Joint Nature Conservation Committee

Scottish MPA Project
Data Confidence Assessments

CENTRAL FLADEN NATURE CONSERVATION MPA

JULY 2014

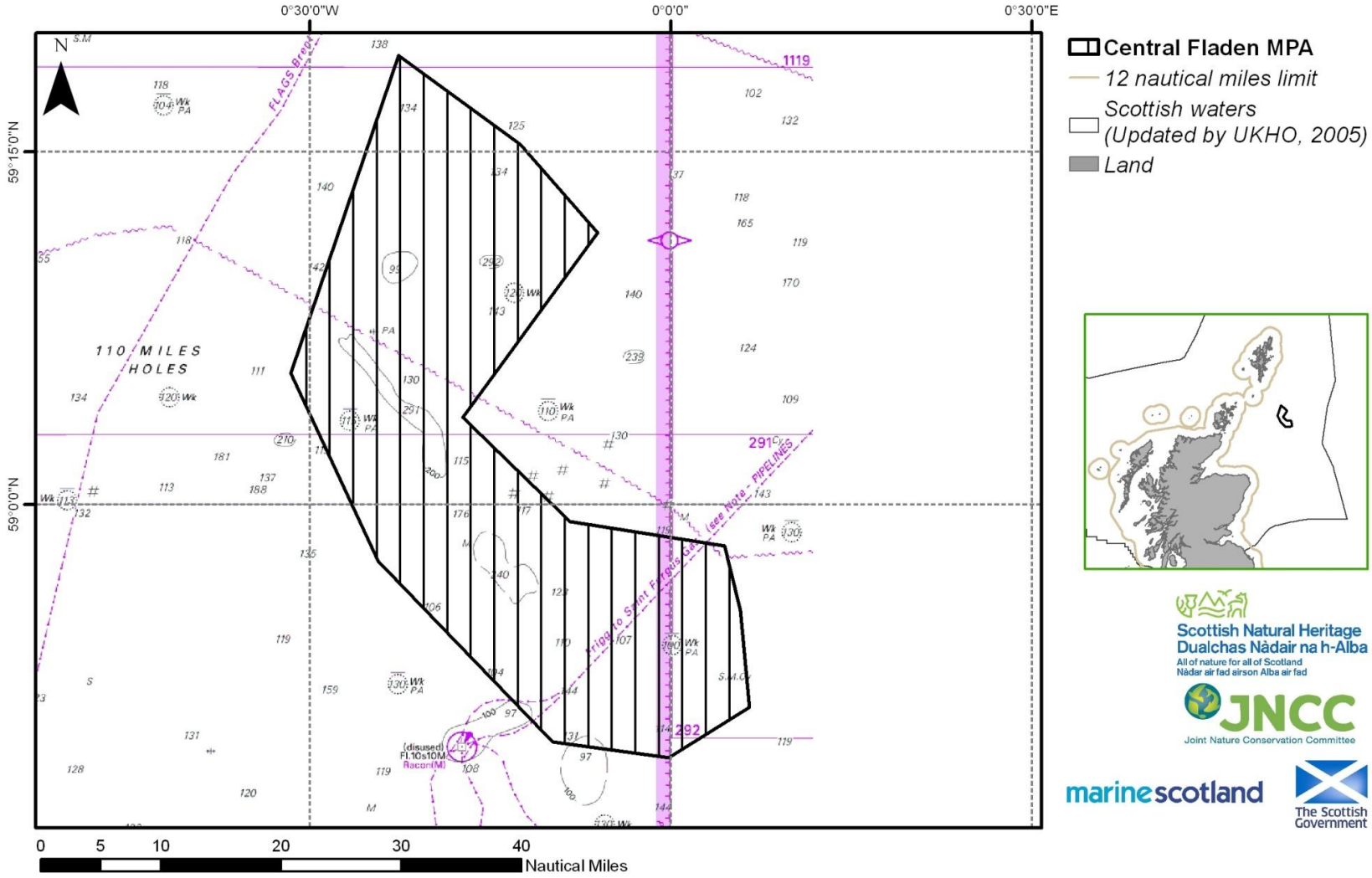
The following documents provide further information about the Central Fladen Marine Protected Area (MPA):

- 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-6476

Document Distribution List and Version Control				
Format	**Version**	**Issue date**	**Version development and review**	**Issued to**
Electronic	2.0	03/05/2013	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	19/07/2013	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	09/07/2014	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 **Map showing the location of the Central Fladen 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	Central Fladen	**Date of initial assessment**	21st August 2012	**Assessors**	ALR, NC, PC, ML

The Central Fladen MPA was defined as a search location within the Fladen Grounds Broad Search Area and is recommended for the protection of the seapens and burrowing megafauna component, and the tall seapen (*Funiculina quadrangularis*) component of burrowed mud habitat, and the geodiversity features representing the Fladen Deeps Key Geodiversity Area (Brooks *et al.,* 2013). The boundary for the MPA was defined from survey stations that met or exceeded the average seapen density for burrowed mud habitat across the wider Fladen grounds to the north, and includes the occurrences of the tall seapen recorded in the south. The boundary also includes a sub-glacial tunnel valley geodiversity feature representative of the Fladen Deeps Key Geodiversity Area (Brooks *et al.,* 2013).

Protected features			
Biodiversity	Burrowed mud (BM)	**Geodiversity**	Overlaps Key Geodiversity Area – Fladen Deeps Sub-glacial tunnel valley from the Quaternary of Scotland Block (Brooks *et al.,* 2013)

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

Ocean quahog (*Arctica islandica*) aggregations – results from the analysis of samples collected on the 2011 International Bottom Trawl Survey (IBTS) Quarter 3 (grabs) and the 2013 RV Cefas Endeavour survey of the Fladen Grounds (grabs and photographic imagery) recorded that adults and juveniles were present in the MPA, mainly in the south-east area. Ocean quahog is well represented in other MPAs in the Scottish area of the North Sea therefore it was excluded from further assessment in the Fladen Grounds.

Offshore subtidal sands and gravels – results from the analysis of samples collected on the 2013 RV Cefas Endeavour survey of the Fladen Grounds (grabs and photographic imagery) record the isolated occurrence of the feature in the base of the tunnel valley and in the southern part of the MPA. Habitat map products from predictive models also suggest the feature occurs in the southern part of the MPA. This feature is well represented in other MPAs in the Scottish area of the North Sea therefore it was excluded from further assessment in the Fladen Grounds.

Shelf deeps – the Central Fladen MPA has a shelf deep running through it corresponding to the sub-glacial tunnel valley geological feature. This shelf deep has been excluded from further assessment as a supporting large scale feature due to a lack of information/evidence of its functional significance.

