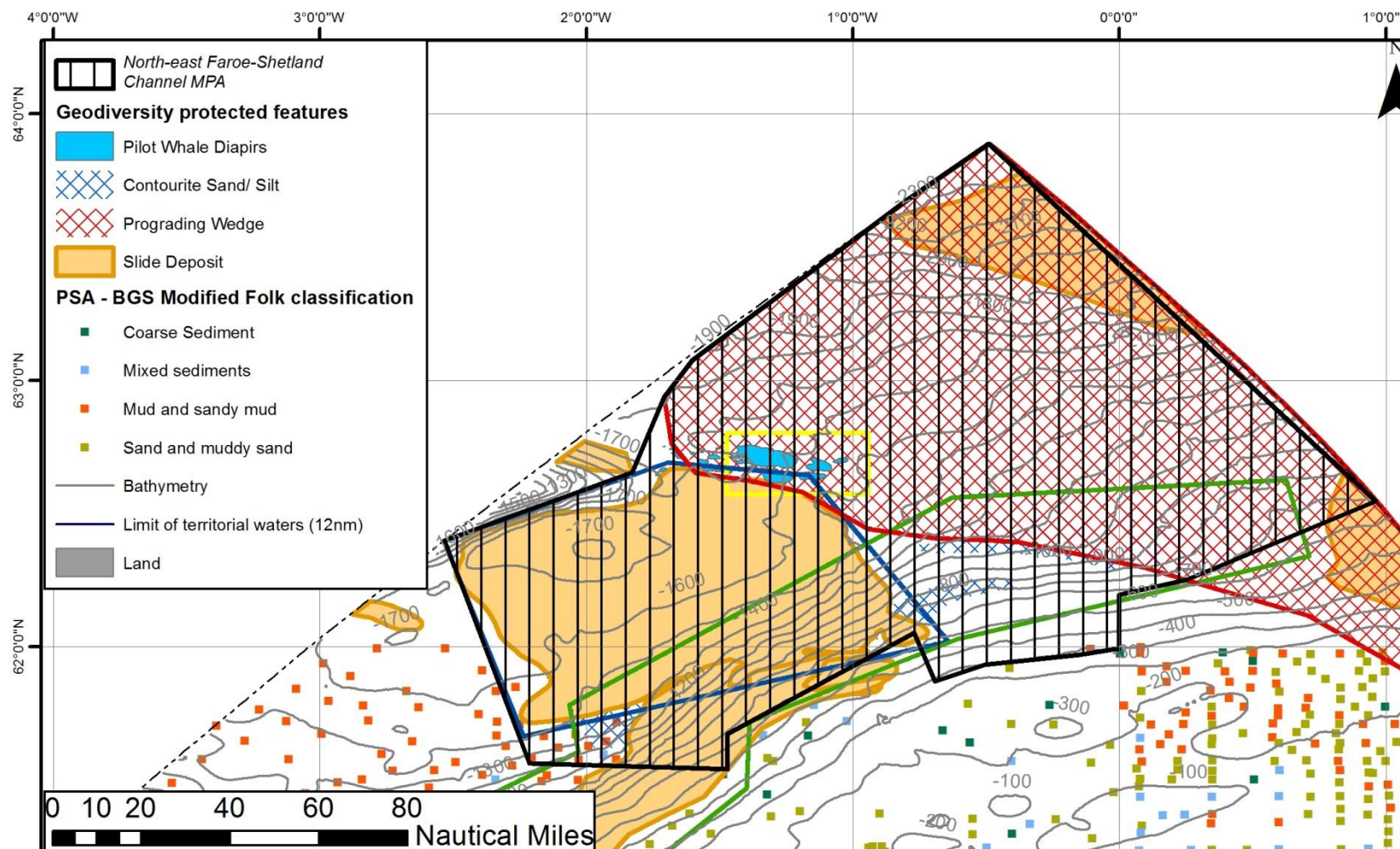


## Map of the North-east Faroe-Shetland Channel MPA showing the known distribution of biodiversity protected features





# Map of the North-east Faroe-Shetland Channel MPA showing the known distribution of geodiversity protected features



Scottish Natural Heritage  
Dualchas Nàdair na h-Alba  
All of nature for all of Scotland  
Nàdar air fad airson Alba air fad

marinescotland



Map displayed in geographic coordinates WGS84. The exact limits of the UK Continental Shelf are set out in the Continental Shelf (Designation of Areas) Order 2013, Statutory Instrument 2013/3162 (© Crown Copyright). Landmass Ordnance Survey © Crown Copyright and database right 2011. All rights reserved. Scotland (Adjacent waters) Updated by the Law of the Sea Division, United Kingdom Hydrographic Office October 2005. Bathymetry © GEBCO, 2011. Geodiversity data and MPA © JNCC and SNH 2014. All rights reserved. PSA data © BGS. MPA data © JNCC & SNH, 2014.



