Joint Nature Conservation Committee

Scottish MPA Project

Data Confidence Assessments

GEIKIE SLIDE AND THE HEBRIDEAN SLOPE NATURE CONSERVATION MPA

JULY 2014

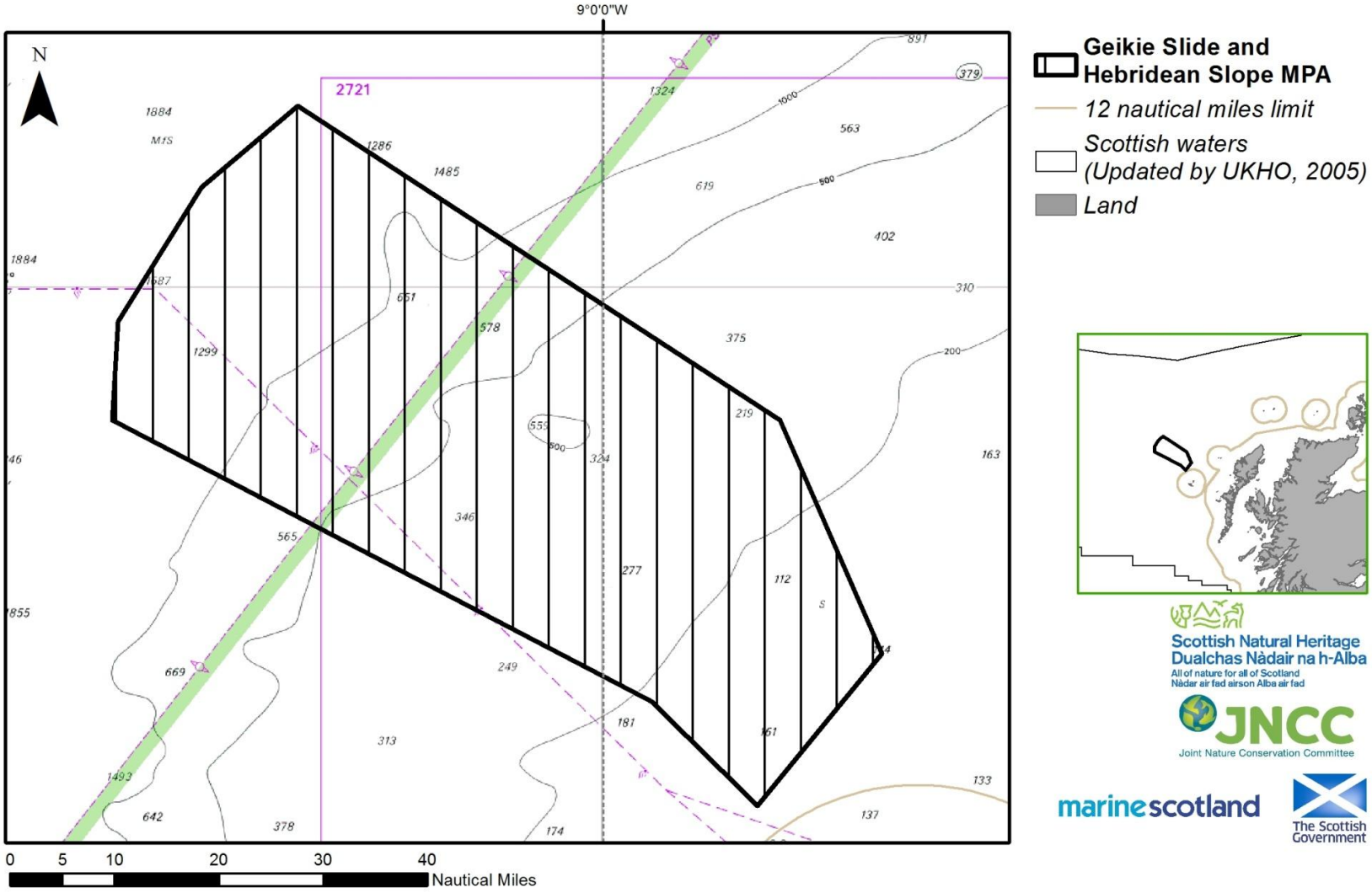
The following documents provide further information about the Geikie Slide and Hebridean Slope Marine Protected Area (MPA):

- Site Summary Document
- Detailed assessment against the MPA Selection Guidelines
- Management Options Paper

The documents are all available at www.jncc.defra.gov.uk/page-6481

Document Distribution List and Version Control				
Format	**Version**	**Issue date**	**Version development and review**	**Issued to**
Electronic	1.0	28/11/2012	Internal drafting and creation of version 1.0 for internal review.	Internal JNCC
Electronic	2.0	11/04/2013	Internal drafting and review of pre-version 2.0 drafts by JNCC SMPA team and Grade 7 staff and editorial review prior to release to MPA Sub Group	MPA Sub Group
Electronic	3.0	10/06/2013	Review of document to take into account MPA Sub-Group comments by JNCC SMPA team prior to release to MPA Sub Group for sign-off	MPA Sub Group
Electronic	4.0	12/07/2013	Review of document to take into account MPA Sub-Group comments by JNCC SMPA team and editorial review before release of document for public consultation.	Uploaded to JNCC website
Electronic	5.0	18/07/2014	Document update to align with designation status and text revised in response to consultation and independent review report	Delivery to Marine Scotland to support MPA designation and upload to JNCC website

Figure 1 Geikie Slide and Hebridean Slope 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.
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MPA name	Geikie Slide and Hebridean Slope	**Date of initial assessment**	26th July 2012	**Assessors**	ALR, NC, PC, ML, OCA
The Geikie Slide and Hebridean Slope MPA protects the burrowed mud habitat, Atlantic-influenced offshore subtidal sands and gravels on the slope and shelf, Atlantic-influenced offshore deep-sea mud on the slope, the continental slope, and features representative of the Geikie Slide key geodiversity area (Brooks *et al.,* 2013). The MPA boundary captures the range of sediments and their associated biological diversity with depth on the Hebridean slope, burrowed mud in the bathyal zone, and encompasses an area of offshore subtidal sands and gravels on the continental shelf.					

Protected features			
Biodiversity	Burrowed mud (BM) Atlantic-influenced offshore subtidal sands and gravels (OSSG) on the slope, and shelf Atlantic-influenced offshore deep sea muds (ODSM) on the slope Continental slope (CS)	**Geodiversity**	Overlaps with a proposed key geodiversity area – Geikie Slide Slide deposits from the Submarine Mass Movement Block (Brooks *et al.*, 2013)

Feature exclusions (MPA search features recorded within the MPA but excluded from the assessment with reasons)

Blue ling – Blue ling spawning grounds are reported to overlap with the MPA (Large *et al.*, 2010). However, the spawning grounds are considered adequately protected by the existing blue ling fisheries management measure (EC Council Regulation (EC) No 43/2009) and so the feature was excluded from further assessment.

Orange roughy – there are records of juvenile orange roughy present in the MPA, however there is no other evidence to suggest that the area is important to the life history of this mobile species and so it was excluded from further assessment.

Coral gardens – Soft corals on drop stones have been identified through trawl surveys in the MPA (Marine Scotland Science bycatch data, 2000-2009), and Henry & Roberts (2014) identify that they may be considered examples of the MPA search feature coral gardens. However, we consider that not enough is known about the characteristics of these examples and that the feature is already well represented by existing measures in Scotland's seas; coral gardens were therefore excluded from further assessment in this site.

