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Scottish MPA Programme

Data confidence assessment

SOUTHERN TRENCH POSSIBLE MPA

JUNE 2019

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Document version control			
Version	**Date**	**Author**	**Reason / Comments**
Version 1	29/01/2014	Laura Clark	Revised MPA proposal format, updating MPA search location version (ver. 10 - 20/12/2012).
Version 2-4	17/02/2014-17/07/2014	Various	Refinements and document development.
Version 5	21/07/2014	John Baxter	QA review and sign-off.
Version 6	24/07/2014	Katie Gillham	Edits to address QA comments.
Version 7	16/03/2015	Ben James and Graham Epstein	Updated into possible MPA format with revised maps.
Version 8	07/04/2015	Katie Gillham	Review prior to Scientific Advisory Committee.
Version 9	18/09/2018	Sam Black and Katie Gillham	Review and Update.
Version 10	21/09/2018	Ben James	QA Review.
Version 11	25/09/2018	Sam Black	Refinements in response to initial QA review. Finalisation for SNH Scientific Advisory Committee.
Version 12	17/10/2018	Sam Black and Katie Gillham	Address comments from SNH Scientific Advisory Committee.
Version 13	17/10/2018	Ben James	QA review.
Version 14	18/10/2018	Sam Black and Katie Gillham	Finalisation for SNH Senior Leadership Team review.
Version 15	02/11/2018	Sam Black	Finalisation for SNH Protected Areas Committee.
Version 16	04/04/2019	Sam Black, Sarah Cunningham	Updating scale bar on adjusted density maps for minke whale following SAC comments. Addition of burrowed mud data from MS suitable *Nephrops* ground layer. Final review of text.

Distribution list			
Format	**Version**	**Issue date**	**Issued to**
Electronic	SL10	20/12/2012	SNH web publication [B1149456 / 25(#44)].
Electronic	2	17/02/2014	SNH SAC MPA Sub-group.
Electronic	5	23/07/2014	Marine Scotland officials.
Electronic	5	24/07/2014	SNH web publication [A1122998 / 16(#24)].
Electronic	8	13/04/2015	SNH SAC MPA Sub-group.
Electronic	8	16/11/2015	SNH web publication [A1568157 / 12(#20)].
Electronic	9	20/09/2018	Ben James.

Electronic	10	25/09/2018	Sally Thomas.
Electronic	11	28/09/2018	SNH Scientific Advisory Committee.
Electronic	14	18/10/2018	Sally Thomas (SLT).
Electronic	15	02/11/2018	SNH Protected Areas Committee.
Electronic	16	05/04/2019	Marine Scotland officials.

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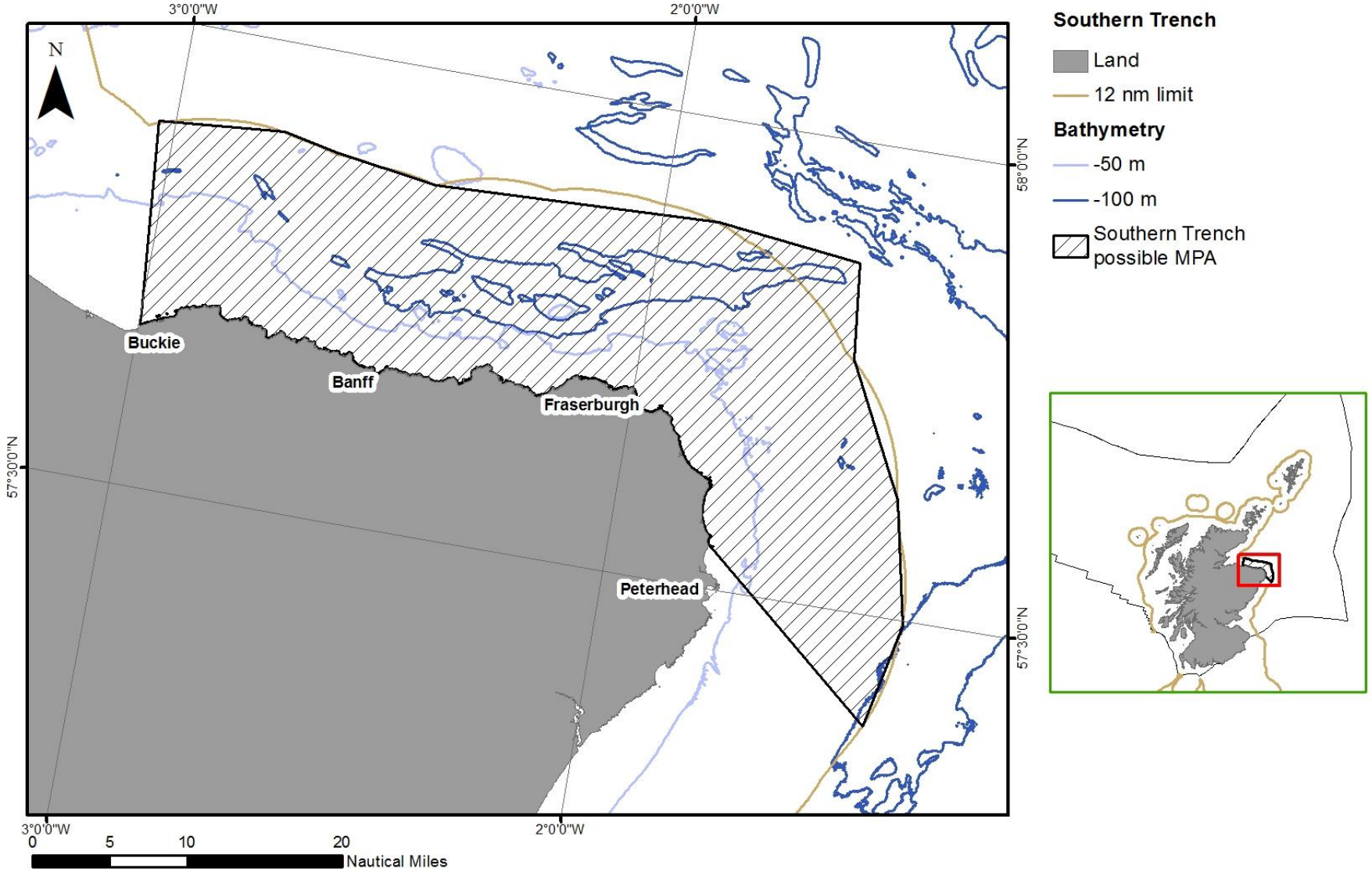
Figure 1 Southern Trench possible MPA



Map projected in Europe Albers Equal Area Conic (Modified Standard Parallels - Standard Parallel 1 = 50.2; Standard Parallel 2 = 58.5). Coastline ©Crown copyright and database right [2019].
All rights reserved. Ordnance Survey Licence number 100017908. The exact limits of the UK Continental Shelf are set out in orders made under section 1(7) of the Continental Shelf Act 1964 (© Crown Copyright).
Landmass Ordnance Survey © Crown Copyright and database right 2019. All rights reserved. Scotland (Adjacent waters) Updated by the Law of the Sea Division, United Kingdom Hydrographic Office 2019.
Biological data from Geodatabase of Marine features in Scotland (GeMS) in part from Defra MB0102 ©Crown Copyright. Bathymetry © Crown Copyright 2019. All rights reserved. License No. EK001-201310001.
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Name of possible MPA	Southern Trench	**Assessor(s)**	BJ; LC; SM; LK; KG; MC; SB

