

Scottish MPA Project Assessment against the MPA Selection Guidelines

FIRTH OF FORTH BANKS COMPLEX NATURE CONSERVATION MPA

JULY 2014

The following documents provide further information about the Firth of Forth Banks Complex Nature Conservation 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-6480

Firth of Forth Banks Complex MPA - Assessment Against the MPA Selection Guidelines v5.0 July 2014

Document Distribution List and Version Control				
Format	Version	Issue date	Version development and review	Issued to
Electronic	1.0	01/03/2013	Internal drafting and review of pre-version 1.0 drafts by JNCC SMPA team and Marine Scotland Science prior to release to MPA Sub Group as example pMPA documentation	MPA Sub Group
Electronic	2.0	22/03/2013	Review of documents to take account of MPA Sub Group comments and release to Joint Committee as example pMPA documentation.	Joint Committee
Electronic	3.0	30/05/2013	Review of document to take into account editorial review and Grade 7 review prior to release to MPA Sub Group for sign-off.	MPA Sub Group
Electronic	4.0	16/07/2013	Review of document to take into account MPA Sub-Group comments and release of document for public consultation.	Uploaded to JNCC website
Electronic	5.0	07/07/2014	Document update to align with designation status and revise text in response to consultation and independent review report	Delivery to Marine Scotland to support MPA designation and uploaded to JNCC website

Firth of Forth Banks Complex MPA - Assessment Against the MPA Selection Guidelines v5.0 July 2014

Background

This document provides details of JNCC's assessment of the Firth of Forth Banks Complex Nature Conservation MPA (herein referred to as 'MPA') against the <u>Scottish</u> <u>MPA Selection Guidelines</u>. 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.

<u>MPA search feature</u> - specified marine habitats, species and large-scale features which underpin the selection of Nature Conservation MPAs.

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

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

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

<u>Potential area for an MPA</u> - 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.

<u>Nature Conservation MPA</u> – a location that has been approved by Ministers for designation.

Details of evidence supporting the designation of the Firth of Forth Banks Complex MPA are provided in the Data Confidence Assessment document.

FIRTH OF FORTH BANKS COMPLEX 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

Summary of assessment The MPA has four protected features – offshore subtidal sands and gravels, ocean quahog (*Arctica islandica*) aggregations, shelf banks and mounds (Wee Bankie, Scalp Bank, Montrose Bank and Berwick Bank) and a key geodiversity feature (Quaternary of Scotland - moraines) representative of the Wee Bankie Key Geodiversity Area (Brooks *et al.*, 2013). Ocean quahog aggregations are considered to be Threatened and/or Declining by the OSPAR Commission. There is evidence to suggest that two of the shelf bank and mound features are of wider functional significance to the overall health and biodiversity of Scotland's seas; Wee Bankie for foraging seabirds (Daunt *et al.*, 2008; Camphuysen *et al.*, 2011) and grey seals (McConnell *et al.*, 1999, Jones *et al.*, 2013), and Berwick Bank for foraging grey seals (Prime and Hammond, 1990; McConnell *et al.*, 1999; Jones *et al.*, 2013) and as a spawning ground for plaice, the larvae of which may be important for repopulating exploited stocks along the east coast of England (Lockwood and Lucassen, 1984). The moraine geodiversity features are regarded as scientifically important for the key role they play in improving our understanding of the glacial retreat history of the last British Irish Ice Sheet (Brooks *et al.*, 2013).

Detailed assessment			
Protected features	Guideline 1a	Guideline 1b	Guideline 1c
	Presence of key features [MPA search features and geodiversity equivalents]	Presence of features under threat and/or subject to rapid decline	Functional significance for the overall health and diversity of Scottish seas
Biodiversity			
Ocean quahog aggregations	✓	✓ OSPAR T&D ¹	
Offshore subtidal sands and gravels	✓		
Shelf banks and mounds	*		 ✓ Enhanced primary productivity; seabird and grey seal foraging areas (Wee Bankie and Berwick Bank); fish spawning ground (Berwick Bank)
Geodiversity			
Moraines (Quaternary of Scotland)	✓		

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



Map showing the location of the Firth of Forth Banks Complex MPA

Map projected in Mercator (World) projection, geographic coordinate system WGS1984. 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. MPA © JNCC and SNH, 2014. All rights reserved. Admiralty Chart © Crown Copyright, 2013. All rights reserved. License No. EK001-20130405. NOT TO BE USED FOR NAVIGATION



Map of the Firth of Forth Banks Complex MPA showing the known distribution of protected features

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. Biological data from Geodatabase of Marine features in Scotland (GeMS v4) © Crown Copyright; MPA & geodiversity data © JNCC and SNH 2014. EUSeaMap © EUSeaMap © EUSeaMap Consortium 2012 (www.emodnet-seabedhabitats.eu)

Map of the Firth of Forth Banks Complex MPA showing the location and extent of the shelf banks and mounds by multibeam bathymetry data



All of nature for all of Scotland Nádar air fad airson Alba air fad



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 Corwn 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. Multibeam data © UKHO, 2010. MPA © JNCC and SNH. All rights reserved. Processed bathymetry © MS, JNCC, NOC, BGS & SNH, 2011, © JNCC, NOC & BGS, 2014.