Off-shelf offshore deep-sea mud habitats and offshore subtidal sands and gravel habitats – JNCC considered the protection afforded to these features by existing (fisheries) measures and noted that the priority MPA search features identified for OSPAR Region V are offshore deep-sea muds and offshore subtidal sands and gravel habitats on the continental slope rather than the off-shelf examples. Consequently, these off-shelf habitats were excluded from the assessment.

Data used in assessment			
Version of GeMS holding feature data used to support site selection	Ver.4	**Other datasets used** (not in GeMS) [superscripts are used to reference these datasets in the following discussion]	• [1]British Geological Survey (BGS) Marine Particle Size Analysis (PSA) dataset (February 2012)) - data collected between 1967 and 1987 categorised according to the Folk scheme and subsequently to the EUNIS habitat classification by JNCC based on the BGS modified Folk scheme

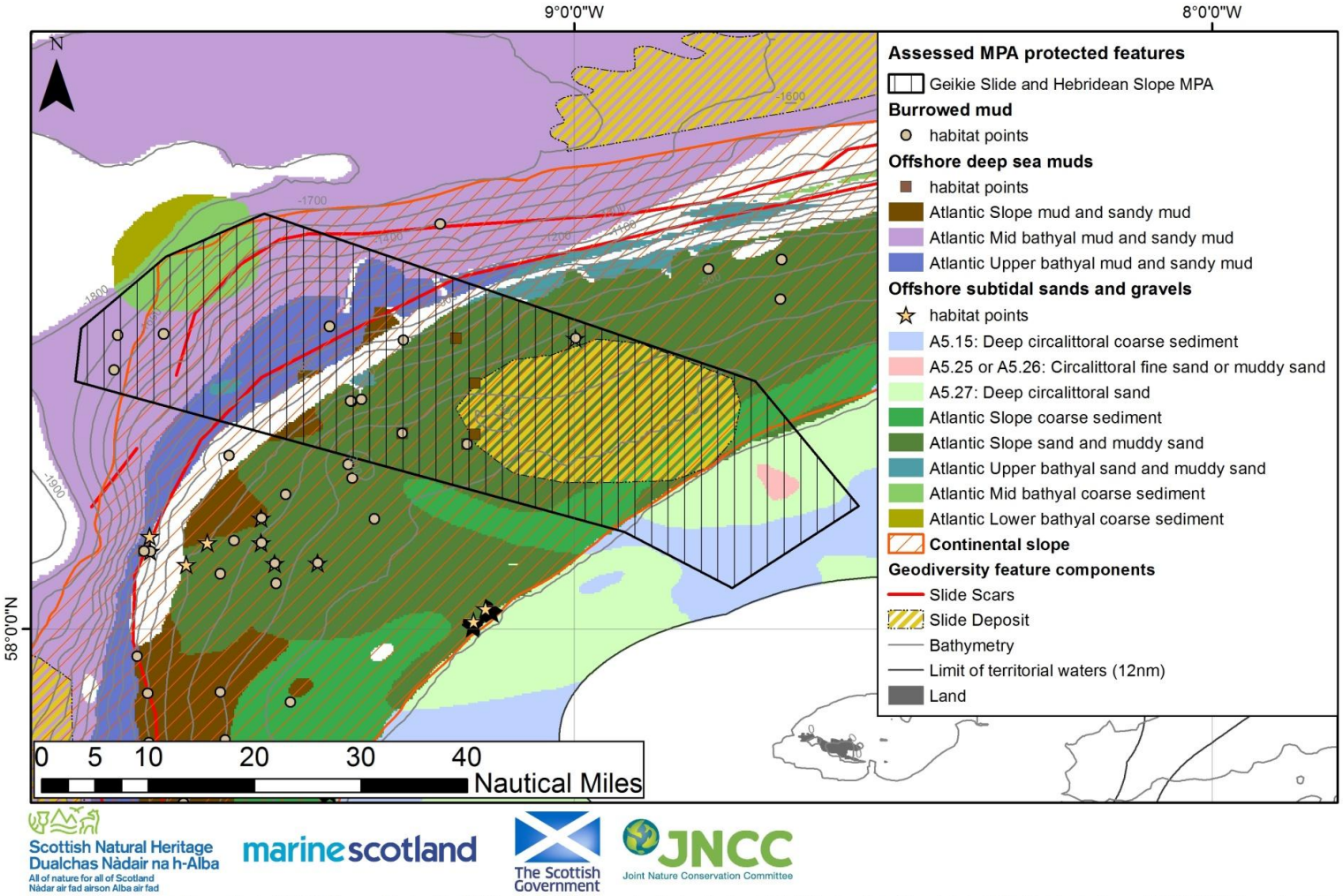
Summary of data confidence assessment (see detailed assessment on following pages)						
Confident in underpinning data	**Yes**	OSSG ODSM CS	**Partial**	BM	**No**	-

Confident in presence of identified features?	BM, OSSG ODSM CS	**Data suitable to define extent of individual MPA features**	**Yes**	**Partial**	**No**
			-	BM, OSSG ODSM CS	-

Summary	JNCC are confident in the presence of the burrowed mud habitat on the continental slope, supported by the data from underwater footage from MSS stock assessment surveys. MSS trawl surveys in 2008 and 2009 provide evidence of deep-water seapens (*Umbellula* sp.) from the muddy low region of the slope; a species indicative of deep-water burrowed mud habitat. The habitat maps produced by the habitat modelling projects UKSeaMap 2010 (McBreen *et al.,* 2011) and EUSeaMap (Cameron and Askew, 2011) predict offshore subtidal sands and gravels to extend throughout the south-eastern shelf and upper slope area of the MPA, with a patch at the base of the slope in the north-western area. JNCC are confident in the presence of offshore subtidal sands and gravels within the MPA, supported by British Geological Survey sample data, and to a lesser degree by Marine Scotland Science deep-water towed video survey ground type determinations. Offshore deep-sea muds are predicted to be dominant on the lower part of the slope in the north-western area. We are confident in the presence of this mud habitat since its presence is validated by data from underwater video footage captured by Marine Scotland Science. It is notable that the MPA boundary includes examples of the five biological zones that characterise the Hebridean slope according to Hughes *et al.* (2014). We are uncertain on the extent of the offshore deep-sea muds, burrowed mud and offshore subtidal sands and gravel habitats within the MPA, since our knowledge of their distribution is currently based largely on the predicted habitat map derived from the habitat models from the UKSeaMap 2010 and EUSeaMap 2011 projects. Our uncertainty stems from some inconsistencies between the predicted habitat map and the data from the few isolated sample points available for the features. The uncertainty in the boundary between the offshore deep-sea muds/burrowed mud records and the offshore subtidal sands and gravels probably reflects a patchy habitat distribution at a fine scale within the MPA. A patchy distribution of habitats at this geographical scale is not expected to compromise the conservation value of the habitats (see

	the viability and fragmentation assessments in the Detailed Assessment against the Guidelines document). Further survey ground-truthing in the MPA is necessary before we can have more certainty on the full range of component biotopes present and their extent and distribution within the MPA. Further data are also required to assess the ecological condition of the biodiversity features present within the MPA.

Figure 2 The known distribution of protected features within the Geikie Slide and Hebridean Slope MPA



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). Scotland (Adjacent waters) Updated by the Law of the Sea Division, United Kingdom Hydrographic Office October 2005. Landmass Ordnance Survey © Crown Copyright and database right 2011. All rights reserved. Bathymetry © GEBCO, 2011. Biological data from Geodatabase of Marine features in Scotland (GeMS_v4) © Crown Copyright; MPA and geodiversity data © JNCC and SNH 2014. All rights reserved.