Southern Trench possible MPA is shown on Figure 1. It is shaped around the Southern Trench, a large undersea valley consisting of an area of deep water (~250 m) extending along the south of the outer Moray Firth, approximately 10 km from the coast between Banff and Fraserburgh. The Southern Trench is an exceptional example of an enclosed (glacial) seabed basin and is regarded as scientifically important in helping to understand ice sheet drainage patterns in this region. Detailed morphological analysis suggests it was formed from at least two erosion events operating in different directions (Brooks *et al.,* 2013). Shelf deeps in the possible MPA are enclosed topographic depressions on the sea bed which, in most cases, are created by glacial erosion during periods of low sea level. The resulting deeps have remained open and are significantly deeper than surrounding sea bed. The waters off Fraserburgh produce frontal zones with strong horizontal gradients in surface and/or bottom temperatures. Fronts can concentrate nutrients and plankton and are often associated with pelagic biodiversity hotspots as they attract prey assemblages and higher trophic level foragers such as cetaceans. The southern boundary of the possible MPA has been shaped to incorporate the core part of the front off Fraserburgh. The geology and hydrography of the possible MPA form a backdrop for a further two protected features: burrowed mud and minke whale. Minke whales are sighted particularly frequently in the outer Moray Firth (the northern section of the possible MPA) during summer. Burrowed mud has been recorded both inside and outside the shelf deep area (Greathead *et al*., 2007; Allan *et al*., 2012; Hirst *et al*., 2012; Moore, 2017). The possible MPA also overlaps the marine part of the Troup, Pennan and Lion's Heads Special Protection Area (SPA) and with the Southern Moray Firth third-party MPA proposal submitted jointly by Whale and Dolphin Conservation, the Hebridean Whale and Dolphin Trust and Cetacean Research and Rescue Unit for minke whale.

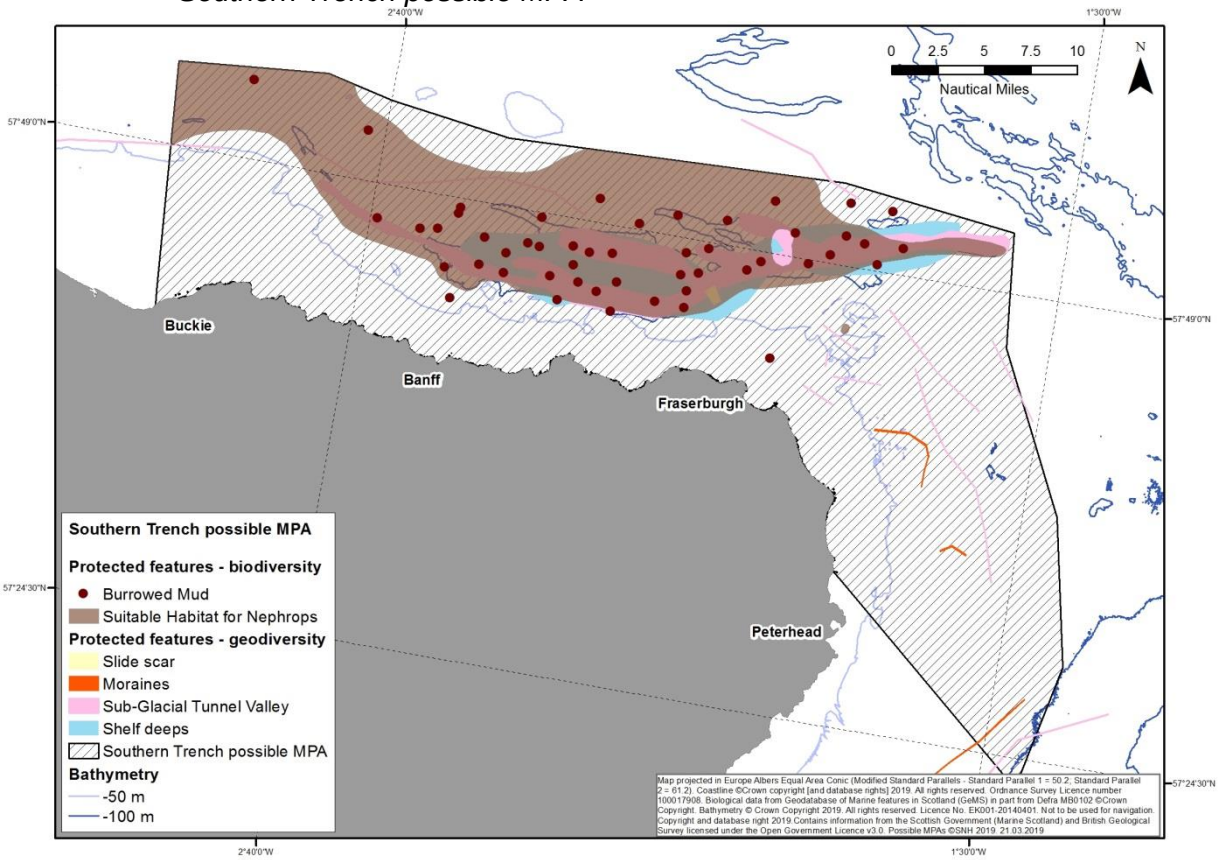
Proposed protected features			
Biodiversity	*Burrowed mud (BM)* *Fronts (FR)* *Minke whale (MW)* *Shelf deeps (SD)*	**Geodiversity**	*Quaternary of Scotland - sub-glacial tunnel valleys and moraines (GEO)* *Submarine Mass Movement - slide scars (GEO)*

Data used in assessment			
Version of GeMS database	*Ver.7*	*Other datasets used in feature map (specify) -*	• *Contextual mapping (coastline; bathymetry; MPA boundaries; other protected areas).* • *MSS 2008-10* Nephrops *database (Allan* et al*., 2012).* • *MSS Suitable Habitat for Nephrops data (MSS, 2017).* • *Habitat modelling: Aggregated effort-corrected sightings data and modelled predicted densities and persistence of minke whale 2000 - 2012 (Paxton* et al*., 2014a).* • *Seasonal frequent fronts data layers at 1.2 km resolution based on ocean thermal imagery (Dec 1998 - Nov 2008) (Miller* et al*., 2010).* • *Seasonal frequent fronts datalayers at 300 m and 1 km resolution based on ocean colour imagery (2009 - 2011) (Miller* et al*., 2014).* • *SEA 5 BGS multibeam survey (Holmes* et al*., 2004).* • *Civil Hydrography Programme (CHP) multibeam bathymetry survey coverage, Todhead point to Bosies Bank (CHP, 2009).* • *Marine Scotland multibeam dataset (Marine Scotland, 2011; shown in Hirst* et al*., 2012).*