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

Summary of	The MPA contains combinations of protected features and there is evidence that supports our conclusion that offshore subtidal sand and
assessment	gravel habitats may be functionally linked with ocean quahog aggregations based on what is known about the habitat preferences of ocean
	quahog (Witbaard & Bergman, 2003; Sabatini & Pizzolla, 2008). There is also evidence to support the wider functional linkages between
	the protected features and the wider marine environment; particularly shelf banks and mounds as foraging areas for seabirds and grey
	seals. Seabed habitat mapping data from Sotheran & Crawford-Avis (2014a & 2014b) confirms the presence of a number of different types
	of sand and gravel habitats relative to the range of sand and gravel habitat types predicted to occur across the wider OSPAR Region.
	However without comparative information for other areas in the OSPAR Region the conclusion against the 2b assessment is uncertain.
	We consider that offshore subtidal sand and gravel habitats are likely to be typical and that the size of the MPA is large enough to support
	the feature, but there is not enough information available with which to provide comment on longevity of the habitat. Fragmentation of the
	habitat is likely to be natural in the Firth of Forth Banks area because of localised hydrographic processes. Sampling station data from the
	MPA identified ocean quahog present within the water depth range and sediment types in which they are expected to occur (see Sabatini
	& Pizzolla, 2008; Witbaard & Bergman, 2003). The size of the MPA and the inclusion of sediment types suitable for ocean quahog
	colonisation means that the MPA may be considered to include a coherent, as opposed to a fragmented, example of the protected feature.
	Although there were multiple records of ocean quanog identified within the samples the evidence is not sufficient to support an
	assessment of feature abundance.
	There is evidence to suggest that two of the shelf bank and mound features are of wider functional significance to the health and
	biodiversity of Scotland's seas; Wee Bankie for foraging seabirds (Daunt et al., 2008; Camphuysen et al., 2011) and grey seals
	(McConnell et al., 1999, Jones et al., 2013), and Berwick Bank for foraging grey seals (Prime and Hammond, 1990; McConnell et al.,
	1999; Jones et al., 2013) and as a spawning ground for plaice, the larvae of which may be important for repopulating exploited stocks
	along the east coast of England (Lockwood and Lucassen, 1984). This evidence supported the inclusion of these shelf banks and mounds
	within the three areas that comprise the Firth of Forth Banks Complex MPA. A fourth shell bank and mound feature within the area (Marr
	Bank) was not included due to a lack evidence of it being an area of wider functional significance and that the three shell bank and mound
	reatures aready included represented the range of offshore sublidar sand and graver habitat types present within the area.
	I here is no information on the condition of the protected features within the MPA, however information on their sensitivity to pressures
	associated with activities suggests there is a risk that they may have been modified by human activity. Within the MPA Region it is
	considered that there is a high risk to ocean quanog aggregations and that onshore subtidal sand and gravel habitats have a range in risk
	or being significantly damaged by numan activity due to the range in sensitivity of different types of offshore sublidar sand and graver habitate to preserve approximate and and graver
	habitats to pressures associated with activities to which they are exposed. Morallies are considered to be at medium risk of damage by
	Thurnan activity across sociating states.
	niree of the live parts of the stage 2 guideline have been met (2a, 2c and 2e). We are uncertain as to whether the stage 2b
	guidenne nas been met and the stage zo guidenne nas not been met.

² East (Offshore) MPA Region as described in the <u>Scottish MPA Selection Guidelines</u>