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

### Summary of assessment

The MPA contains combinations of protected features. The interaction between converging water masses and the sloping edges of the channel creates the environmental conditions suitable for the settlement of deep-sea sponge aggregations (Bett, 2001, Axelsson, 2003). As well as functional linkages between the protected features of the MPA, there is evidence that the unique conditions along the Faroe-Shetland Channel slope supports the health and biodiversity of Scotland's seas by enhancing overall productivity in the region.

The deep-sea sponge aggregations recorded conform to the boreal ostur variant of the habitat, with typical densities of sponges in line with the OSPAR Commission definition of the habitat (OSPAR, 2010). JNCC concluded that the deep-sea sponge aggregations have high natural biological diversity. All records of deep-sea sponge aggregations that have been verified with high or medium confidence in this part of the Faroe-Shetland Channel are encompassed within the MPA boundary (Henry & Roberts, 2014) and the habitat itself is thought to be persistent but may experience seasonality and sporadic reproductive periods. We consider the MPA to include a coherent example of deep-sea sponge aggregations. The MPA includes offshore subtidal sand and gravel and offshore deep-sea mud habitats representative of those present in this part of the Faroe-Shetland Channel (Bett, 2012). We consider the MPA to include coherent examples of these offshore subtidal sand and gravel and offshore deep-sea mud habitats. However, there is limited available information to assess their levels of natural biological diversity.

There is no information on the condition (in terms of bio- or geodiversity quality) of the protected features within the MPA, but information on their sensitivity to pressures associated with marine activities to which they are exposed suggests there is a risk that all the biodiversity protected features may have been modified by human activity. Within the MPA Region<sup>2</sup> there is considered to be a high risk of significant damage to deep-sea sponge aggregations. For offshore deep-sea mud and offshore subtidal sand and gravel habitats there is a range in the likely risk of being significantly damaged by human activity in MPA Region. This variance in risk is a reflection of the range in sensitivity of different types of these habitats to the pressures associated with activities to which they are exposed. Slide deposits, contourite sand/silt deposits and prograding wedge geodiversity features are considered to be at low risk of damage across Scotland's seas; mud diapirs are not considered to be at risk of damage across Scotland's seas based on a lack of exposure to activities associated with pressures to which the feature is sensitive.

**Three of the five parts of the stage 2 guidelines have been met (2a, 2c and 2e). We are unsure as to whether the 2b guideline has been met for offshore subtidal sands and gravels and offshore deep-sea muds. The 2d guideline has not been met for the biodiversity protected features.**

<sup>2</sup> North (Offshore) MPA Region as described in the [Scottish MPA Selection Guidelines](#)