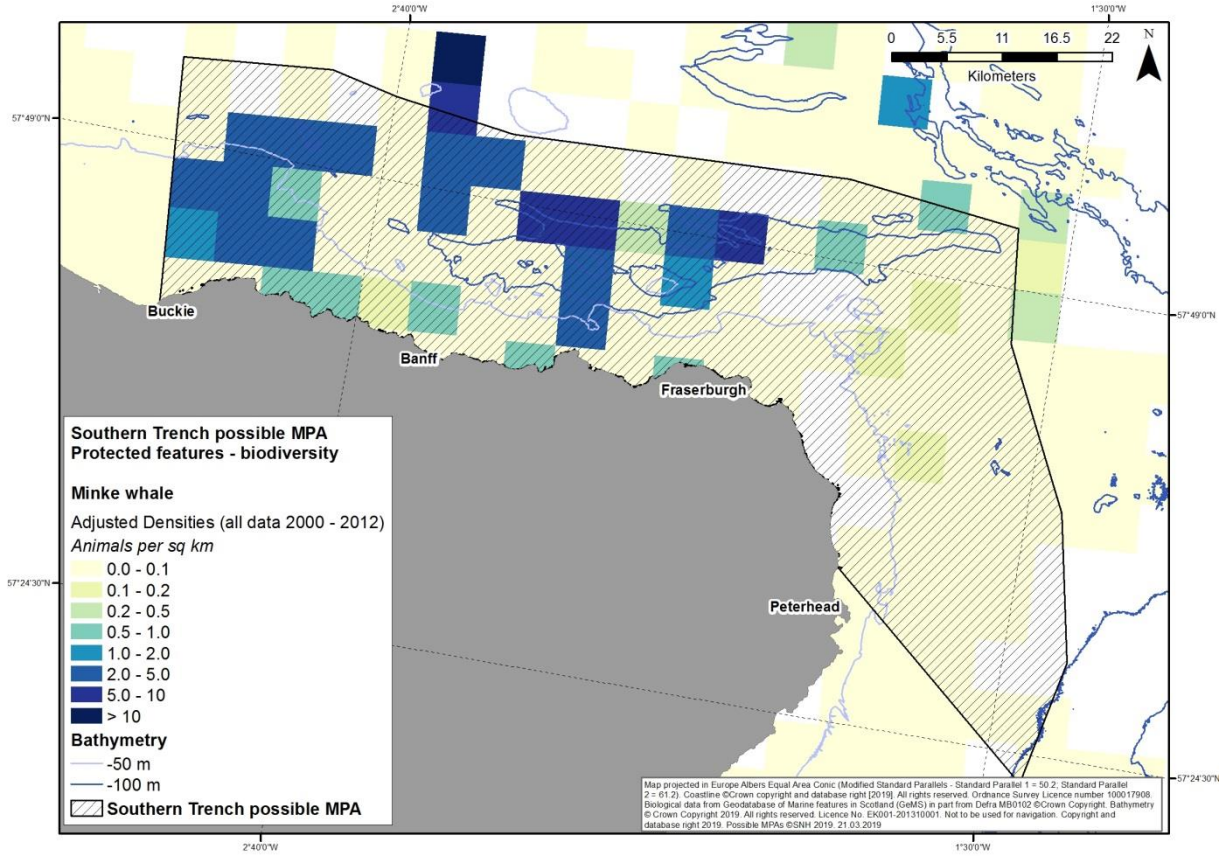
Summary of data confidence assessment (see detailed assessment on following pages)							
Confident in underpinning data		**Yes**	✓	**Partial**		**No**	
Confident in presence of identified features?	✓	**Data suitable to define extent of individual proposed protected features**		✓		**Partial**	**x**
				FR;SD;GEO;MW		BM	
Summary	*We are confident in the presence of the proposed protected features within the possible MPA and the underpinning data. The data on these features are shown in Figure 2i - iv overleaf.* *The shelf deeps of the Southern Trench were mapped as part of a Strategic Environmental Assessment (Holmes* et al., *2004), supplemented by data from a Marine Scotland multibeam survey in 2011 (Marine Scotland, 2011). Burrowed mud has been recorded at a coarse resolution across and beyond the shelf sill by Marine Scotland* Nephrops *fisheries surveys in 2008 - 2010 (Allan* et al., *2012), by a Marine Scotland seabed habitat survey in 2011 (Hirst* et al*., 2012) and by CEFAS in 2015 (Moore, 2017). The extent of burrowed mud is reasonably well defined in the northern part of the possible MPA, but data are lacking to define its distribution in the southern part. The presence and distribution of seasonal frontal systems within the possible MPA has been determined from ocean thermal imagery (Miller* et al*., 2010; 2014), and data on the geodiversity proposed protected features stem from a number of sources (collated through Brooks* et al*., 2013).* *There is high confidence in the presence of minke whales, based on effort-corrected sightings data collated for the Joint Cetacean Protocol (JCP) and additional datasets, as analysed by Paxton* et al. *(2014a) to inform the Scottish MPA Programme. The analysis used survey data (2000 - 2012) from 23 distinct datasets and includes data (2010 - 2012) from the Cetacean Research and Rescue Unit (CRRU) that runs a programme of surveys in a region of the outer Moray Firth overlapping the possible MPA. Adjusted observed densities for minke whale, based on all the data available for spring, summer and autumn, suggest that the species is observed at high relative densities within the possible MPA compared to wider Scottish territorial waters. When these data are modelled, an area of the outer Moray Firth overlapping the possible MPA is persistently predicted to support above average densities of minke whale (this is seasonal and at the scale of Scottish territorial waters) over the period from 2000 to 2012 (Paxton* et al., *2014a).*						

Figures 2i - iv *The known/modelled distribution[1] of proposed protected features within the Southern Trench possible MPA*

(i)



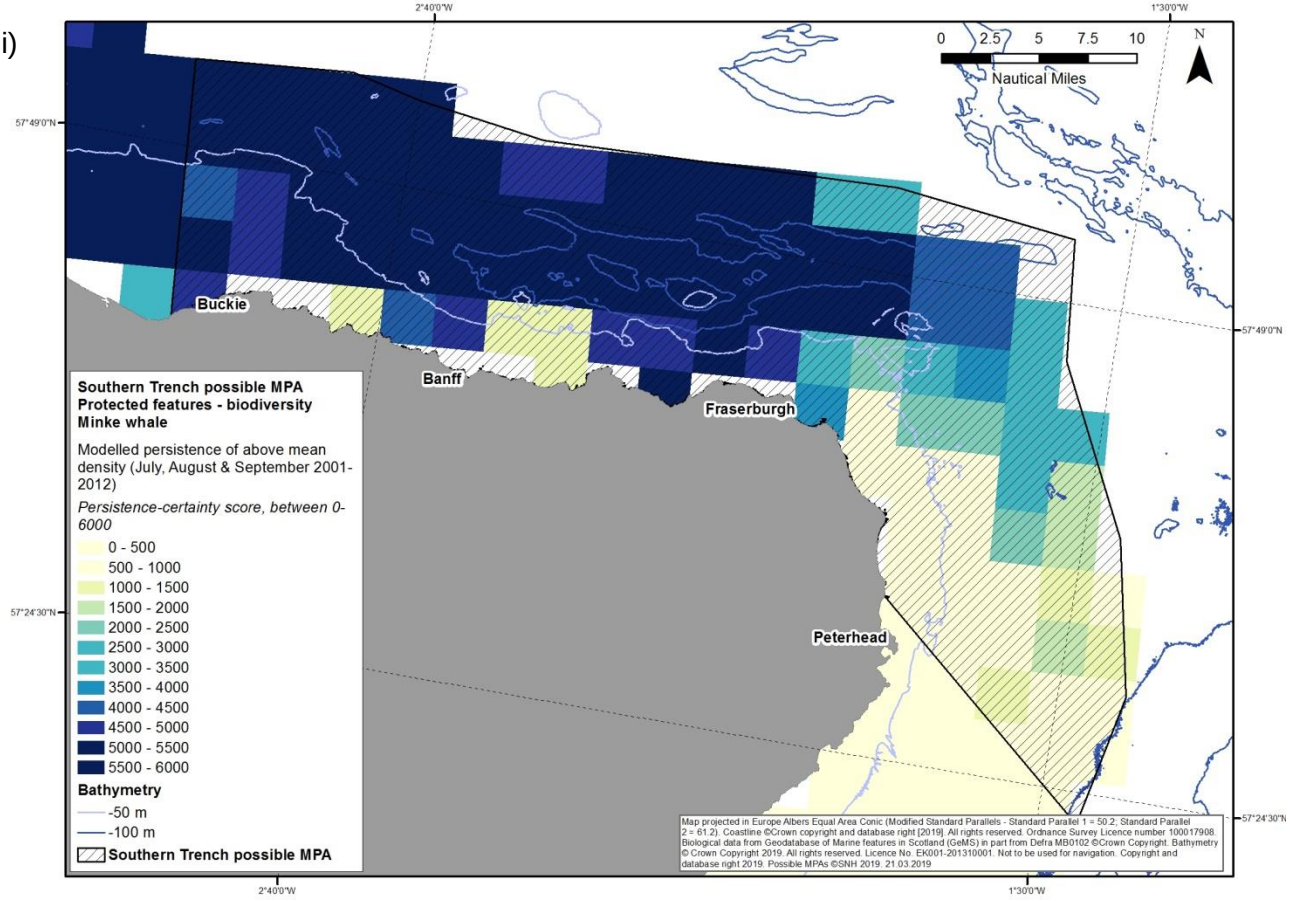
(ii)