Detailed assessment			
Guideline 2a Ti fu	The search location contains combinations of features, rather than single isolated features, especially if those features are functionally linked		
Ocean quahog is known to occur in a range of sediments from coarse clean sand to muddy sand in the infralittoral, circalittoral, circalittoral offshore and bathybenthic offshore environment in water depths of 4 to 400m (Witbaard & Bergman, 2003; Sabatini & Pizzolla, 2008). This range of environmental parameters covers the offshore subtidal sand and gravel habitats search feature present within the MPA. There is also evidence to support functional linkages between the protected features and the wider marine environment. Berwick Bank and Wee Bankie support sand and gravel habitats suitable for colonisation by sandeels, a key prey item for top predators in the North Sea food chain. As a result, the Firth of Forth Banks have been identified as critical for foraging seabirds (Daunt <i>et al.,</i> 2008; Camphuysen <i>et al.,</i> 2011) and grey seals (McConnell <i>et al.,</i> 1999; Jones <i>et al.,</i> 2013). Berwick Bank is also thought to be a spawning ground for Plaice (<i>Pleuronectes platessa</i>), the larvae of which may be important for repopulating exploited stocks along the east coast of England (Lockwood & Lucassen, 1984).			
Guideline 2b T	ne search location contains example(s) of features with a high natural biological diversity (for habitats only)		
Offshore subtidal sands and gravels	 Within a given depth range the underlying substrate characteristics are likely to be a strong determinant of the types of species present in sand and gravel communities (Eleftheriou & Basford, 1989). Therefore, biodiversity might be expected to be highest within a given area that contains a range of different physical types of sand and gravel habitats. With this in mind, the MPA boundaries have been developed to include a range of offshore subtidal sand and gravel habitats. Information on offshore subtidal sand and gravel habitats within the MPA has been drawn from seabed habitat maps based on verified sediment and multibeam backscatter data (Sotheran & Crawford-Avis, 2014a & 2014b), and analysis of photographic image data and grab samples from the <i>NLV Pole Star</i> survey of the Firth of Forth Banks area which took place in October 2011 and opportunistic sampling during the 2011 IBTS Q3 survey (Axelsson <i>et al.</i>, 2014; Goudge & Morris, 2014; Pearce <i>et al.</i>, 2014): On the shelf in OSPAR Region II, EUSeaMap³ predicts eight different types of offshore subtidal sand and gravel EUNIS Level 4 habitats to occur. Based on the seabed habitat mapping data presented in Sotheran & Crawford-Avis (2014a & 2014b), the MPA 		
	includes examples of four of these habitat types:		
	 A5.14 Circalittoral coarse sediment A5.15 Deep circalittoral coarse sediment A5.26 Circalittoral muddy sand; and A5.27 Deep circalittoral sand Circalittoral mixed sediments (A5.44) are also recorded.		

³ This project modelled a combination of physical data describing the marine environment with information from biological sampling to refine ecologically-relevant thresholds to produce a broad-scale predictive map of seabed habitats across Europe. Further information is available online at http://jncc.defra.gov.uk/EUSeaMap

Guideline 2b	The search location contains example(s) of features with a high natural biological diversity (for habitats only)
	The habitat maps show the predominant seabed habitats to be sands and coarse sediments within the circalittoral and deep circalittoral biological zones across the MPA. The eastern area has seabed habitats comprising of offshore deep circalittoral sands (A5.27) with areas of raised bathymetry and small banks of offshore deep circalittoral coarse sediment (A5.15). As the seabed shallows toward the Wee Bankie area, the raised banks remain of a coarse sedimentary nature but change in their biological zone to become circalittoral (A5.14). This pattern remains the case over the raised areas of this region, with the troughs and deeper channels holding circalittoral muddy sands (A5.26) and deep circalittoral sands (A5.27) (Sotheran & Crawford-Avis, 2014a & 2014b). There is general agreement in the presence and distribution of the main habitats between these detailed data and the habitat predictions from EU SeaMap.
	Consideration of the map information alongside the photographic image data and grab sample data from the NLV Pole Star survey is summarised for each part of the possible MPA below:
	Wee Bankie including Scalp Bank
	The still image data indicated presence of the SS.SMx.CMx.FluHyd (<i>Flustra foliacea</i> and <i>Hydrallmania falcata</i> on tide-swept circalittoral mixed sediment) biotope based on identification of species living on the seabed within the Wee Bankie inc. Scalp Bank part of the MPA (Axelsson <i>et al.</i> , 2014). Eleven grab samples were also taken from this part of the MPA as part of the <i>NLV Pole Star</i> survey in October 2011. These samples did not fit well within the existing Marine Habitat Classification of Britain & Ireland and so have been allocated to new biotope proposals (Pearce <i>et al.</i> , 2014):
	• [Polychaete-rich <i>Galathea</i> community with encrusting bryozoans and other epifauna on offshore circalittoral mixed sediment] (SS.SMx.OMx.[PoGintBy])
	[Spiophanes bombyx aggregations in offshore sands] (SS.SSa.OSa.[Sbom])
	Proposed biotopes identified in this work will be considered, alongside those from other work streams, in the planned development of the offshore section of the Marine Habitat Classification of Britain & Ireland later in 2014. The proposed biotopes come under the EUNIS Level 4 habitats offshore circalittoral coarse sediment, offshore circalittoral sand or muddy sand and offshore circalittoral mixed sediment.
	Berwick Bank
	Still image data support the presence of the SS.SMx.CMx.FluHyd (<i>Flustra foliacea</i> and <i>Hydrallmania falcata</i> on tide-swept circalittoral mixed sediment) biotope to the east of the area based on identification of species living on the seabed, as well as areas of circalittoral mixed sediments, circalittoral muddy sand and the SS.SMx.CMx.FluHyd biotope to the north of the area. To the west there are records of circalittoral mixed sediment, circalittoral muddy sand and the SS.SMx.CMx.FluHyd habitat (Axelsson <i>et al.,</i> 2014).
	Eight grab samples were taken from across the Berwick Bank part of the MPA as part of the <i>NLV Pole Star</i> survey in October 2011. These samples did not fit well within the existing Marine Habitat Classification of Britain & Ireland and so have been allocated to a new biotope proposal (Pearce <i>et al.</i> , 2014) - [<i>Spiophanes bombyx</i> aggregations in offshore coarse sands] (SS.SCS.OCS.[Sbom]). The proposed biotope comes under the offshore coarse sands EUNIS Level 4 habitat.