Detailed assessment	
Guideline 2a	The search location contains combinations of features, rather than single isolated features, especially if those features are functionally linked
<p>There are combinations of protected features present within the MPA. The functional linkage between the deep-sea sponge aggregations and the continental slope appears a result of the interaction between the continental slope and five different water masses converging in the channel. This layering of water of different temperatures and densities and its interaction with the sloping edges of the channel generates an area of deep water mixing between 350 and 650m, which are known as the 'intermediate water masses' (Sherwin, 1991). Here, enhanced water-current speeds and the availability of hard substrata (cobbles and boulders) at the deep water mixing zone provides ideal settlement conditions for deep-sea sponge aggregations, which are known to occur between 400 and 600m (Bett, 2001; Axelsson, 2003).</p> <p>As well as functional linkages between the protected features of the MPA, there is general evidence to support the role of the Faroe-Shetland Channel slope in supporting the health and biodiversity of Scotland's seas. The layering of water at different temperatures and densities in the channel allows internal waves to form, which are important in the provision of food to benthic invertebrates such as cold-water corals (Frederiken <i>et al.</i>, 1992). More generally, the diversity and abundance of species present has been shown to be linked to the presence of the mixing zone at the intermediate water masses. For example, benthic fauna show maximum diversity and abundance in the intermediate water masses (Bett, 2000, 2001, Narayanaswamy <i>et al.</i>, 2005, 2010). The same observation is true for fish assemblages (Bullough <i>et al.</i>, 1998; Gordon, 2001). Dependent on depth, a wide range of sediment types may be present on the continental slope that provide habitat for a range of benthic species. These habitats range from cobbles and boulders in shallower areas of the slope to finer-grained sands and muds in deeper areas (Bett, 2000). The interaction between prevailing hydrographic processes and the continental slope may enhance feeding conditions through the aggregation of principle prey items (e.g. squid, herring, blue whiting and krill) for several species of cetacean, including sperm whale, minke whale, killer whale, fin whale, long-finned pilot whale and Atlantic white-sided dolphin (Macleod, 2004; Macleod <i>et al.</i>, 2006, Stone, 1988; Swift <i>et al.</i>, 2002; Weir <i>et al.</i>, 2001). The topography of the Faroe-Shetland Channel slope and wider channel is thought to have functional significance as a migratory pathway/corridor for several cetacean species. Based on the data available, fin and sperm whales are the most regular users of the route. These cetacean species seem to use the channel as a passageway to move through into colder, temperate waters to the north to feed in the early summer months whilst some remain in the channel (e.g. Macleod <i>et al.</i>, 2006) before travelling.</p>	
Guideline 2b	The search location contains example(s) of features with a high natural biological diversity (for habitats only)
Deep-sea sponge aggregations	Records of deep-sea sponge aggregations within the MPA were derived from the Strategic Environmental Assessment (SEA) surveys that took place in 1999 (in the OSPAR Database of threatened and declining habitats, 2014-02-18 release) and 2006 (Howell <i>et al.</i> , 2010), and the International Council for the Exploration of the Sea (ICES) Vulnerable Marine Ecosystems Database from 2011 (ICES WGDEC VME Database, 2014). All data points within the MPA have been verified as conforming to the habitat definition for deep-sea sponge aggregations as defined by the OSPAR Commission (OSPAR, 2010). Specifically, the area is thought to represent the boreal 'ostur' variant of the habitat, which comprises dense aggregations of desmosponges (Klitgaard <i>et al.</i> , 1997; Henry & Roberts, 2014). JNCC consider deep-sea sponge aggregations to have high natural biological diversity within the MPA based on these data.
Offshore deep sea muds	Information for offshore deep-sea mud habitats within the MPA have been drawn from National Oceanographic Centre (NOC) biotope assignments for data points collected during the SEA4 surveys (Bett, 2012). Infaunal analysis of sampling data from surveys conducted between 1996 and 2002 across the whole Faroe-Shetland Channel area identified eight primary biotopes (Bett, 2012). These biotopes are distinguished by their substrate-type, the depth at which they are found, and the characterising infaunal species