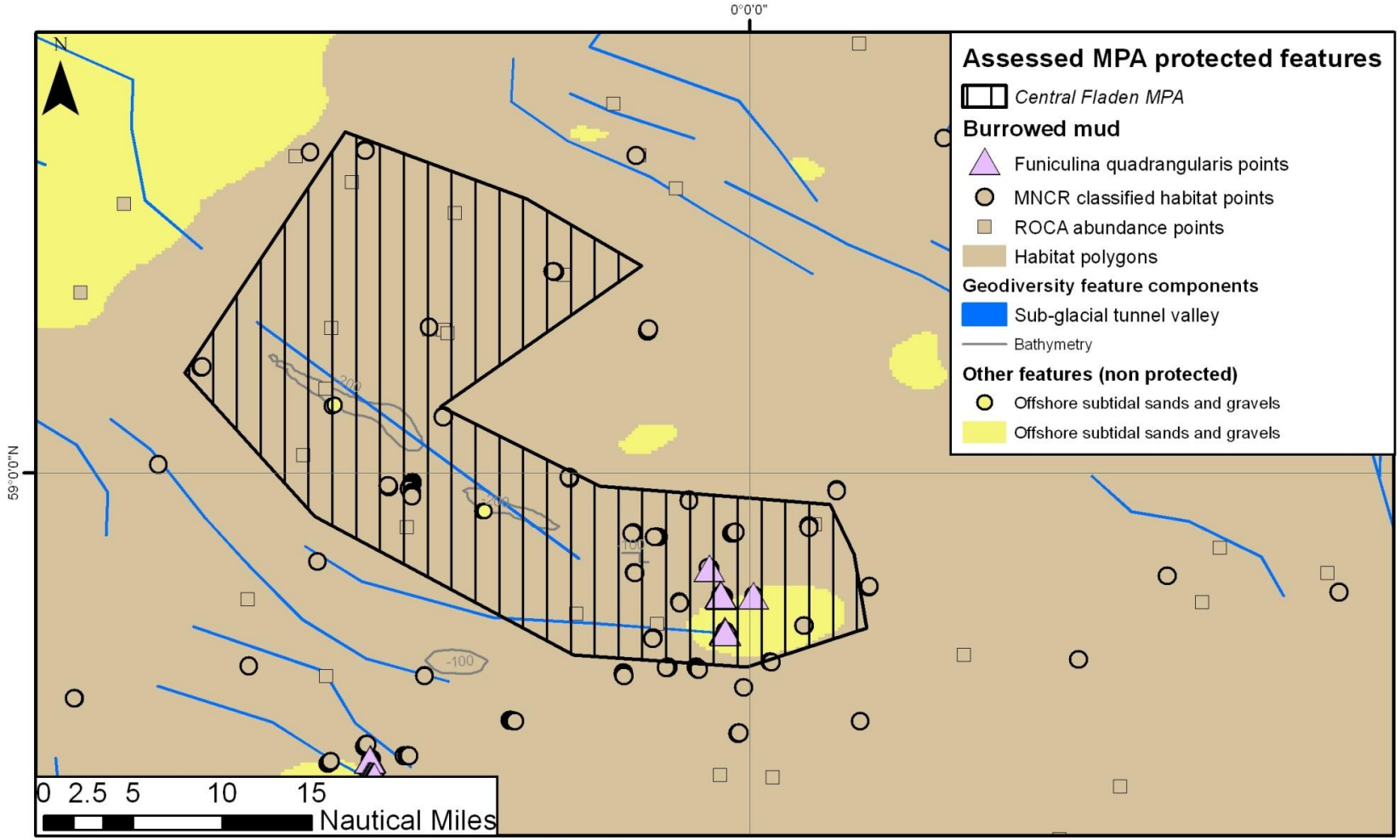
Data used in assessment			
Version of GeMS holding feature data used to support site selection	Ver.4	**Other datasets used** (not in GeMS) [superscripts are used to reference these datasets in the following discussion]	• [1]British Geological Survey (BGS) Marine Particle Size Analysis (PSA) dataset (February 2012) - data collected between 1967 and 1987 classed according to the Folk classification and subsequently to the EUNIS habitat classification by JNCC based on the BGS modified Folk scheme • [2]Marine Scotland Science (MSS) 2001 – 2011 Particle Size Analysis (data • [3]Marine Scotland Science 2008 - 2010 *Nephrops* underwater Towed Video survey database • [4]2013 Fladen Grounds RV Cefas Endeavour survey (CEND01/13X); Particle Size Analysis data & infaunal abundance data from grab samples, with acoustic data (Eggleton, *et al.,* 2013) • [5]EuSeaMap predictive habitat mapping project habitat map (Cameron and Askew, 2011). Note that the product used in the maps is the 2012_08 version, which is an improvement on that published in the 2011 report

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

Confident in presence of identified features?	BM	**Data suitable to define extent of individual MPA protected features**	**Yes**	**Partial**	**No**
			✓	-	**-**

Summary	JNCC have high confidence in the presence of the burrowed mud habitat within the Central Fladen MPA. A JNCC commissioned survey of the MPA in 2013 confirmed the presence and extent of the seapens and burrowing megafauna community, and verified the presence of a population of the tall seapen (*Funiculina quadrangularis*) (Eggleton *et al.,* 2013). Sampling across the MPA confirmed the seapens and burrowing megafauna biotope was well distributed across the area, whereas the tall seapen component appears more restricted to the southern part of the MPA. An additional significant source of evidence comes from Marine Scotland Science's *Nephrops* fisheries stock assessment video footage from 2008 to 2010[3]. The sampling methods employed on these surveys are suitable for verifying the burrowed mud habitat through the recording of substrate type and the presence of characterising epifauna; these data have been processed according to Marine Scotland Science's semi-quantitative ROCA abundance scale (Allan, *et al.*, 2012) (labelled as 'ROCA abundance points' in Figure 2 & Map C to distinguish their coverage from the recent commissioned survey coverage). Further analysis of the seabed samples from the recent survey have established the range of infaunal communities across the burrowed mud habitat, and enable a more conclusive assessment of the biodiversity within the MPA.

Figure 2 Map of the known distribution of protected features within the Central Fladen MPA



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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	✓	**Multiple records collected pre 2000**	**-**
Comments	The majority of the burrowed mud evidence was collected during a dedicated MPA survey conducted in 2013 (Eggleton *et al.,* 2013). Further evidence was collected through opportunistic sampling in 2011 during fisheries survey work. A large number of habitat feature records within this MPA were sourced from MSS *Nephrops* stock assessment Towed Video surveys conducted in 2004, 2008 – 2010[3]. PSA results from MSS *Nephrops* stock assessment survey samples[2] verifying the presence of the burrowed mud habitat were collected between 2001 and 2011, and are supported by BGS data[1] collected between 1980 and 1985. The underlying predictive habitat map was developed in 2010 (McBreen *et al.,* 2011), and updated by the EU SeaMap Project in 2011 (Cameron & Askew, 2011). The sub-glacial tunnel valleys were mapped in 2012 (Brooks *et al.,* 2013).		

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) – British Geological Survey (BGS) PSA data and Marine Scotland Science (MSS) PSA data	✓
Comments	Evidence was collected during the 2013 JNCC-commissioned dedicated habitat survey utilising the RV Cefas Endeavour (Eggleton *et al.,* 2013), as well as opportunistic habitat surveying aboard the RV Scotia by collaborating with MSS during bottom trawl surveys (Goudge & Morris, 2014). MSS provided a significant amount of the burrowed mud habitat feature records and PSA samples within this MPA, which were collected during *Nephrops* stock assessment surveys. The habitat map produced by the UKSeaMap 2010 Project is the result of work undertaken by JNCC to build habitat distribution models by combining physical data describing the marine environment with information from biological sampling; these models can generate a broad-scale map predicting the distribution of seabed habitats (McBreen *et al.,* 2011). These models were updated in 2011 by the EU SeaMap Project (Cameron & Askew, 2011). The substrate layer used in the models is underpinned by BGS PSA records from seabed sediment samples. The sub-glacial tunnel valleys are mapped from Olex echosounder recordings (Brooks *et al.,* 2013).				