Guideline 2b	The search location contains example(s) of features with a high natural biological diversity (for habitats only)
	Montrose Bank
	Analysis of still image data confirm the presence of the EUNIS Level 4 habitat circalittoral coarse sediments, a large expanse of circalittoral muddy sand and the SS.SMx.CMx.FluHyd biotope to the north-east of this part of the MPA and the EUNIS Level 4 habitats circalittoral mixed sediment and circalittoral muddy sands, and the SS.SMx.CMx.FluHyd biotope to the south (Axelsson <i>et al.</i> , 2014). A cluster of photographic images from a station sampled opportunistically during an Marine Scotland Science survey conducted in 2011 verify the presence of offshore subtidal sands and gravels, specifically offshore circalittoral sand (SS.SSa.OSa) biotopes to the east of the Montrose Bank (Goudge & Morris, 2014).
	Twenty-one grab samples were taken from across the Montrose Bank part of the MPA as part of the <i>NLV Pole Star</i> survey in October 2011. These samples did not fit well within the existing Marine Habitat Classification of Britain & Ireland and so have been allocated to new biotope proposals (Pearce <i>et al.</i> , 2014):
	 [Polychaete-rich Galathea community with encrusting bryozoans and other epifauna on offshore coarse sediment] (SS.SCS.OCS.[PoGintBy])
	 [Spiophanes bombyx aggregations in offshore coarse sands] (SS.SCS.OCS.[Sbom])
	• [Spiophanes bombyx aggregations in offshore sands] (SS.SSa.OSa.[Sbom])
	 [Polychaete-rich Galathea community with encrusting bryozoans and other epifauna on offshore circalittoral mixed sediment] (SS.SMx.OMx.[PoGintBy])
	The proposed biotopes come under the EUNIS Level 4 habitats offshore circalittoral coarse sediment, offshore circalittoral sands and coarse sands and offshore circalittoral mixed sediment. These further verify the presence of these types of offshore subtidal sands and gravels in this part of the MPA.
	In summary, ground-truth data from survey and habitat maps generated using data collected on the <i>NLV Pole Star</i> combined with other physical parameter data layers verify the presence of a number of different types of sand and gravel habitats relative to the range of sand and gravel habitat types predicted to occur across the wider OSPAR Region. The assessment concludes that the offshore subtidal sand and gravel habitats within the MPA are likely to have a high natural biological diversity, but until further comparative analyses with other similar areas in the OSPAR Region are completed, our assessment remains uncertain.
Guideline 2c	The search location contains coherent examples of features, rather than smaller, potentially more fragmented ones

Ocean quahog aggregations	Ocean quahogs are typically found below the surface of medium- to fine-grained sand, sandy mud and silty-sand (Sabatini & Pizzolla, 2008) and in water depths of 4 to over 400m (Witbaard & Bergman, 2003). Survey data from the MPA confirm that ocean quahog are present within the depth range and sediment types in which they are expected to occur. We consider that the size of the MPA and the inclusion of sediment types suitable for ocean quahog colonisation are likely to support a coherent, as opposed to a fragmented, example of the protected feature. However, the extent to which aggregations of the species are present is uncertain. It is notable that although ocean quahog are exceptionally long-lived, recruitment of new individuals to an aggregation may be sporadic and may be as infrequent as once in more than 10 years in some localities (Ridgeway & Richardson, 2011).

