Scottish Natural Heritage
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Conservation and Management Advice

SOUTHERN TRENCH POSSIBLE MPA

JUNE 2019

DRAFT

This document provides advice to Public Authorities and stakeholders about the activities that may affect the protected features of Southern Trench possible Marine Protected Area (pMPA). It provides advice from Scottish Natural Heritage (SNH) under Section 80 of the Marine (Scotland) Act 2010 and the Joint Nature Conservation Committee (JNCC) under Section 127 of the Marine & Coastal Access Act (2009) to public authorities as to matters which are capable of damaging or otherwise affecting the protected features of MPAs, how the Conservation Objectives of the site may be furthered or their achievement hindered, and how the effects of activities on MPAs may be mitigated. It covers a range of different activities and developments but is not exhaustive. It focuses on where there is a risk to achieving the Conservation Objectives. The paper does not attempt to cover all possible future activities or eventualities (e.g. as a result of accidents), and does not consider cumulative effects.

Further information on marine protected areas and management is available at -

https://www2.gov.scot/Topics/marine/marine-environment/mpanetwork

For the full range of MPA site documents and more on the fascinating range of marine life to be found in Scotland's seas, please visit -

www.nature.scot/mpas or www.jncc.defra.gov.uk/scottishmpas

Document version control			
Version	**Date**	**Author**	**Reason / Comments**
1	26/11/2018	Sam Black	Transferring initial draft conservation advice into new template and updating/completing
2	18/01/2019	Sam Black, Chris Leakey	Adding/editing ecosystem function, natural resources and wider benefits information
3	08/02/2019	Sarah Cunningham, Fiona Manson	Review of document and minke whale text Annex 1
4	18/02/2019	Sam Black, Nick Everett, Ness Kirkbride	Geodiversity conservation objectives and ecosystem services infographic
5	15/03/2019	Lisa Kamphausen	Completion of research and survey requirements
6	21/03/2019	Sarah Cunningham	Update to species licensing references in Annex 1 and cleared some comments that were dealt with.
7	28/03/2019	Sarah Cunningham	Final QA
8	04/04/2019	Sarah Cunningham, David Donnan, Sam Black	Insertion of Figure 3. Review of fisheries related text and climate change text. Addition of paragraph on seaweed harvesting and text on military activities. Checking footnotes. Updating scale bar on adjusted density map for minke whale and addition of burrowed mud data from MS suitable *Nephrops* ground layer to map.
9	14/05/19	Sarah Cunningham, Sam Black	Revision following Marine Scotland comments.
10	21/05/19	Sarah Cunningham, Sam Black.	Addition on information on Section 127 of the Marine & Coastal Access Act (2009) following endorsement by JNCC. Edits following additional comments from Marine Scotland.
11	06/06/19	Sarah Cunningham	Accepting track changes for final version

Distribution list			
Format	**Version**	**Issue date**	**Issued to**
Electronic	6	21/03/2019	Gayle Holland Marine Scotland LOT Lily Burke, Elaine Tait, Finlay Bennet Marine Scotland
Electronic	7	29/03/2019	Katie Gillham for sign off
Electronic	8	05/04/2019	Marine Scotland officials.
Electronic	9	15/05/2019	Marine Scotland officials.
Electronic	9	17/05/2019	Peter Chaniotis JNCC.
Electronic	11	06/06/2019	Marine Scotland officials.

Contents

1 Overview of document

This document provides details of the Conservation and Management Advice for Southern Trench possible Marine Protected Area (pMPA) and it is divided into eight main sections. The introduction in section 2 gives an overview of Southern Trench pMPA and its contribution in terms of conservation and wider benefits. Section 3 provides an overview of the roles of the various bodies involved with advising, regulating and managing the marine protected area. Section 4 describes the protected features and their condition, and section 5 introduces the Conservation Objectives for the site. Section 6 describes the threats and pressures to which the protected features are sensitive, and section 7 provides the management advice for these activities. Section 8 identifies what further research and surveys may be required to increase our understanding of how the protected features utilise the site for which they are designated.

2 Introduction

2.1 Purpose statement

The Southern Trench pMPA has been proposed to protect four biodiversity features: burrowed mud, fronts, minke whale and shelf deeps; as well as two geodiversity features: Quaternary of Scotland and Submarine Mass Movement. By doing so it contributes to the Scottish, UK and OSPAR MPA networks, the conservation of the wider marine environment around Scotland and progress towards Good Environmental Status. The main purpose of the Southern Trench pMPA is to conserve the protected features in favourable condition. This makes a contribution to the OSPAR MPA network in the North-East Atlantic.

2.2 Conservation benefits

Southern Trench pMPA provides conservation benefits by affording protection to burrowed mud, fronts, minke whales, shelf deeps and two geodiversity features. In summary the conservation benefits of this designation are:

- Protection for an area containing persistently above average densities of minke whale where both juvenile and adult whales are regularly observed feeding.
- An additional replicate of burrowed mud within a pMPA on the east coast of Scotland complementing the burrowed mud protected in the Central Fladden MPA, which is isolated in relation to water circulation.
- Conservation of the persistent front within the pMPA ensures that productivity and feeding conditions utilised by local mobile species are maintained.
- Preservation of a geologically unique shelf deeps feature on the Scottish continental shelf and its associated biological communities.
- A location which contributes to our understanding of past ice sheet behaviour and global climate change through the protection of the sites geodiversity features.

2.3 Wider benefits

The protected features of the pMPA provide ecosystem services locally and to the wider marine environment. We describe these ecosystem services in terms of their functions and natural resources, which in turn lead to benefits for people.

Figure 1 illustrates how the protected features of Southern Trench pMPA contribute to benefits for people. There can be many complex interactions and dependencies amongst the protected features, their functions, associated natural resources and the benefits we gain from them.

The functions associated with the protected features of Southern Trench pMPA are described in Annex 1 as part of the site's Conservation Objectives. The features together, especially when taken within the context of the whole MPA and/or local ecosystem, contribute to certain functions more than others, e.g. carbon storage and nutrient cycling. The functions of the protected features are fundamental to the continued supply of natural resources and benefits associated with this pMPA and to the long-term health of the protected features.

Southern Trench pMPA lies in the Outer Moray Firth along the northern Aberdeenshire coast. In terms of resources the site encompasses an area widely known for its wildlife and dramatic seascapes where minke whale and bottlenose dolphin are regularly sighted and enjoyed by visitors and local communities. The coastline of the pMPA is populated by a number of historic harbours and ports which are home to a large portion of the Scottish fishing fleet. The waters within and around the pMPA have been utilised for fish and shellfish resources for many years and are important to local communities. The pMPA is also geologically unique as it includes a large deep underwater valley from which the site takes its name.

The natural resources of the Southern Trench pMPA contribute towards a range of benefits for people. The diverse and abundant wildlife present opportunities for nature watching and tourism and recreation and also contribute to spiritual and cultural wellbeing. The wildlife also provides opportunities for knowledge development. Fish and shellfish resources also create benefits through the provision of food and nutrition and jobs and businesses, resulting in a unique environment appreciated widely for its biodiversity and important fishing industry. At a wider scale, the subglacial tunnel valleys and moraines which make up the Quaternary of Scotland geodiversity feature helps us in reconstructing past ice sheets, telling a story of past global climate change that is relevant to future climate change projections.

The benefits that arise from the functions and natural resources of the pMPA are typically small in the context of the whole of Scotland, but some are of greater importance for this MPA and the people that use it. There is potential for benefits to be enhanced. This may be achieved by improving the quantity or quality (health) of the protected features themselves and/or through promoting, for example, more recreational enjoyment or use of natural resources that is compatible with the site's Conservation Objectives.

Figure 1 *Benefits to people associated with protected features of the Southern Trench pMPA*

*Imagery prepared by the British Geological Survey, with bathymetry data provided courtesy of the Maritime and Coastguard Agency's UK Civil Hydrography Programme © Crown copyright.

2.4 Contribution to policy commitments

Managing this MPA to conserve burrowed mud, fronts, minke whale, shelf deeps and the two geodiversity features: Quaternary of Scotland and Submarine Mass Movement will ensure the continued provision of the benefits above as well as the site's contribution to:

- An ecologically coherent network of MPAs which are well managed under the OSPAR convention and national legislation.
- The protection of burrowed mud which is a Priority Marine Feature and an OSPAR threatened and declining habitat ('sea-pen and burrowing megafauna communities').
- Progress towards achieving Good Environmental Status in relation to biological diversity, seafloor integrity and underwater noise.
- The protection, enhancement and health of the marine area under the Marine (Scotland) Act 2010.
- Restoring marine and coastal ecosystems and increasing the environmental status of our seas under the Scottish Biodiversity Strategy.
- Helping to adapt to climate change under The Scottish Climate Change Adaptation Programme by increasing the resilience of habitat and species in the area.

3 Roles

This document provides advice for Southern Trench pMPA in relation to activities that may affect the protected features. More detailed advice can be provided to public authorities to inform their decision-making as required. In doing this, our aim is to ensure the Conservation Objectives for the protected features are met.

