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Mapping habitats and biotopes from acoustic datasets to strengthen the information base of Marine Protected Areas in Scottish waters – Phase 2 (Barra Fan and Hebrides Terrace Seamount Area)

Ian Sotheran, Alison Benson & Oliver Crawford-Avis

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For further information please contact:

Joint Nature Conservation Committee
Monkstone House
City Road
Peterborough PE1 1JY

www.jncc.defra.gov.uk

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Summary

The objective of this project was to generate seabed habitat maps for locations coinciding with Scottish possible Nature Conservation MPAs with full coverage acoustic datasets to as detailed a hierarchical level as possible within the Marine Habitat Classification for Britain and Ireland (version 04.05), also known as MNCR classification (Connor *et al* 2004).

Phase one of the project focused on four areas, Approaches to the Firth of Forth, Wee Bankie to Gourdon, Solan Bank to Fair Isle and the West Shetland Shelf possible MPA. Phase 1 investigated a range of mapping methods whereas phase 2 is focused on using a top-down/rule based methodology and is focused on two areas, The Eastern approaches to the Firth of Forth and an area surveyed by Ifremer (The Barra Fan and Hebrides Terrace Seamount). This report deals with the Barra Fan and Hebrides Terrace Seamount area.

The constituent polygons within the habitat/biotope maps are labelled to an appropriate level of the Habitat Classification and using biozones recently determined by the Deep Sea Habitat Working Group (DSHWG) led by JNCC (Megan Parry 2014, pers. comm 9th May) these were translated to the corresponding deep sea EUNIS code where possible.

In order to generate a seabed habitat map for the area the associated data were required to undergo some preliminary preparation and processing to ensure suitability and compatibility with the mapping methodology employed.

The data were then processed using a top-down approach based on the methods developed by MESH, UKSeaMap and EUSeaMap, which utilised the updated seabed substrate information provided by NOC, generated by expert interpretation of Ifremer multibeam bathymetric data.

A habitat map for the Barra Fan and Hebrides Terrace Seamount area has been produced (the level of habitat detail which could be mapped was restricted to level 3 of the EUNIS classification with associated metadata and peripheral supplementary data to aid in future analysis and interpretation). A confidence assessment using the MESH confidence assessment method has been undertaken for the habitat map produced and confidence maps accompany the habitat map.

The assumptions and limitations of the data and the techniques and processes used to produce the maps are discussed to aid understanding and application of the map.

These maps make an important contribution to the evidence base for the presence and extent of MPA search features underpinning the proposition of possible MPA in Scotland's seas.

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1 Introduction

1.1 Background to Marine Protected Areas

Scottish Government is committed to a 'clean, healthy, safe, productive and biologically diverse marine and coastal environment that meets the long term needs of people and nature' (Marine Scotland 2011a). The Marine (Scotland) Act 2010[1] and the UK Marine and Coastal Access Act 2009[2] contain provisions for Scottish Ministers to designate Marine Protected Areas (MPAs) in the seas around Scotland as part of a range of measures to manage and protect Scotland's seas for current and future generations (SNH & JNCC 2012).

Work to identify MPAs is being delivered by the Scottish MPA Project, a joint project between Marine Scotland (Scottish Government), Scottish Natural Heritage (SNH), the Joint Nature Conservation Committee (JNCC), Historic Scotland and the Scottish Environment Protection Agency (SEPA) (SNH & JNCC 2012).

Marine Scotland (MS) have responsibility for marine nature conservation through the powers in the Acts, however SNH and JNCC function within the project to provide guidance and scientific advice on the selection of Nature Conservation MPAs and the development of an ecologically coherent network. SNH lead on advice concerning Nature Conservation MPAs within Scottish territorial waters and JNCC lead on advice concerning Nature Conservation MPAs in offshore waters (beyond 12 nautical miles (nm) from the coast) adjacent to Scotland. The Nature Conservation MPAs will recognise features that are rare, threatened and/or representative and which contribute to a wider MPA network (SNH & JNCC 2012; Marine Scotland 2011b).

Possible Nature Conservation MPAs have been proposed to Scottish Government based on the best available scientific evidence, incorporating stakeholder input which was sought at various stages and built into the project. The proposals are underpinned by the presence of Search Features; a range of important features for which MPAs are considered to be an appropriate conservation measure. The sufficiency of data, quality or condition of the features and the suitability of the information source has driven the identification of areas. Search Features are a subset of Priority Marine Features (PMF) in Scotland's seas. A PMF is a habitat or species which has been identified as being of conservation importance in the seas around Scotland. More information on the identification of PMFs and search features can be found in the Site Selection Guidelines and the Advice to Scottish Government on selection of Nature Conservation MPAs (SNH & JNCC 2012; Marine Scotland 2011b).

2 General objective

The objective of this project is to generate seabed habitat maps for locations coinciding with possible Nature Conservation MPAs with full coverage acoustic datasets to as detailed a hierarchical level as possible within the Marine Habitat Classification for Britain and Ireland (version 04.05)[3], also known as MNCR classification (Connor *et al* 2004).

[1] http://www.scotland.gov.uk/Topics/marine/seamanagement/marineact

[2] http://www.legislation.gov.uk/ukpga/2009/23/contents

[3] http://jncc.defra.gov.uk/page-1584

The constituent polygons within the habitat maps were to be labelled to an appropriate level of the Habitat Classification and translated to the corresponding EUNIS[4] code. Where possible, mapping was to use the biotope and biotope complex level EUNIS level 4 & 5, however, with only seabed substrate data available this area could only be mapped at EUNIS Level 3.

2.1 Areas to be mapped

An area identified for which multibeam bathymetry and backscatter data were available is The Barra Fan and Hebrides Terrace Seamount (Figure 1). Multibeam bathymetry (MBES) datasets, collected by Ifremer, have been processed and interpreted by the NOC using Folk sediment classes (Folk 1954) plus rock and have subsequently been reclassified into EUNIS level 3 substrate classes, to produce a seabed substrate map for the area.