Guideline 2c Th	ne search location contains coherent examples of features, rather than smaller, potentially more fragmented ones
Offshore subtidal sands and gravels	Habitat maps (Sotheran & Crawford-Avis, 2014a & 2014b) and biotope assignment of 2011 still and grab sample data (Axelsson <i>et al.</i> , 2014; Goudge & Morris, 2014; Pearce <i>et al.</i> , 2014) confirm the offshore subtidal sand and gravel habitats in the Firth of Forth Banks Complex MPA comprises a mosaic of different sediment types. This mosaic is considered to be largely natural within the area due to the interaction between the bank features and oceanic currents, resulting in varying sedimentary deposition rates and a patchwork of different sediment types. There is not enough information available on the longevity of species and communities associated with offshore subtidal sand and gravel habitats with which to comment on whether the protected feature will persist naturally through time or exhibit successional/cyclical tendencies. However, animals living in these habitats such as polychaetes and bivalve molluscs have a relatively quick generational turnover meaning the habitat may exhibit successional/cyclical tendencies. Overall, our assessment is that the habitat is likely to be naturally fragmented in the MPA because of localised hydrographic processes.
Shelf banks and mounds	Berwick Bank and the Wee Bankie including Scalp Bank are considered to be of wider functional significance to the health and biodiversity of Scotland's seas. These bank features support sand and gravel habitats suitable for the colonisation of sandeels (Wright <i>et al.</i> , 2000). Sandeels are a key prey item in the diet of top predators in the North Sea. The shallow nature of the bank and mound features makes sandeels more available to foraging seabirds. Findings from the Centre of Ecology and Hydrology's long-term research programme based on the Isle of May demonstrate the critical importance of the Firth of Forth Banks to foraging seabirds, particularly black-legged kittiwake (<i>Rissa tridactyla</i>), northern gannet (<i>Morus bassanus</i>) and common guillemot (<i>Uria aalge</i>). The breeding success of the black-legged kittiwake has been linked to the availability of sandeels on the Firth of Forth Banks (Daunt <i>et al.</i> , 2008) and seabirds nesting as far away as Berwick and Northumberland have been observed foraging in the Firth of Forth Banks area (Camphuysen <i>et al.</i> , 2011).
	Grey seal (<i>Halichoerus grypus</i>) are thought to use the bank areas, particularly the Wee Bankie and Berwick Bank, as foraging areas for sandeel and demersal fish (Prime and Hammond, 1990; McConnell <i>et al.</i> , 1999; Jones <i>et al.</i> , 2013). Berwick Bank is also thought to be an important spawning ground for plaice, the larvae of which may be important for repopulating exploited stocks along the east coast of England (Lockwood & Lucassen, 1984).

Guideline 2d	The search location contains features considered least damaged / more natural, rather than those heavily modified by human activity ⁴
Ocean quahog aggregations	There is no evidence on the condition of ocean quahog in the MPA. Consequently, the possible condition of the protected feature has been inferred from information on exposure to activities associated with pressures to which ocean quahog may be sensitive (Marine Scotland, 2013). Rasterised Vessel Monitoring System (VMS) data from fishing vessels from 2006-2009, which are coarse in resolution, VMS point data from 2009-2011, and good anecdotal evidence of under-15m vessel activity, indicate that half the surveyed records of ocean quahog and half of the area of suitable sediments for ocean quahog colonisation within the MPA are

⁴ 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 Th ac	ne search location contains features considered least damaged / more natural, rather than those heavily modified by human tivity ⁴
	exposed to activities (otter trawling and scallop dredging) linked to pressures to which the feature may have a high-medium sensitivity. As such, there is a risk that ocean quahog may have been modified by human activity.
Offshore subtidal sands and gravels	There is no direct evidence on the condition of offshore subtidal sand and gravel habitats in the MPA. Consequently, the possible condition of the protected feature has been inferred from information on exposure to activities associated with pressures to which offshore subtidal sand and gravel habitats may be sensitive (Marine Scotland, 2013). Rasterised VMS data from fishing vessels from 2006-2009, which are coarse in resolution, VMS point data from 2009-2011, and good anecdotal evidence of under-15m vessel activity, indicate that approximately half the predicted extent and surveyed records of offshore subtidal sand and gravel habitats within the MPA are exposed to activities (demersal seine netting, otter trawling, and scallop dredging) linked to pressures to which the feature may have a sensitivity ranging from not sensitive to high. This range of sensitivity is due to variation between low and high energy sub-types of offshore subtidal sand and gravel habitats and the composition of the communities which may be present. The EUSeaMap map predicts a moderate level of energy at the seabed in this MPA, suggesting a lower sensitivity to the pressures to which the habitats are exposed. However, there is a risk that offshore subtidal sand and gravel habitat within the MPA may have been modified by human activity.
Moraines	There is no direct evidence on the condition of the moraines within the MPA. Consequently, the possible condition of the protected feature has been inferred from information on exposure to activities associated with pressures to which moraines are considered to be sensitive (Brooks, 2013). Rasterised VMS data from fishing vessels from 2006-2009, VMS point data from 2009-2011, and good anecdotal evidence of under-15m vessel activity, indicate that the majority of the moraine geodiversity features within the MPA are exposed to activities (scallop dredging and otter trawling) linked to pressures to which the feature has a medium sensitivity. As such, there is a risk that the moraines may have been modified by human activity.