Guideline 2b	The search location contains example(s) of features with a high natural biological diversity (for habitats only)
	<p>reported. Three of these biotopes are mud-based habitats. The North-east Faroe-Shetland Channel MPA contains examples of all three mud-based primary biotopes identified by Bett (2012):</p> <ul style="list-style-type: none"> <li>• <i>Oweniidae-Capitellidae-Maldanidae</i> in Arctic mud and sandy mud</li> <li>• <i>Cirratulidae-Oweniidae-Thyasiridae</i> in Arctic mud and sandy mud</li> <li>• <i>Capitellidae-Oweniidae-Myriotrochidae</i> in Arctic mud and sandy mud</li> </ul> <p>This MPA covers the north of Shetland area of the channel, and when combined with the Faroe-Shetland Sponge Belt MPA, together represent biodiversity both to the north and west of Shetland in the Faroe-Shetland Channel. However there are limited other data for the habitats present throughout the wider region against which the biodiversity of the habitats within the MPA can be compared.</p> <p>Overall, JNCC recognise there is insufficient information to conduct a comparative assessment of levels of natural biological diversity and thus it is not possible to conclude whether or not offshore deep sea muds meet the stage 2b guideline.</p>
Offshore subtidal sands and gravels	<p>Information for offshore subtidal sand and gravel habitats within the MPA has been drawn from National Oceanography Centre biotope analysis of data points collected during the SEA4 surveys (Bett, 2012). Infaunal analysis of data from surveys conducted between 1996 and 2002 across the whole Faroe-Shetland Channel area resulted in the identification of eight primary biotopes (Bett, 2012). These biotopes are distinguished by their underlying substrate, the depth at which they are found and their characterising infaunal species. Five of these biotopes are sand and gravel-based habitats.</p> <p>The North-East Faroe-Shetland Channel MPA represents examples of three of the five offshore subtidal sand and gravel-based biotopes identified by Bett (2012).</p> <ul style="list-style-type: none"> <li>• <i>Spionidae-Terebellidae-Syllidae</i> in Atlanto-Arctic sand and muddy sand</li> <li>• <i>Spionidae-Capitellidae-Syllidae</i> in Atlanto-Arctic sand and muddy sand</li> <li>• <i>Cirratulidae-Maldanidae-Maldanidae</i> in Arctic sand and muddy sand</li> </ul> <p>This MPA covers the north of the Shetland area of the channel and in combination with Faroe-Shetland Sponge Belt MPA, represents biodiversity both to the north and west of Shetland in the Faroe-Shetland Channel. However there are limited other data for the habitats present throughout the wider region against which the biodiversity of the habitats within the MPA can be compared.</p> <p>Overall, JNCC recognise there is insufficient information to conduct a comparative assessment on the natural levels of biological diversity for these habitat types and thus conclude whether or not offshore subtidal sands and gravels meet the stage 2b guideline.</p>

Guideline 2c	The search location contains coherent examples of features, rather than smaller, potentially more fragmented ones
Deep-sea sponge aggregations	<p>There is little information pertaining to the typical levels of fragmentation of the protected feature; however, sponges from the class Hexactinellida have been reported at densities of 4-5m<sup>-2</sup>, whilst 'massive' growth forms of sponges from class Demospongia have been reported at densities of 0.5-1m<sup>-2</sup> (OSPAR, 2008a). Records present within the MPA are considered to conform to these densities (Henry &amp; Roberts, 2014) and all records verified with high or medium confidence within this part of the Faroe-Shetland Channel have been included within the MPA boundary. The MPA is assessed as being of the appropriate size to support the protected feature as the larval phase of many sponge species is thought to be short lived (Konnecker, 2002), with high settlement observed close to adult sponges (Maldonado &amp; Riesgo, 2008; Nichols &amp; Barnes, 2005). Evidence suggests that the dominant species associated with this habitat type are slow growing and may take several decades to reach sizes which are commonly encountered (Klitgaard &amp; Tendal, 2004) and that sponge aggregations can persist for a long time in the absence of disturbance (Hill <i>et al.</i>, 2010). Hexactinellid sponges may experience seasonality which influences their growth rate and perhaps reproductive period (Leys &amp; Lauzon, 1998). Overall, we consider that the MPA includes a coherent as opposed to a fragmented example of the deep-sea sponge aggregations habitat.</p>
Offshore deep-sea muds and Offshore subtidal sands and gravels	<p>Analysis of infaunal sampling data from surveys conducted between 1996 and 2002 across the whole Faroe-Shetland Channel area resulted in the identification of eight primary biotopes (Bett, 2012). The MPA boundary encompasses examples of large extents of all biotopes reported to be present in this part of the Faroe-Shetland Channel. Overall, we consider that offshore deep-sea mud and offshore subtidal sand and gravel habitats in the MPA are likely to be coherent as opposed to fragmented.</p>
Continental slope	<p>There is general evidence to support the role of the Faroe-Shetland Channel slope in supporting the health and biodiversity of Scotland's seas. The layering of water at different temperatures and densities in the channel allows internal waves to form, which are important in the provision of food to benthic invertebrates such as cold-water corals (Frederiken <i>et al.</i>, 1992). The diversity and abundance of species present has been linked to the presence of the mixing zone at the intermediate water masses. For example, benthic fauna show a diversity and abundance maximum at the intermediate water masses (Bett, 2000, 2001, Narayanaswamy <i>et al.</i>, 2005, 2010). The same is true for fish assemblages (Bullough <i>et al.</i>, 1998; Gordon, 2001). Dependent on depth, a range of sediment types may be present on the continental slope, from cobbles and boulders in shallower areas of the slope to finer-grained sands and muds in deeper areas (Bett, 2000), providing habitat for a range of benthic species. The interaction between hydrographic processes and the continental slope may enhance feeding conditions through the aggregation of principle prey items (e.g. squid, herring, blue whiting and krill) for several species of cetacean, including sperm whale, minke whale, killer whale, fin whale, long-finned pilot whale and Atlantic white-sided dolphin (Macleod, 2004; Macleod <i>et al.</i>, 2006, Stone, 1988; Swift <i>et al.</i>, 2002; Weir <i>et al.</i>, 2001). The topography of the Faroe-Shetland Channel slope and wider channel is thought to be of functional significance as a migratory pathway/corridor for several cetacean species. Of these, based on the data available, fin and sperm whales are the most regular users of the route. These cetacean species seem to use the channel as a passageway to move through into colder, temperate waters to the north to feed in the early summer months whilst some remain in the channel (e.g. Macleod <i>et al.</i>, 2006) before travelling.</p>