[4] http://eunis.eea.europa.eu/

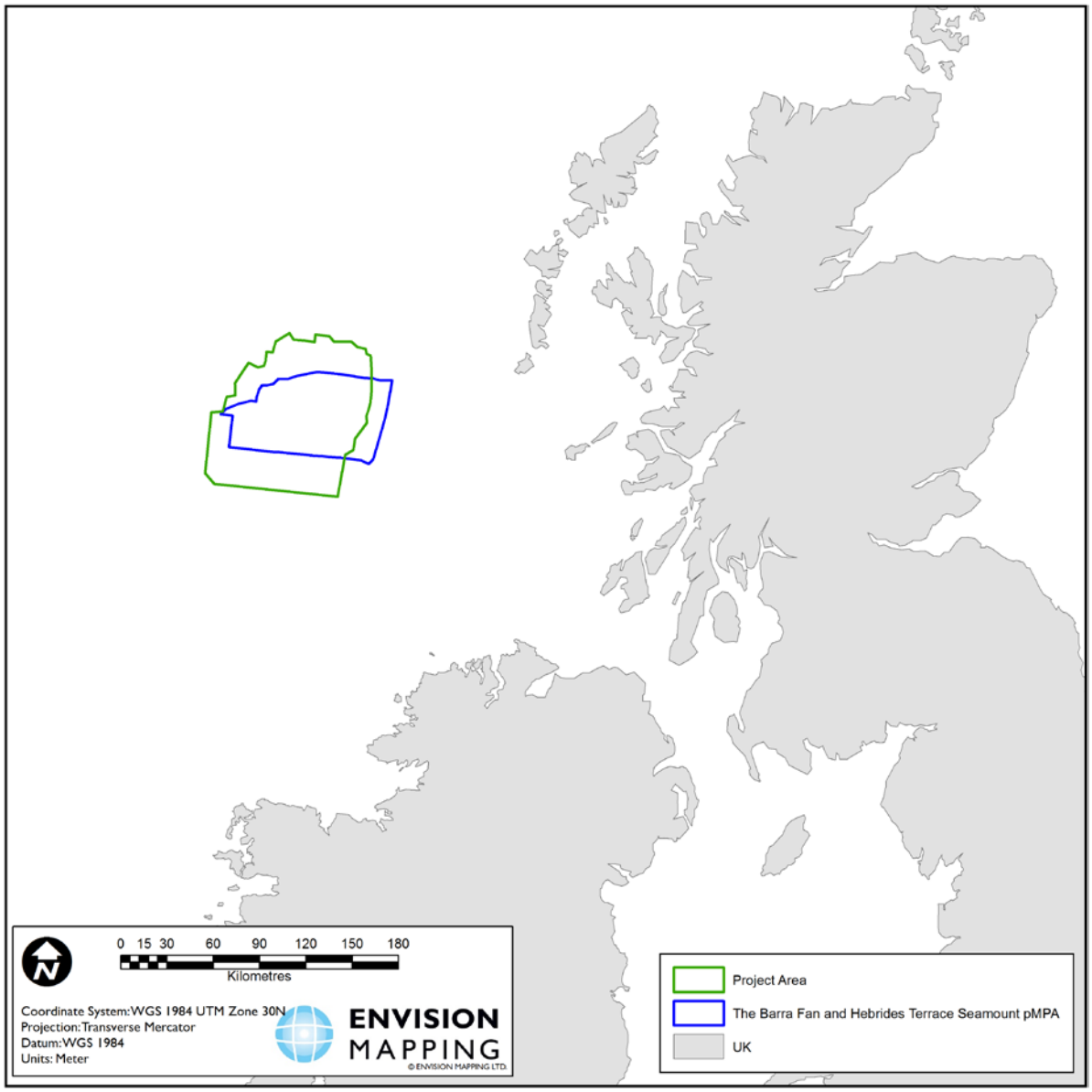

Figure 1. Outline of the project area, The Barra Fan and Hebrides Terrace Seamount, west of Scotland. Note pMPA boundary is the version as at the point of public consultation, 2013.

3 Methods

In order to generate a seabed habitat map the data associated with the area were required to undergo some preliminary preparation and processing to ensure suitability and compatibility with the mapping methodology employed.

The data were processed using a top-down rule-based approach based on the methods developed by MESH[5] (Coltman *et al* 2008), UKSeaMap[6] (McBreen *et al* 2011) and EUSeaMap (Cameron & Askew 2011; EUSeaMap 2012).

[5] MESH modelling: http://www.searchmesh.net/Default.aspx?page=1951[5]

[6] UKSeaMap 2010: http://jncc.defra.gov.uk/ukseamap

This process utilised the bathymetric data and seabed substrate information provided by the NOC, and biological zone (biozone) limits determined by expert participants at a JNCC deep sea classification workshop held in April 2014 (Megan Parry 2014, pers comm. 9th May).

3.1 Data preparation and processing

Datasets were available as GIS files; polygon features were available from NOC seabed substrate maps. The acoustic datasets used were gridded rasters for bathymetry data, backscatter and bathymetric derivatives such as slope and aspect were also available. The bathymetric data set was imported into GIS, and consistent spatial parameters for all datasets were implemented which included a grid resolution of 50m for both the biozone data and the bathymetric data.

3.2 Habitat mapping methods

The mapping methodology used a rule-based/top-down process in which coarse-resolution models of physical parameters are intersected with seabed substrata data to produce a categorised map of physical habitats at EUNIS level 3. As a result of processing of multibeam surveys in the study area, a seabed substrate map has been produced by NOC using the backscatter and bathymetry datasets from Ifremer, with associated PSA sample data (JNCC *et al* 2013). New biozone information has been determined by assessment of the properties of ocean water masses and the associated fauna within their footprint, with proxy depth levels decided by the participants at a JNCC deep sea classification workshop held in April 2014 (Megan Parry 2014, pers comm. 9th May) (Table 1).

To incorporate these new and updated datasets the rule-based – top-down approach was employed for the area and is detailed in section 3.2.1.

3.2.1 Top-down – Rule-based mapping

Rule-based mapping used a series of input datasets which are reclassified using a system of rules or defined parameters to identify areas which have specific physical parameters associated with habitat classes. The key stages are illustrated in Figure 2.