Guideline 2e T	he search location contains features considered to be at risk 5 of significant damage by human activity
Ocean quahog aggregations	The protected feature is considered to be at high risk in MPA Region (Chaniotis <i>et al.</i> , 2014). This is primarily driven by pressures associated with the extraction for oil and gas, installation of marine infrastructure, otter trawling and scallop dredging.
Offshore subtidal sands and gravels	The protected feature is considered to be at low to high risk in MPA Region due to the range in sensitivity of different types of offshore subtidal sand and gravel habitats to pressures associated with activities to which they are exposed (Chaniotis <i>et al.</i> , 2014). This is primarily associated with bottom-contact mobile fishing-gear use such as otter trawling and the installation and maintenance of marine infrastructure.

⁵ 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 <u>Scottish MPA Selection Guidelines</u>) was assessed to provide a qualitative measure of risk. Risk assessments for the various activities were examined to produce an <u>overall qualitative risk assessment by MPA Region</u>. 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.

Guideline 2e T	he search location contains features considered to be at risk 5 of significant damage by human activity
Moraines	Moraines are considered to be at medium risk of damage across Scotland's seas (Brooks, 2013). This is primarily driven by pressures associated with otter trawling and scallop dredging.

Stage 3 - Assessment of the appropriate scale of the search location in relation to the search features it contains

Summary of	The MPA reflects the distribution of survey records of ocean quahog, the inclusion of suitable sediments for colonisation by
assessment	ocean quahog, and the inclusion of a range of different types of offshore subtidal sand and gravel habitats representative of the
	Firth of Forth Banks area. It also includes the shelf bank and mound features considered to be of functional significance and/or
	geodiversity interest.

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			
Ocean quahog aggregations	The MPA boundaries have been drawn to focus on survey records of ocean quahog and to include areas of sediments considered suitable for ocean quahog colonisation (Sabatini & Pizzolla, 2008).		
Offshore subtidal sands and gravels	The MPA boundaries have been drawn to encompass examples of as many different types of offshore sand and gravel habitats as possible that are considered representative of the wider Firth of Forth Banks area. This decision is supported by full coverage seabed habitat mapping (Sotheran & Crawford-Avis, 2014a & 2014b), EUSeaMap and biotope assignment from photographic image and grab samples (Axelsson <i>et al.</i> , 2014; Goudge & Morris, 2014; Pearce <i>et al.</i> , 2014).		
Moraines/Shelf banks and mounds	The MPA boundaries have been drawn to focus on the bank features considered to be of wider functional significance to the health and biodiversity of Scotland's seas within the Firth of Forth Banks area – Wee Bankie (including Scalp Bank) and Berwick Bank. This also includes the moraines geodiversity feature representative of the Wee Bankie Key Geodiversity Area (Brooks <i>et al.</i> 2013). Marr Bank has not been included in the Firth of Forth Banks Complex MPA as there was no available evidence showing its functional significance to the health and biological diversity of Scotland's seas.		

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

Summary of	Mechanisms exist through the European Commission under the Common Fisheries Policy to support the introduction of
assessment	spatial/temporal fisheries measures to conserve the protected features of the MPA. For licensed activities, JNCC consider this
	could be addressed through the Environmental Impact Assessment (EIA) process. There is therefore potential for management
	measures to be implemented successfully to achieve the conservation objectives of the protected features of the MPA.

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 within the MPA are to 'conserve – feature condition uncertain'. This uncertainty is a consequence of the lack of direct evidence available to confirm that the features are in favourable condition. We consider that the protected features may have been modified by human activity (see 2d), but that there is potential for all the protected features to be conserved.

Mechanisms exist through the European Commission under the Common Fisheries Policy to support the introduction of spatial/temporal fisheries measures to conserve the protected features within the MPA. Should licensed activities occur within the MPA in the future, JNCC 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 in due course.

Further discussion concerning management of the protected features of the MPA is provided in the Firth of Forth Banks Complex Management Options Paper.