Guideline 2d	The search location contains features considered least damaged / more natural, rather than those heavily modified by human activity <sup>3</sup>
Deep-sea sponge aggregations	There is no evidence on the condition of deep-sea sponge aggregations within the MPA. Consequently, the possible condition of this protected feature has been inferred from information on exposure to pressures associated with activities to which the feature is considered to be sensitive (Marine Scotland, 2013). Rasterised Vessel Monitoring System (VMS) data from fishing vessels from 2006-2009, which has a coarse resolution, VMS point data from 2009-2011, and pipeline and telecommunications cable information sourced from UK DEA and UK SubSea Cables indicate that almost all records have been exposed to activities (otter trawling and set netting, and to a lesser extent pipeline and telecommunications cables) linked to pressures to which the feature has a high sensitivity. As such, there is a risk that deep-sea sponge aggregations may have been modified by human activity.
Offshore deep sea muds	There is no evidence on the condition of offshore deep-sea mud habitats within the MPA. Consequently, the possible condition of this feature has been inferred from information on exposure to activities associated with pressures to which the feature is considered to be sensitive (Marine Scotland, 2013). Rasterised VMS data from fishing vessels from 2006-2009, which has a coarse resolution, VMS point data from 2009-2011, and pipeline and telecommunications cable information sourced from UK DEAL and UK SubSea Cables, indicate that a third of ground-truthed data points are exposed to activities (such as otter trawling and set netting, and to a lesser extent pipeline and telecommunications cables) linked to pressures to which the feature has a sensitivity ranging from not sensitive to highly sensitive. This range of sensitivity varies according to the energy regime (high to low energy) that creates local sub-types of offshore deep-sea muds. Hydrographic studies of the area (e.g. Sherwin, 1991) suggest relatively high energy levels at the seabed in this MPA, and therefore suggest a likely sensitivity at the lower range for the feature but given the variance in sensitivity the ecological significance of such modification is uncertain.
Offshore subtidal sands and gravels	There is no evidence on the condition of offshore subtidal sand and gravel habitats within the MPA. Consequently, the possible condition of this proposed protected feature has been inferred from information on exposure to activities associated with pressures to which the feature is considered to be sensitive (Marine Scotland, 2013). Rasterised VMS data from fishing vessels from 2006-2009, which has a coarse resolution, VMS point data from 2009-2011 and pipeline and telecommunications cable information sourced from UK DEAL and UK SubSea Cables indicate that approximately a third of ground-truthed data points have been exposed to activities (such as otter trawling and set netting, and to a lesser extent pipeline and telecommunications cables) linked to pressures to which the feature has a sensitivity ranging from not sensitive to highly sensitive. This range of sensitivity varies according to the energy regime (high to low energy) that creates local sub-types of offshore sands and gravels. Hydrographic studies of the area (e.g. Sherwin, 1991) suggest relatively high energy levels at the seabed in this MPA, and therefore suggest a likely sensitivity at the lower range for the feature but given the variance in sensitivity the ecological significance of such modification is uncertain.