Data confidence assessment	JNCC's assessment of data confidence considered the age and source of the data, the type of sampling methodologies used and the overall coverage of data across the MPA

Age of data (Map A)			
Multiple or majority of records collected post 2000	BM, ODSM, OSSG CS	**Multiple records collected pre 2000**	OSSG
Comments	The majority of data for the biodiversity features have been collected between 2000 and 2009 by Marine Scotland Science. The evidence base for offshore subtidal sand and gravels includes PSA results of substrate samples collected by the British Geological Survey between 1984 and 1988[1]. The polygon for the continental slope was digitised by specialists from the National Oceanography Centre (NOC) in 2009, and the area of slope within this MPA was based on 2008 GEBCO data and TOBI sidescan data from 1998 (Jacobs & Porritt, 2009).		

Source of data (Map B)					
Targeted data collection for nature conservation purposes	-	**Statutory monitoring (marine licensing etc)**	✓	**Fisheries survey work**	✓
Data collection associated with development proposals (EIA etc.)	-	**Recreational / volunteer data collection**	-	**Other** (specify) – BGS, UKSeaMap 2010, EUSeaMap	✓
Comments	The majority of records of the protected features were derived from an assessment of MSS Deepwater *Nephrops* stock assessment survey video footage. The more recent by-catch data were sourced from MSS trawl survey records and supplement the data on burrowed mud habitats. Information on the presence and distribution of the burrowed mud feature came from the assessment by Hughes *et al.*, (2014) of the data collected from surveys on the Hebridean slope in the SEA7 region. The underlying predicted habitat map (UKSeaMap 2010) is the result of work undertaken by JNCC to combine the physical data describing the marine environment with information from biological sampling, generating a broad-scale predictive model for seabed habitats (McBreen *et al*, 2011). JNCC cross-checked the UKSeaMap product against the more recent EUSeaMap product which supersedes UKSeaMap 2010, and verified that the same components and extents of EUNIS Level 3 habitat types are still predicted to be present within the site boundary (Cameron and Askew, 2011). PSA results from samples collected in the area by BGS provide additional verification of substrate type[1]. The polygon for the continental slope was digitised by specialists from the National Oceanography Centre (NOC) as part of work completed for Defra in support of the national MPA projects to further a deep-sea habitat classification scheme (Jacobs & Porritt, 2009). The feature was digitised through the analysis of the GEBCO digital atlas (http://www.gebco.net/) and other acoustic survey datasets (TOBI sidescan, multibeam bathymetry and backscatter).This polygon is from the physiographic feature dataset which fed into the SNH-JNCC contract to characterise and identify key geodiversity areas in Scottish waters (Brooks *et al.*, 2013).				

Sampling methods / resolution							
Feature	**Modelled**	**Acoustic / remote sensing**	**Remote video / camera**	**Infaunal - grab / core**	**Fisheries trawl**	**Diving**	**Sediment sampling**
OSSG	✓		✓				✓
BM			✓		✓		
ODSM	✓		✓				
CS	✓	✓					
Comments	Most of the biological records of protected features within the MPA were derived from a selection of underwater video footage from MSS deepwater *Nephrops* stock assessment surveys. The MSS sampling targeted areas of seabed sediment considered as suitable habitat for *Nephrops norvegicus* using a range of drop-down camera frames, with either an oblique or downward facing view. Data generated from other surveys which also were not primarily targeted for habitat assessment were used; records from MSS trawl surveys supplement the data on burrowed mud habitats. The benthic area trawled is represented by the location of the vessel at the end of the trawl, rather than the entire path of the vessel during the trawl. The UKSeaMap2010 predicted habitat map used in this assessment was developed by JNCC (McBreen et al, 2011). EUSeaMap habitat map used in this assessment was developed by a consortium of European partners led by JNCC (Cameron and Askew, 2011). Grab and core samples were taken during surveys conducted by the BGS and the PSA results underpin the predicted habitat maps. JNCC acknowledge that the spatial accuracy of older PSA records may be limited by modern standards where the Decca Main Chain or similar types of positioning systems were used.						

Data coverage (Maps A to F)					
Across the MPA					
Numerous protected feature records evenly distributed across MPA?	**-**	**Numerous protected feature records scattered across MPA with some clumping?**	✓	**Few or isolated protected feature records - possibly clumped?**	-
For Individual features					
Multiple records of individual protected features providing indication of extent and distribution throughout MPA?	-	**Few or scattered records of specific protected features making extent and broad distribution assessment difficult?**	BM ODSM	**Few or isolated records of specific protected feature records**	OSSG
Are acoustic remote sensing data available to facilitate the development of a full coverage predictive seabed habitat map?	No				

Data coverage (Maps A to F)	
Comments	**Continental slope (CS)** • Major Cenozoic Structures SNH-JNCC contract to characterise and identify key geodiversity areas in Scottish waters (Brooks *et al.*, 2013). The polygon for the continental slope was digitised by specialists from the National Oceanography Centre (NOC) as part of work completed for DEFRA in support of the national MPA projects to further a deep-sea habitat classification scheme (Jacobs. & Porritt. 2009). The feature was digitised through the analysis of the GEBCO digital atlas (http://www.gebco.net/) and other acoustic survey datasets (TOBI sidescan, multibeam bathymetry and backscatter). The upper slope edge of this dataset aligns with the general habitat classification principles (i.e. limit of the deep/offshore circalittoral biological zone) that were used in predictive mapping of the UKSeaMap 2010 and EUSeaMap projects, and therefore provides spatial agreement with the broad-scale habitat data used to predict the extent of features. **Burrowed mud (BM)** • Biotope analysis of Marine Scotland Science deep-underwater footage from the Hebridean slope (Allen, *et al*., 2014a) – The analysis of underwater video footage from three MSS *Nephrops* stock assessment survey stations confirm the presence of the burrowed mud habitat. One record comes from a survey in 2004 and the remainder from another survey in 2009. The habitat observed was characterised as deep sea mud with a large number of faunal burrows considered to have been made by *Nephrops norvegicus*. Although no *Nephrops* individuals were seen, the shape and structure of the burrows observed were comparable with previous descriptions of typical *Nephrops* burrows, with characteristic crescentiform entrances, sedimentary ejecta, and broad 'drive-ways' (Allen *et al.*, 2014a). This earlier opinion was supported by the authors' further assessment of the proximity to actual MSS *Nephrops* trawling haul counts, finding that high counts were recorded further up the slope in the MPA and that trawling surveys caught *Nephrops* on the slope between ~250m down to ~800m across the whole survey area (Allen *et al.,* 2014b). The stations lie between 550m and 800m and are situated at the base of the area predicted by UKSeaMap 2010 to be Atlantic Slope sand and muddy sand (which qualifies as offshore subtidal sands and gravels). JNCC's confidence is lower for the extent of the offshore subtidal sands and gravels predicted by EUSeaMap given the paucity of PSA data that supports the mapping. • MSS Coral bycatch records collated from trawl surveys 2000-2009 (in GeMS v4) - Species indicative of deep water burrowed mud were identified in 2008 and 2009 on the slope in the north-western area of the MPA by Marine Science Scotland from bycatch records collated from trawl surveys. These data provide recent confirmation of the presence of deep-water seapens (*Umbellula* sp. and *Kophobelemnon* sp.) at every sampling location (consisting of seven records distributed across four clusters of data points). These records intersect with the predicted distribution of offshore deep-sea muds (UKSeaMap 2010). These species are characteristic in deep-water soft sediments, and in other deep-water areas (e.g. the MAREANO project area in Norwegian waters), populations of these species in such a habitat are considered as the deep-sea equivalent of the shallower biotope 'sea pens and burrowing megafauna'. These records are recorded in GeMS with 'uncertain' determination reflecting the level of certainty in whether these species fully characterise the search feature burrowed mud. In-situ survey would verify whether the seapens are present within sandy or muddy habitat, and whether these records would confirm the presence of burrowed mud habitat. • Hughes *et al.* (2014) confirmed that bathymetric trends in habitat type and megafaunal distribution occur along the full extent of the