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

Summary of assessment	The MPA makes a contribution to the MPA network for a range of different types of offshore subtidal sand and gravel habitats on the continental shelf and ocean quahog (an OSPAR Threatened and/or Declining species) in OSPAR Region II. The Firth of Forth Banks Complex is considered to be a relatively isolated system and localised hydrodynamics has a positive effect on productivity in the area (Scott <i>et al.</i> , 2010). Each of the three parts of the MPA are considered to be important in their own right. The Wee Bankie including Scalp Bank is important for its geodiversity and biodiversity interests as well as its role in supporting the wider functional significance of Scotland's seas. Berwick Bank is important for its wider functional significance and is the only location where adult ocean quahog has been sampled in the MPA. Montrose Bank is important for its high diversity of offshore subtidal sand and gravel habitats and the high number of juvenile ocean quahog sampled by comparison to the other two parts of the MPA.		
Detailed assessment			
The potential area contributes significantly to the coherence of the MPA network in the seas around Scotland			
Assessment of biodiversity features			
Feature	Summary		
Ocean quahog aggregations	The MPA provides representation for sediments of the appropriate type to support ocean quahog populations and areas where both adult and juvenile ocean quahog have been sampled. As an OSPAR Threatened and/or Declining species in OSPAR Region II, it is considered important to have greater replication for the feature in the OSPAR Region. For further information please see the ocean quahog aggregations adequacy assessment (SNH and JNCC, 2014).		
Offshore subtidal sands and gravels	The MPA provides representation of a range of different types of Atlantic influenced shelf offshore subtidal sand and gravel habitats predicted to occur in OSPAR Region. For further information please see the offshore subtidal sand and gravel habitats adequacy assessment (SNH and JNCC, 2014).		
Shelf banks and mounds	Berwick Bank and the Wee Bankie including Scalp Bank provide representation and replication for shelf bank and mound features considered to be of wider functional significance in OSPAR Region II. The Firth of Forth is considered to be a relatively isolated system, as is demonstrated in studies showing retention of sandeel larvae (Marine Scotland Science, 2012). A study by Scott <i>et al.</i> , (2010) suggests that localised hydrodynamics in the Firth of Forth Banks area has a positive effect of productivity in the area, supporting enhanced levels of sub-surface chlorophyll due to enhanced vertical mixing. For further information please see the shelf banks and mounds adequacy assessment (SNH and JNCC, 2014).		

Assessment of geodiversity features		
Geodiversity features ⁶	A large proportion of the Wee Bankie moraine formation (a Key Geodiversity Area under the Quaternary of Scotland block) is located within the Wee Bankie (including Scalp Bank) part of the MPA. This formation comprises a series of prominent (20m high) submarine glacial ridges, composed of poorly sorted sediments (boulders, gravels, sands and clays) which were deposited at an ice limit during the deglaciation of the last Ice Age. The moraines representative of the Wee Bankie are interpreted as marking an ice limit at some stage during ice retreat from the Last Glacial Maximum. These moraines have played a central role in discussions regarding the offshore extent of the Late Devensian ice in the North Sea basin and remain scientifically important because they have a key role to play in furthering understanding of the glacial retreat history of the last British-Irish Ice Sheet (Brookes <i>et al.,</i> 2013).	

⁶ 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.

Data sources and bibliography

- Axelsson, M., Dewey, S. and Allen, C. (2014). Analysis of seabed imagery from the 2011 survey of the Firth of Forth Banks Complex, the 2011 IBTS Q4 survey and additional deep-water sites from Marine Scotland Science surveys (2012). JNCC Report No. 471.
- Brooks, A.J., Kenyon, N.H., Leslie, A., Long., D. and Gordon, J.E. (2013). *Characterising Scotland's marine environment to define search locations for new Marine Protected Areas. Part 2: The identification of Key Geodiversity Areas in Scottish waters.* Scottish Natural Heritage Commissioned Report No. 432.
- Brooks, A.J., (2013). Assessing the sensitivity of geodiversity features in Scotland's seas to pressures associated with human activities. Scottish Natural Heritage Commissioned Report No. 590.
- Camphuysen, K., Scott, B. and Wanless, S. (2011). *Distribution and foraging interactions of seabirds and marine mammals in the North Sea: a metapopulation analysis.* Available online from: <<u>http://www.abdn.ac.uk/staffpages/uploads/nhi635/ZSLpaper-kees.pdf</u>>.
- Chaniotis., P.D., Crawford-Avis, O.T., Cunningham, S., Gillham, K., Tobin, D., Linwood, M. (2011). *Identifying locations considered to be least damaged/more natural in Scotland's seas.* Report produced by the Joint Nature Conservation Committee, Scottish Natural Heritage and Marine Scotland for the Scottish Marine Protected Areas Project.
- Chaniotis, P.D., Cunningham, S., Gillham, K., Epstein, G. (2014). Assessing risk to Scottish MPA search features at the MPA regional scale. Final report produced by the Joint Nature Conservation Committee, Scottish Natural Heritage and Marine Scotland for the Scottish Marine Protected Areas Project.
- Daunt, F., Wanless, S., Greenstreet, S.P.R., Jensen, H., Hamer, K.C. and Harris, M.P. (2008). *The impact of the sandeel fishery on seabird food consumption, distribution and productivity in the northwestern North Sea*. Canadian Journal of Fisheries and Aquatic Science **65**: 362-81.
- Eleftheriou, A. and Basford, D.J. (1989). *The macrobenthic infauna of the offshore northern North Sea.* Journal of the Marine Biological Association of the United Kingdom. **69:** 123-143.
- Goudge, H. and Morris, L. (2014) Seabed imagery analysis from three Scottish offshore towed video surveys: 2011 MSS IBTSQ3 survey, 2011 1111s FRV Scotia Rona-Windsock survey & 2011 MSS Rockall survey (2012). JNCC Report 470.
- Jones, E., McConnell, B., Sparling, C., Matthiopoulos, J. (2013). Grey and harbour seal density maps. Report from the Sea Mammal Research Unit to Marine Scotland. Available online from: <u>http://www.scotland.gov.uk/Resource/0041/00416981.pdf</u>
- Lockwood, S.L, and Lucassen, W. (1984). The recruitment of juvenile plaice (Plueronectes platessa) to their parent spawning stock. ICES Journal of Marine Science **41:** 268-75.
- Marine Scotland (2013). Features, Activities, Sensitivities Tool (FEAST) online resource. Available online from: <u>www.marine.scotland.gov.uk/FEAST/</u>. *Version 1.0 (August 2013).*
- Marine Scotland Science (2012). *Marine Protected Areas and sandeels (<u>Ammodytes marinus</u> & <u>A. tobianus</u>). Position paper for 4th MPA Workshop, Heriot-Watt University, 14-15 March 2012. Available online from: <<u>http://www.scotland.gov.uk/Resource/0038/00389460.doc</u>>.*
- McConnell, B.J., Fedak, M. A., Lovell, P, and Hammond, P.S. (1999). *Movements and foraging areas of grey seals in the North Sea.* Journal of Applied Ecology **36:** 573–90.