Section 80 of the Marine (Scotland) Act 2010 and Section 127 of the Marine & Coastal Access Act (2009) gives Scottish Natural Heritage (SNH) and the Joint Nature Conservancy Council (JNCC) the remit to provide advice and guidance to public authorities as to the matters which are capable of damaging or otherwise affecting the protected features of Nature Conservation MPAs, how the conservation objectives of the site may be furthered or their achievement hindered and how the effects of activities in MPAs may be mitigated.

It is the role of public authorities to ensure that the activities they regulate, permit or licence do not hinder the achievement of the Conservation Objectives of Southern Trench pMPA. The management advice in this document is provided to assist public authorities in managing the activities outlined in Table 2 and carrying out their duties under Section 82 and 83 of the Marine (Scotland) Act 2010 and under Section 125 and 126 of the Marine & Coastal Access Act (2009).

Stakeholders can provide additional evidence to support the development of management including local knowledge of the environment and of activities. This will contribute to the development of well-designed and effective management measures.

4 Protected features and status

The Southern Trench pMPA has been selected to become part of Scotland's MPA network which in turn has been established to help conserve and recover a range of Scotland's important marine habitats, wildlife, geology and landforms.

Table 1 provides a summary of the protected features within the pMPA, their condition within the site and the broader conservation status of the protected features.

The locations and extent of the protected features within the Southern Trench pMPA are shown on Figure 2. This may have been superseded by more up-to-date information on extent/distribution of features since the publication of this document. The most up-to-date distribution of the features described is available to view at National Marine Plan Interactive[1].

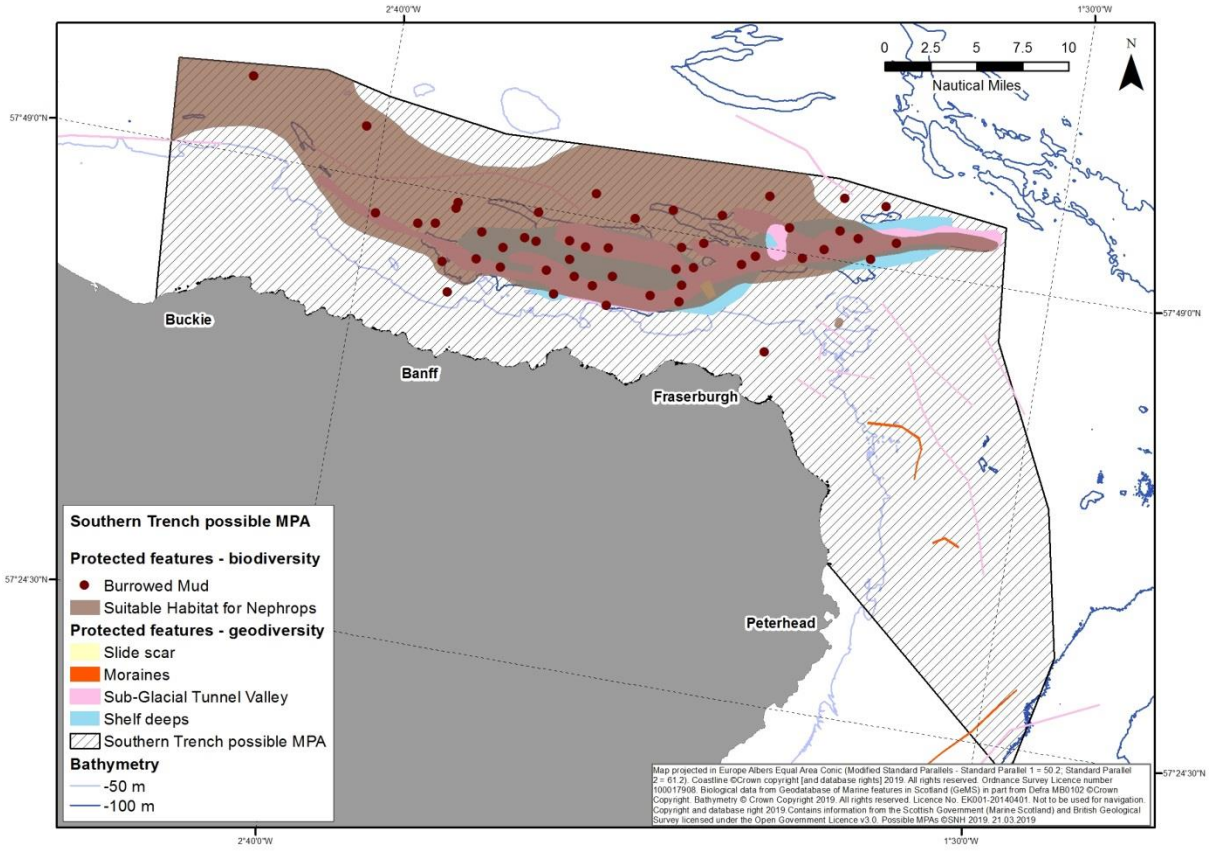
Table 1. Protected features and condition for the Southern Trench pMPA. Feature condition refers to the condition of the protected feature assessed at a site level. Broader conservation status is the overall condition of the feature throughout its range as outlined by the footnotes.

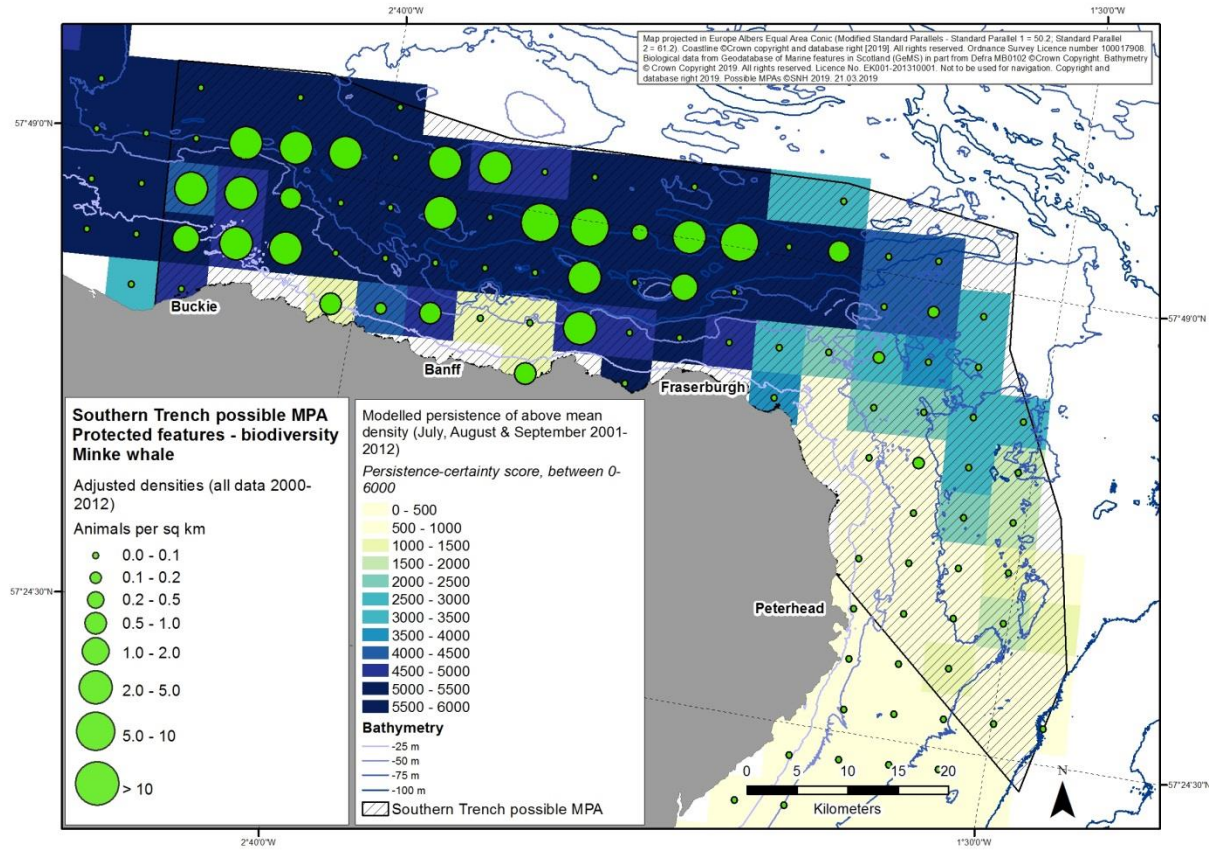
Protected Features	Feature condition	Assessment date	Broader conservation status*
Burrowed mud	Favourable	2019	OSPAR Threatened and/or Declining*
Fronts	Favourable	2019	N/A
Minke whale	Favourable	2019	UK: Favourable European Region: Favourable#
Shelf deeps	Favourable	2019	N/A
Quaternary of Scotland	Favourable	2019	N/A
Submarine Mass Movement	Favourable	2019	N/A