Data coverage (Maps A to F)	
	slope west of the Hebrides, although these vary slightly in the depth at which they occur from south to north along the slope. It is therefore reasonable to consider that the highly bioturbated mud habitat observed below -1300m to the north and within The Barra Fan and Hebrides Terrace Seamount MPA are present at the base of the slope within the MPA. • MSS Deepwater towed video survey records 2000-2009 (in GeMS v4) – These data are a subset of processed MSS *Nephrops* stock assessment underwater footage captured on the Hebridean slope, which record the presence of burrows and a judgement of ground type. Four records lie in the central area of the MPA intersecting an area predicted to be Atlantic Slope sand and muddy sand (i.e. offshore subtidal sands and gravels - UKSeaMap 2010). Only two of the records specify the underlying habitat; one being 'sandy mud' (station DW0902) and the other being 'gravelly sand' (station DW0903). Whilst burrows were present in all four records, confidence in the certainty of these data representing the burrowed mud feature is low. This is due to the lack of substrate information for two of them and the contradiction with the one that records gravelly sand present. The video footage from station DW0902 which recorded the presence of burrows in sandy mud was selected to undergo seabed habitat and taxonomic analysis (Axelsson *et al.,* 2014). Whilst occasional large feeding burrows were observed, the lack of visible characteristic epifauna, and the lack of infaunal data together with a limited amount of burrowing within the sediment made it more appropriate to assign the tows to offshore deep-sea mud (Axelsson *et al.*, 2014) (see ODSM below). The other three stations also underwent seabed habitat and taxonomic analysis (Allen *et al.*, 2014a). One was verified as representative of the burrowed mud feature whilst the other two were assigned to the offshore deep-sea mud feature on account of the infrequency of burrows observed and presence of fauna uncharacteristic of the feature (Allen *et al.*, 2014a). **Atlantic-influenced slope and shelf offshore subtidal sands and gravels (OSSG)** • UKSeaMap 2010 (in GeMS v4) – This predicted habitat map indicates that offshore subtidal sands and gravels extend throughout the south-eastern area of the MPA, with a patch in the north-western area at the base of the slope. More specifically, the map predicts that A5.15 deep circalittoral coarse sediment, A5.25 circalittoral fine sand or A5.26 circalittoral muddy sand, and A5.27 deep circalittoral sand occur on the shelf. On the slope feature, Atlantic slope coarse sediment (at the shelf break), Atlantic slope sand & muddy sand (which is the largest habitat component by area of this feature in the MPA), and small patches (relative to the size of the MPA) of Atlantic Upper bathyal mixed sediment and Atlantic Upper bathyal sand and muddy sand, are present. Atlantic Mid bathyal coarse sediment overlaps with the base of the slope polygon and, within the MPA, extends marginally onto the bathyal region. Atlantic Lower bathyal coarse sediment occurs beyond the base of the slope. • EUSeaMap (Cameron and Askew, 2011) – JNCC checked whether the more recent EUSeaMap habitat model has significantly changed the previous predicted distribution of habitats from UKSeaMap 2010. Improved bathymetry datasets used in EUSeaMap meant there was a minor alteration to the biological zone boundaries. In the deep-sea, there was a change in the predicted extent of the OSSG habitats identified from UKSeaMap2010 but the habitats are all still present on the slope. The UKSeaMap and EUSeaMap models used the same substrate input layer (for UK waters), although the EUSeaMap project used these data at a reduced spatial resolution. As the substrate type is a key driver in determining the distribution of offshore subtidal sand and gravel habitat, Maps A, B and C reflect the finer resolution UKSeaMap2010 data.

Data coverage (Maps A to F)	
	• [1]British Geological Survey (BGS) Marine Particle Size Analysis (PSA) dataset (February 2012) - These data comprise sediment sampling campaigns between 1967 and 1987 across the UK waters, from which the PSA results were categorised according to the Folk scheme and subsequently to EUNIS categories/BGS modified Folk classification. Note these data also contribute to the BGS substrate map used in the predictive seabed habitat modelling projects UKSeaMap2010 & EUSeaMap habitat maps. There are six sediment samples collected by BGS within the predicted extent of the offshore subtidal sands and gravels. One of these records shows the presence of the modified Folk class/EUNIS class 'mixed sediments' on a small patch of predicted offshore subtidal sands and gravels on the slope. Four samples recorded the presence of the modified Folk class/EUNIS class 'sand and muddy sand' where three samples lie within the extent of the predicted offshore subtidal sands and gravels on the shelf and one lies down the slope. The remaining sample records the presence of the modified Folk class/EUNIS class 'coarse sediment' and lies close to the south-eastern boundary of the MPA on the shelf. • MSS Deepwater TV station survey records 2000-2009 (in GeMS v4) – These data are a subset of processed MSS *Nephrops* stock assessment underwater footage captured on the Hebridean slope that record the presence of burrows. Four records intersect the area predicted to be offshore subtidal sands and gravels (Atlantic Slope sand and muddy sand - UKSeaMap 2010). Only two of these records have supporting information that specifies the underlying ground type – one being 'gravelly sand' and the other being 'sandy mud' and are located on the slope and shelf region of the MPA. Whilst burrows are present, there is low confidence in the presence of the typical communities of the burrowed mud feature (as discussed for BM above) at these stations. Of the two records that have habitat descriptions, only one supports the presence of the offshore subtidal sands and gravels within the area predicted for this feature (UKSeaMap 2010). • Offshore subtidal sands and gravel habitat is confirmed at a depth of approximately 700 - 990m to the north of the site, and again between 350 - 860m in a area surveyed slightly south of the Geikie slide and Hebridean slope MPA (Hughes *et.al.* 2014). Hughes *et al.* (2014) consider this feature is a continuum along the slope and therefore JNCC consider it reasonable to assume the feature is present within this MPA, despite there being no samples from their work within the site. • There are no biotope records available to confirm the biological diversity of the offshore subtidal sands and gravels feature in the MPA. Future targeted surveying within the area is required to provide such information. **Atlantic-influenced slope offshore deep sea muds (ODSM)** • UKSeaMap 2010 (in GeMS v4) - This habitat map predicts that offshore deep-sea muds are the dominant habitats in the north-western part of the MPA covering the lower third of the slope. More specifically, the map predicts that there are several small patches of Atlantic slope mud and sandy mud, Atlantic upper bathyal mud and sandy mud, and Atlantic Mid bathyal mud and sandy mud. The latter extends marginally onto the bathyal region within the boundary. • EUSeaMap (Cameron and Askew, 2011) – JNCC checked whether the more recent EUSeaMap habitat model has significantly changed the previous predicted distribution of habitats from UKSeaMap 2010. Improved bathymetry datasets used in EUSeaMap meant there was a minor alteration to the biological zone boundaries. In the deep-sea, there was a change in the predicted extent of