Sampling methods / resolution							
Feature	**Modelled**	**Acoustic / remote sensing**	**Remote video / camera**	**Infaunal - grab / core**	**Fisheries trawl**	**Diving**	**Sediment sampling**
BM	✓	✓	✓	✓			✓
Comments	During the 2013 survey aboard the RV Cefas Endeavour, video and still images were captured using a camera sledge and seabed samples collected using a day grab. Stations were located across the MPA with a higher frequency of sampling within the core area to verify the presence and extent of the tall seapen previously recorded. The day grab samples help characterise the infaunal communities within the MPA. Acoustic data were collected during transits between ground truthing stations within Central Fladen as well as between this site and two other pMPAs under consideration at the time, with 100% multibeam coverage of two additional areas (measuring approximately 8 km x 4 km) located within and to the south-west of the Central Fladen core. Multibeam bathymetry and backscatter data along with benthic grab, video and still samples were used to create broadscale habitat maps illustrating the feature extent. During the 2011 IBTS Quarter 3 survey aboard the RV Scotia, video and still images of the seabed were captured using a drop down camera system, with supplementary seabed samples collected using a day grab. Stations were identified to target search locations as part of an opportunistic sampling strategy since only the downtime between the main bottom trawls was available for seabed work. The 2004, and 2008-2010 MSS *Nephrops* stock assessment video sampling from which burrowed mud feature records were determined was targeted at areas of suitable seabed sediment substrates and utilised a towed camera system. PSA samples were collected to verify the sediment type but samples of sediment infauna were not collected. The BGS PSA data used here is from seabed sediment samples collected in the 1980s. It is acknowledged that the spatial accuracy of older PSA records may be limited in places where the Decca Main Chain or similar types of positioning systems will have been used that generally have lower spatial accuracy than modern techniques. Sub-surface PSA results from cores have not been reported here. The data used to identify the geodiversity features (tunnel valleys) were collected using echosounder recordings held within the Olex database (Brooks *et al.,* 2013).						

Data coverage (Maps A to I)					
Across 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?**	**-**
Individual features					
Multiple records of individual protected features providing indication of extent and distribution throughout the MPA?	✓	**Few or scattered records of specific protected features making extent and broad distribution assessment difficult?**	**-**	**Few or isolated records of specific protected feature records**	**-**
Are acoustic remote sensing data available to facilitate the development of a full coverage predictive seabed habitat map?			A habitat map has been produced using the extent of the acoustic data and samples acquired on the 2013 Fladen Grounds RV Cefas Endeavour survey[4] (Map I). Acoustic data consists of a full coverage block within the southern part of the Central Fladen MPA and a network of lines acquired when transiting between stations across the remainder of the MPA (Map G & H).		

Comments

Burrowed mud (BM)

- UKSeaMap 2010 (in GeMS v4) – The habitat map predicts that EUNIS habitat 'A5.37 Deep circalittoral mud' is the dominant habitat and occurs across the majority of the MPA. The polygons of this habitat map make up the Fladen ground broad search area and serve as a proxy for the extent of the Burrowed mud habitat. The EU SeaMap predictive habitat mapping project updated the UK SeaMap 2010 product but the output remains the same for the EUNIS habitat type predicted to occur across the MPA.
- 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 Folk and subsequently to the EUNIS habitat classification by JNCC based on the BGS modified Folk scheme. Note these data underpin the BGS substrate map used in the predictive seabed habitat mapping project UKSeaMap2010 habitat map[1]. Of the 29 sediment samples collected by the BGS within the predicted extent of the mud feature, 27 record the presence of the modified Folk /EUNIS class 'mud and sandy mud' and are evenly distributed within the extent of the predicted mud habitat within the MPA. The remaining two points record the presence of the modified Folk/EUNIS class 'sand and muddy sand' and lie within the central area of the predicted deep circalittoral mud habitat.
- Marine Scotland Science 2001 – 2011 Particle Size Analysis (PSA) data[2] - Of the 33 sediment samples collected by MSS between 2001 and 2011 within the MPA, 14 record the presence of Folk class 'sandy mud', 18 'muddy sand' and 1 'sand'. The sandy mud records are clustered in the northern part of the MPA and are directly transferable to the modified folk/EUNIS category of 'mud and sandy mud'. However the muddy sand records, well distributed across the MPA, are not directly transferable to the modified Folk/EUNIS category 'sand and muddy sand' without % mud content information as the threshold between this and the former modified Folk class is part way through the muddy sand Folk class. In the context of the BGS PSA data, despite the distribution of mud and sandy mud throughout the MPA, the more

Data coverage (Maps A to I)	
	southerly records appear to have higher variability in their mud content than the northerly records. • MSS *Nephrops* stock assessment video analysis 2004 (in GeMS v4) (Greathead *et al.,* 2011) – A single station from the 2004 towed video survey lies in the northern portion of the MPA, the analysis of which confirms the presence of the feature component 'seapens and burrowing megafauna in circalittoral fine mud' (MNCR code - SS.SMu.CFiMu.SpnMeg). • 2011 International Bottom Trawl Survey (IBTS) Quarter 3 Survey (0911S) (in GeMS v4) (Goudge & Morris, 2014) – 2 stations were sampled by video/stills and grab during the fishing down-time of a bottom trawl survey in 2011. The stations lie in the centre of the MPA at the edge of the sub-glacial tunnel valley. The video/stills sampling confirmed the presence of the burrowed mud feature through the identification of the component 'seapens and burrowing megafauna in circalittoral fine mud' (classified as Mosaic of SS.SMu.OMu & SS.SMu.CFiMu.SpnMeg).Only one grab sample was collected and only classified to the biotope complex level of 'offshore circalittoral mud', noting the presence of the polychaete worms *Diplocirrus glaucus* and *Paramphinome jeffreysii* and the brittlestar *Amphiura chiajei*. • 2013 Fladen Grounds RV Cefas Endeavour survey (CEND01/13X) (Eggleton *et al*., 2013) – Within the MPA, 22 stations were sampled with video/stills equipment from which the habitat type and epifaunal abundance were identified. A total of 348 still images were captured at these 22 stations (in GeMS v4). From this information habitat types and biotopes were determined, resulting in 7 transects determined as the SS.SMu.CFiMu.SpnMeg, 5 of which are the sub-biotope SS.SMu.CFiMu.SpnMeg.Fun on account of the abundance of the tall seapen present. The sub-biotopes are all located in the core area. 13 stations were determined to be the biotope complex 'circalittoral fine mud'. All of these stations had evidence of megafaunal burrows, including Norway lobster *Nephrops norvegicus*, and the majority record the occurrence of seapens. Video data analyses determined all 13 stations as indicative of burrowed mud on account of the abundance of the characteristic species of the SS.SMu.CFiMu.SpnMeg biotope falling short of the typical values for seapens of the biotope according to Connor *et al.,* (2004). At the scale of the still samples, each of these 13 stations include samples that have been determined as SS.SMu.CFiMu.SpnMeg. Multivariate analysis of the video samples detected several statistical clusters of biological community groups in the Central Fladen MPA. Differences were due to the presence/absence of certain species identifiable from the photographic imagery. Final biotope assignment was based on the epifaunal species present across the sites that were characteristic of biotope and/or sub-biotope classes. The habitat of the remaining 2 video stations was determined as offshore circalittoral mixed sediment, therefore are not examples of the burrowed mud feature. These stations were located at the bottom of sub-glacial tunnel valley, where the substrate included coarser material such as gravel, pebbles and cobbles. Grab samples[4] were retrieved from 37 stations within the MPA. Particle Size Analysis of these samples resulted in 32 determined as modified Folk class/EUNIS 'mud and sandy mud', 3 determined as modified Folk class/EUNIS 'mixed sediment' and 2 determined as modified Folk class/EUNIS 'sand and muddy sand'. The latter 2 classes are not examples of the burrowed mud feature's habitat type. Taxonomic and multivariate analysis of these grab samples has been completed. The analysis detected that samples generally clustered by site. The Central Fladen samples represented a broad range of biological community groupings. Generally the infaunal clusters were characterised by species that were not specific to any one biotope. However, 2 infaunal statistical clusters from the whole dataset were possible to assign to an existing biotope (EUNIS A5.376 '*Paramphinome jefferysii*, *Thyasira spp*. and *Amphiura filiformis* in offshore circalittoral sandy mud) which 9 samples in the Central Fladen MPA, mostly in the north, were determined as. This is considered a