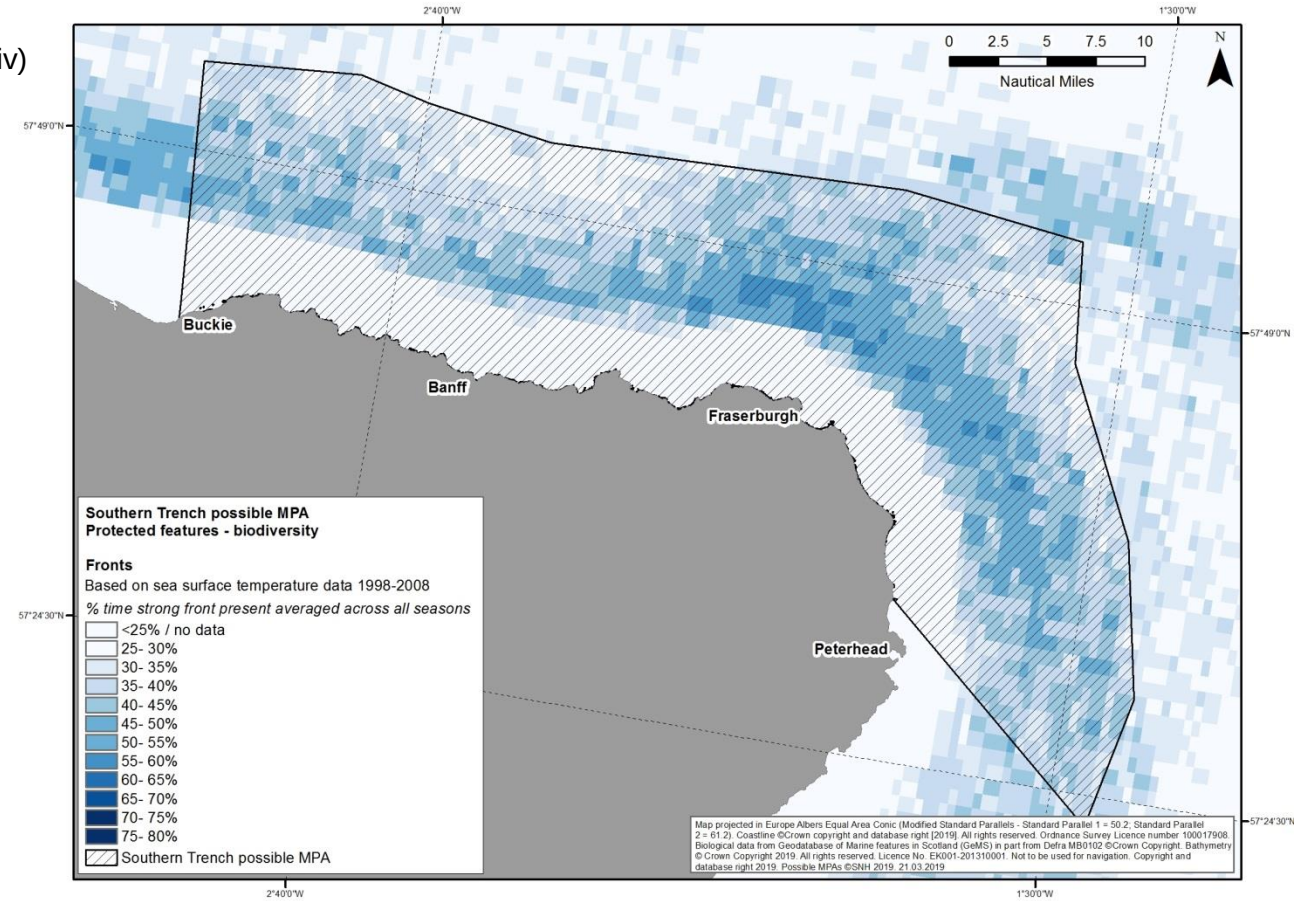
[1] Note: The Submarine Mass Movement (Slide scars) proposed protected feature is under-represented in the mapping of geodiversity interests within the possible MPA. Grid boxes used in modelling work are 5 x 5 km.

SOUTHERN TRENCH POSSIBLE MPA - DATA CONFIDENCE ASSESSMENT

(iii)



(iv)



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Data confidence assessment	Our assessment of data confidence is based on consideration of the age and sources of the data, sampling methods used and overall coverage across the possible MPA (see Figure 2i-iv and Maps A - E). Existing protected areas are shown on Map G.

Age of proposed protected feature data					
Number of records collected within last 6 years	**Many** *BM;FR;SD; MW;GEO*	**Number of records collected 6-12 years ago**	**Many** *BM;FR;SD; MW;GEO*	**Number of records >12 years old**	**Some** *FR; MW*
Comments	*The shelf deeps of the Southern Trench were mapped as part of SEA 5 (Holmes* et al., *2004) and Marine Scotland multibeam surveys of the area (Marine Scotland, 2011). Records of burrowed mud across and beyond the shelf sill were made between 2008 and 2010 by Marine Scotland* Nephrops *fisheries surveys (Allan* et al., *2012), in 2011 by the Marine Scotland East Coast PMF survey (Hirst* et al., *2012) and in 2015 by CEFAS (Moore, 2017). Ocean thermal imagery has informed the presence and distribution of seasonal frontal systems in a study that used data from December 1998 - November 2008 (Miller* et al., *2010; 2014). Minke whale data comprise datasets collated for the Joint Cetacean Protocol (JCP) and additional datasets, as analysed by Paxton* et al. *(2014a), as part of spatial modelling undertaken to inform the Scottish MPA Project. Twenty-three separate datasets (with records from between 2000-2012) were used to inform the analysis, including CRRU data (2010 - 2012) that were collected from within the possible MPA.*				

Source of proposed protected feature data					
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) -	
Comments	*Burrowed mud has been recorded as a result of* Nephrops *fishery survey work undertaken by Marine Scotland (Allan* et al*., 2012) and targeted nature conservation surveys (Hirst* et al*., 2012; Moore 2017). Data regarding shelf deeps, fronts and geodiversity features have been recorded through the SEA/MS multibeam survey (Holmes* et al*., 2004; Marine Scotland, 2011) and ocean thermal imagery studies by Defra (Miller* et al*., 2010). Further geodiversity features were derived from a data collation exercise undertaken as part of a Defra-led research project (Brooks* et al., *2009) with key geodiversity areas in Scottish waters subsequently identified through an SNH and JNCC commissioned desk-based review (Brooks* et al., *2013).* *Minke whale data comprise datasets collated for the Joint Cetacean Protocol (JCP) and additional datasets, as analysed by Paxton* et al. *(2014a) to inform the Scottish MPA Programme. The analysis used 23 different datasets including: the SCANS & SCANSII projects coordinated by the Sea Mammal Research Unit; the European Seabirds at Sea studies coordinated by the Joint Nature Conservation Committee; data from the Sea Watch Foundation that come from a range of different projects and surveys, including data collected by volunteers; Hebridean Whale and Dolphin Trust data; University of Aberdeen data from the Moray Firth and data from the Cetacean Research and Rescue Unit, that run a programme of surveys in the outer Moray Firth overlapping the possible MPA. The full list of datasets used in the analysis is described in Paxton* et al. *(2014a & b).*				

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Sampling methods / resolution							
Feature	**Modelled**	**Acoustic / remote sensing**	**Remote video / camera**	**Infaunal - grab / core**	**Sediment**	**Diving**	**Visual census**
BM	✓	✓	✓	✓	✓		
FR	✓						
MW	✓						✓
SD	✓	✓	✓				
Comments	*The MS-led fisheries and nature conservation-oriented surveys sampled burrowed mud using grab and remote video methodologies (Allan* et al.*, 2012; Hirst* et al.*, 2012). The shape of the shelf deeps have been modelled using SEA / Marine Scotland multibeam datasets (Holmes* et al.*, 2004; Marine Scotland, 2011). The distribution of fronts is derived from ocean thermal imagery data at 1 - 4 km resolution, collected between December 1998 and November 2008 (Miller* et al.*, 2010; 2014). The resulting frequent thermal front layers are mapped to a resolution of 1.2 km. All minke whale data were collected by visual census and only effort-corrected boat and aircraft-based sightings data were used (Paxton* et al., 2014a*). Twenty-three distinct datasets were aggregated as part of the analysis. All data were collected by observers who had observation as their primary task while on effort. The data were used to create estimated densities (corrected for availability and detectability) of minke whale per square km. These are mapped at a resolution of 5 km x 5 km. Generalised Estimating Equation (GEE) models were then used to predict relative densities of minke whale for all of Scottish territorial waters on a 5 km x 5 km resolution grid. The highest survey effort for minke whale across Scottish waters is during summer, which reflects both the seasonal occurrence of the species and the fact that cetacean surveys are highly dependent on weather and sea-state.*							