Data coverage (Maps A to F)	
	the OSSG habitats identified from UKSeaMap2010 but the habitats are all still present on the slope. The UKSeaMap and EUSeaMap models used the same substrate input layer (for UK waters), although the EUSeaMap project used these data at a reduced spatial resolution. As the substrate type is a key driver in determining the distribution of offshore deep sea mud, Maps A, B and C reflect the finer resolution UKSeaMap2010 data. • 2007- 2009 JNCC Selection of Marine Scotland Science videos from deep-water towed video surveys (Axelsson *et al.*, 2014) (in GeMS v4) - One video tow from a 2009 *Nephrops* stock assessment survey (station DW0902) confirms the presence of offshore deep-sea muds, defined as Atlantic upper slope mud (Howell, 2010) within the MPA. This record overlaps with the area predicted to be Atlantic Slope sand and muddy sand, which qualifies as offshore subtidal sands and gravels (UKSeaMap 2010) but most likely reflects possible issues with both the precise determination of sediment substrate type from video and the classification resolution of the predictive modelling where there is a scarcity of underpinning PSA data. • Biotope analysis of Marine Scotland Science deep-underwater footage from the Hebridean slope (Allen, *et al*, 2014a) – The analysis of underwater video footage from five MSS *Nephrops* stock assessment survey stations confirm the presence of offshore deep-sea muds habitats. One record comes from a survey in 2000 and the remainder from another survey in 2009. The stations lie between 350m and 600m and are situated in the area predicted to be Atlantic Slope sand and muddy sand (which qualifies as offshore subtidal sands and gravels (UKSeaMap 2010)). Similarly to the previous bullet point, the contradiction reflects the two key factors affecting levels of certainty. • Deep-sea mud habitat presence is confirmed at a depth of approximately 790-1000m to the north and again between 600-880m in a site surveyed slightly south of the Geikie slide and Hebridean slope MPA (Hughes *et al*., 2014). Hughes *et al.* (2014) consider this feature is a continuum along the slope and therefore JNCC consider it reasonable to assume the feature is present within this MPA, despite there being no samples from their work within the site. After Hughes *et al.* (2014) characterised the biological diversity on the Hebridean slope they determined there are five distinct biological zones with associated communities that change with depth present along the Hebridean slope. The MPA contains all five zones; Outer Shelf and Shelf Break zone, Upper Slope zone, *Ophiocten gracialis* zone, Xenophyophore zone & Decapod burrowing zone (Map F). **Geodiversity** The eastern extent of the MPA boundary has been drawn to encompass the entire extent of the slide deposit feature from the Submarine Mass Movement block as this represents the Geikie Slide key geodiversity area, as defined in Brooks *et al.*, 2013.

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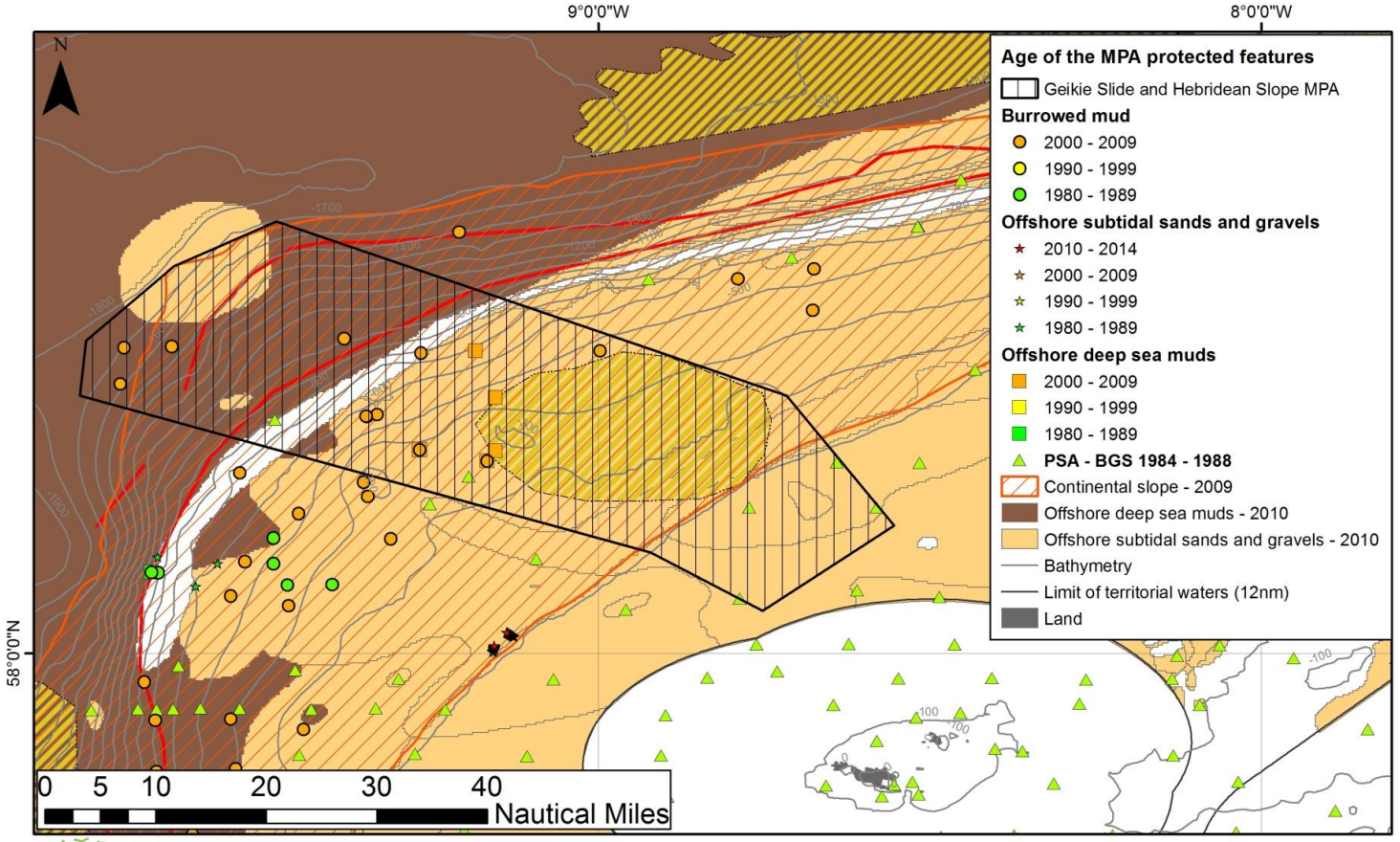