Data coverage (Maps A to I)	
	component biotope of the offshore deep sea muds search feature. The remaining infaunal samples were assigned to the following habitat types: deep circalittoral mud (23), subtidal sand (2) and subtidal mixed sediment (3) of which the latter 2 are not habitat types relevant to the burrowed mud feature. • Marine Scotland Science 2008 - 2010 *Nephrops* underwater Towed Video survey database (Allan *et al.,* 2012)[3] - MSS analysed the abundance of seapens and other megafauna from underwater video footage collected between 2008 and 2010 from Nephrops stock assessment stations scattered relatively evenly throughout the predicted distribution of mud habitats. These data confirmed the presence of *Nephrops* burrows and seapens characteristic of the burrowed mud habitat across the whole MPA. Within the database, megafauna abundance is recorded according to a 4 point abundance scale (Rare, Occasional, Common and Abundant, ROCA) used by MSS (Allan *et al.,* 2012), whereas *Nephrops* burrow density (av. no. burrows/m^2) is recorded, rather than number of individuals observed. PSA results are also recorded for each station. A key finding was the tall seapen (*F. quadrangularis*) recorded at one station in the south-east of the MPA in 2010 with an abundance considered to be 'Occasional' – approximately 30 individuals. The analysis also reported the presence of the following seapen species (ROCA abundance scale results in brackets from across the years): the slender sea pen *V. mirabilis* (abundant, common, occasional and rare records present) and phosphorescent sea pen *P. phosphorea* (common and occasional records present). Burrow densities at the stations within the MPA (14, of which 3 are in the Central Fladen) range from 0.0 (av. no. burrows/m^2) to 0.5, the mean being 0.28. This density is just under the average for the values across the Fladen grounds (0.33) (i.e. data from stations outside of the MPAs). These data have not been classified into a biotope according to the Marine Habitat Classification for Britain and Ireland (Connor *et al.,* 2004) since the other infaunal species were not recorded. These records are presented as 'ROCA abundance points' in Figure 2 and Map C, and separately in Map D (burrow density values scaled according to the range recorded in the Fladen and scaled ROCA abundance values for all 3 seapen species recorded at each station). **Geodiversity** • The sub-glacial tunnel valleys (Quaternary of Scotland Block) were mapped from extensive echosounder recordings held within the Olex database (Brooks *et al.,* 2013) (Map E & F). The tunnel valley running through the middle of the MPA corresponds with the shelf-deep feature mapped from UK Admiralty Charts.

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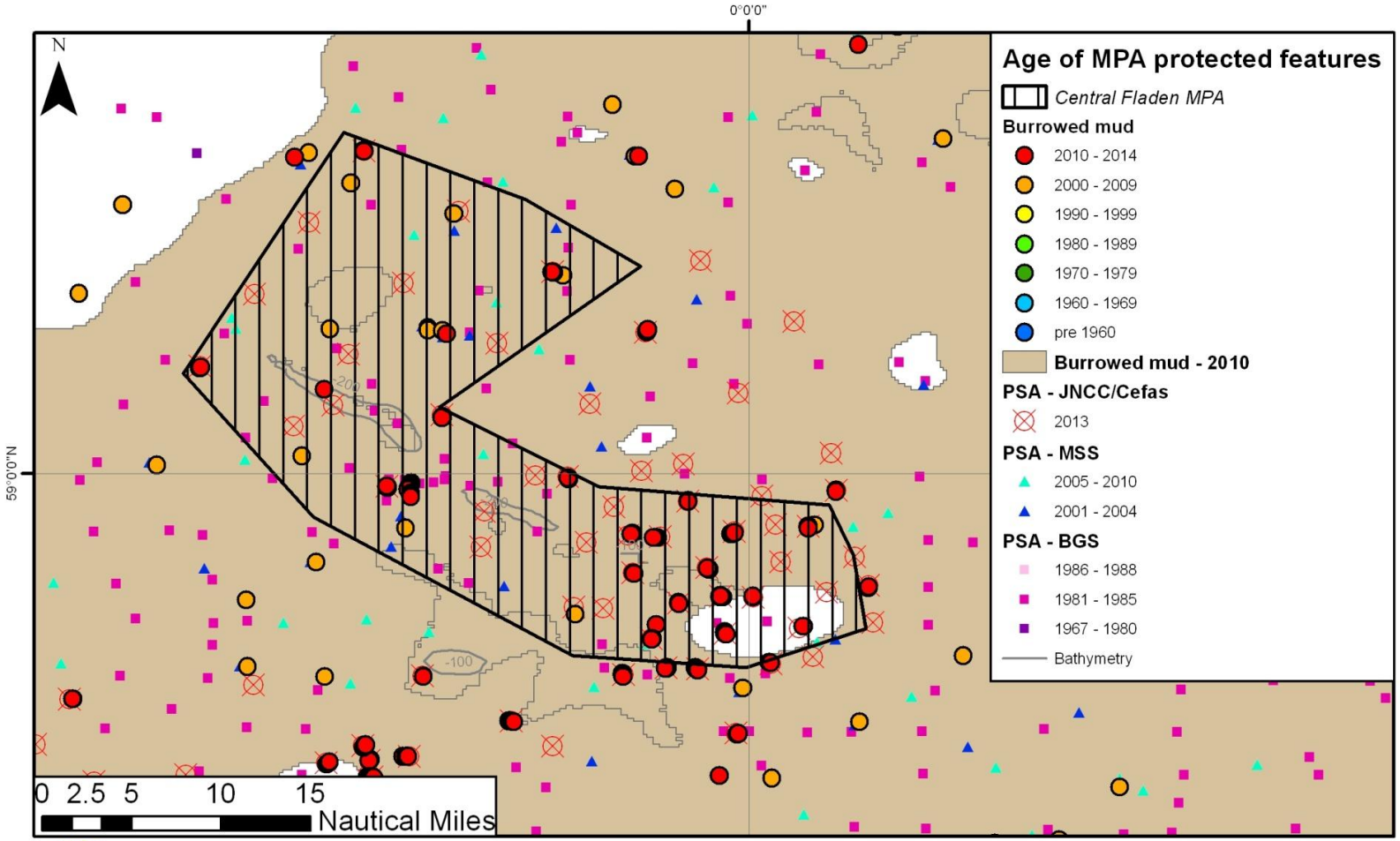