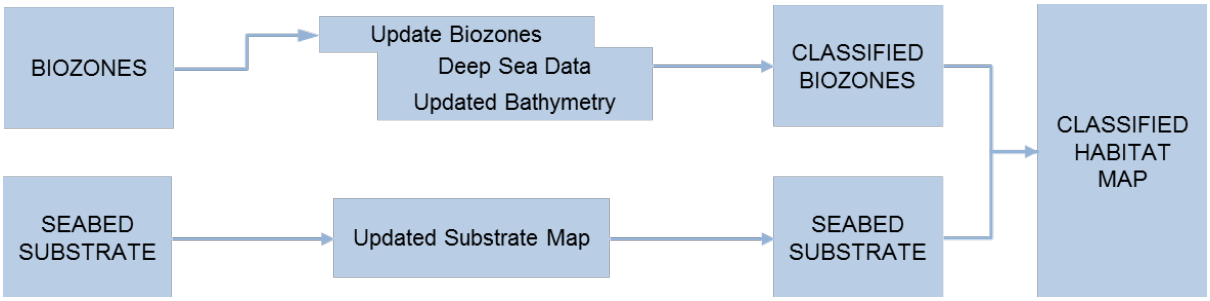

Figure 2. The key stages for a top-down mapping methodology.

A series of input datasets are required to produce the habitat map:

- biological zones, which reflect the changes in biological communities due to corresponding changes in light (where applicable), energy and depth; and
- seabed substrate, which reflect changes in substrate type associated with changes in biological communities

The determination and extent of deep water biological zones were determined by assessment of the properties of ocean water masses and the associated fauna within their footprints by expert participants at a JNCC deep sea classification workshop held in April 2014. These will be discussed in the deep-sea classification supporting paper (Parry *et al* in draft). The biological zones depth proxies are shown in Table 1.

Table 1. Biological depth zones and their ranges used for mapping purposes.

Biological zones within study area (shallowest to deepest)	Approximate depth range (m)
Deep Circalittoral	<200
Upper Bathyal	200-300
Mid Bathyal	300-1200
Lower Bathyal	1200-2000
Upper Abyssal	2000-3000

The input dataset for the biological zones was constructed using contours derived from the bathymetric data at the intervals associated with each biological zone (Table 1). These contours were then smoothed as there were occasional artefacts within the bathymetric data which produced very irregular or angular contours. The areas between the contours were then converted to raster format and classified to the appropriate biological zone.

The input dataset corresponding to the seabed substrate was provided by a recently produced seabed sediments and rock layer which was generated by NOC from interpretation of backscatter and bathymetric and ground-truthing datasets. The data consisted of a GIS polygon file with associated attributes for seabed substrate classified according to Folk sediment classes (Folk 1954) plus rock. The classes have subsequently been grouped into a smaller number of simplified substrate classes which relate to the MNCR and EUNIS habitat classifications (Long 2006), with rock identified separately from sediments:

- Rock.
- Mud and sandy mud.
- Sand and muddy sand.
- Coarse sediment.
- Mixed sediment.

Figure 3 shows these simplified categories in relation to the Folk classes.

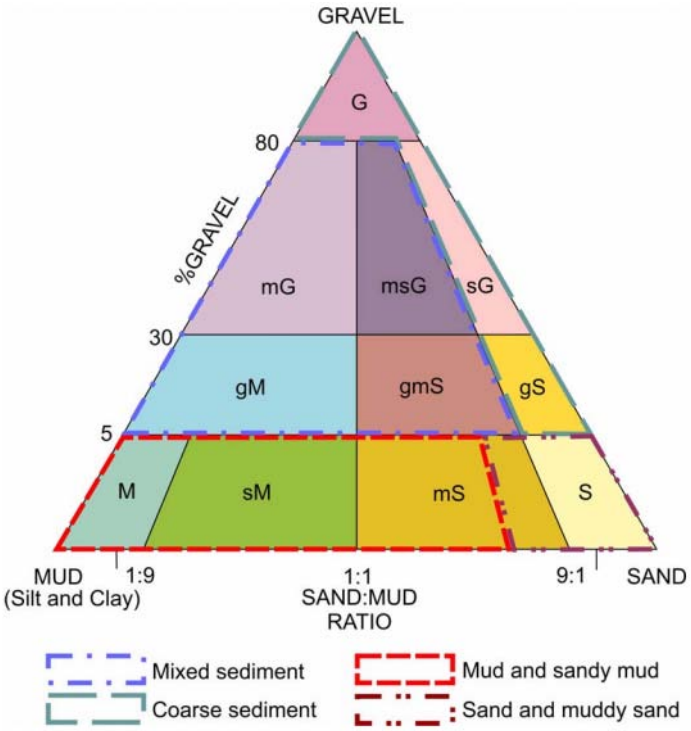

Figure 3. Folk Classification (Folk 1954) with simplified sediment classes delineated (after Long 2006).

This simplified seabed substrate polygon layer was then converted to a raster dataset with a 50m resolution (to match the bathymetry data resolution) with each pixel given a value to represent the simplified classes above.

Table 2. EUNIS, biozones and allocated codes and their physical parameters used for mapping the Barra Fan and Hebrides Terrace Seamount Area.