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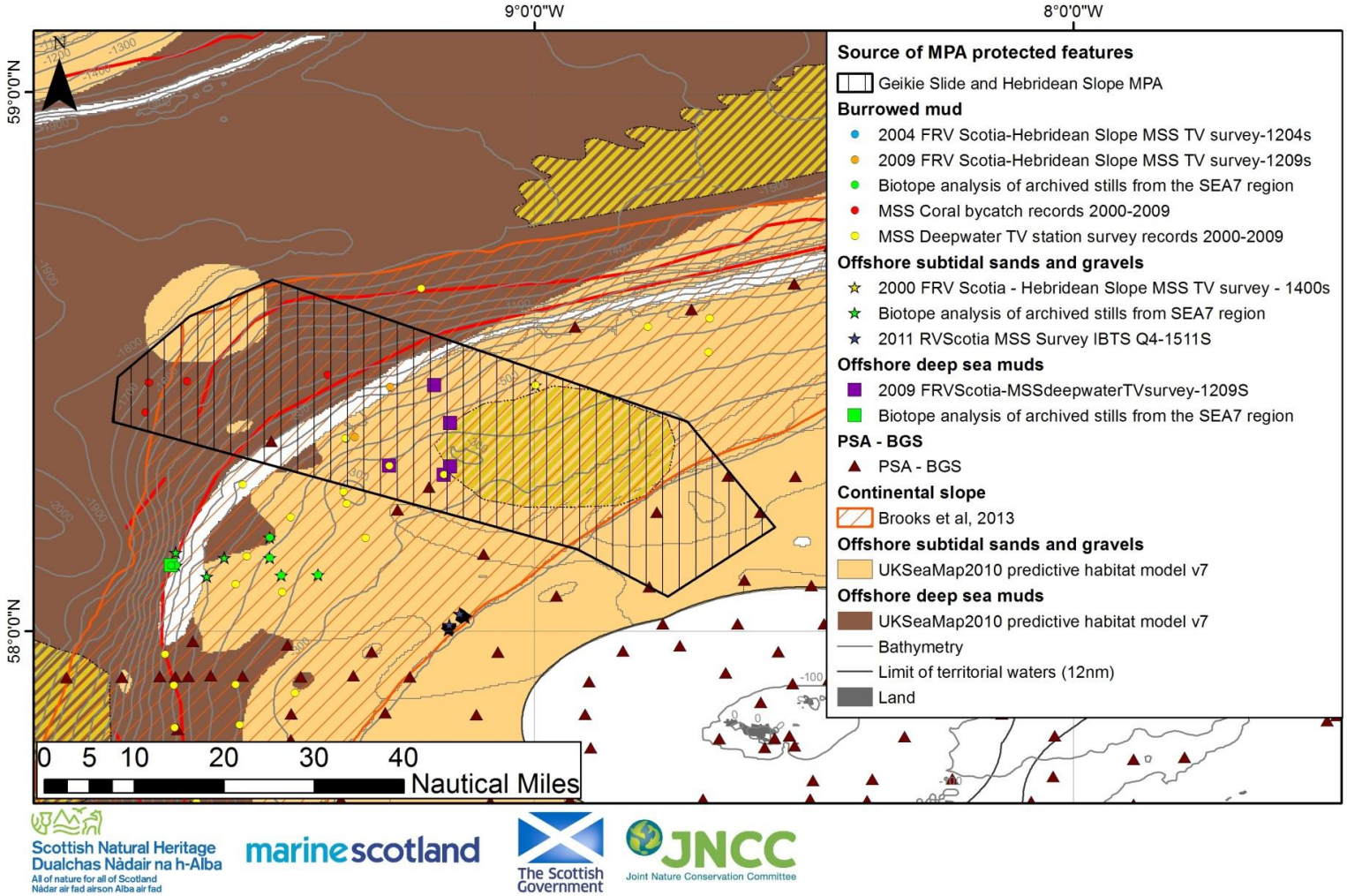

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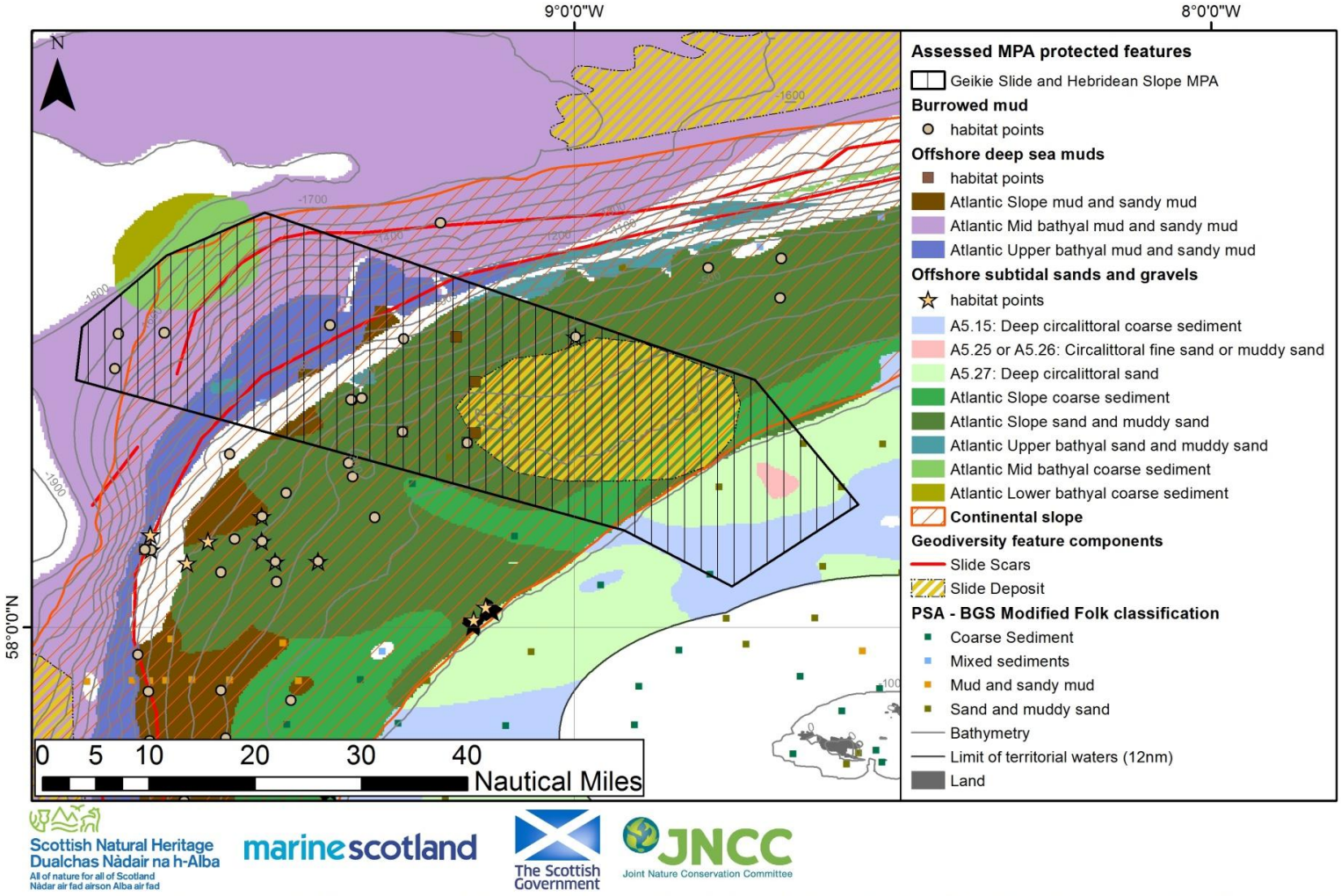