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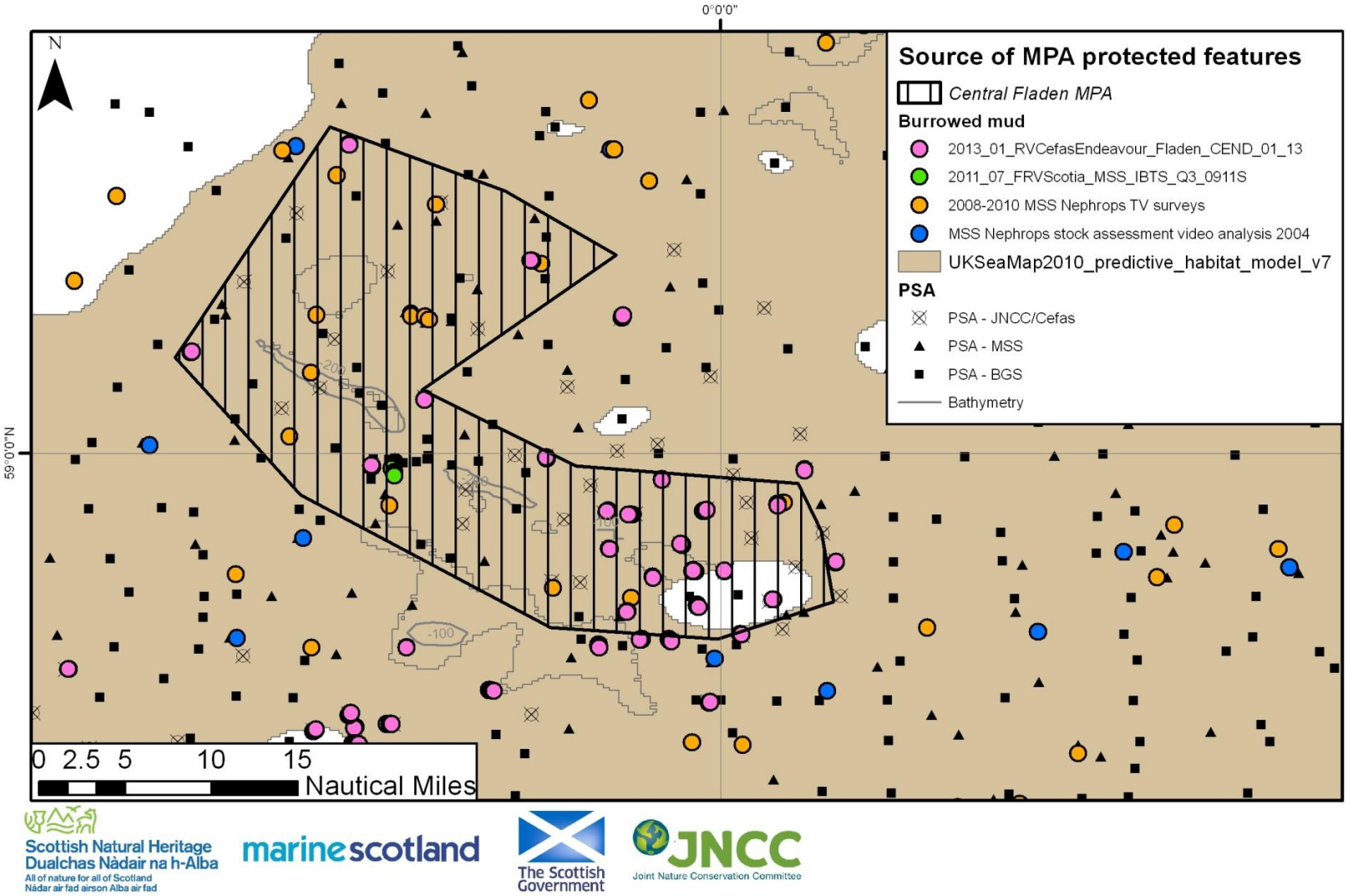

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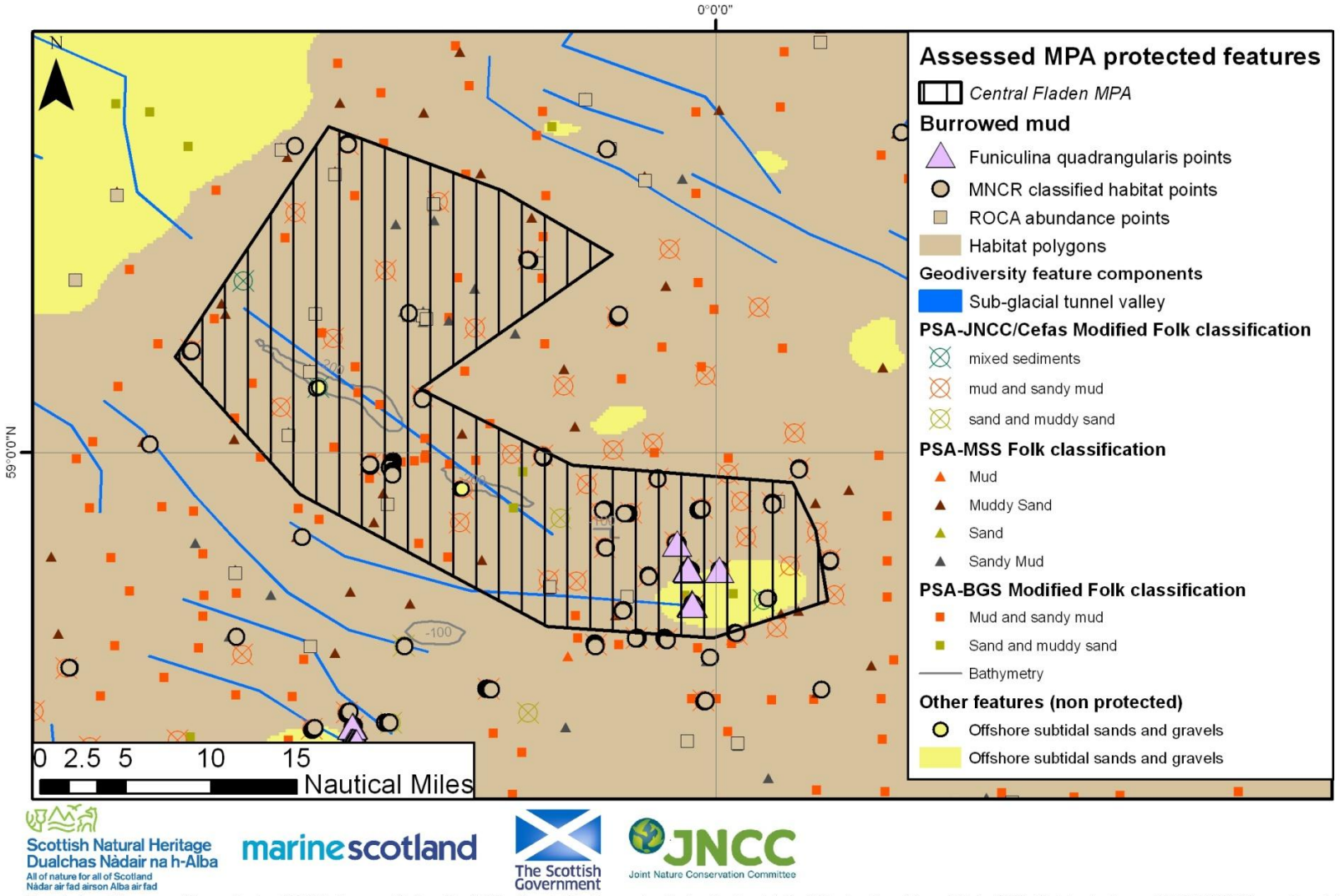