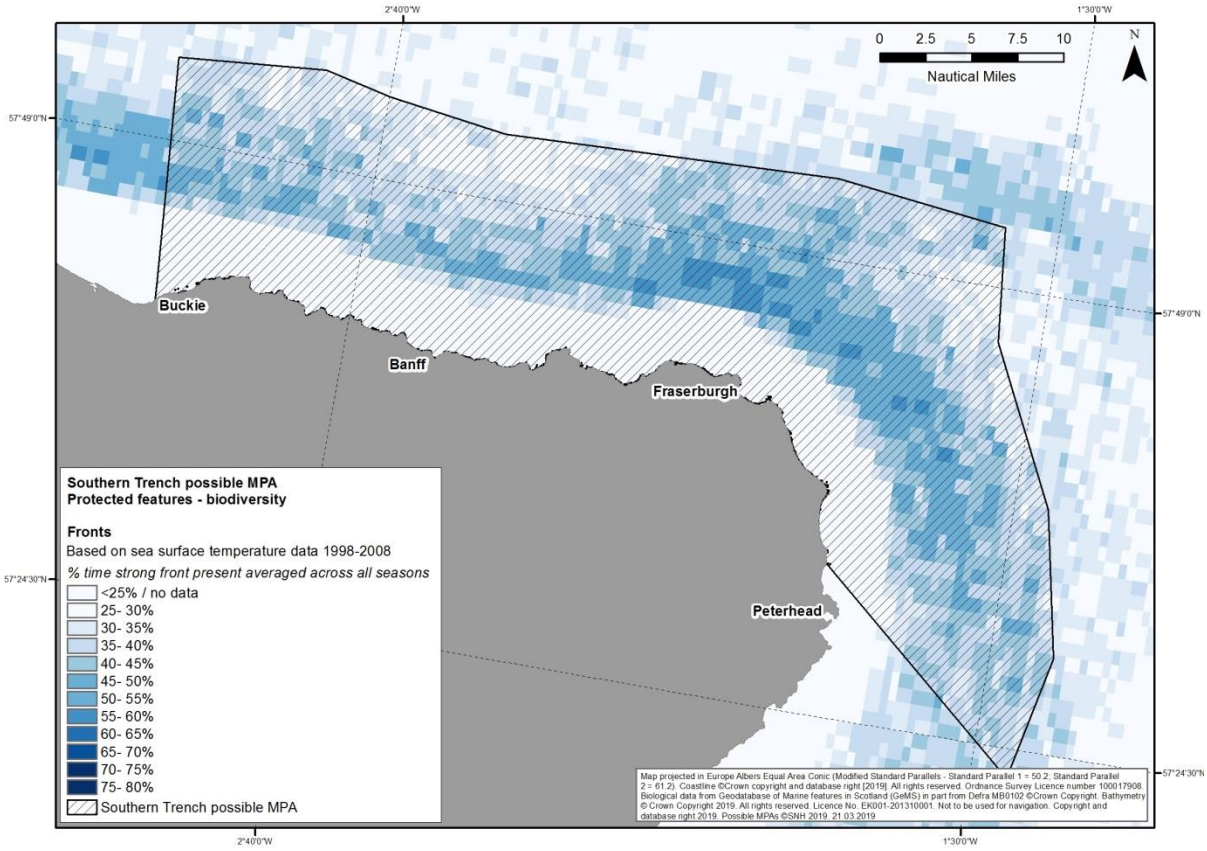
* For burrowed mud this is the status for Region II – North Sea under the OSPAR Convention.
# For minke whale this is their Favourable Conservation Status for the UK and the Marine Atlantic Biogeographic Region (MATL) in Europe as reported under Article 17 of the Habitats Directive in 2013. Note there is an update to this due in 2019.

[1] https://marinescotland.atkinsgeospatial.com/nmpi/

Figure 2 *Location of the Southern Trench pMPA and distribution of the proposed protected features*






2°40'0"W
1°30'0"W
57°49'0"N
57°24'30"N
0 2.5 5 7.5 10
Nautical Miles
N
Buckie
Banff
Fraserburgh
Peterhead
Southern Trench possible MPA
Protected features - biodiversity
Fronts
Based on sea surface temperature data 1998-2008
% time strong front present averaged across all seasons
<25% / no data
25- 30%
30- 35%
35- 40%
40- 45%
45- 50%
50- 55%
55- 60%
60- 65%
65- 70%
70- 75%
75- 80%
Southern Trench possible MPA
Map projected in Europe Albers Equal Area Conic (Modified Standard Parallels - Standard Parallel 1 = 50.2; Standard Parallel 2 = 61.2). Coastline ©Crown copyright and database right [2019]. All rights reserved. Ordnance Survey Licence number 100017908. Biological data from Geodatabase of Marine features in Scotland (GeMS) in part from Defra MB0102 ©Crown Copyright. Bathymetry © Crown Copyright 2019. All rights reserved. Licence No. EK001-201310001. Not to be used for navigation. Copyright and database right 2019. Possible MPAs ©SNH. 2019. 21.03.2019

5 Conservation objectives

5.1 Background

Conservation Objectives set out the desired quality of the protected features within the Southern Trench pMPA (Annex 1) and they are in place at the time the site is formally designated. They provide the framework for the setting of site conservation measures (management) and for public authorities in managing the activities outlined in Table 2 and carrying out their duties under Section 82 and 83 of the Marine (Scotland) Act 2010.

5.2 Relationship between feature condition and Conservation Objectives

The Conservation Objectives seek to *conserve* protected feature(s) of a MPA where evidence exists that it is in favourable condition in the site, or where there is uncertainty concerning the assessed condition of a feature (see section 4) but no reason to suspect deterioration in condition since designation. Where evidence exists that a feature is declining and/or damaged and therefore is in unfavourable condition in the site, the Conservation Objectives will seek to *recover* the protected feature.

All of the biodiversity and geodiversity features are in favourable condition at Southern Trench pMPA and therefore the Conservation Objectives seek to conserve this condition.

6 Feature sensitivity

The following sections provide an overview of the pressures most relevant to the protected features. Further information on feature sensitivity can be found at Marine Scotland's Feature Activity Sensitivity Tool (FEAST)[2] and also for the features not covered by FEAST, Marine Evidence based Sensitivity Assessment (MarESA)[3]. The information in FEAST reflects our current understanding of the interactions between activities, pressures and features. It highlights that activities can give rise to a range of pressures which the protected features may be sensitive to. Our assessment of sensitivity is based on a feature's tolerance (response to change) and its ability to recover.

6.1 Burrowed Mud

Burrowed mud habitats are highly sensitive to physical disturbance caused by a range of activities. Activities that cause physical disturbance including penetration, abrasion or removal of the seabed can be highly damaging to both mobile and sessile epifaunal and infaunal species that characterise the habitat type. Physical disturbances leading to water flow, wave exposure and pronounced siltation alterations are also detrimental as burrowing species experience feeding rate disruption and greater energy expenditure that impacts reproduction and recruitment. Burrowed mud habitats are also particularly vulnerable to pollution. High fluxes of nutrients or organic material can cause hypoxia and physical burial leading to defaunation, alteration of species composition and changes to ecosystem functioning. Burrowing species do have the capacity to recover from such impacts

[2] http://www.marine.scotland.gov.uk/feast/
[3] https://www.marlin.ac.uk/sensitivity/sensitivity_rationale

(albeit this may be slowly) provided that the habitat has not been permanently changed, pressures that they are sensitive to are removed/avoided, suitable environmental conditions are maintained and that there are undisturbed neighbouring burrowed mud communities which can recolonise the area.

6.2 Minke whale

Minke whales are considered to be sensitive to entanglement and incidental bycatch. Entanglement represents the single most frequently-documented cause of mortality for minke whales in Scottish waters (based on Scottish Marine Animal Stranding Scheme data 2012-2017).There is evidence of minke whales with lacerations/scars associated with entanglement (Northridge et al., 2010). Additionally, minke whales are known to be sensitive to underwater noise, although the degree to which they are sensitive is not well understood. There is potential for auditory injury, disturbance and displacement from foraging areas as a result of activities which produce underwater noise at frequencies which overlap with the whales' hearing range. Minke whales are also considered to be sensitive to collision and incidental bycatch. There is evidence of minke whales with injuries that could have been caused by collision with boat propellers, blunt trauma injuries associated with collision with the bows of vessels (Laist *et al.,* 2001). Minke whales may be sensitive to water pollution through exposure to bioaccumulated contaminants. Whilst there is little information available regarding the recovery potential of minke whales to such pressures, the risk of exposure to these pressures can be minimised through the adoption of best practice and relevant mitigation.

6.3 Fronts

The thermal front within the pMPA could be sensitive to pressures such as changes in tidal flow or physical changes to the sea bed. Activities that have potential to cause substantial changes to either water flow or to the seabed topography could have implications for the structure or distribution of the feature within the pMPA and therefore secondary effects on its functional role. Currently most pressures associated with human activities in the marine environment are considered unlikely to cause significant risk of impact on the fronts feature within the pMPA.