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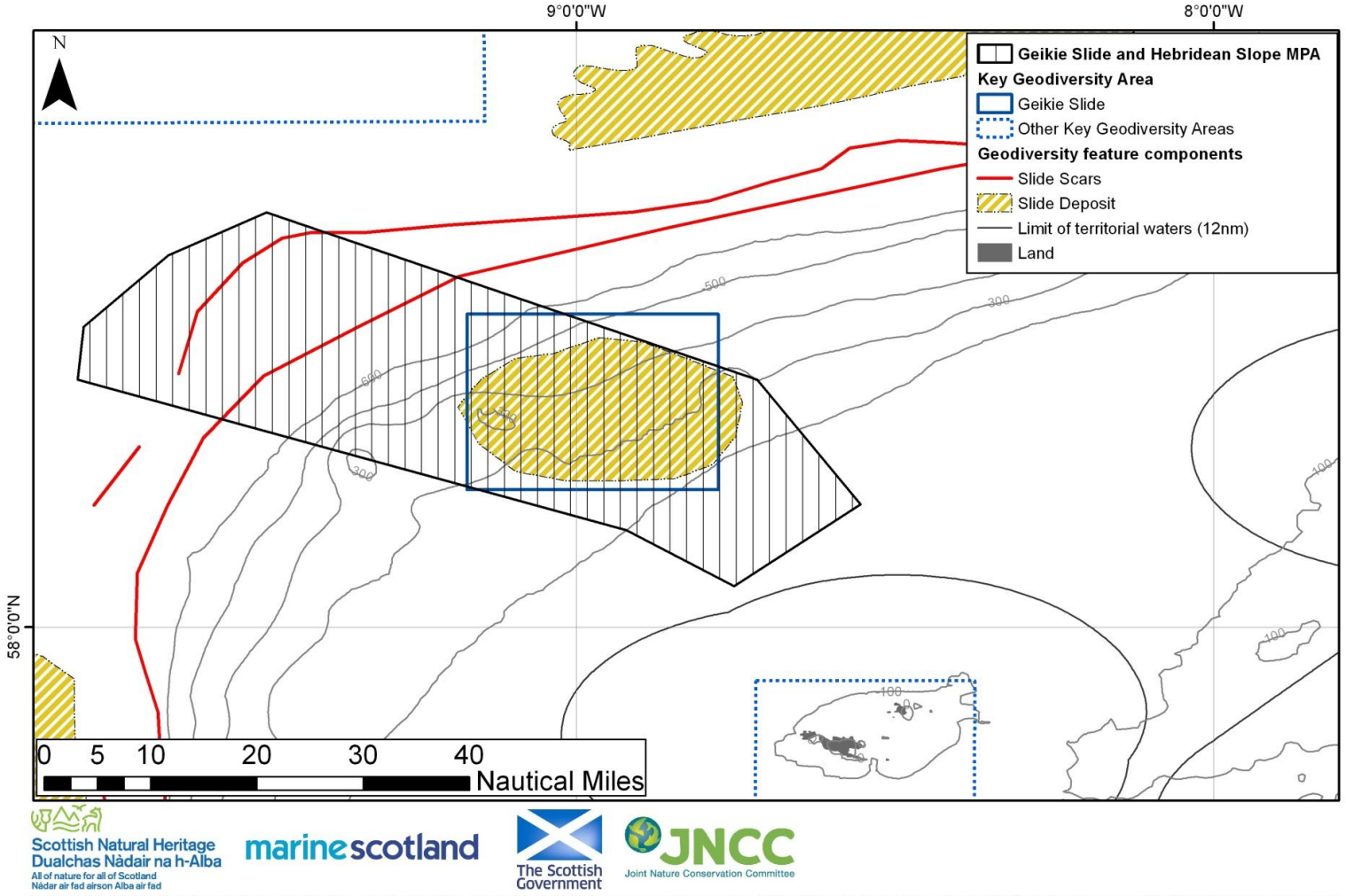

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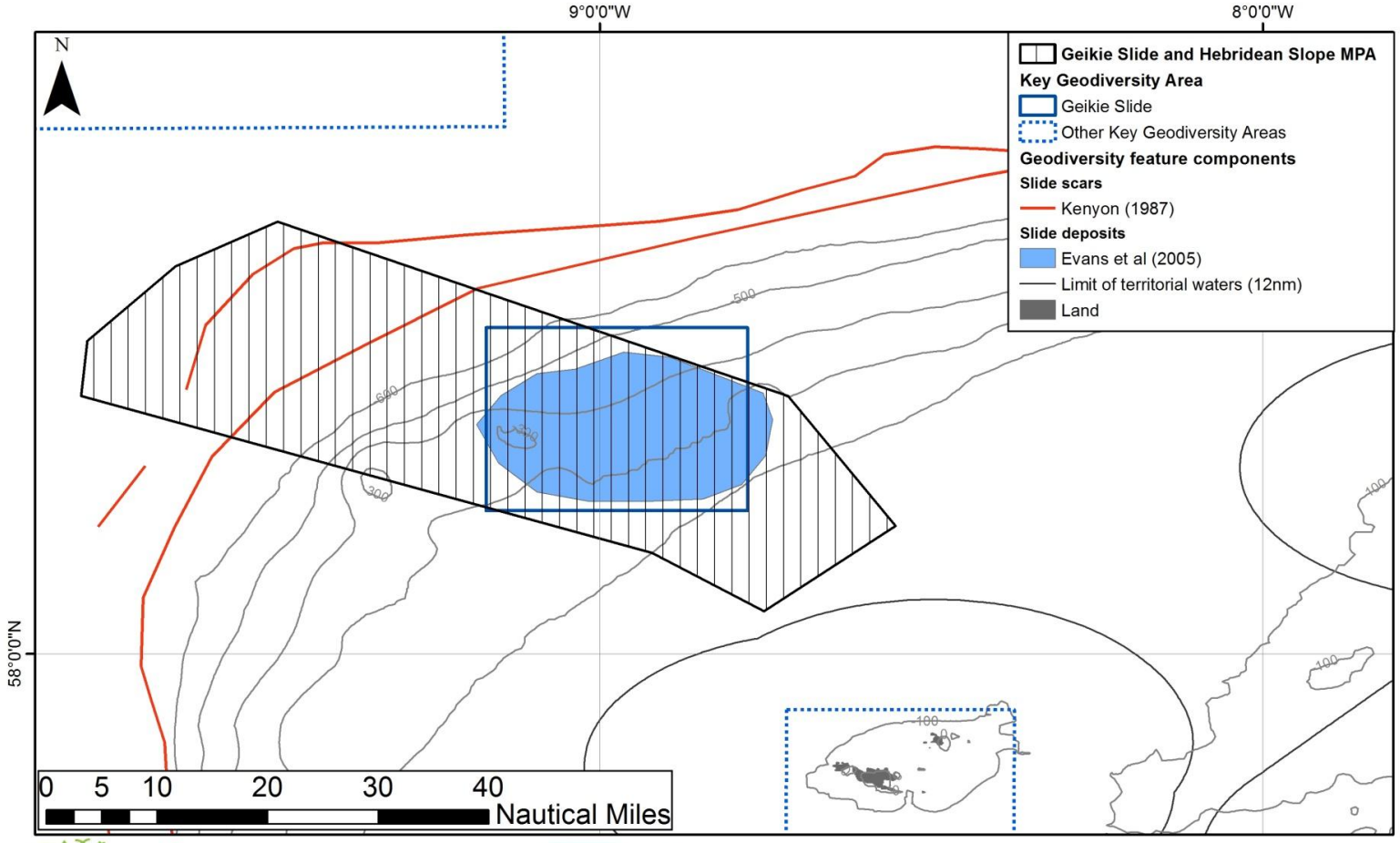
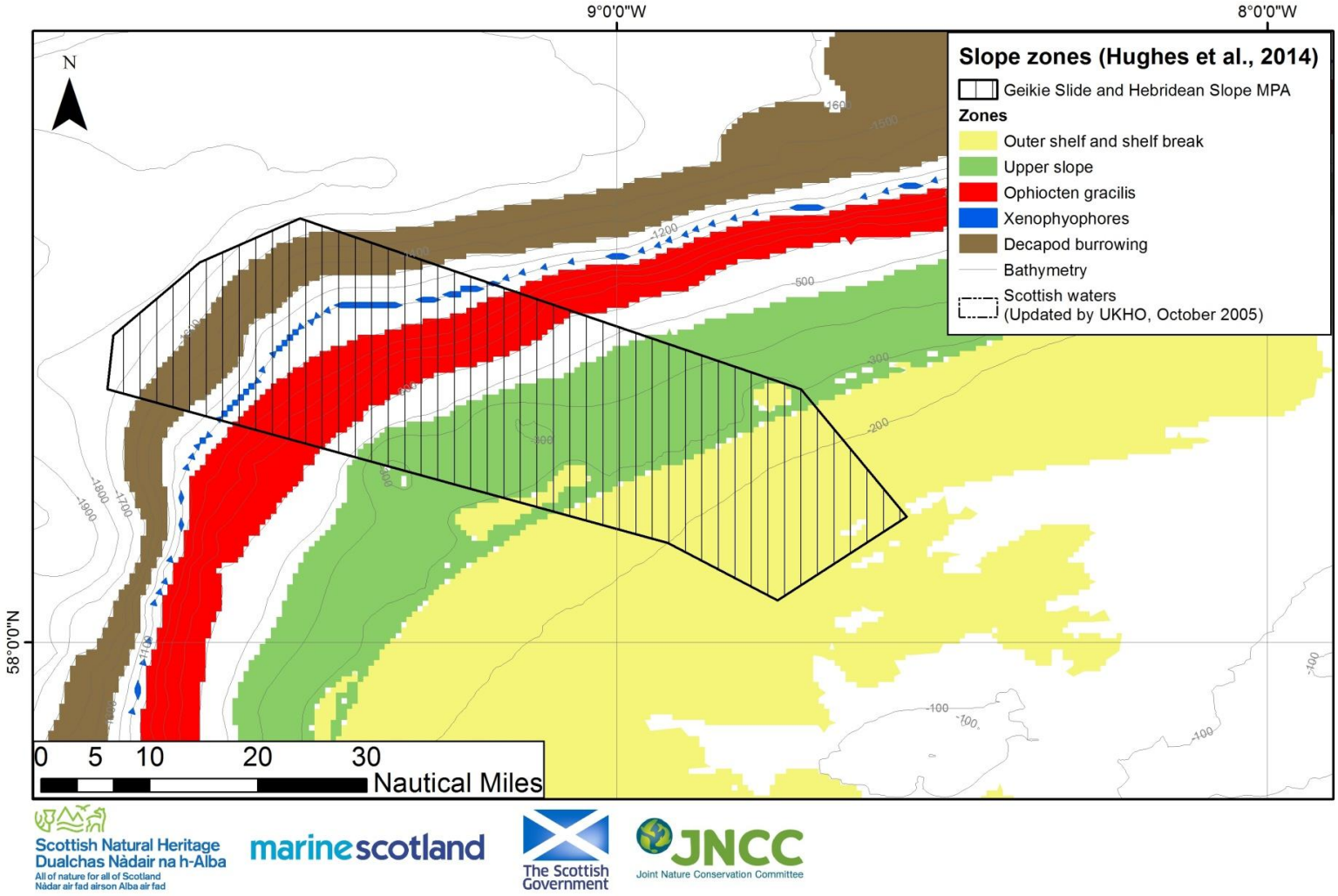
THE EVIDENCE BASE