Proposed protected feature data coverage							
Across the possible MPA							
Large numbers of proposed protected feature records distributed across the possible MPA		**Numerous proposed protected feature records scattered across the possible MPA with some clumping**	✓	**Numerous proposed protected feature records possibly with some clumping. Boundary not defined solely by recorded feature distribution**		**Few or isolated proposed protected feature records - possibly clumped**	
For individual features							
Multiple records of individual proposed protected features providing an indication of extent and distribution throughout the possible MPA	✓ *BM;FR; MW*	**Few or scattered records of specific proposed protected features making extent and broad distribution assessment difficult**		**Few or isolated records of specific proposed protected features**			
Are modelled data available to facilitate understanding of feature distribution across the possible MPA?	*Yes – available modelled data provides a good understanding of the distribution of the proposed protected features (see Maps 2i-iv and Maps A-B).*						

SOUTHERN TRENCH POSSIBLE MPA - DATA CONFIDENCE ASSESSMENT

Proposed protected feature data coverage	
Comments	*There is high confidence in the presence of all proposed protected features in this possible MPA. The data suitably define the extent of fronts, shelf deeps and geodiversity features. The extent of burrowed mud is well defined in the northern part of the possible MPA, but data are lacking to define its distribution in the southern part.* *There is high confidence in the seasonal presence of high relative densities of minke whale within the possible MPA (relative to wider Scottish waters) based on effort corrected sightings of minke whale, and also from modelling which predicts that the Moray Firth persistently supports above average densities of the species during summer. Areas to the west of the possible MPA which are predicted to persistently support above average densities of minke whale have not been included in the boundary because of a lack of effort corrected sightings data.*

Data sources and bibliography

Year	Title	Features covered
2019	Moore, C. G. (2019). Biological analyses of underwater video from monitoring and research cruises in Lochs Ailort and Fyne, the Sounds of Barra and Mull, inner Moray Firth, off Wester Ross, Noss Head and Rattray Head, and around the Southern Trench in outer Moray Firth. Scottish Natural Heritage Research Report No. 1085. Available from <https://www.nature.scot/snh-research-report-1085-biological-analyses-underwater-video-monitoring-and-research-cruises>	BM
2017	Marine Scotland Science. (2017). Suitable Habitat for Nephrops data. Area Management - Norway Lobster (Nephrops norvegicus) - Functional Units. Metadata ID: Marine_Scotland_FishDAC_1993. Available from <https://spatialdata.gov.scot/geonetwork/srv/eng/catalog.search#/metadata/Marine_Scotland_FishDAC_1993>	BM
2017	Miller, F., McCallum, S., White, A., Azzarello, J. & Caryl, F. (2017). Predictive mapping of seabed features within selected Special Areas of Conservation and Nature Conservation MPAs in Scottish territorial waters using available datasets. Scottish Natural Heritage Commissioned Report No. 980. Available from <https://www.nature.scot/snh-commissioned-report-980-predictive-mapping-seabed-features-within-selected-special-areas>	BM
2017	Moore, C.G. (2017). Biological analyses of underwater video from ongoing monitoring and research cruises in Lochs Sunart, Etive and Alsh, sea lochs off South Skye, the Sounds of Barra and Arisaig and around the Southern Trench. *Scottish Natural Heritage Commissioned Report No. 959*. Available from <https://www.nature.scot/snh-commissioned-report-959-biological-analyses-underwater-video-ongoing-monitoring-and-research>	BM
2014	Miller, P.I., Xu, W. and Lonsdale, P. (2014). Seasonal shelf-sea front mapping using satellite ocean colour to support development of the Scottish MPA network. *Scottish Natural Heritage Commissioned Report No. 538*. Available from <https://www.nature.scot/snh-commissioned-report-538-seasonal-shelf-sea-front-mapping-using-satellite-ocean-colour-support>	FR
2014	Paxton, C.G.M., Scott-Hayward, L.A.S. and Rexstad, E. (2014a). Statistical approaches to aid the identification of Marine Protected Areas for minke whale, Risso's dolphin, white-beaked dolphin and basking shark. *Scottish Natural Heritage Commissioned Report No. 594*. Available from <https://www.nature.scot/snh-commissioned-report-594-statistical-approaches-aid-identification-marine-protected-areas-minke>	MW
2014	Paxton, C.G.M., Scott-Hayward, L.A.S. and Rexstad, E. (2014b). Review of available statistical approaches to help identify Marine Protected Areas for cetaceans and basking shark. *Scottish Natural Heritage Commissioned Report No. 573.* Available from < https://www.nature.scot/snh-commissioned-report-573-review-available-statistical-approaches-help-identify-marine-protected>	MW

SOUTHERN TRENCH POSSIBLE MPA - DATA CONFIDENCE ASSESSMENT

Data sources and bibliography		
Year	**Title**	**Features covered**
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 (final report). *Scottish Natural Heritage Commissioned Report No. 432*. Available from <http://www.nls.uk/e-monographs/2013/432.pdf>	GEO
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* **3**(9). ISSN: 2043-7722. Available from <http://www.scotland.gov.uk/Resource/0041/00410486.pdf>	BM
2012	Hirst, N.E., Clark, L. and Sanderson, W.G. (2012). The distribution of selected MPA search features and Priority Marine Features off the NE coast of Scotland. *Scottish Natural Heritage Commissioned Report No. 500.* Available from <https://www.nature.scot/snh-commissioned-report-500-distribution-selected-mpa-search-features-and-priority-marine-features>	BM
2012	Scottish Natural Heritage. (2012). *Marine Protected Areas and cetaceans. Position paper for the 4th MPA Workshop, Heriot-Watt University, 14-15 March 2012.* Available from <http://www.scotland.gov.uk/Resource/0038/00389523.doc>	MW
2012	SNH and JNCC. (2012). *Marine Protected Areas and large scale features. Position paper for the 4th MPA Workshop, Heriot-Watt University, 14-15 March 2012.* Available from <https://www.nature.scot/scottish-mpa-project-large-scale-features-position-paper>	SD
2011	Marine Scotland. (2011). *British Geological Survey marine multibeam survey of Noss Head and Southern Trench on behalf of Marine Scotland and Scottish Natural Heritage*. Data shown in Hirst *et al*., 2012.	GEO
2010	Miller, P.I., Christodoulou, S. and Saux-Picart, S. (2010). *Oceanic thermal fronts from Earth observation data - a potential surrogate for pelagic diversity*. Report to the Department of Environment, Food and Rural Affairs. Defra Contract No. MB102. Plymouth Marine Laboratory, subcontracted by ABPmer, Task 2F, pp. 24. Available from <http://randd.defra.gov.uk/Document.aspx?Document=MB0102_9104_TRP.pdf>	FR
2009	Brooks, A.J., Roberts, H., Kenyon, N.H. and Houghton, A.J. (2009). *Accessing and developing the required biophysical datasets and datalayers for Marine Protected Areas network planning and wider marine spatial planning purposes. Report No 8: Task 2A. Mapping of Geological and Geomorphological Features*. ABP Marine Environmental Research Ltd. Available from <http://randd.defra.gov.uk/Document.aspx?Document=mb0102_8589_TRP.pdf>	GEO
2009	CHP. (2009). *Civil Hydrography Programme Data. Todhead Point to Bosies Bank HI115.* Accessed March 2014.	GEO
2008	Bradwell, T., Stoker, M.S., Golledge, N.R., Wilson, C.K., Merritt, J.W., Long, D., Everest, J.D., Hestvik, O.B., Stevenson, A.G., Hubbard, A.L., Finlayson, A.G. and Mathers, H.E. (2008). The northern sector of the last British Ice Sheet: Maximum extent and demise. *Earth-Science Reviews* **88**: 207-226.	GEO
2007	Greathead, C.F., Donnan, D.W., Mair, J.M. and Saunders, G.R. (2007). The sea pens *Virgularia mirabilis*, *Pennatula phosphorea* and *Funiculina quadrangularis*: distribution and conservation issues in Scottish waters. *Journal of Marine Biological Association of the UK* **87**:1095-1103.	BM
2007	Robinson, K.P., Baumgartner, N., Eisfeld, S.J., Clark, N.M., Culloch, R.M., Haskins, G.M., Zapponi, L., Whaley, A.R., Weare, J.S. and Tetley, M.J. (2007). The summer distribution and occurrence of cetaceans in coastal waters in the outer southern Moray Firth in northeast Scotland (UK). *Lutra* **50**: 19-30.	MW