<sup>3</sup> The Least damaged/more natural stage 2d assessment considers protected feature exposure to activities associated with pressures to which the features are sensitive. This is distinct from the work outlined in Chaniotis *et al.*, (2011), which mapped available activities data at the scale of Scotland's seas to identify broad areas of low/no activity from which to identify MPA search locations in the initial phase of the MPA selection process. Unlike the stage 2d assessment Chaniotis *et al.*, (2011) did not consider the location of features or their sensitivity to pressures.



Guideline 2d	The search location contains features considered least damaged / more natural, rather than those heavily modified by human activity <sup>3</sup>
Prograding wedge, slide deposits, contourite sand/silt and mud diapirs	There is no information on the condition of the geodiversity protected features representative of the West Shetland Margin Contourite Deposits, Pilot Whale Diapirs, Miller Slide or North Sea Fan Key Geodiversity Areas within the MPA. Consequently, the possible condition of the protected features has been inferred from information on exposure to activities associated with pressures to which the features are considered to be sensitive (Marine Scotland, 2013). Rasterised VMS data from fishing vessels from 2006-2009, which has a coarse resolution, VMS point data from 2009-2011 and pipeline and telecommunications cable information sourced from UK DEAL and UK SubSea Cables indicate that less than ten percent of the slide deposit, contourite sand/silt deposits and prograding wedge features are exposed to activities (e.g. otter trawling) associated with pressures to which the geodiversity protected features are sensitive. The slide deposit and sand/silt deposits are thought to have a medium sensitivity to some of the pressures to which the features are exposed, and the prograding wedge feature a low sensitivity. The pilot whale diapirs are not currently thought to be exposed to activities linked to pressures to which the geodiversity protected feature is considered sensitive. Based on low levels of exposure to activities associated with pressures to which the geodiversity protected features are sensitive, we consider they are unlikely to have been significantly modified by human activity.

Guideline 2e	The search location contains features considered to be at risk <sup>4</sup> of significant damage by human activity
Deep-sea sponge aggregations	The protected feature is considered to be at high risk in the MPA Region (Chaniotis <i>et al.</i> , 2014). This risk is primarily driven by pressures associated with otter trawling and set (fixed) netting.
Offshore deep-sea muds and offshore subtidal sands and gravels	The protected features are considered to be subject to a range in risk, from low to high levels, in the MPA Region (Chaniotis <i>et al.</i> , 2014). The range in risk is due to the variation in sensitivity of different types of habitats to activities to which they are exposed. Sensitivity will be different in different sub-types of offshore subtidal sand and gravel and offshore deep sea mud habitats depending on the communities which are present. This risk is primarily associated with bottom-contact fishing activity.
Prograding wedge, slide deposits, contourite sand/silt and mud diapirs	Slide deposits, contourite sand/silt deposits and prograding wedge features are considered to be at low risk of damage across Scotland's seas (Brooks, 2013). This is primarily driven by pressures associated with otter trawling. Mud diapirs are not considered to be at risk of damage across Scotland's seas because of a lack of exposure to activities associated with pressures to which the feature is sensitive.

<sup>4</sup> Information on the sensitivity of the biodiversity protected features to pressures and their associated activities was taken from Marine Scotland (2013). The degree to which a feature is exposed to activities associated with pressures to which it is sensitive in each MPA Region (as described in the [Scottish MPA Selection Guidelines](#)) 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 do not reflect the level of risk at the scale of the MPA. The sensitivity of the geodiversity protected features to pressures and their associated activities was taken from Brooks (2013) and an assessment of risk was undertaken at the national level..