6.4 Shelf deeps

Shelf deeps are considered to be robust, entirely natural in origin and are not considered to be at risk of significant damage from human activity.

6.5 Quaternary of Scotland (subglacial tunnel valleys and moraines)

Subglacial tunnel valleys are highly resistant to human activities (having been formed in bedrock by erosion under ice sheets) and are either considered not sensitive or to have a low sensitivity to pressures arising from human activities. In the vast majority of instances, most pressures associated with human activity in the marine environment will not be sufficient to impact geological and geomorphological seabed features (Brooks, 2013). Moraines are relict features that are composed of glacial till. Their resistance to erosion is highly variable and depends upon the composition and level of consolidation of the till. Overall, moraines are considered to have a medium sensitivity to sub-surface abrasion and changes in tidal flow, and a high sensitivity to physical removal.

6.6 Submarine Mass Movement (slide scars)

In the vast majority of instances, most pressures associated with human activity in the marine environment will not be sufficient to impact geological and geomorphological seabed features (Brooks, 2013). This feature, which formed in bedrock and sediments after the ice sheet had melted, is generally resistant. However as a relic of past processes, it has no resilience. It is considered to have a medium sensitivity to physical removal and to any activities that could cause obscuring (ABPmer, 2009).

7 Management

7.1 Advice to support management

Table 2 provides SNH's advice to support management for activities where we consider this may be necessary to achieve the Conservation Objectives for the protected features. The advice is focused on the activities that cause an effect (a pressure) that a feature is sensitive to. Pressures can be physical (e.g. abrasion of the seabed), chemical or biological. Different activities may cause the same pressure, e.g. fishing using bottom gears and aggregate dredging both cause abrasion which can damage the surface of the seabed.

Our advice takes a risk-based approach, i.e. we are focusing on providing advice where we believe there is a risk to achieving the Conservation Objectives. We have identified risks to achieving the Conservation Objectives where there is an overlap between protected features and activities associated with pressures that the features are sensitive to. We have provided management advice to support public authorities and others in managing these risks. Our advice is based on existing data and information on protected features and relevant activities and our understanding of the relationships between the features and activities. We have identified a range of management advice:

- management to remove or avoid pressures;
- management to reduce or limit pressures; or
- no additional management required.

For our advice on fisheries management we have also stated where we think this should be 'considered' or 'recommended'. The term 'considered' is included to highlight that a fishery-feature interaction exists, but circumstances mean that a specific recommendation for action cannot / or need not be made at this point. However, there is sufficient cause to make fishery managers aware and for them to consider if a fishery management measure may be helpful in achieving Conservation Objectives – particularly where there may be a synergy between the benefits of management actions for the fishery and the Conservation Objectives for the feature. The term 'recommended' highlights than a fishery-feature interaction exists, there is a reasonable evidence base and a specific recommendation can be made/ justified.

New or other activities would need to be considered on a case-by-case basis. In particular seaweed harvesting has not been included within our management advice at the current time because the activity is new. Whilst it is recognised that there is potential for a variety of impacts, e.g. species disturbance, abrasion of seabed

habitats and changes to trophic links, there are uncertainties about how significant these impacts could be and the evidence base is still being developed.

We recognise that stakeholders can provide local environmental knowledge and more detailed information on activities, including in relation to intensity, frequency and methods. This additional information will help public authorities and others develop more specific management, focussed on the interaction between features and activities. If new information becomes available our management advice may be revised.

Activities that are considered not likely to affect the protected features (other than insignificantly) are listed in Table 3. Spatial data relating to the location and extent of the activities listed can be accessed on Marine Scotland's National Marine Plan Interactive[4] (where available).

7.2 Best Practice

In our management advice for activities in Annex 3 we refer to the development, adoption or use of 'best practice' as a way of managing interactions between activities and the features. Best practice is taken to mean approaches or procedures that are developed and accepted by regulators and relevant stakeholders as being an effective way of dealing with an interaction between a habitat or species and the pressures created by an activity. Much of this best practice is already being implemented by sectors and regulators, e.g. pre-application discussions between developers and regulators, the Scottish Marine Wildlife Watching Code and Technical Standards for Scottish Finfish Aquaculture.

7.3 Conservation Measures

Activities and developments subject to licensing that could affect the protected features of the pMPA also need to be assessed. Authorities need to determine whether if by carrying out their duties e.g. permitting an activity to take place, it would hinder the achievement of the Conservation Objectives of the p MPA. This is referred to as an assessment under Section 82 or Section 83 of the Marine (Scotland) Act 2010 and Section 126 of the Marine and Coastal Access Act 2009.

There are currently no site-specific conservation measures yet for the protected features of the site but the need for additional measures will be considered if the pMPA is designated.

8 Research and survey requirements

We recognise that there are still important gaps in our understanding and knowledge of the features of this site. We will identify research and survey projects to inform our understanding of these aspects. The requirements identified below are not a commitment to undertake this work. However, by highlighting these gaps we hope to inform future discussions with parties interested in undertaking research in this site and/or on these features, to help direct research and aid monitoring priorities.

[4] https://marinescotland.atkinsgeospatial.com/nmpi/

1. Continued use of contingency sampling on an opportunistic basis to examine the distribution of burrowed mud by utilising other data collection opportunities, e.g. *Nephrops* TV (Marine Scotland Science/Fisheries Research Services).
2. Analyses of drop down video collected during 2018 EMFF survey work.

Table 2. SNH's advice to support management for Southern Trench possible MPA for activities which are considered capable of affecting the proposed protected features.

Where a cell is coloured grey this indicates that management is already in place and/or no additional management is considered to be required to achieve the Conservation Objectives. Whilst fronts and shelf deeps are proposed protected features of the possible MPA, they are not included in this table because no additional management is currently required. The potential for cumulative effects (e.g. related to noise, disturbance and collision) needs to be taken into account, particularly when considering management for minke whales. An * has been used to highlight those activities to which the advice under 'Boat use associated with both commercial and recreational activities' also applies.

Activities considered capable of affecting the proposed protected features	**Advice to support management**	
	Burrowed Mud	**Minke Whale**
Boat use associated with both commercial and recreational activities (with the exception of **Wildlife tour boats** – see separate advice below.)	**No additional management required**	**Reduce or Limit Pressures** Reduce risk of collisions with and disturbance[5] of minke whales from boats when watching or attempting to watch marine wildlife by following the SMWWC (Scottish Marine Wildlife Watching Code[6]). Reduce risks of collisions and disturbance from licensable activities that result in increased vessel traffic for defined periods for example through the use of vessel management plans as part of the consenting/licensing process. This may include agreed routes and potential speed restrictions.

[5] Disturbance is defined as 'the result of direct or indirect interaction with people that changes the behaviour of any animal or changes the environment, which in turn affects the well-being or survival of an animal in the short, medium or long-term.'

[6] https://www.nature.scot/professional-advice/land-and-sea-management/managing-coasts-and-seas/scottish-marine-wildlife-watching-code

Activities considered capable of affecting the proposed protected features	Advice to support management	
	Burrowed Mud	**Minke Whale**
Cables and pipelines*	**No existing management required** for existing cable and pipeline infrastructure. **Reduce or limit pressures** Minimise the footprint of new cables and pipelines within areas of burrowed mud habitat. Early discussion of siting, design and construction is recommended to reduce the potential of impacts. Key details which should be discussed will include pre-application surveys, siting and installation techniques.	**Reduce or limit pressures** Early discussion of siting, design and construction is recommended to reduce the risks of disturbance to minke whale caused by the development and installation of new cable and pipeline infrastructure. Key details which should be discussed will include pre-application surveys, siting and installation techniques.
Coastal development e.g. construction of piers, slipways, jetties etc.*	**Reduce or limit pressures** Minimise the potential impact of new coastal development within areas of burrowed mud habitat using best practice via the existing licensing process. This will best be achieved through early pre-application discussion and the agreement on pre-application surveys to map potential burrowed mud, identification of a suitable development footprint and subsequent siting and construction techniques.	**Reduce or limit pressures** Reduce the risks of disturbance to minke whales from activities associated with high source levels of underwater noise (e.g. pile-driving and blasting). We encourage early pre-application discussions to discuss techniques and methods to decrease the impacts from underwater noise – this may involve noise abatement technology, pile management strategies etc.[7] Minimise the potential impact of coastal development on the habitat of sandeels. This will best be achieved through early pre-application discussion and the agreement on pre-application surveys to map potential sandeel habitats, identification of a suitable development footprint and subsequent siting and construction techniques.

[7] JNCC Guidelines for minimising risks of injury from piling and blasting (http://jncc.defra.gov.uk/pdf/jncc_guidelines_piling%20protocol_august%202010.pdf, http://jncc.defra.gov.uk/pdf/JNCC_Guidelines_Explosives%20Guidelines_August%202010.pdf).