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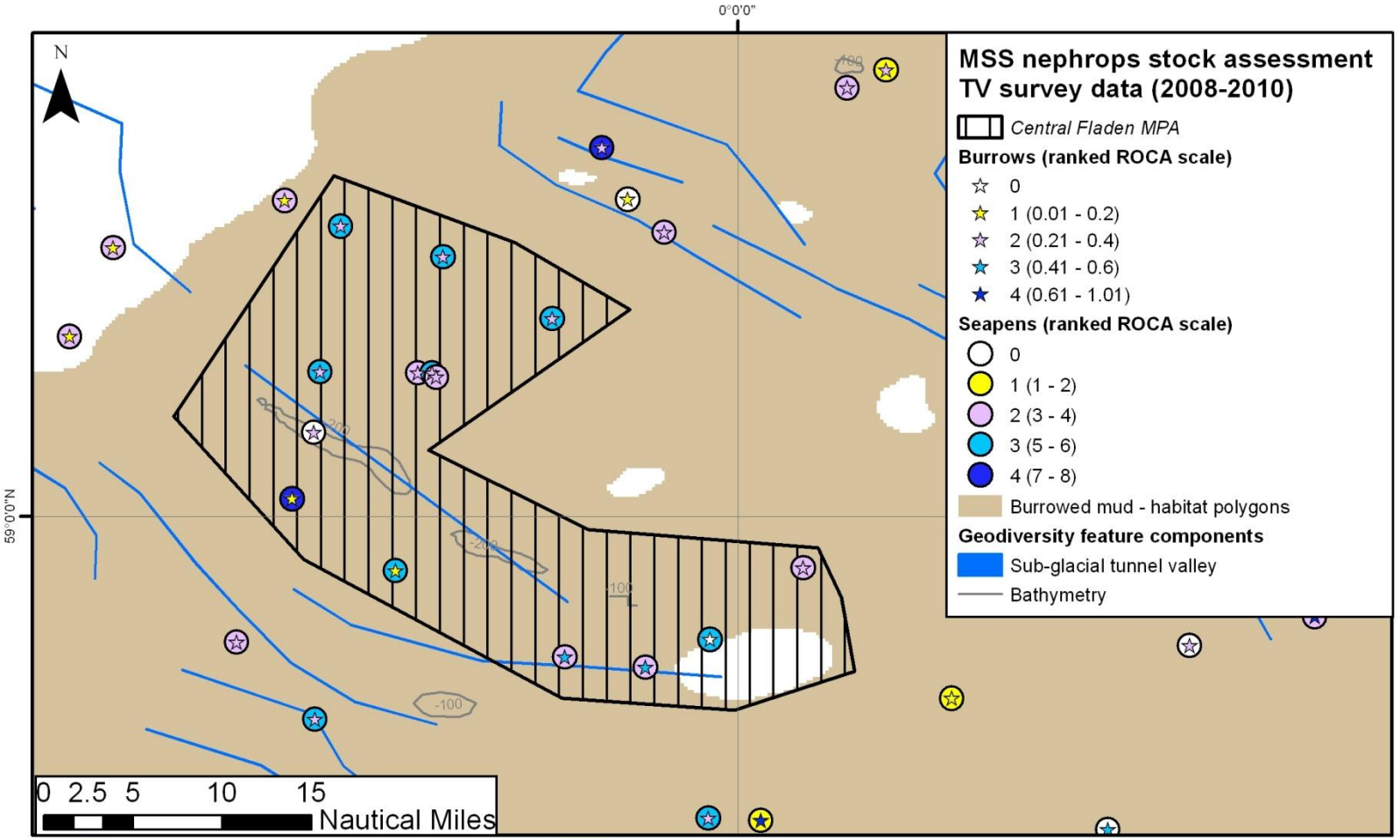

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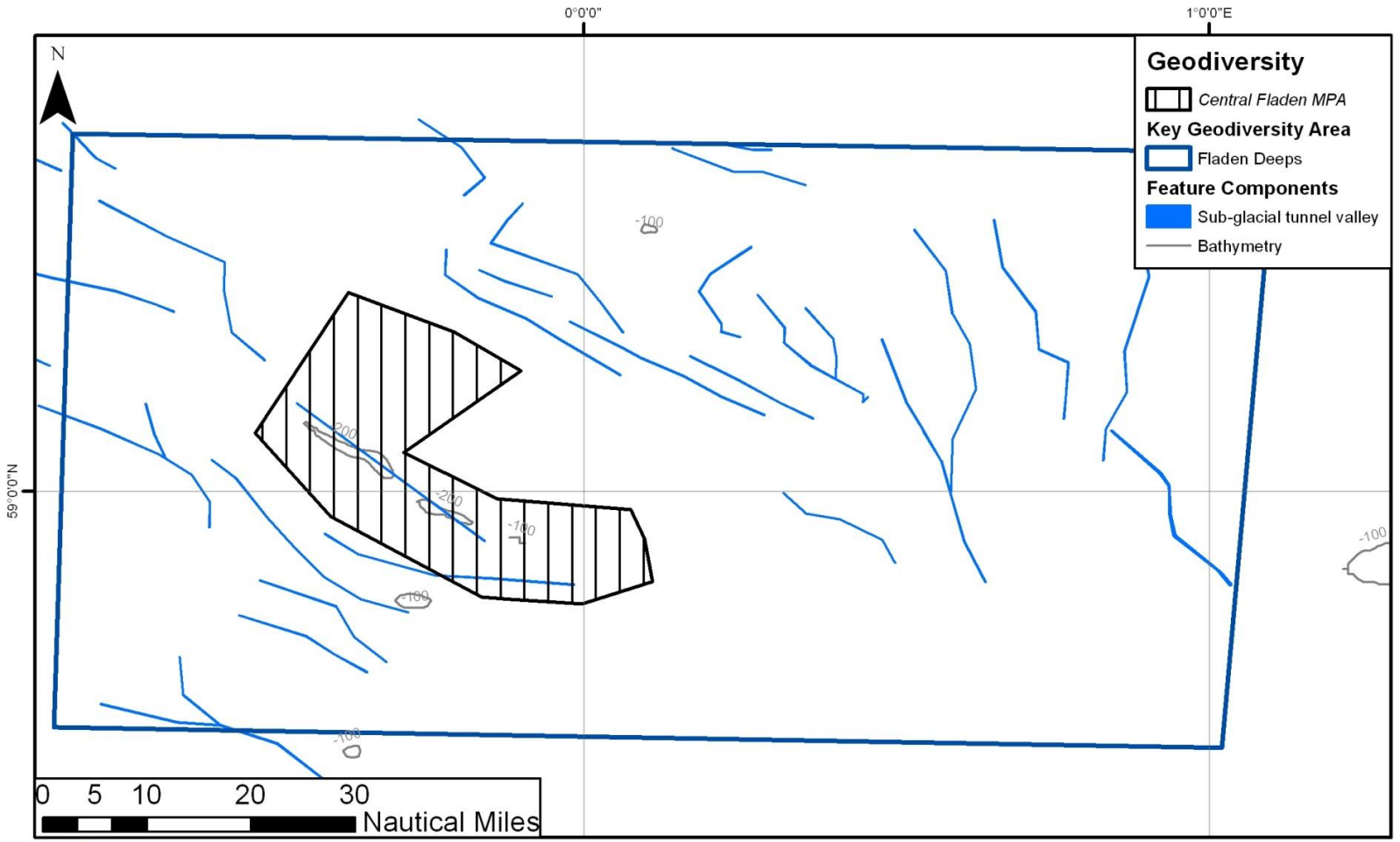