Stage 3 - Assessment of the appropriate scale of the search location in relation to the search features it contains	
Summary of assessment	The MPA boundary reflects the full extent of the records for deep sea sponge aggregations on the slope in this part of the Faroe-Shetland Channel that have been verified with high or medium confidence (Henry & Roberts, 2014). It also includes the International Council for Exploration of the Sea Working Group on Deep-water Ecology recommended closure for Vulnerable Marine Ecosystems (VMEs). The boundary captures the range of key geodiversity interests present. The north-east of the boundary tracks the extent of Scottish waters, and the west and north-western boundary follows the slide deposit feature representative of the Miller Slide Key Geodiversity Area. The resulting shape also represents the diversity associated with the offshore subtidal sand and gravel and offshore deep sea mud habitats in this part of the Faroe-Shetland Channel.
Detailed 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	
Deep-sea sponge aggregations	The MPA boundary has been drawn to encompass all ground-truthed records of deep-sea sponge aggregations in this part of the Faroe-Shetland Channel that have been verified with high or medium confidence (Henry & Roberts, 2014). The isobaths used to draw the MPA boundary encompass the 400-600m depth band where deep-sea sponge aggregations are recorded in the Faroe-Shetland Channel (Axxelson, 2003; Howell <i>et al.</i> , 2007). This concurs with the ICES recommendation for a fisheries closure over the sponge records identified as VMEs (ICES, 2013).
Offshore deep-sea muds  Offshore subtidal sands and gravels	The MPA boundary has been drawn to capture the range of as many different types of Arctic influenced sediments as possible, as well as to capture variation in benthic biological diversity with depth as highlighted by Bett (2012). The 400-1500m depth band was used to help define the boundary, and aims to include the full range of environmental conditions within the Faroe-Shetland Channel, from the highly dynamic and varied water masses at 300-600m, to the Arctic waters where temperatures can be sub-zero at >600m (Bett, 2012). The MPA also includes the benthic diversity and abundance-maximum present in the intermediate water masses between 400 and 700m (Bett, 2000, 2001; Narayanaswamy <i>et al.</i> , 2005, 2010).
Geodiversity features	The MPA boundary has been drawn with a view to maximising the inclusion of geodiversity features representative of Key Geodiversity Areas within the Faroe-Shetland Channel (Brooks <i>et al.</i> , 2013). Features representative of the North Sea Fan, Miller Slide, West Shetland Margin Contourite Deposits and the Pilot Whale Diapirs are all included.

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

<b>Summary of assessment</b>	<b>Mechanisms exist through the European Commission under the Common Fisheries Policy to introduce spatial/temporal management measures on fishing activities to conserve the protected features within the MPA. For licensed activities, we consider this could be addressed through the Environmental Impact Assessment (EIA) process. There is therefore potential for management measures to be implemented successfully and the conservation objectives of the protected features of the MPA to be achieved.</b>
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#### 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 objectives of the protected features of the MPA are to 'conserve – feature condition uncertain'. This uncertainty is a consequence of the lack of direct evidence available to confirm the condition of the protected features. We consider that the biodiversity protected features may have been modified by human activity (see 2d), but that there remains the potential for these features to be conserved.

Mechanisms exist through the European Commission under the Common Fisheries Policy to support the introduction of spatial/temporal measures to manage fisheries activities to conserve the full range of features within the MPA. We consider licensed activities could be addressed through the EIA process. There is therefore potential for management measures to be implemented successfully and the conservation objectives of the protected features of the MPA to be achieved.

*Note:* the International Council for the Exploration of the Sea (ICES)\Northwest Atlantic Fisheries Organisation (NAFO) Joint Working Group on Deep-water Ecology (WGDEC) which met in March 2013 recommended a closure to all bottom-contact fishing practices which encompasses the known extent of deep sea sponge aggregations in the North-east Faroe-Shetland Channel MPA (ICES, 2013). This would be for the purpose of protecting vulnerable marine ecosystems, which in this case encompasses the deep-sea sponge aggregations MPA search feature.

Further discussion concerning management of the protected features of the MPA is provided in the North-east Faroe-Shetland Channel Management Options Paper.