Activities considered capable of affecting the proposed protected features	Advice to support management	
	Burrowed Mud	**Minke Whale**
Fishing - demersal mobile/active gear*	**Reduce or limit pressures** Management measures to reduce or limit demersal mobile/active fishing gear within areas of burrowed mud habitat ***should be considered***.	**Remove or avoid pressures** The exclusion of hydraulic fishing[8] methods from habitat supporting sandeels (as a key prey species of minke whales) within the site ***is recommended.***
Fishing – static gear*	**No additional management required**	**Reduce or limit pressures** The further development and adoption of existing best practice[9] to reduce or limit the risk of entanglement of minke whales in creel ropes and long lines ***is recommended***. Exclusion of the use of drift nets and nets set on the seabed (tangle, trammel, gill) between June and October due to the risk of entanglement ***is recommended***.

[8] SNH considers that hydraulic dredging includes suction dredging and also fishing methods that use jets to blow/move the sediment and then pass a dredge over this seabed. These forms of fishing can significantly alter the sediment and penetrate it to a point where they affect its ability to support sandeels.
[9] Scottish Entanglement Alliance best practice guide: https://www.scottishentanglement.org/downloads/best-practise-guide-for-fishermen/

Activities considered capable of affecting the proposed protected features	Advice to support management	
	Burrowed Mud	**Minke Whale**
Fishing – pelagic*	**No additional management required**	**Reduce or limit pressures** The development and adoption of best practice to reduce or limit the risk of incidental catch of minke whales ***should be considered***. Measures ensuring that fishing activity does not prevent or disrupt the availability of key prey species (e.g. herring, sprat) for minke whales ***are recommended.*** **Remove or avoid pressures** The exclusion of targeted fishing for sandeels ***is recommended*** because of the importance of sandeels as a prey species for minke whale[10].
Marine disposal sites*	**Reduce or limit pressures** Minimise the likely effects of new disposal sites where there would be likely to be an impact upon burrowed mud habitats. Early pre-application discussions are recommended and these should focus on the appropriate siting of new disposal sites and any pre-submission surveys to avoid impacts within areas of burrowed mud habitat.	**Reduce or limit pressures** Minimise the potential impact of new disposal sites on the habitat of sandeels. Early pre-application discussions are recommended and these should consider the appropriate siting of new disposal sites and any pre-submission surveys to ensure that the habitat of sandeels is maintained in extent and suitability.

[10] A proportion of the possible MPA overlaps with the existing East of Scotland sandeel fisheries closure.

Activities considered capable of affecting the proposed protected features	Advice to support management	
	Burrowed Mud	**Minke Whale**
Military – planned exercises*	**No additional management required**	**Reduce or limit pressures** Reduce the risks of disturbance to minke whale from activities associated with high source levels of underwater noise (e.g. sonar activities, explosives) by following agreed protocols set out in the Maritime Environmental and Sustainability Assessment Tool (MESAT)[11].
Oil and Gas exploration / commissioning	**Reduce or limit pressures** Minimise the potential impact of oil and gas development on burrowed mud habitats via the existing licensing process. Early pre-application discussion is recommended and will assist with the identification of the need for any surveys to map habitats to inform siting and design.	**Reduce or limit pressures** Activities associated with oil and gas development that increase the risk of disturbance, acoustic injury, and disturbance, collisions and entanglement should be minimised. Early pre-application discussion is recommended and will assist with the development of key mitigation techniques such as noise management strategies etc.
Ports and harbours*[12]	**No additional management required**	**Reduce or limit pressures** Reduce the risks of disturbance to minke whales from activities associated with high source levels of underwater noise (e.g. pile-driving and blasting) between June and October. We encourage early pre-application discussions to discuss techniques and methods to decrease the impacts from underwater noise – this may involve noise abatement technology, pile management strategies etc.[13]

[11] See: http://jncc.defra.gov.uk/pdf/011113_MOD_SNCB_SOI_final.pdf
[12] The advice on boat use only applies to boats doing work on behalf of a Port or Harbour Authority i.e. the risks associated with vessels being used by others needs to be considered by those organisations and individuals and are not the responsibility of the Port or Harbour Authority

Activities considered capable of affecting the proposed protected features	Advice to support management	
	Burrowed Mud	**Minke Whale**
Renewable energy*	**Reduce or limit pressures** Minimise the potential impact of renewable energy development on burrowed mud habitats via the existing licensing process. Early pre-application discussion is recommended and will assist with the identification of the need for any surveys to map habitats to inform siting and design.	**Reduce or limit pressures** Activities associated with renewable energy development that increase the risk of disturbance, acoustic injury, collisions and entanglement of minke whales, such as piling and blasting, mooring lines / anchor lines, should be minimised. Early pre-application discussion is recommended and will assist with the development of key mitigation techniques such as piling strategies etc. [7] Minimise the potential impact of renewable energy development on the habitat of sandeels. Early pre-application discussion is recommended and will assist with the identification of the need for any surveys to map habitats to inform siting and design to minimise the footprint of the activity on sandeel habitat.

[13] JNCC Guidelines for minimising risks of injury from piling and blasting (http://jncc.defra.gov.uk/pdf/jncc_guidelines_piling%20protocol_august%202010.pdf, http://jncc.defra.gov.uk/pdf/JNCC_Guidelines_Explosives%20Guidelines_August%202010.pdf).

Activities considered capable of affecting the proposed protected features	Advice to support management	
	Burrowed Mud	**Minke Whale**
Scientific survey/research*	**Reduce or limit pressures** Minimise the likely effects of scientific surveys where there would be likely to be an impact upon burrowed mud habitats. This should focus on agreeing and adopting best practice.	**Reduce or limit pressures** Pressures associated with scientific acoustic surveys should be minimised through existing best practice measures[14] to ensure that minke whales within the possible MPA are not disrupted between June and October. Survey work that is targeted on minke whales should abide by the SMWWC to reduce or limit the risks of collision and disturbance. If this is not achievable then further discussion and a species licence[15] should be sought from SNH and appropriate mitigation agreed.[16]
Seismic and other broad scale acoustic surveys*	**No additional management required**	**Reduce or limit pressures** Minimise the impact of seismic or other acoustic surveys which may cause injury or disturbance to minke whales through following the JNCC Guidelines for minimising the risk of injury and disturbance to marine mammals from seismic surveys[14].
Wildlife tour operators	**No additional management required**	**Reduce or limit pressures** Reduce risk of collisions with and disturbance of minke whales from boats by following the SMWWC[17] and the WiSe (Wildlife Safe[18]) accreditation scheme.

[14] http://jncc.defra.gov.uk/pdf/jncc_guidelines_seismicsurvey_aug2017.pdf. Note noise abatement technologies and ongoing research may offer alternative mitigation to that mentioned in the guidance.
[15] https://www.nature.scot/professional-advice/safeguarding-protected-areas-and-species/licensing/licensing-forms-and-guidance
[16] Any sampling or tagging of minke whale also requires a Home Office Licence (https://www.gov.uk/guidance/research-and-testing-using-animals).
[17] https://www.nature.scot/professional-advice/land-and-sea-management/managing-coasts-and-seas/scottish-marine-wildlife-watching-code
[18] https://www.wisescheme.org/

Table 3. Activities that are considered not likely to affect the proposed protected features (other than insignificantly)[19]

Activity	Comments
Anchorages and moorings	Although there are various locations used infrequently as anchorage areas in the summer, there are no marked recreational anchorages or moorings within the pMPA.
Discharges – industrial and agricultural	There are two industrial discharge points on the boundary of the pMPA: one at Macduff Harbour and one at Fraserburgh Harbour. Both discharge points are within harbour exclusions zones and are controlled under the Water Environment (Controlled Activities) (Scotland) Regulations 2005 (CAR Regulations). Neither are considered to affect the proposed protected features of the pMPA.
Discharges – sewage	There are numerous sewage outlets along the boundary of the pMPA however all outlets meet SEPA's Compliance Assessment Scheme and hold Controlled Activity Regulations licenses and therefore are not considered to affect the proposed protected features of the pMPA.
Ferry routes	The site boundary overlaps with the Aberdeen to Kirkwall and Aberdeen to Lerwick passenger ferry routes but these are not likely to affect the proposed protected features of the pMPA.
Tourism and recreation	Excluding boat operators offering wildlife tours (covered under 'Wildlife tour operators' in Table 2), tourism and recreation is believed to occur at a level which is not considered likely to affect the proposed protected features of the pMPA.

[19] Only the specific examples of activities listed in the table have been excluded, rather than the broad activity types. New plans or projects will still need to be considered by the relevant competent authority (see Table 2 for further details).

Annex 1. Southern Trench possible MPA Conservation Objectives

The box below provides the high-level Conservation Objective statements. The full Conservation Objectives, which includes site-specific advice and information on the features that form part of this possible MPA, are provided in the tables that follow. These tables are grouped split by feature type, i.e. habitats, species, large-scale features and geomorphology. The site specific advice and information provides more detail in relation to each of the high level Conservation Objective statements for each feature type, e.g. detail on the extent of a habitat within a site and what the supporting features are for a species.