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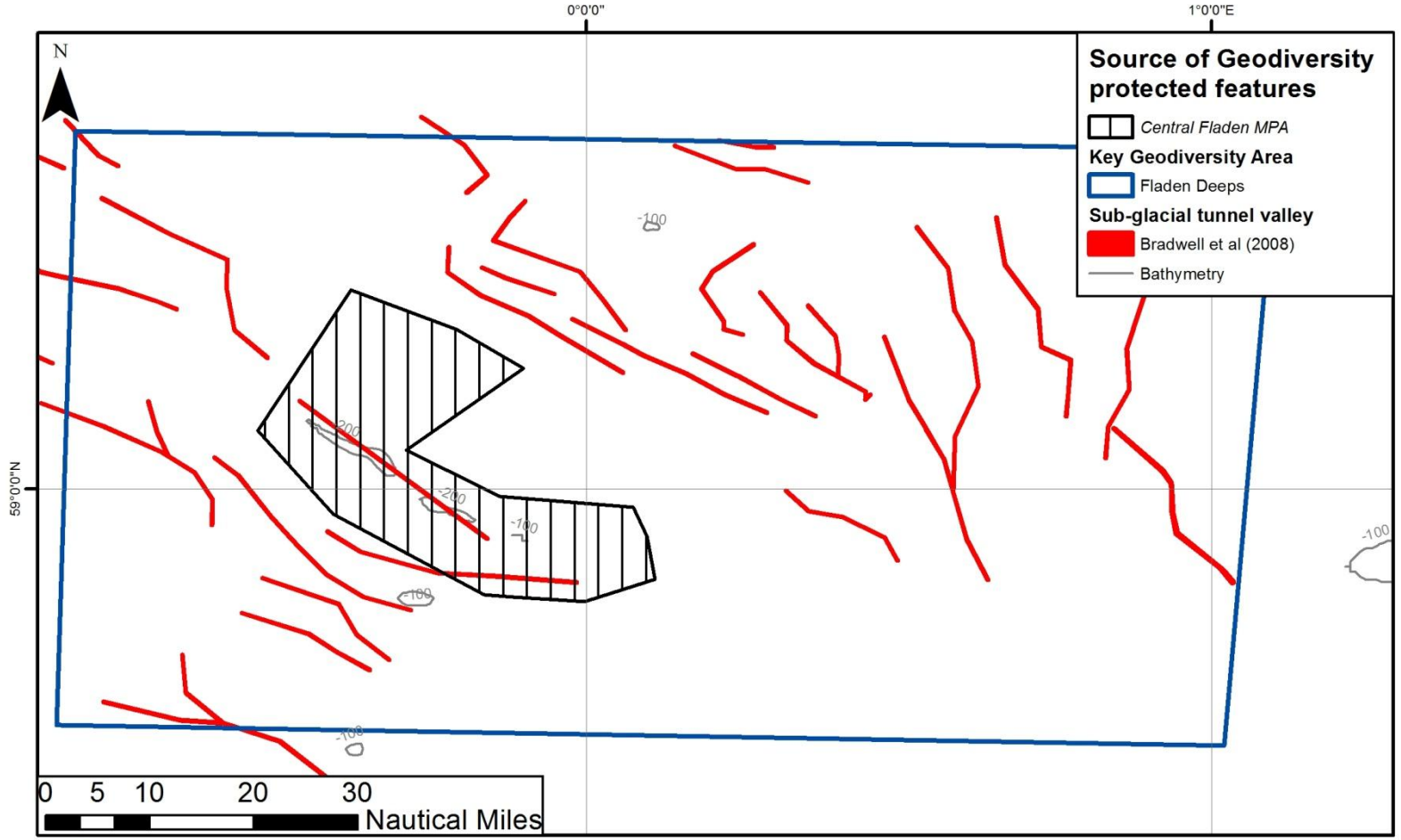

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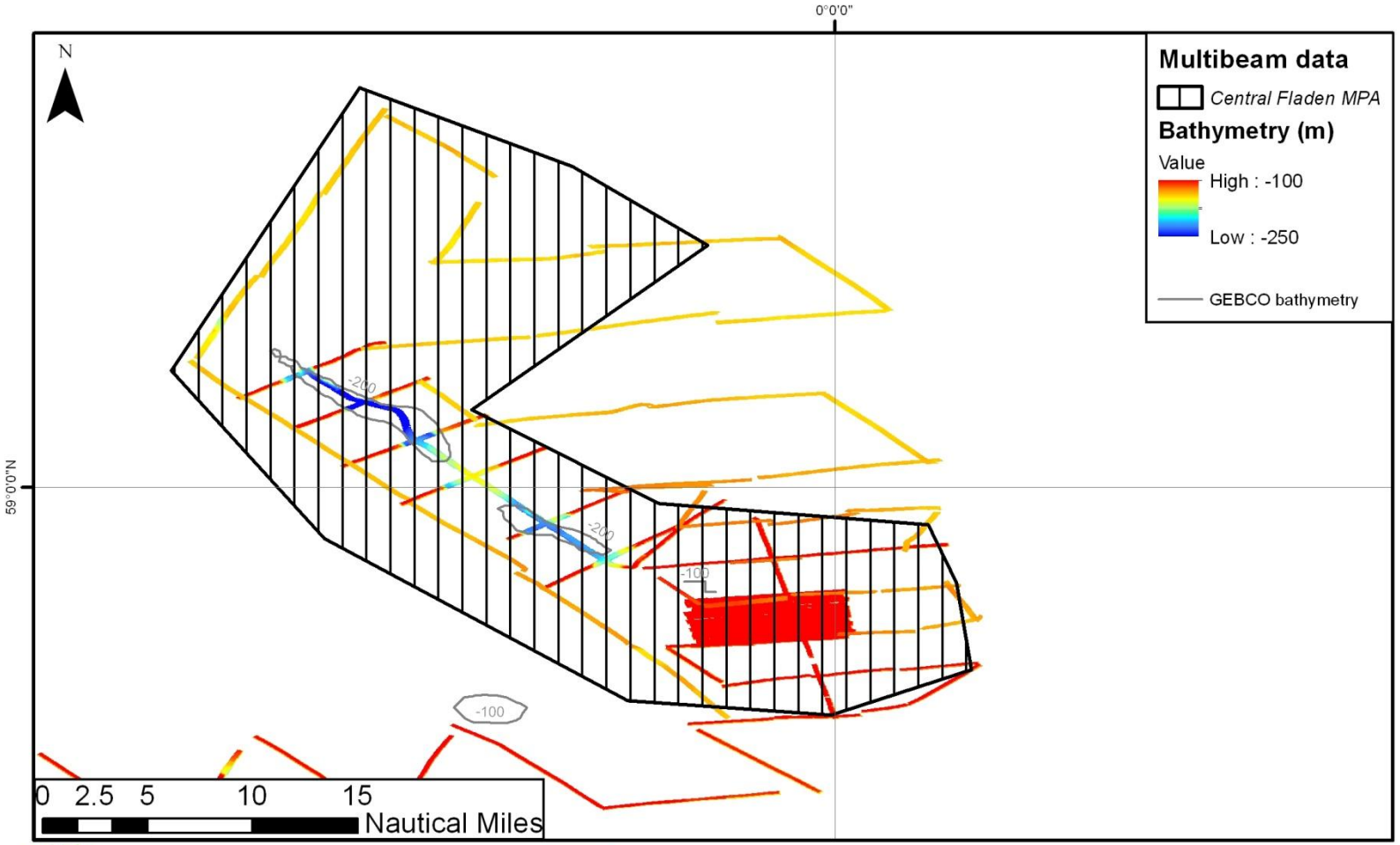