Substrate	Biological zone	Depth (m)	Deep sea Habitat Name	Allocated Code (not in MNCR 04.05 classification)	EUNIS Name	EUNIS Code
Coarse Sediment	Offshore Circalittoral	<200	Offshore circalittoral coarse sediment*	SS.SCS.OCS*	Deep circalittoral coarse sediment	A5.15
	Upper Bathyal	200-300	Upper bathyal coarse sediment	DS.UB.CRS	Not in classification	-**
	Mid Bathyal	300-1200	Mid bathyal coarse sediment	DS.MB.CRS	Not in classification	- **
	Lower Bathyal	1200-2000	Lower bathyal coarse sediment	DS.LB. CRS	Not in classification	-**
	Upper Abyssal	2000-3000	Upper abyssal coarse sediment	DS.UA.CRS	Not in classification	-**
Rock	Upper Bathyal	200-300	Upper bathyal rock	DS.UB.RCK	Deep-sea rock and artificial hard substrata	A6.1
	Mid Bathyal	300-1200	Mid bathyal rock	DS.MB.RCK	Deep-sea rock and artificial hard substrata	A6.1
	Lower Bathyal	1200-2000	Lower bathyal rock	DS.LB. RCK	Deep-sea rock and artificial hard substrata	A6.1
	Upper Abyssal	2000-3000	Upper abyssal rock	DS.UA.RCK	Deep-sea rock and artificial hard substrata	A6.1
Mixed Substrata	Upper Bathyal	200-300	Upper bathyal mixed substrata	DS.UB.MIX	Deep-sea mixed substrata	A6.2
	Mid Bathyal	300-1200	Mid bathyal mixed substrata	DS.MB.MIX	Deep-sea mixed substrata	A6.2
	Lower Bathyal	1200-2000	Lower bathyal mixed substrata	DS.LB. MIX	Deep-sea mixed substrata	A6.2
	Upper Abyssal	2000-3000	Upper abyssal mixed substrata	DS.UA.MIX	Deep-sea mixed substrata	A6.2
Sand and Muddy Sand	Upper Bathyal	200-300	Upper bathyal sand and muddy sand	DS.UB.SMS	Deep-sea sand and muddy sand	A6.3/A6.4
	Mid Bathyal	300-1200	Mid bathyal sand and muddy sand	DS.MB.SMS	Deep-sea sand and muddy sand	A6.3/A6.4
	Lower Bathyal	1200-2000	Lower bathyal sand and muddy sand	DS.LB.SMS	Deep-sea sand and muddy sand	A6.3/A6.4
	Upper Abyssal	2000-3000	Upper abyssal sand and muddy sand	DS.UA.SMS	Deep-sea sand and muddy sand	A6.3/A6.4
Mud and Sandy Mud	Upper Bathyal	200-300	Upper bathyal mud and sandy mud	DS.UB.MSM	Deep-sea mud and sandy mud	A6.5
	Mid Bathyal	300-1200	Mid bathyal mud and sandy mud	DS.MB.MSM	Deep-sea mud and sandy mud	A6.5
	Lower Bathyal	1200-2000	Lower bathyal mud and sandy mud	DS.LB. MSM	Deep-sea mud and sandy mud	A6.5
	Upper Abyssal	2000-3000	Upper abyssal mud and sandy mud	DS.UA.MSM	Deep-sea mud and sandy mud	A6.5

* this is an existing habitat of the MNCR classification scheme
** deep sea coarse sediment does not currently exist in the EUNIS classification scheme

3.3 Assumptions

Certain assumptions have been made during the mapping process, relating to the input data quality and the relationships between the physical and biological environments, and then applied when producing the maps.

The spatial accuracy of all data is assumed to be correct for all map products. The spatial resolution of the mapping is effectively 50m which should be within tolerances and accuracy of most modern position fixing equipment.

The seabed substrate layer which has been used as input to the rule base mapping is interpreted using geophysical acoustic data supported by limited irregular ground-truthing. It is assumed the substrate classes identified can be detected with the geophysical acoustic data and that these substrate classes and the simplified classes used with the rule-based mapping process are accurately mapped, therefore any inherent assumptions or inaccuracies within the seabed substrate map will apply to any outputs from the rule-based mapping.

Within the rule-based mapping, using physical parameters to determine the distribution of biological zones and energy regimes matched with seabed substrate assumes these parameters are accurately determined and can predict the biological habitat/biotope which occurs within the range of parameters mapped.

3.4 Summary of the data utilised in the processing

3.4.1 Acoustic data

The preparation and processing of the acoustic data reduces the original resolution of the data but does allow for consistency throughout the data set and seamless processing. All datasets were prepared by conversion to a grid/raster format or when the data was already in a raster format the data were transformed to a consistent spatial resolution and dimensions. Figure 4 shows the bathymetric dataset post-processing with Figure 5 showing the resulting biological zones produced from the smoothed bathymetric contours.