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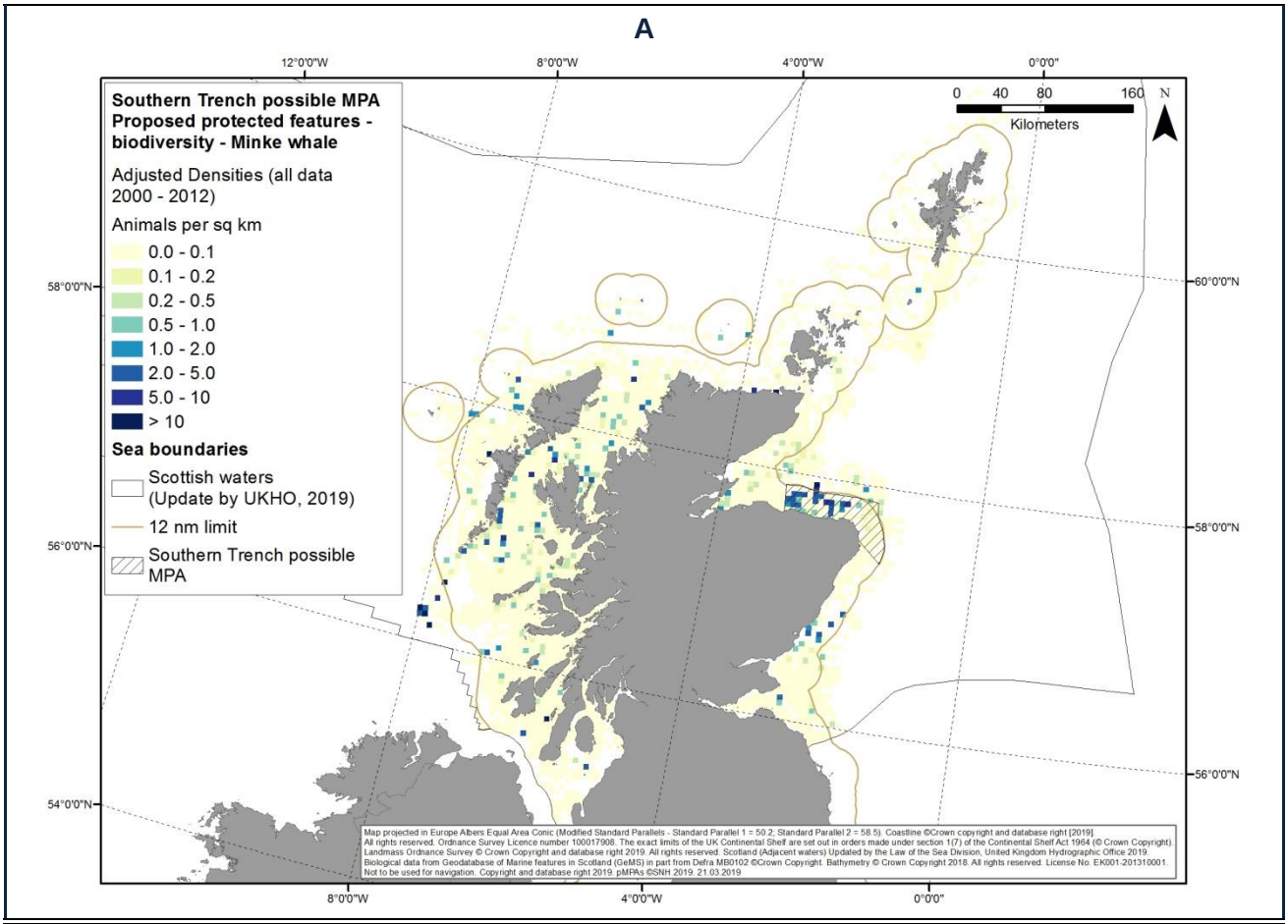
Data sources and bibliography		
Year	**Title**	**Features covered**
2004	Holmes, R., Bulat, J., Henni, P., Holt, J., James, C., Kenyon, N., Leslie, A., Long, D., Musson, R., Pearson, S. and Stewart, H. (2004). DTI Strategic Environmental Assessment Area 5 (SEA5): Seabed and superficial geology and processes. *British Geological Survey Report CR/04/064N*. BGS, Edinburgh.	GEO

SOUTHERN TRENCH POSSIBLE MPA - DATA CONFIDENCE ASSESSMENT

THE EVIDENCE-BASE

A



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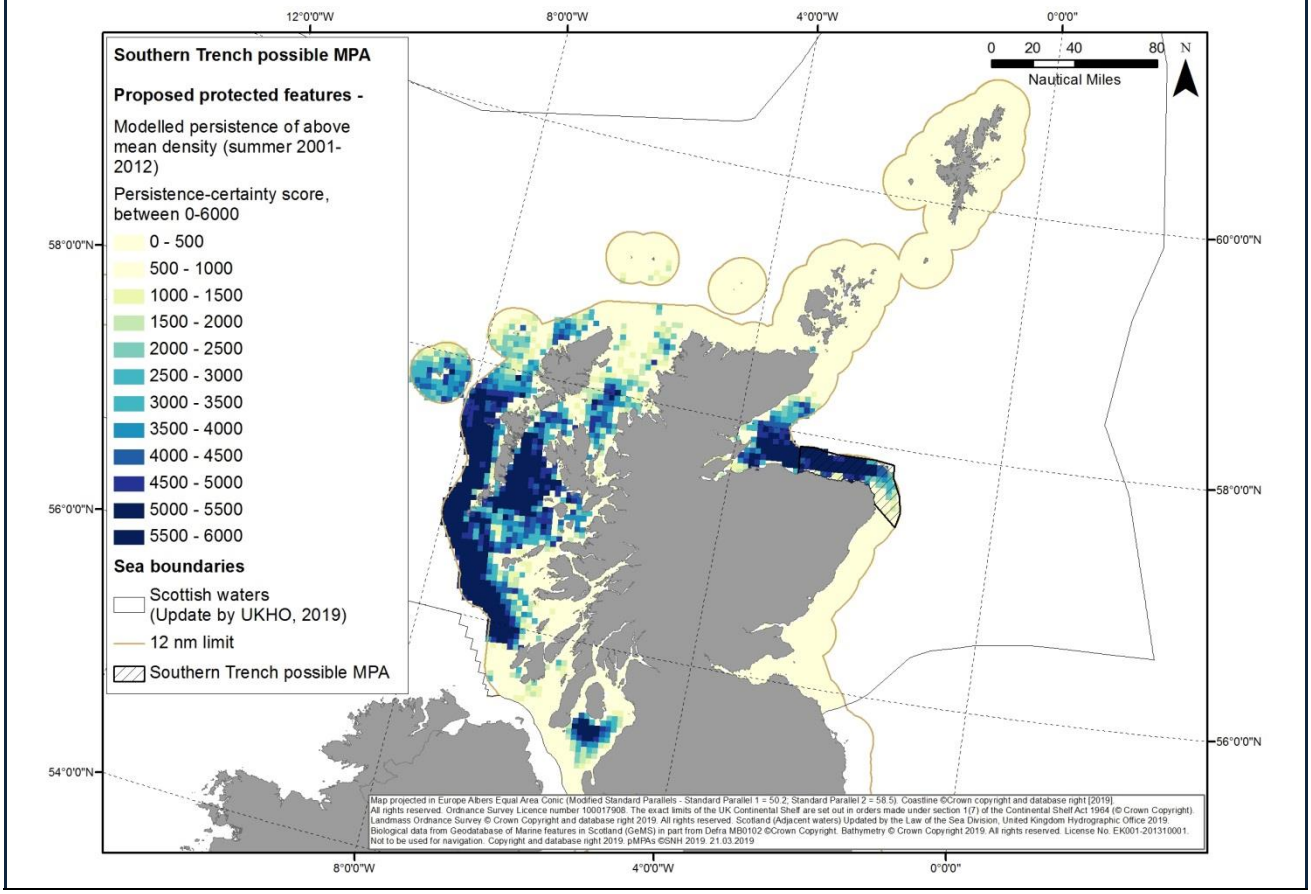