E

THE EVIDENCE BASE



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). Scotland (Adjacent waters) Updated by the Law of the Sea Division, United Kingdom Hydrographic Office October 2005. Bathymetry © GEBCO, 2011. MPA © JNCC and SNH 2014. All rights reserved.

F

Data sources and bibliography		
Year	**Title**	**Features covered**
2014a	Allen, C., Dewey, S., and Axelsson, M., (2014). Biotope analysis of Marine Scotland Science underwater footage from the Hebridean Slope. Report for the Joint Nature Conservation Committee, JNCC Report 511	BM, ODSM
2014b	Allen, C., Dewey, S., and Axelsson, M., (2014). Biotope analysis of Marine Scotland Science underwater footage from the Hebridean Slope. Report for the Joint Nature Conservation Committee, JNCC Report 511 Addendum	BM
2014	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. Report for the Joint Nature Conservation Committee, JNCC Report 471.	ODSM
2014	Henry, L-A and Roberts, M. (2014). Developing an interim technical habitat definition of coral gardens and its subsequent application to verify suspected records in UK waters. Report for the Joint Nature Conservation Committee. JNCC Report 507	Coral gardens
2014	Geodatabase of Marine features in Scotland (GeMS) Version 4	BM, CS, ODSM, OSSG
2014	Hughes, D.J., Nickell, T, and Gontarek, S. (2014). Biotope analysis of archived stills from the SEA7 region of Scotland's seas (2011). JNCC Report 502.	ODSM BM
2013	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	CS Geodiversity
2011	Cameron, A. and Askew, N. (eds.). (2011). EUSeaMap - Preparatory Action for development and assessment of a European broad-scale seabed habitat map final report. Available at http://jncc.gov.uk/euseamap	OSSG, ODSM
2011	Chaniotis, P.D., Crawford-Avis, O.T., Cunningham, S., Gillham, K., Tobin, D. and Linwood, M. (2011). Profiles of locations considered to be least damaged/more natural in Scotland's seas. Supplementary report produced by the Joint Nature Conservation Committee, Scottish Natural Heritage and Marine Scotland for the Scottish Marine Protected Areas Project. Available from <http://www.scotland.gov.uk/Resource/Doc/295194/0121829.pdf>	-
2011	Cunningham, S., Gillham, K., Chaniotis, P.D., Crawford-Avis, O., Linwood, M. and Payne, O. (2011). Assessing the contribution of other area-based measures to the ecological coherence of the MPA network in Scotland's seas. Report produced by Scottish Natural Heritage, the Joint Nature Conservation Committee and Marine Scotland for the Scottish Marine Protected Areas Project. Available from <www.scotland.gov.uk/Resource/Doc/295194/0121831.pdf>	-

2011	McBreen, F., Askew, N., Cameron, A., Connor, D., Ellwood, H. and Carter, A., 2011. UK SeaMap 2010 Predictive mapping of seabed habitats in UK waters, JNCC Report 446, ISBN 0963 8091	OSSG ODSM
2010	Howell, K.I. (2010). A benthic classification system to aid in the implementation of marine protected area networks in the deep/high seas of the NE Atlantic. *Biological Conservation,* 143: 1041–1056	
2010	Large, P.A., Diez, G., Drewery, J., Laurans, M., Pilling, G.M., Reid, D.G., Reinert, J., South, A.B., and Vinnichenko, V.I., 2010. Spatial and temporal distribution of spawning aggregations of blue ling (Molva dypterygia) west and northwest of the British Isles. ICES Journal of Marine Science, **67**. 494-501.	Blue ling
2009	Jacobs, C. and Porritt, L., 2009. Deep sea habitats - contributing towards completion of a deep-sea habitat classification scheme, NOCS Research and Consultancy Report No.62	CS
1967-1988	British Geological Survey particle size analysis (PSA) data (dates refer to data collection period for the entire dataset)	OSSG