OSPAR Commission. (2008a). List of Threatened and/or Declining Species and Habitats. Reference Number: 2008-6.

Data sources and bibliography

<http://www.ospar.org/documents/DBASE/DECRECS/Agreements/08-06e_OSPAR%20List%20species%20and%20habitats.doc>.

- OSPAR Commission. (2008b). Case Reports for the OSPAR List of Threatened and/or Declining Species and Habitats. OSPAR Commission. Biodiversity Series. <<u>http://qsr2010.ospar.org/media/assessments/p00358_case_reports_species_and_habitats_2008.pdf</u>>.
- Pearce, B., Grubb, L., Earnshaw, S., Pitts, J., and Goodchild, R. (2014). *Biotope Assignment of Grab Samples from Four Surveys Undertaken in 2011* Across Scotland's Seas (2012). JNCC Report No 509.
- Prime, J. H. and Hammond, P. S. 1990. The diet of grey seals from the southwestern North Sea assessed from analyses of hard parts found in faeces. Journal of Applied Ecology. **27.** 435-447.
- Ridgway, I.D. and Richardson, C.A. (2011). Arctica islandica: the longest lived non colonial animal known to science. Reviews of Fish Biology and Fisheries. **21:** 297-310.
- Sabatini, M. and Pizzolla, P. (2008). Arctica islandica. Icelandic cyprine. Marine Life Information Network: Biology and Sensitivity Key Information Subprogramme [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 07/06/2010]. Available online from: <<u>http://www.marlin.ac.uk/speciesinformation.php?speciesID=2588</u>>.
- Scott, B.E., Sharples, J., Ross, O.N., Wang, J., Pierce, G.J and Camphuysen, C.J. (2010). Sub-surface hotspots in shallow seas: fine-scale limited locations of top predator foraging habitat indicated by tidal mixing and sub-surface chlorophyll. Marine Ecology Progress Series **408**: 207-26.
- SNH & JNCC (2014). Assessment of the adequacy of the Scottish MPA network for MPA search features: summary of the application of the stage 5 selection guidelines. Final report produced by Scottish Natural Heritage, the Joint Nature Conservation Committee and Marine Scotland for the Scottish Marine Protected Areas Project.
- Sotheran, I. & Crawford-Avis, O. (2014a). Mapping habitats and biotopes to strengthen the information base of Marine Protected Areas in Scottish waters. JNCC Report 503.
- Sotheran, I. & Crawford-Avis, O. (2014b). Mapping habitats and biotopes to strengthen the information base of Marine Protected Areas in Scottish waters. Phase 2. JNCC Report 526.
- Witbaard, R. and Bergman, M.J.N. (2003). The distribution and population structure of the bivalve Arctica islandica L. In the North Sea: what possible factors are involved? Journal of Sea Research **50**: 11-25.
- Wright, P.J., Jensen, H. and Tuck, I. (2000). *The influence of sediment type on the distribution of the lesser sandeel, Ammodytes marinus.* Journal of Sea Research, **44:** 243-56.