<b>Stage 5 - Assessment of the contribution of the potential area to the MPA network</b>	
<b>Summary of assessment</b>	The MPA makes a contribution to the MPA network for a number of features: the boreal ostur variant of deep-sea sponge aggregations in OSPAR Region II – the only region where this type of the feature has been recorded in Scotland's seas; Atlantic and Arctic influenced slope and off-shelf offshore subtidal sands and gravels; offshore deep-sea mud habitats in OSPAR Regions I & II, and an area of the Faroe-Shetland Channel slope. The MPA also makes a contribution to a number of key geodiversity features.
<b>Detailed assessment</b>	
<b>The potential area contributes significantly to the coherence of the MPA network in the seas around Scotland</b>	
<b>Assessment of biodiversity features</b>	
<b>Feature</b>	<b>Summary</b>
Deep-sea sponge aggregations	The MPA provides representation for the boreal ostur variant of deep-sea sponge aggregations in OSPAR Region II – the only region where this type of the feature has been recorded in Scotland's seas. As an OSPAR Threatened and/or Declining habitat, it is considered important to have greater replication for the feature on the grounds of increasing resilience. The MPA makes a contribution to one of at least three recommended areas for deep-sea sponge aggregations to be included in the Scottish MPA network and a different ecological type of the habitat in comparison to other examples present in OSPAR Region V. For further information please see the deep-sea sponge aggregations adequacy assessment (SNH and JNCC, 2014).
Offshore deep-sea muds	The MPA provides representation for large areas of Arctic and smaller areas of Atlantic influenced slope and off-shelf offshore deep-sea mud habitats predominantly in OSPAR Region I, but also to a lesser extent in OSPAR Region II in Scotland's seas. It represents one of two recommended examples of Atlantic and Arctic influenced slope and off-shelf, offshore deep-sea mud habitats being protected in OSPAR Regions I and II. For further information please see the offshore deep-sea muds adequacy assessment (SNH and JNCC, 2014).
Offshore subtidal sands and gravels	The MPA provides representation for Arctic and Atlantic influenced slope and off-shelf offshore subtidal sand and gravel habitats in OSPAR Regions I and II in Scotland's seas. It represents one of two recommended examples of Atlantic and Arctic influenced slope and off-shelf, offshore, subtidal sand and gravel habitats being protected in OSPAR Regions I and II in Scotland's seas. For further information please see the offshore subtidal sands and gravels adequacy assessment (SNH and JNCC, 2014).
Continental slope	The MPA provides representation for one of two recommended areas of the Scottish continental slope being protected within the Scottish MPA network. The Faroe-Shetland Channel slope is considered ecologically and hydrographically distinct to the Hebridean slope and so the recommendation is for at least one example of each area of the slope to be included. The MPA makes a contribution to the protection of an area of the Faroe-Shetland Channel slope. For further information please see the continental slope adequacy assessment (SNH and JNCC, 2014).

<b>Assessment of geodiversity features</b>	
Geodiversity features <sup>5</sup>	<p>The MPA includes a significant number of geodiversity features representative of Key Geodiversity Areas in Scotland's seas (Brooks <i>et al.</i>, 2013). This includes a large proportion of the West Shetland Margin Contourite Deposits. The contourite deposits to the west of Shetland together form a complex of sandy bedforms that are unique to UK waters and have provided one of the first detailed studies of this scientifically important sedimentary facies. These deposits from previous interglacial periods also act as the failure plane for submarine sediment slides offshore Scotland and Norway, and therefore represent an important area for future studies.</p> <p>A significant proportion of the Northern Sea Fan (which has accumulated sediments over the last 1.1 million years (Ma)) is included within the MPA boundary. The North Sea Fan is a large example of a trough-mouth fan system and is one of the largest such features identified on the north-east Atlantic margin. It is considered scientifically important since it holds a detailed archive of information on the Pleistocene glacial history of the British and Fennoscandian ice sheets stretching back to at least 1.1 Ma.</p> <p>The entirety of the Pilot Whale Diapirs; a series of deep-water sediment mounds measuring 2-3km across and which rise more than 70m above the surrounding seafloor, are present within the MPA boundary. These mounds are formed from sediment that has been transferred to the seabed from strata more than 24 Ma old and are unusual in that they are the only known diapirs found in the UK waters that breach the seabed surface. The diapirs are scientifically important in that they have a key role to play in furthering understanding of sub-surface fluid migration pathways in the Faroe-Shetland Channel.</p> <p>The MPA also includes the entire extent of the Miller Slide. Large-scale slides are a characteristic feature along the Scottish continental slope and a number of mass-failure events have now been recognised. Larger slides (such as the Miller Slide) may have lateral extents of over 50km whilst smaller slides (like the Afen Slide) may be only a few kilometres wide. Along with the other five examples of large-scale slide events, the Miller Slide is suggested to be broadly representative of the range of slides found in Scottish offshore waters.</p>

<sup>5</sup> For geodiversity the stage 5 assessment primarily considers the contribution of the MPAs to the principal 'networks' of marine geodiversity interests present in Scottish waters (representativity). The MPA Selection Guidelines propose that there should be minimal duplication of geodiversity features at a national level.



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