SOUTHERN TRENCH POSSIBLE MPA - DATA CONFIDENCE ASSESSMENT

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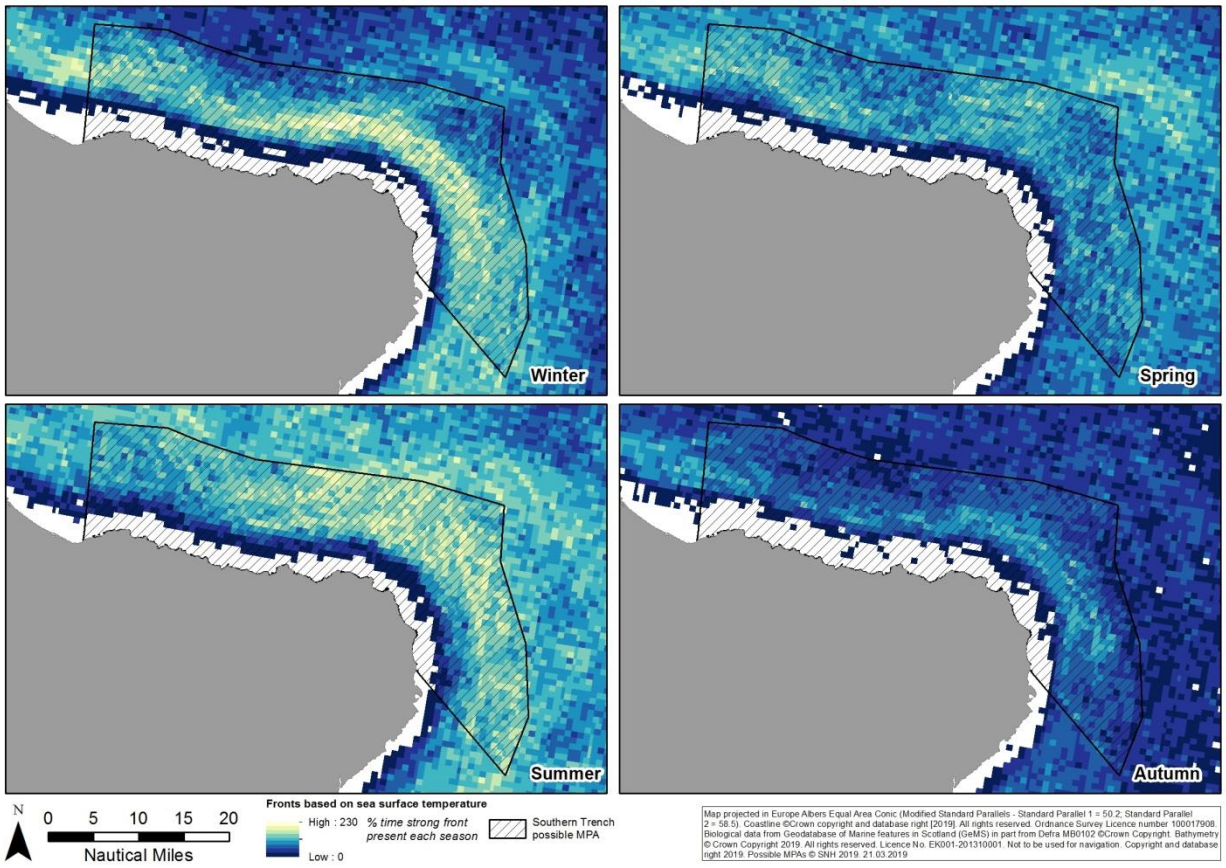

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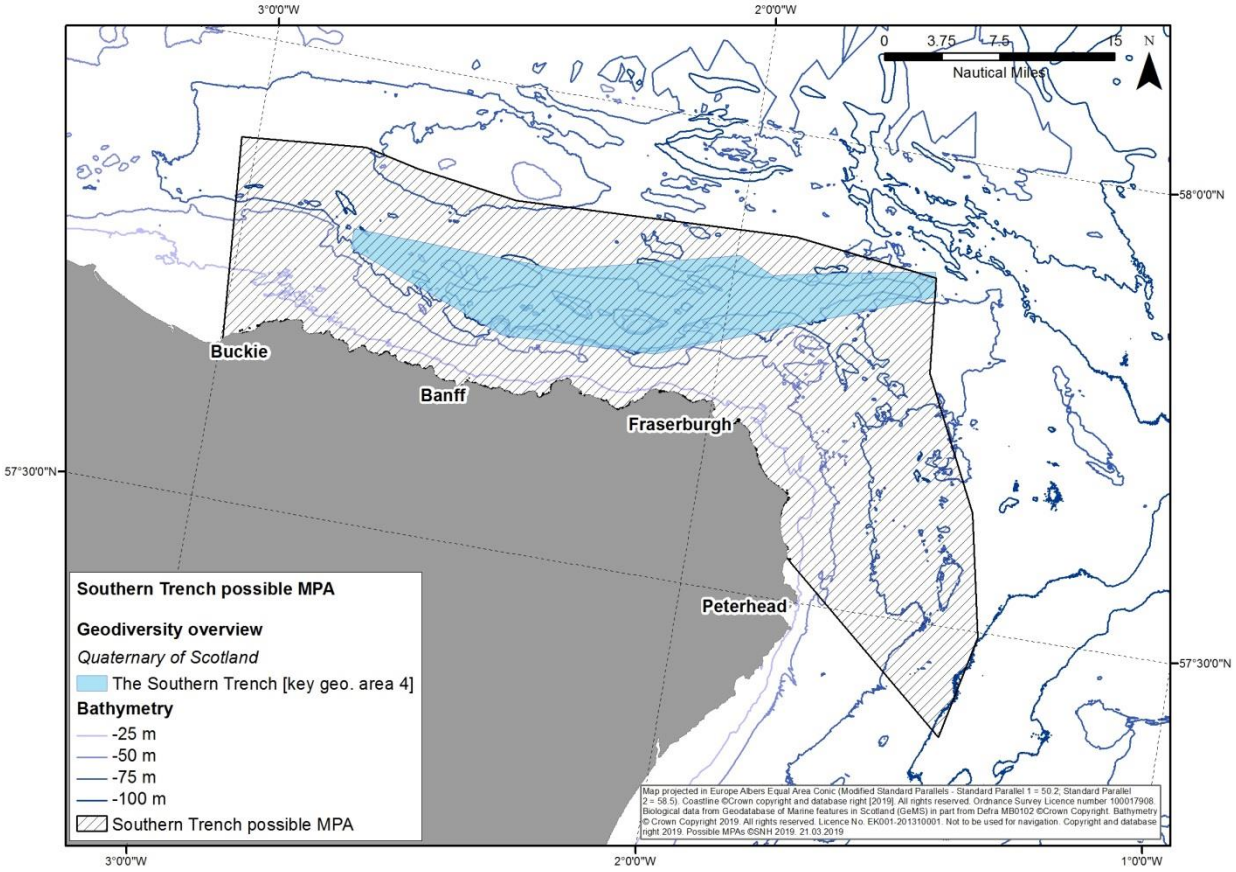