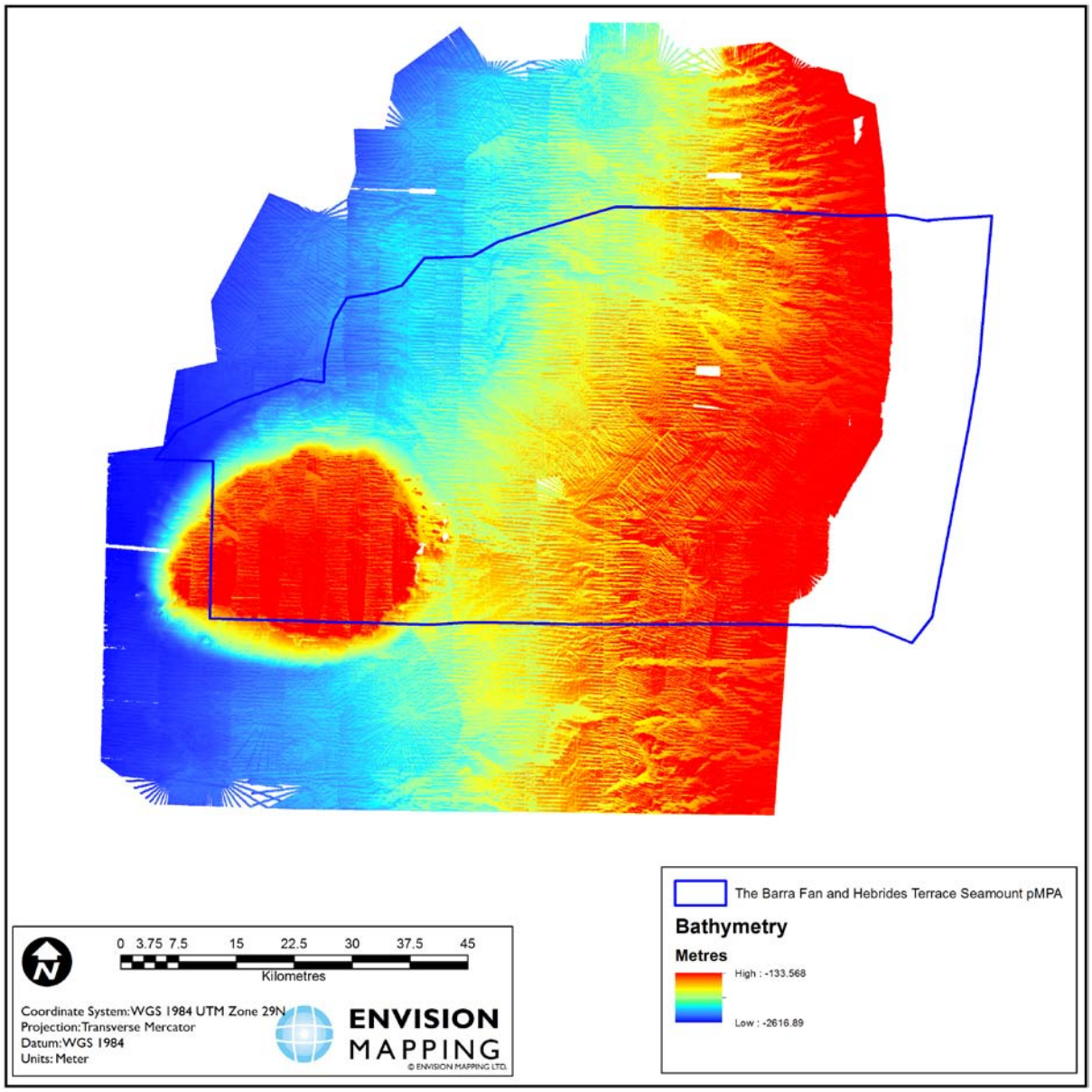

Figure 4. Processed bathymetry data for the Barra Fan and Hebrides Terrace Seamount area. Note pMPA boundary is the version as at the point of public consultation, 2013.

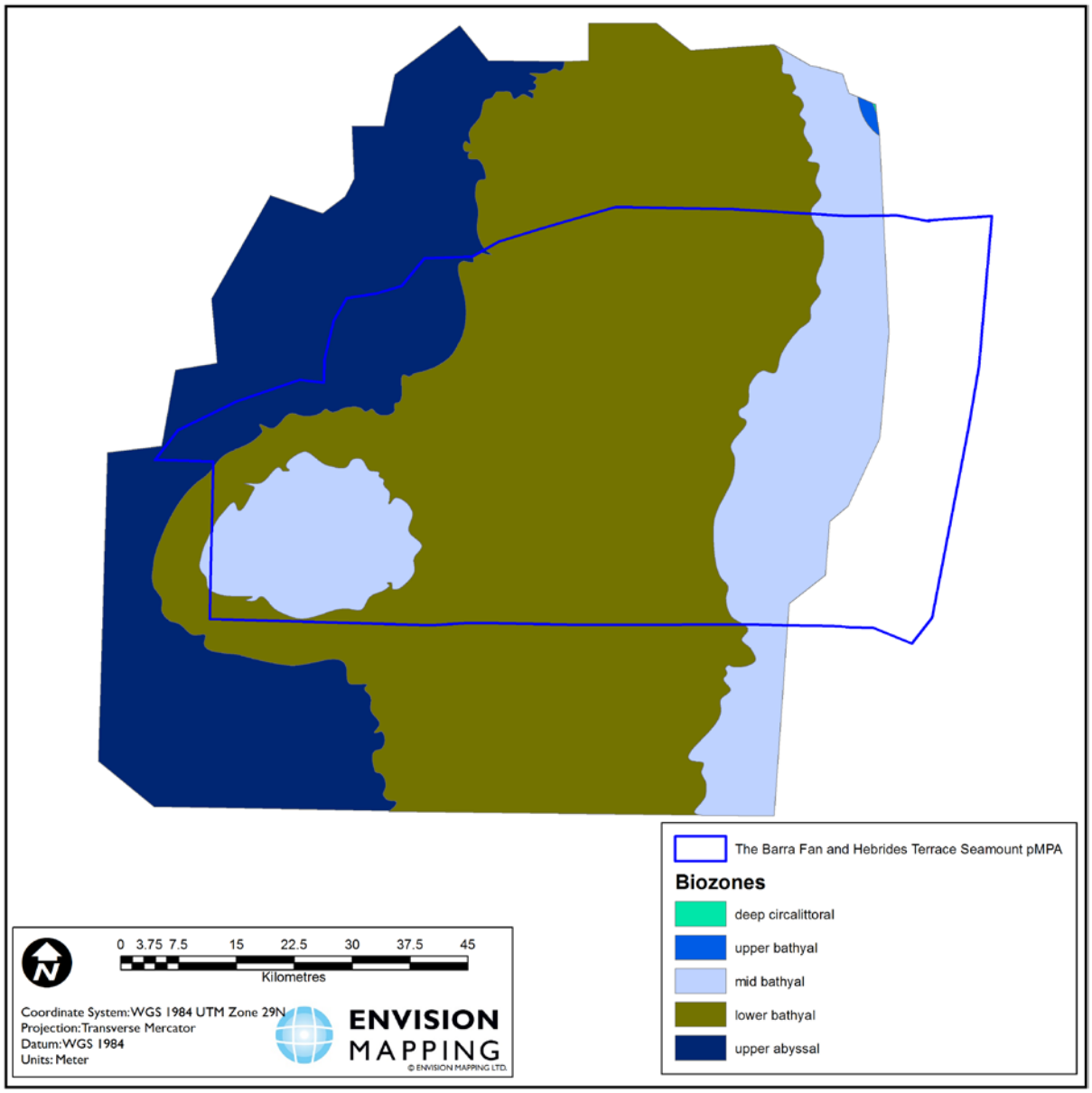

Figure 5. Biological zones data for the Barra Fan and Hebrides Terrace Seamount area.
Note pMPA boundary is the version as at the point of public consultation, 2013.