Information is also provided below on how minor changes to features should be considered and the influence of environmental change on features, particularly in relation to climate change for context.

A definition of the terms used is in the Glossary (Annex 2).

A map of the possible MPA, the location of the features and the place names mentioned in the site-specific information is provided in Figure 2.

Southern Trench possible MPA
Protected features(s): Habitats – Burrowed Mud Mobile species – Minke Whale Geomorphological features – Shelf deeps, subglacial tunnel valleys and moraines, slide scars Large-scale features - Fronts
The Conservation Objectives of the Southern Trench possible MPA, are that the protected features • so far as already in favourable condition, remain in such condition • so far as not already in favourable condition, be brought into such condition, and remain in such condition “Favourable condition”, with respect to a marine habitat, means that a) its extent is stable or increasing; and b) its structures and functions, its quality, and the composition of its characteristic biological communities are such as to ensure that it is in a condition which is healthy and not deteriorating. Any temporary deterioration in condition is to be disregarded if the habitat is sufficiently healthy and resilient to enable its recovery from such deterioration. “Favourable condition”, with respect to a mobile species of marine fauna, means that a) the species is conserved or, where relevant, recovered to include the continued access by the species to resources provided by the possible MPA for, but not restricted to, feeding, courtship, spawning or use as nursery grounds;

b) the extent and distribution of any supporting features upon which the species is dependent is conserved or, where relevant, recovered; and
c) the structure and function of any supporting feature, including any associated processes supporting the species within the possible MPA, is such as to ensure that the protected feature is in a condition which is healthy and not deteriorating.

“Favourable condition”, with respect to a feature of geomorphological interest, means that
a) its extent, component elements and integrity are maintained;
b) its structure and functioning are unimpaired; and
c) its surface remains sufficiently unobscured for the purposes of determining whether the criteria in paragraphs (a) and (b) are satisfied.

For the purpose of determining whether a feature of geomorphological interest is sufficiently unobscured under paragraph (3)(c), any obscuring of that feature entirely by natural processes is to be disregarded.

“Favourable condition”, with respect to a large-scale feature, means that
a) the extent, distribution and structure of that feature is maintained;
b) the function of the feature is maintained so as to ensure that it continues to support its characteristic biological communities and their use of the site including, but not restricted to, feeding, spawning, courtship or use as nursery grounds; and
c) the processes supporting the feature are maintained.

For the purpose of determining whether a protected feature is in favourable condition any alteration to that feature brought about entirely by natural processes is to be disregarded.

Interpretation of temporary deterioration in condition (for marine habitats) and consideration of minor changes
For marine habitats any temporary deterioration in condition is to be disregarded if the marine habitat is sufficiently healthy and resilient to enable its recovery from such deterioration. In order to determine what “temporary deterioration” is we must know the longevity of the habitat and timescales involved to enable a habitat (protected feature) to fully recover. Resilience can vary widely between ecosystems and ecological resilience has been defined as "the capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks". It is generally recognised that high biodiversity in a system makes it more resilient to some forms of disturbance. For the other features (mobile, large-scale and geomorphological features) temporary short-term and/or minor changes in the proposed protected features due to human activity may be considered not to compromise the Conservation Objectives and will be considered on a case by case basis. Assessments should consider the timing, duration and scale of the impact on the features and their ability to recover. Factors determining the potential for features to recover following temporary deterioration vary between features. These are described in more detail in Annex 2 ‘‘*Factors determining the potential for features to recover’*.

Environmental change	
The Conservation Objectives recognise and acknowledge that the protected features of the possible MPA (pMPA) are part of a complex, dynamic and multi-dimensional marine environment. Marine habitats and mobile species are exposed to a wide range of drivers of change. This may include changes to habitats or resources that species rely on that reflect their natural cycles and also broader environmental changes, i.e. those related to climate change and environmental variability that are beyond the scope of the pMPA. Any alterations to the proposed protected features that are brought about by entirely by natural processes are to be disregarded when assessing against the Conservation Objectives. In relation to the Southern Trench pMPA and its protected features, the following effects of climate change are relevant as outlined below. These effects should be taken into account when considering plans and projects within Southern Trench pMPA as additional pressures may reduce the protected features resilience to climate change and additionally climate change impacts may start to hinder their ability to recover from human activities.	
Burrowed mud	Burrowed mud communities occur in deep water and are unlikely to be affected by changes in wave exposure and intensity driven by climate change. However any changes in water movements that reach

	these low energy habitats may result in the disruption of feeding, burrowing and reproduction recruitment (Strong *et al*., unpublished). As the dominant species in burrowed mud have planktonic phases, changes in the hydrodynamic regime will influence the distribution and potential viability of the larvae. This, in turn, may modify the connectivity between subpopulations and their long-term viability (Strong *et al.,* unpublished). Ocean acidification may have negative effects on the physiology of the larval stage of species, with larvae of *Nephrops norvegicus* reared under acidified conditions having a larger energetic demand, although this does appear to vary greatly between broods (Wood *et al*., 2015). Based on the required use of calcium carbonate, 'seapens and burrowing megafauna in circalittoral fine mud' has been classified as being moderately sensitive to ocean acidification (Strong *et al*., unpublished). Burrowed muds are thought to have a low sensitivity to local temperature changes due to the feature naturally occurring in the 5°C to 10°C temperature range, though the mud burrowing amphipod (*M. loveni*), is considered to have a high sensitivity (Strong *et al.,* unpublished).
Minke Whale	Climate change is expected to produce a shift in the range of cetacean species. It is expected that cetaceans will track water temperature changes in order to remain within their ecological niches. Ecosystem change involving the loss or the disturbance of megafauna species such as minke whale can lead to alteration in ecosystem functioning (Macleod *et al.*, 2005; Lambert *et al.*, 2011). Environmental variability and climate change have a role to play in determining the stock status of fish that minke whales prey upon. Sea temperature changes and other climate change pressures could result in a change in the abundance and distribution of prey within and outside the site and subsequently affect minke whales using this pMPA.
Fronts	The fronts in this area rely on northern, cold water Fair Isle currents and a warm-water plume extending out from the inner Moray Firth (Tetley, 2004). Climate change may lead to fundamental shifts in oceanic and atmospheric circulation patterns (Harley *et al.,* 2006). Changes in water circulation patterns as well as other effects as a result of climate change e.g. sea level rise and long periods of calm weather could lead to changes in the seasonal mixing of water bodies (Holt *et al.,* 2016, De Dominicis *et al.,* 2018, Beth Scott pers.comm, 2019). Additionally changes in nutrient levels (at shelf edges and from river input) and salinity could alter the levels of plankton productivity which is important for supporting animals higher up the food chain (Wakelin *et al.,* 2015, Beth Scott pers.comm, 2019).The fronts in the pMPA are influenced by freshwater and coastal currents and so these factors may be particularly relevant. The expectation is that the fronts in this pMPA will persist under climate change pressures but the degree to which they may change in their location, stratification (levels of mixing) and associated productivity is unclear.
Shelf Deeps	Shelf deeps are discrete topographic features of the seafloor that will persist in their present form unless exposed by falling sea levels in a future glacial period. Their biological communities, in common with

	those of the surrounding shelf, will potentially be affected by climate-sensitive changes in the hydrography and primary productivity of the overlying water mass. However, the lack of detailed information on the composition of shelf deep communities precludes any specific assessment of longevity.
Quaternary of Scotland (subglacial tunnel valleys and moraines)	As an erosional feature formed by ice over millennia the subglacial tunnel valleys are likely to be highly resistant to climate change. The resilience of the moraines is highly variable and depends upon the composition and level of consolidation of the till. Whilst well-compacted moraines can also be considered highly resistant, those which are poorly consolidated may well be sensitive to large-scale changes in water flow, wave exposure and sedimentation. Such sensitivities constitute a worthy consideration, particularly given that climate change is expected to drive an increase in mean annual maximum wave height and a change in wind speed over the 21st century (Palmer *et al*, 2018).
Submarine Mass Movement (slide scars)	As the slide scars within the Southern Trench were formed largely in bedrock, it is likely that they are mostly resistant to any effects of climate change. Slide scar landforms formed in sediment could be sensitive to large-scale changes in water flow, wave exposure and sedimentation.

HABITATS

Extent		
Feature	**Site specific advice**	**Site specific information**
Burrowed mud	Conserve the current extent and distribution of burrowed mud habitat within the site so that it is stable or increasing.	Within the pMPA the burrowed mud feature is predominantly located along the outer Moray coast, both within and outside the trench between depths of ~ 70 -188 m. From a survey carried out in 2011 the habitat is estimated to cover a total area of approximately 225 km^2 (Hirst *et al*., 2012). Subsequent studies have determined that the habitat is in and around the trench feature (Axelsson *et al*., 2017; Moore *et al*., 2017, 2019). Assessments should focus on activities involving significant abrasion or disruption of seabed sediments, those which may significantly alter local water hydrographic and sedimentary processes and those which may lead to an increase in organic particulate matter in the immediate area.