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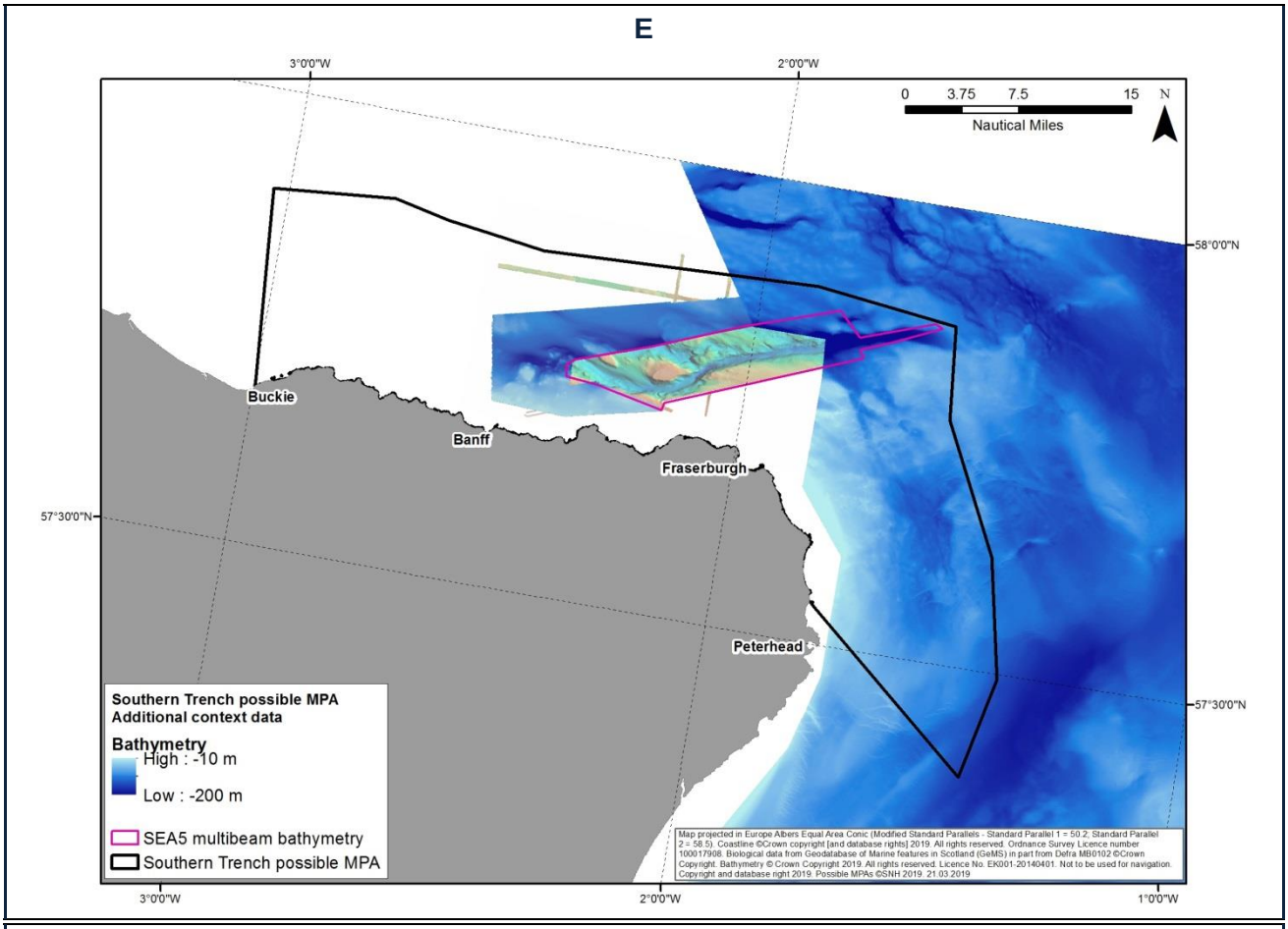

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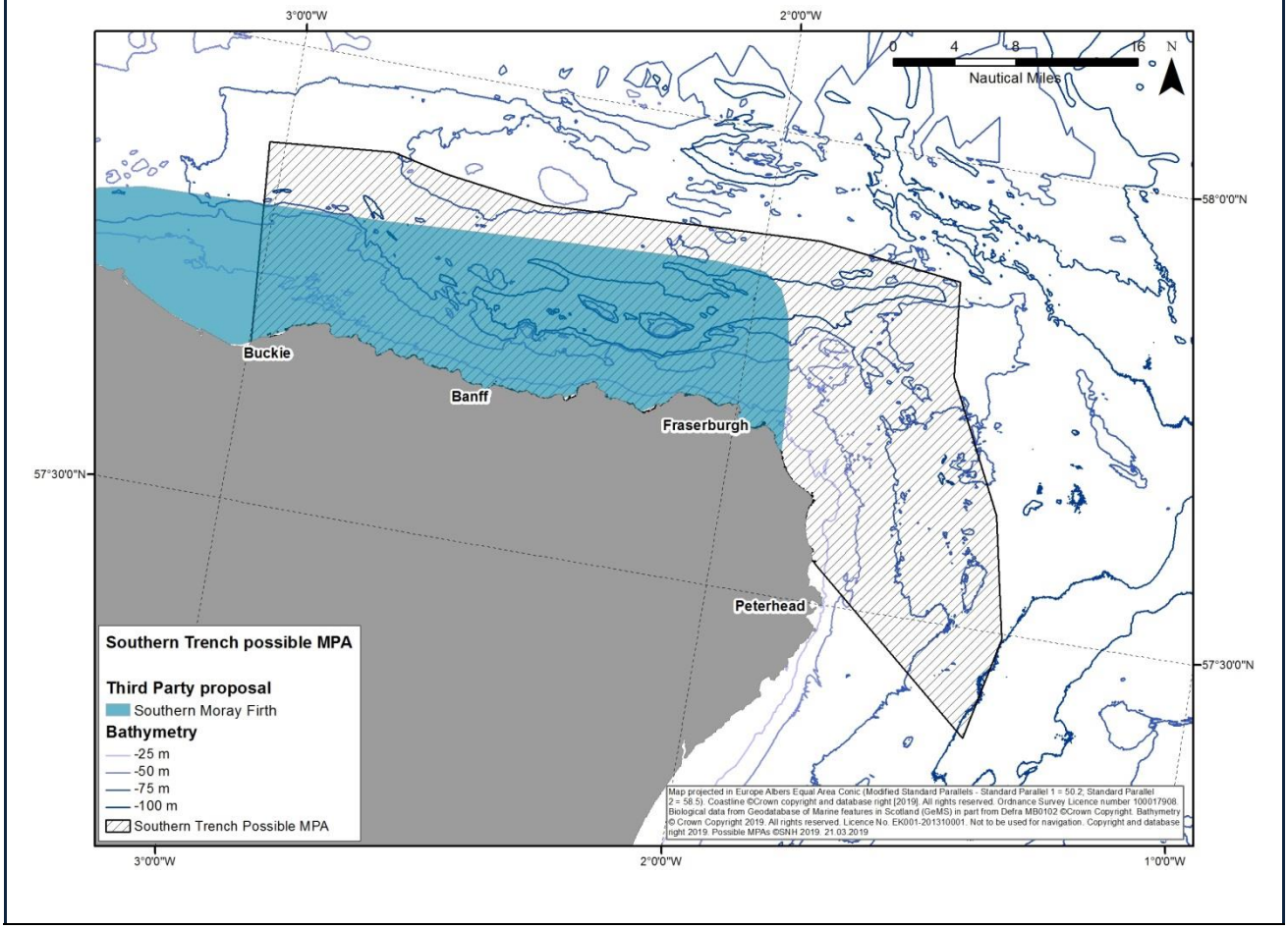

SOUTHERN TRENCH POSSIBLE MPA - DATA CONFIDENCE ASSESSMENT