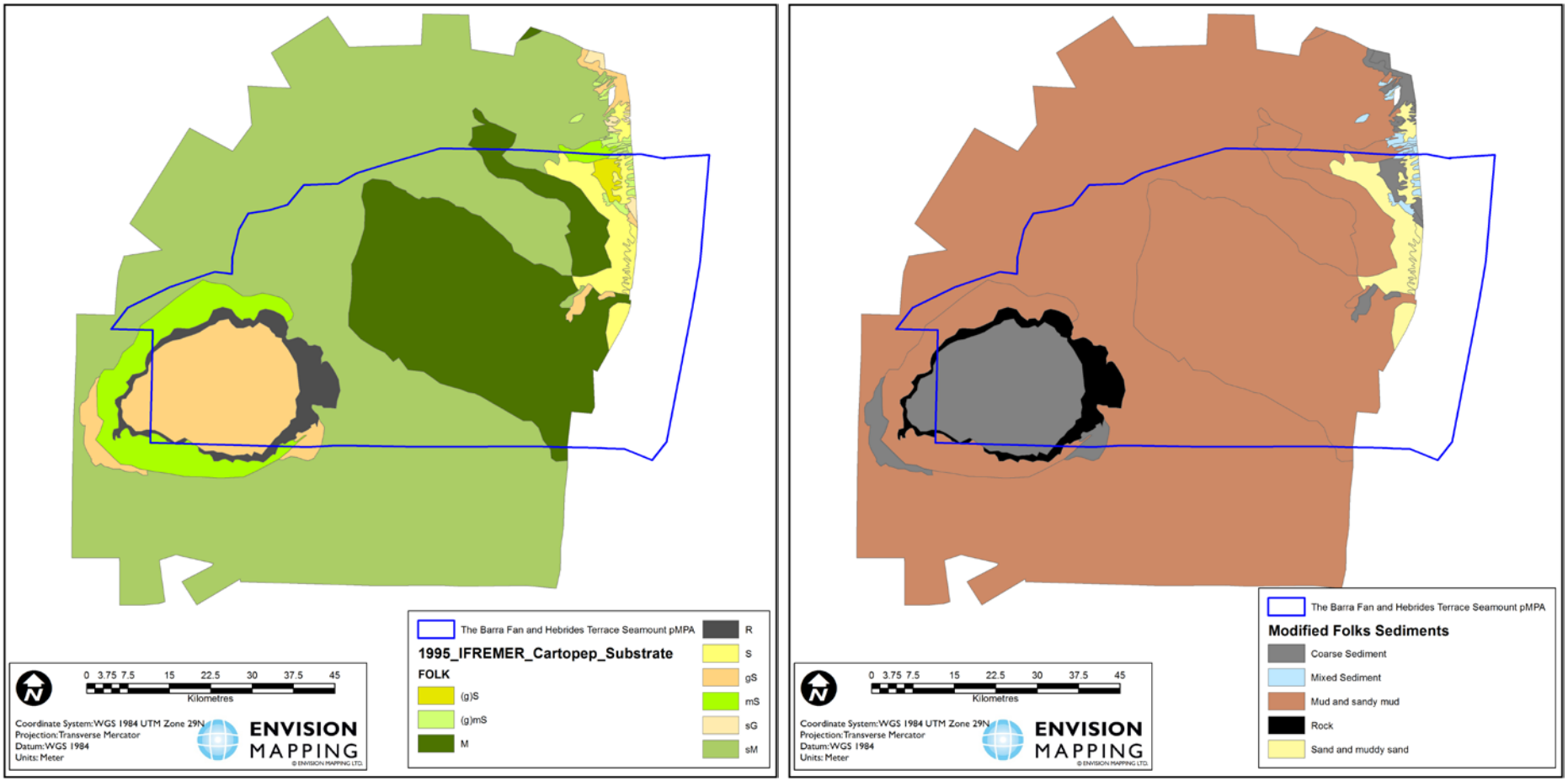

Figure 6. Seabed substrates according to Folk classes (left) and simplified after Long (2006) (right) for the Barra Fan and Hebrides Terrace Seamount area. Note pMPA boundary is the version as at the point of public consultation, 2013.

The top-down approach uses seabed substrate classes based upon a simplified Folk classification and the supplied NOC seabed substrate map was used with the substrates grouped using this scheme. Figure 6 shows the seabed substrates according to the Folk classification in comparison with the simplified seabed substrates. A judgement had to be made on which simplified class the muddy sand Folk class polygons should be determined as. This Folk class is split between sand and muddy sand and mud and sandy mud simplified classes (Long 2006) at the point at which the ratio of sand to mud is 1:4. NOC expert opinion determined them as falling into the mud and sandy mud class taking account of the surrounding ground-truthing data available and interpretation of the backscatter signal in comparable areas.

4 Results

The resulting map (Figure 7) produced using the top-down/rule-based mapping method shows the predominant seabed habitats to be mud and sandy mud within both the lower bathyal and upper abyssal biological zone regions. The seamount is characterised by rocky slopes in the lower bathyal area with coarser sediments on the broad peak within the mid bathyal region. The Barra fan area slopes from the offshore circalittoral with coarse sediments down to mud and sandy mud in the deeper areas. There is sand and muddy sand present on the slope and this material extends into the lower bathyal region, which is muddier.