Structures		
Feature	**Site specific advice**	**Site specific information**
Burrowed mud	Conserve the current physical structure of the burrowed mud. Conserve the three dimensional structure created by fauna and flora (e.g. infaunal burrows created by *Nephrops*) that are associated with this habitat.	The habitat is characterised by stable fine muddy substrates supporting burrowing infauna. In this pMPA it is composed of the biotope 'Seapens and burrowing megafauna in circalittoral fine mud' (SS.SMu.CFiMu.SpnMeg). The burrowing megafauna characteristic of burrowed mud communities are important bioturbators of the sediment they inhabit. This activity creates a three dimensional structure of burrows which increases the structural complexity and depth of oxygen penetration into the sediments. This enhances the survival of smaller species which can live in the burrows and increases biodiversity in what would otherwise be a generally low diversity habitat (Hughes 1998, Widdicombe *et al.,* 2004). Burrowing species such as *Nephrops norvegicus, Pennatula phosphorea*, *Calocaris*

		macandreae, *Callianassa subterranea* and *Goneplax rhomboides* are common within the Southern Trench pMPA. These species are also present alongside other burrowing organisms such as *Virgularia mirabilis* and *Munida* sp. (Hirst *et al*., 2012; Moore, 2017). Assessments should focus on activities which may significantly alter water flow characteristics as well as those involving significant abrasion or disruption of seabed sediments.

Function and quality
The boxes below provide the site specific advice on the '**function of the habitat and its quality'** element of this conservation objective. 'Quality' in this context is taken to mean the processes relevant to the features e.g. water movement, chemical water quality parameters etc., and are referred to as environmental conditions in the table below. Consideration of the functioning of the habitat and supporting environment on which it relies needs to take into account the wider functioning and environmental conditions within this marine area. Southern Trench pMPA surrounds a large, ~200 m deep undersea trench off of the coast on a relatively narrow, shallow area of the inner continental shelf. It is the most topographically complex region in the Moray Firth (Brooks *et al*., 2013). The complex seabed topography creates a range of environmental conditions including enhanced tidal mixing and water column stratification in the spring and summer, which function together to support the habitats and species within the site. Southern Trench pMPA has been assessed as having 'good' or 'high' overall water body status in 2016 in relation to the water body assessments for the Water Environment and Water Services (Scotland) Act 2003. This assessment includes consideration of water chemistry, pollutants, the physical condition of the water body, plant and animal communities, including plankton and the risk from invasive non-native species. There is inter-dependence between the habitats in the Southern Trench pMPA and the surrounding environment, with the habitats providing functions that support the wider environment and the environment providing conditions that support the habitats. Together, the habitats and supporting environment lead to direct and indirect benefits for people. The sections below identify key functions associated with each habitat; different habitats contribute to different functions to different degrees. It is also useful to consider some functions at the scale of the whole site / local ecosystem, such as resilience to invasive non-native species (INNS)

and disease. For example, the combined function of the range of habitats in Southern Trench pMPA is likely to contribute to the ability of the local ecosystem to resist, recover from or adapt to the introduction of a non-native or disease/pathogens.			
Feature	**Site specific advice**		**Site specific information**
Burrowed mud	Conserve the functions provided by burrowed mud and the environmental conditions that support them.	<u>Key functions</u> • Biomass production • Larval/gamete supply (supporting connectivity) • Habitat for other species (supporting biodiversity) • Carbon storage and climate regulation • Nutrient cycling • Waste breakdown and detoxification of water and sediments <u>Environmental conditions</u> • Water movement • Water quality • Coastal processes	Burrowed muds support highly productive infaunal and epifaunal communities which contribute to biomass production. Typical species are described in conservation objective 'Composition of its characteristic biological communities'. Burrowed mud communities also provide an important source of prey for many fish, including the commercial species haddock, cod, skate and dogfish. Burrows and mounds created by the larger burrowing species offer habitat for smaller organisms, which increases the overall diversity of the area (Hughes, 1998). These smaller colonisers benefit from the larger burrowers' irrigation activities which supply both oxygenated water and food, whilst potentially offering refuge from predators. Burrowed mud habitat has a function in larval/gamete supply, which can contribute to connectivity with burrowed mud outside the site. Most of the typical species have a planktonic larval stage and may have a long larval duration and high fecundity allowing larvae/gametes to travel outside the site (Gallego *et al*., 2013). Burrowed mud habitats have the potential for high storage of organic carbon and can have an important contribution to carbon sequestration and climate regulation (Potts *et al*., 2014). The high densities of detritivores, filter feeders and other supported species contained in burrowed mud result in high nutrient cycling and a high capacity for waste breakdown and detoxification. Bioturbation also increases the structural complexity and depth of oxygen penetration of the sediment, allowing more persistent toxins to become locked in deeper layers of mud.

			Maintaining the burrowed mud habitat relies on adequate supply of larval recruits and food (plankton, dissolved and particulate matter) and suitable environmental conditions for growth. Environmental conditions, including water movement patterns and water quality are important in the provision of these requirements. Burrowed mud requires weak tidal streams with good water quality, to maintain the conditions needed for the habitat's survival. The overall condition of Southern Trench pMPA was 'good' or 'high' under the assessment conducted by SEPA for the Water Framework Directive in 2016. The current status of these parameters provides suitable conditions for sustaining the burrowed mud. If any of the environmental conditions were to be significantly altered it could detrimentally affect the function of the burrowed mud. Therefore, the water movement patterns and overall 'good' and 'high' water body status for Southern Trench pMPA should be maintained.

Composition of its characteristic biological communities		
Consideration of characteristic biological communities should not be limited to the list provided below. However it does give an indication of the main species we would expect to be present.		
Feature	**Site specific advice**	**Site specific information**
	Conserve the diversity, abundance and distribution of typical species associated within the burrowed mud (including *Nephrops norvegicus, Pennatula phosphorea*, *Virgularia mirabilis, Goneplax rhomboides*, *Munida sp., Calocaris*	The burrowed mud feature within Southern Trench pMPA is described by the burrowed mud biotope **SS.SMu.CFiMu.SpnMeg.** The most abundant species recorded were *Pennatula phosphorea*, Munida sp., *Calocaris macandreae*, *Callianassa subterranea* and *Goneplax rhomboides* burrows (Hirst *et al*., 2012; Moore, 2017). At a number of locations between 70 - 188 m depth *Pennatula phosphorea* was recorded along with *Virgularia mirabilis*, *Munida* sp. and crustacean burrows, including *Nephrops norvegicus* and *Goneplax rhomboides*. Other species recorded which are characteristic of the **.SpnMeg** biotope included *Pagurus bernhardus*, *Cerianthus lloydii*, *Chaetopterus* sp., *Liocarcinus depurator*, *Asterias rubens* and *Amphiura chiajei* (Hirst *et al*., 2012; Moore, 2017). At one station around 87 m depth the mud-burrowing amphipod *Maera loveni* was also recorded

	macandreae, Callianassa subterranea).	(Hirst *et al*., 2012). Overall the site exhibits a high level of biological diversity with an average Shannon's diversity (H') of 3.5 (range of 3.0 - 4.2) and average species richness of 58.8 per 0.1 m^2 (range of 35 - 95 per 0.1 m^2) (Hirst *et al*., 2012). There is a fairly equal distribution of species across the area (Axelsson *et al*., 2017). Assessments should focus on activities involving significant abrasion or disruption of seabed sediments, those which may significantly alter local hydrographic and sedimentary processes and those which may lead to an increase in organic particulate matter in the immediate area. Temporary or minor changes in the characteristic biological communities due to human activity may be considered not to compromise the Conservation Objectives and will be considered on a case by case basis.

MOBILE SPECIES

Species is conserved		
The boxes below provide the site specific advice on the '*species is conserved'* element of the Conservation Objectives. Information on '*Continued access by the species to resources provided by the MPA for, but not restricted to, feeding, courtship, spawning or use as nursery grounds'* is provided separately below.		
Feature	**Site specific advice**	**Site specific information**
Minke whale	Minke whale in the Southern Trench pMPA are not at significant risk from injury or killing.	This site has been selected primarily on the basis of habitat modelling work showing it consistently supports above average densities of minke whale, backed up by effort-corrected sightings data (Paxton *et al*., 2014). Sightings of minke whale within the pMPA are highest during the months of June to October, however there is evidence that minke whale are present throughout the year, albeit in lower numbers (Robinson *et al*., 2007). This Objective seeks to conserve minke whale by minimising the risk to the animals from injury or killing. For the purposes of the pMPA assessments minke whale are only protected when they are within the site. Any activities that take place within or outside the pMPA that could kill or injure minke whale in the pMPA should be considered in assessments. The interpretation of 'significant' will depend on factors including the scale of the impact, the duration of the activity and measures that are put in place to minimise the risk. An important consideration is whether any killing or injury would result in reduced densities within the site, from which recovery to above average densities cannot be expected. The pMPA complements existing protection of minke whale provided by the European Protected Species legislation (as set out in Regulation 39 of The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended)). This protects minke whale from deliberate and reckless killing and injury – terms are defined in *The protection of marine European Protected Species from injury and disturbance* (Marine Scotland, 2014). Incidental killing and injury is the risk of mortality and injury that remains after mitigation has been put in place through EPS licensing to avoid deliberate and reckless killing and injury. Incidental killing and injury is not covered through the licensing process. Therefore the risk of incidental killing or injury needs to be assessed in relation to the pMPA.