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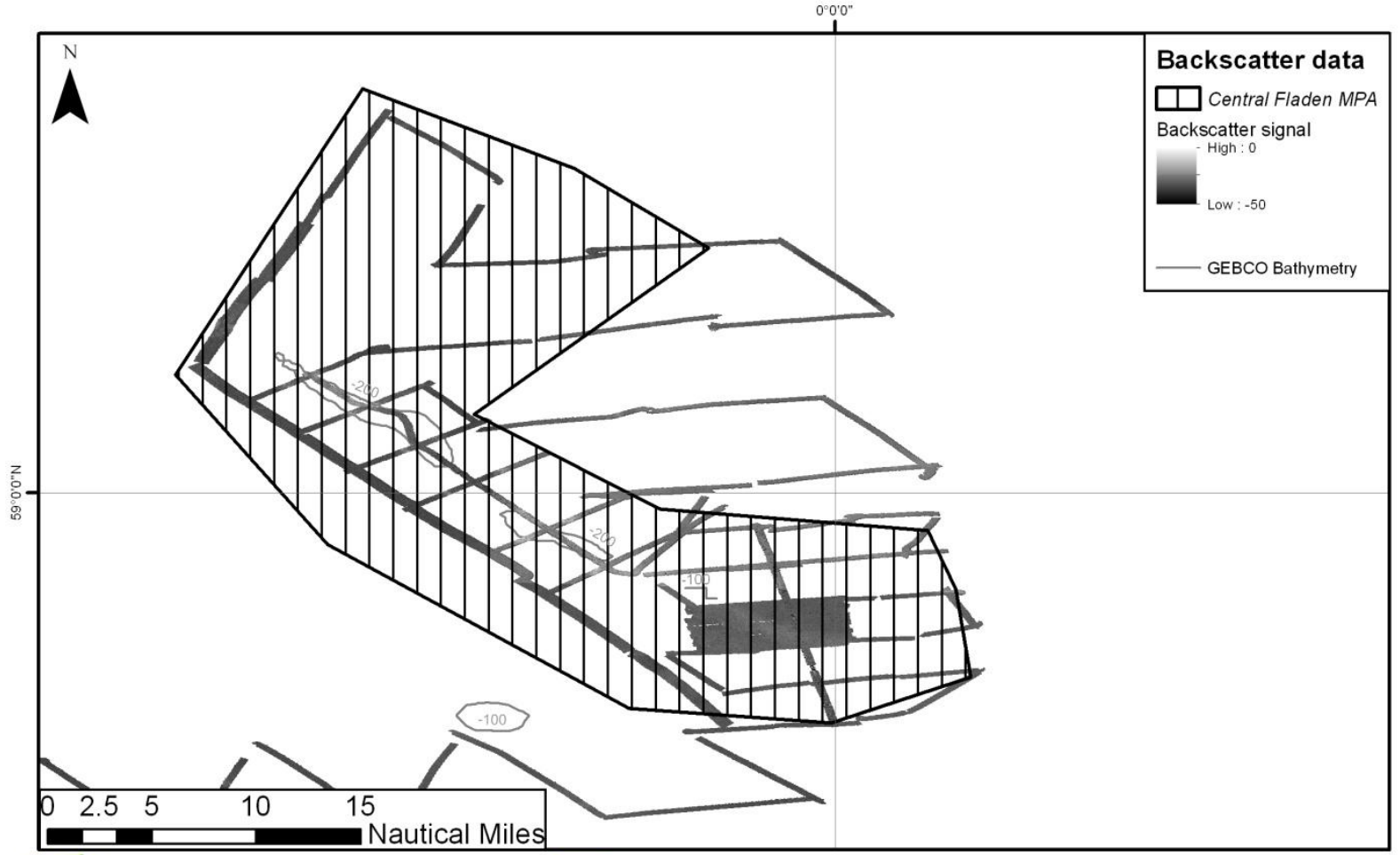

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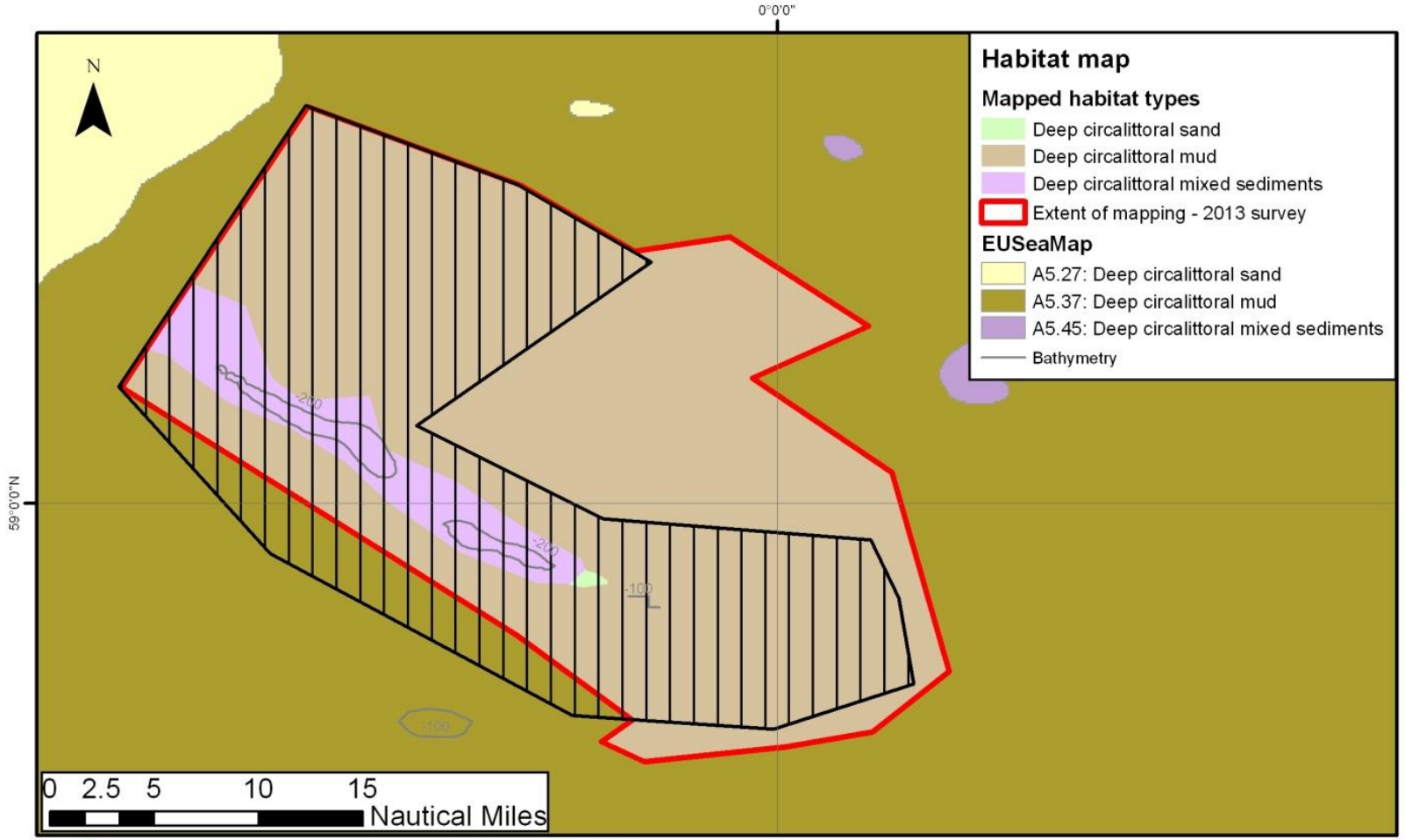

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Data sources and bibliography		
Year	**Title**	**Features covered**
2014	Geodatabase of Marine features in Scotland (GeMS) Version 4.	BM
2014	Goudge, H. and Morris, L. (2014) Seabed imagery analysis from three Scottish offshore towed video surveys: 2011 MSS IBTSQ3 survey, 2011 1111s FRV Scotia Rona-Windsock survey & 2011 MSS Rockall survey. JNCC Report 470.	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.	Geodiversity
2013	Eggleton, J., Jenkins, C. & Schinaia, S. (2013) Offshore seabed survey of the Fladen Grounds Scottish possible MPAs – Final Report. CEFAS Report C5973.	BM
2012	Allan, L., Demain, D., Weetman, A., Dobby, H. and McLay, A., (2012). Data Mining of the Nephrops Survey Database to Support the Scottish MPA Project. *Scottish Marine and Freshwater Science* (9)**.**	BM
2012	British Geological Survey (BGS) Marine Particle Size Analysis (PSA) dataset	-
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	BM
2011	Greathead, C., Demain, D., Dobby, H., Allan, L. and Weetman, A., (2011). Quantitative analysis of the distribution and abundance of the burrowing megafauna and large epifauna community in the Fladen fishing ground, northern north sea. *Scottish Marine and Freshwater Science* (or Marine Scotland Science Report), **2** (2).	BM
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.	BM
2004	Connor, D.W., Allen, J.H., Golding, N., Howell, K.I., Lieberknecht, L.M., Northen, K.O. and Reker, J.B., (2004). The Marine Habitat Classification for Britain and Ireland Version 04.05 JNCC, Peterborough, ISBN 1 861 07561 8.	-