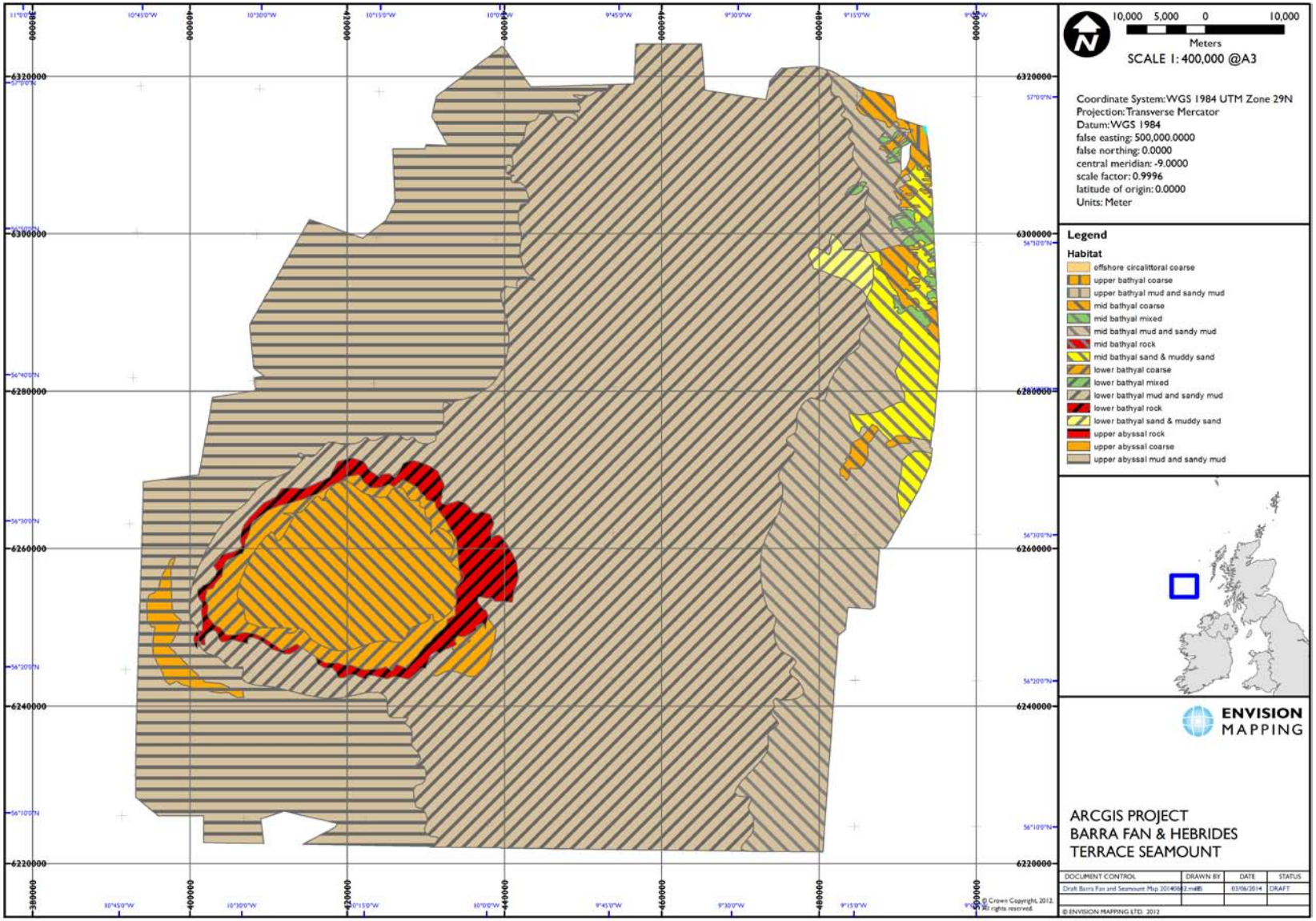

Figure 7. Top-down/Rule-based mapping habitat map for the Barra Fan and Hebrides Terrace Seamount area.

5 Supplemental Information

5.1 Confidence Assessment

In order to assess the suitability of the map to its intended purpose, a confidence assessment using the MESH Confidence Assessment method (MESH 2008) has been undertaken. This approach assesses the quality and suitability of the acoustic data, the point sample data, and the interpretative techniques using a qualitative scoring system (Table 3).

The map for the Barra Fan and Hebrides Terrace Seamount area scores 63 of a possible 100 which is reduced slightly by ground truth data vintage and as the ground truth data was for substrate identification not biological ground truth data were available. The ground truth data were used to generate the seabed substrates and the confidence assessments for these have been included within this map's assessment as the sediments are directly related to the habitats mapped.

Table 2 shows the map with its associated Globally Unique ID *(*GUI) and figure reference, the GUI code is used as the identifier for the map in the MESH confidence assessment results (Table 3).

Table 3. Map titles with associated GUIs and figure references.

Map Title	**MAP GUI**	**Figure**
Barra Fan and Hebrides Terrace Seamount Area Rule-based Map	GB200057	Figure 7

Table 4. MESH confidence assessment output for map produced.

Map GUI	Remote Technique	Remote Coverage	Remote Positioning	RemoteStdsApplied	Remote Vintage	BGTTechnique	PGTTechnique	GTPositioning	GTDensity	GTStdsApplied	GTVintage	GTInterpretation	Remote Interpretation	Detail Level	Map Accuracy	Remote score	GT score	Interpretation score	**Overall score**
GB200057	3	3	2	3	1	-	3	2	2	2	1	2	3	1	1	80	50	41.7	**63**

6 Issues and Limitations

Effective and appropriate application of the maps produced as part of this project is dependent on an understanding and appreciation of the limitations associated with the maps and the processing which has been applied in their production.

The spatial resolution of the data used to produce the maps presented here can vary considerably not only with the spatial accuracy of data acquisition but also the spatial resolution at which habitats are detected by each form of data. The acoustic data had been processed to provide an initial resolution of ~30m but this has been reduced to 50m during processing to provide a consistent resolution and spatial parameters between all datasets used within the mapping process.

The EUNIS Classification and the MNCR habitat classification have been employed as mapping units for the maps produced where possible but as the deep sea section of the MNCR classification is in development and not yet formally incorporated within the classification scheme the mapped units have been assigned to an existing EUNIS class. The deep sea section of the MNCR classification is due to be formally included in 2014.

As the habitat classifications are in constant development and as an increase in knowledge of the marine habitats is gathered the definitions of habitat classes can alter or be refined and it should be understood that the cut-offs and delimitations used may not be accurate, but are the best understanding at the current time.

A rule-based top-down approach does have a range of assumptions associated with the processing methodology and with the datasets used. The processing operates by using a series of thresholds or exact delineations within datasets (i.e. a 200m depth limit for the base of the offshore circalittoral zone) and it is assumed these accurately or best represent the environmental conditions associated with each habitat class. The data employed with the process is also assumed to accurately represent the conditions that occur at each location mapped, whether this be the seabed substrate or the energy levels that occur. Each of these data are derived from either modelled data which has its own assumptions associated with it or by expert interpretation. The seabed substrate map produced by NOC uses sediment sample data to ground-truth the Ifremer multibeam and backscatter data. Sediment sampling techniques can be biased against sampling a surficial or hard substrate that may support epifauna, resulting in a bias towards infaunal habitat/biotopes assignments.

7 Conclusion

The objective of this project was to generate a seabed habitat map for the Barra Fan and Hebrides Terrace Seamount area from full coverage acoustic data from Ifremer interpreted by NOC. The habitats have been mapped using seabed substrates along with depth or biozone classes which where possible have been matched to level 3 within the MNCR and EUNIS classification schemes.

This map will make an important contribution to the evidence base for the Scottish possible MPA, The Barra Fan and Hebrides Terrace Seamount, through best estimation of extent of search features. In this case, this latest mapping of sedimentary habitats down the new biological zones of the MNCR classification scheme, is an improved determination of the extent of offshore subtidal sands and gravels and offshore deep sea muds down the continental slope and into the abyssal zone.

It is critical that such maps are used with clear understanding of how they were generated. The understanding can be supported through the use of the layers of certainty of classification.

8 Acknowledgements

The processed acoustic and seabed substrate datasets for the Barra Fan and Hebrides Terrace Seamount area used in this project originated from the work carried out by the NOC as part of the Agreement between the JNCC, NOC and BGS concerning the processing and interpretation of multibeam and backscatter in Scottish waters for MPA evidence and advice. The multibeam bathymetry and backscatter data were supplied by Ifremer.

We would also like to thank JNCC colleagues, particularly from the Marine Evidence Team, for their input and advice on the practical application and the considerations to be taken account of during the mapping to ensure it has use and benefits for multiple marine projects and programmes.

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Appendix 1: MPA Search Features

Seabed habitats and their components only – full list includes low or limited mobility species, mobile species and large-scale features (Marine Scotland 2011b).

MPA search feature	Component habitats/species	Scottish marine area
Blue mussel beds	*Mytilus edulis* beds on littoral sediments	Territorial waters
	Mytilus edulis and *Fabricia sabella* in littoral mixed sediment	Territorial waters
	Mytilus edulis beds on sublittoral sediment	Territorial waters
	Mytilus edulis beds on reduced salinity infralittoral rock	Territorial waters
Burrowed mud	Seapens and burrowing megafauna in circalittoral fine mud	Both
	Burrowing megafauna and *Maxmuelleria lankesteri* in circalittoral mud	Both
	Tall seapen *Funiculina quadrangularis*	Both
	Fireworks anemone *Pachycerianthus multiplicatus*	Both
	Mud burrowing amphipod *Maera loveni*	Offshore waters
Carbonate mound communities	Carbonate mound communities	Offshore waters
Coral gardens	Coral gardens	Offshore waters
Deep sea sponge aggregations	Deep sea sponge aggregations	Offshore waters
Flame shell beds	*Limaria hians* beds in tide-swept sublittoral muddy mixed sediment	Territorial waters
Horse mussel beds	*Modiolus modiolus* beds with hydroids and red seaweeds on tide-swept circalittoral mixed substrata	Territorial waters
	Modiolus modiolus beds on open coast circalittoral mixed sediment	Territorial waters
	Modiolus modiolus beds with fine hydroids and large solitary ascidians on very sheltered circalittoral mixed substrata	Territorial waters
	Modiolus modiolus beds with *Chlamys varia,* sponges, hydroids and bryozoans on slightly tide-swept very sheltered circalittoral mixed substrata	Territorial waters
Inshore deep mud with burrowing heart urchins	*Brissopsis lyrifera* and *Amphiura chiajei* in circalittoral mud	Territorial waters
Kelp and seaweed communities on sublittoral sediment	Kelp and seaweed communities on sublittoral sediment	Territorial waters
Low or variable salinity habitats	Faunal communities on variable or reduced salinity infralittoral rock	Territorial waters
	Kelp in variable or reduced salinity	Territorial waters

MPA search feature	Component habitats/species	Scottish marine area
Maerl beds	Maerl beds	Territorial waters
Maerl or coarse shell gravel with burrowing sea cucumbers	*Neopentadactyla mixta* in circalittoral shell gravel or coarse sand	Territorial waters
Native oysters	*Ostrea edulis* beds on shallow sublittoral muddy mixed sediment	Territorial waters
	Native oyster *Ostrea edulis*	Territorial waters
Northern sea fan and sponge communities	*Caryophyllia smithii* and *Swiftia pallida* on circalittoral rock	Territorial waters
	Mixed turf of hydroids and large ascidians with *Swiftia pallida* and *Caryophyllia smithii* on weakly tide-swept circalittoral rock	Territorial waters
	Deep sponge communities (circalittoral)	Both
	Northern sea fan *Swiftia pallida*	Both
Offshore deep sea muds	*Ampharete falcata* turf with *Parvicardium ovale* on cohesive muddy sediment near margins of deep stratified seas	Offshore waters
	Foraminiferans and *Thyasira* sp. in deep circalittoral fine mud	Offshore waters
	Levinsenia gracilis and *Heteromastus filifirmis* in offshore circalittoral mud and sandy mud	Offshore waters
	Paramphinome jeffreysii, *Thyasira* spp. and *Amphiura filiformis* in offshore circalittoral sandy mud	Offshore waters
	Myrtea spinifera and polychaetes in offshore circalittoral sandy mud	Offshore waters
Offshore subtidal sands and gravels	*Glycera lapidum*, *Thyasira* spp. and *Amythasides macroglossus* in offshore gravelly sand	Offshore waters
	Hesionura elongata and *Protodorvillea kefersteini* in offshore coarse sand	Offshore waters
	Echinocyamus pusillus, *Ophelia borealis* and *Abra prismatica* in circalittoral fine sand	Offshore waters
	Abra prismatica, *Bathyporeia elegans* and polychaetes in circalittoral fine sand	Offshore waters
	Maldanid polychaetes and *Eudorellopsis deformis* in offshore circalittoral sand or muddy sand	Offshore waters
	Owenia fusiformis and *Amphiura filiformis* in offshore circalittoral sand or muddy sand	Offshore waters

MPA search feature	Component habitats/species	Scottish marine area
Seagrass beds	*Zostera noltii* beds in littoral muddy sand	Territorial waters
	Zostera marina/angustifolia beds on lower shore or infralittoral clean or muddy sand	Territorial waters
	Ruppia maritima in reduced salinity infralittoral muddy sand	Territorial waters
Sea loch egg wrack beds	*Ascophyllum nodosum* ecad *mackaii* beds on extremely sheltered mid eulittoral mixed substrata	Territorial waters
Seamount communities	Seamount communities	Offshore waters
Shallow tide-swept coarse sands with burrowing bivalves	*Moerella* spp. with venerid bivalves in infralittoral gravelly sand	Territorial waters
Tide-swept algal communities	Fucoids in tide-swept conditions	Territorial waters
	Halidrys siliquosa and mixed kelps on tide-swept infralittoral rock with coarse sediment	Territorial waters
	Kelp and seaweed communities in tide-swept sheltered conditions	Territorial waters
	Laminaria hyperborea on tide-swept infralittoral mixed substrata	Territorial waters