		Assessments for both EPS and the pMPA need to be undertaken for minke whale for relevant activities. Unregulated activities (e.g. not subject to licensing or consenting) should still be considered against this conservation objective.

Continued access by the species to resources provided by the MPA for, but not restricted to, feeding, courtship, spawning or use as nursery grounds.		
Feature	**Site specific advice**	**Site specific information**
Minke whale	Conserve the access to resources (e.g. for feeding) provided by the pMPA for various stages of the minke whale life cycle. ***and*** Conserve the distribution of minke whale within the site by avoiding significant disturbance.	For the purposes of the pMPA assessments any activities, whether they take place within or outside the pMPA, should be considered if they have the potential to reduce access to resources or cause disturbance of minke whale in the pMPA. Resources in this context are their prey, and particular areas of the pMPA or habitats that may be used during feeding and for supporting various stages of their lifecycle. Minke whale are present throughout the site during the whole year but sightings are highest during the late summer months (Paxton *et al.*, 2014). However, the areas within the pMPA which may be more important to the species are not fully understood at present. There are two main ways in which minke whale's access to resources could be restricted and disturbance affected and this is where assessments should be focussed: (i) large-scale physical barriers, or (ii) significant disturbance which alters their distribution within the site or disrupts feeding and other behaviours. • <u>Physical barriers</u> Large-scale physical barriers or obstructions within or outside the pMPA may prevent or restrict access to resources to an extent that may result in significant impacts on stages of their life cycle, including feeding. Large cumulative obstructions perhaps in combination with significant disturbance (discussed below) would be of most concern during more sensitive periods of June to October (Anderwald and Evans 2007).

		• Disturbance Disturbance of minke whale generally arises from activities that cause underwater noise although vessel presence alone may also cause disturbance. Direct responses to disturbance can be physiological and/or behavioural such as reduced surfacing time between dives. Indirect and cumulative responses can also occur, which include decreased reproductive success, stress and the disruption of key activities such as feeding. For example, disturbance to minke whale during feeding may reduce the time spent feeding or cause them to move to different areas that are less profitable for foraging. The type of disturbance, its timing, duration and the area over which minke whale are likely to be impacted are important considerations in any assessment of disturbance. Interpretation of 'significant disturbance' will depend on context, but particular focus should be on cumulative disturbances from multiple or repeated activities that prevent or restrict natural behaviours occurring without interruption. It should be interpreted to mean disturbance that affects the distribution of minke whale within the site such that recovery cannot be expected. Effects of activities lasting beyond the average generation time of minke whale are more likely to constitute significant disturbance. 'Significant disturbance' may result in the following effects: • contributes to long term decline in the use of the site by minke whale. • changes to the distribution of minke whale on a continuing or sustained basis. • changes to the behaviour such that it reduces ability of the species to feed efficiently, breed or survive. In addition to this, the disturbance of minke whale is also covered by the European Protected Species legislation and is defined in *The protection of marine European Protected Species from injury and disturbance* (Marine Scotland, 2014). Assessments for EPS licensing still need to be undertaken for relevant activities in addition to the assessment for the pMPA. Unregulated activities (e.g. not subject to licensing or consenting) should still be considered against this conservation objective.

Extent and distribution of any supporting feature and Structure and function of any supporting feature, including any associated processes supporting the species		
Feature	**Site specific advice**	**Site specific information**
Minke whale	Conserve the extent and distribution of any supporting feature upon which minke whale is dependent. ***and*** Conserve the structure and function of supporting features, including processes to ensure minke whale are healthy and not deteriorating.	The pMPA provides good foraging habitat and it may also be used for other parts of their life cycle (Robinson *et al.,* 2007*)*. Our understanding of the supporting features for minke whale within the site is currently limited, but these include their prey species and the habitats that support these. Assessments should focus on activities with the potential to significantly alter the hydrography and those activities that affect the composition of the substrate, e.g. hydraulic dredging, aggregate extraction and dumping (ICES 2016, 2018). These activities are most likely to affect species composition, abundance or concentration of prey species available to minke whale. <u>Prey species</u> Minke whales are known to take a wide range of pelagic shoaling small fish species and the main prey species are the lesser sandeel (*Ammodytes marinus*), sprat (*Sprattus sprattus*), herring (*Clupea harengus*) and mackerel (*Scomber scombrus*) (Anderwald and Evans, 2007). Minke whales are sensitive to prey depletion but the extent to which they are able to respond to reductions in prey availability is not well known. Minke whales could switch to other prey species or move to alternative foraging areas. However the degree to which this is possible may be limited by the availability of suitable alternative prey depending on the time of year and other foraging areas may be less profitable. Therefore the effects of prey depletion within the pMPA are likely to be negative. Consequently, pressures affecting the availability of prey fish are an important consideration. The biology of these fish populations occurs at a scale that is larger than the site itself and therefore management of fisheries is considered in relatively large units (e.g. ICES area IVa and IVb, northern and central North Sea for sandeels). Any future

		management of these fisheries should take account of their importance as prey for minke whale in setting take limits (as currently achieved through ICES advice for other species). <u>Supporting habitats and processes</u> The precise extent and distribution of minke whale prey and supporting habitats within the pMPA are unknown. However, the condition of the seabed inhabited by the main prey species for minke whale and the presence of fronts are important (see Fronts Conservation Objectives). Studies in the southern outer Moray Firth found minke whale distribution was positively correlated with areas of sandy-gravel sediments which represent suitable sandeel habitat (Robinson, Tetley and Mitchelson, 2009). Sandeels utilise coarse sand with low silt content (between depths of 20 and at least 80m (MacLeod *et al.,* 2004) and may use these areas all year (Holland *et al.,* 2005, Wright *et al.,* 2000). Herring are demersal spawners and lay their sticky eggs directly onto the seabed, with a preference for areas of coarse sand, gravel, shells and small stones in high-energy gravel-rich environments. They tend to aggregate around their spawning grounds for some time before spawning (Maravelias *et al*., 2000). Fronts support enhanced biological activity via elevating primary and secondary production and are likely to be important for sandeels (van der Kooij *et al.* 2008) that minke whale feed on. The distribution of herring, particularly pre-spawning aggregations, are also correlated with zooplankton-rich waters associated with frontal zones in the northern North Sea (Kiorboe and Johansen, 1986, Maravelias and Reid, 1997). Further information on fronts and its Conservation Objectives are covered separately and should be considered alongside the information presented here. Activities with the potential to cause significant degradation or abrasion of these seabed habitats may result in the local depletion of these prey species (ICES 2003, 2015) and ultimately affect minke whale using the site. Therefore, relevant activities (e.g. hydraulic dredging, aggregate extraction, dumping) should be considered within assessments for this feature and pMPA (ICES 2016, 2018).

GEOMORPHOLOGICAL FEATURES

(a) Extent, component elements and integrity		
Feature	**Site specific advice**	**Site specific information**
Quaternary of Scotland - *Subglacial tunnel valleys and moraines*	Conserve the feature's extent, component elements and integrity of the Quaternary of Scotland feature.	Component elements refers to the landforms which make up the feature, namely subglacial tunnel valleys and moraines, whilst integrity relates to the collective assemblage of these landforms and their inter-relationships. The Southern Trench subglacial tunnel valleys are a series of basins and valleys. The feature is >58 km in length, has a maximum depth of at least 250 m and has a total seabed area below 100 m water depth of ~550 km^2 (Bradwell *et* al., 2008; Holmes *et al*., 2004). The valleys generally trend west to east although there are smaller tributary valleys perpendicular to this orientation. Moraines are interspersed within this tunnel valley system and also occur at shallower depths further east, to the north and east of Peterhead. Having been created by highly erosional processes, the subglacial tunnel valleys are characterised by erosion resistant geology (Summerfield, 1991). As a result they are considered to be highly resistant to human activities and are either considered not sensitive or to have a low sensitivity to pressures arising from human activities. A loss in the extent, component elements or integrity is therefore not anticipated. Moraines are relict features that are composed of glacial till. Their resistance to erosion is highly variable and depends upon the composition and level of consolidation of the till. Assessments should focus on activities which may significantly alter water flow characteristics as well as those involving significant abrasion or disruption of seabed sediments. A consideration of the scale of the impact or activity in relation to individual component elements and to the full feature should also be be undertaken in assessments in order to conserve the integrity of the feature.
Submarine Mass	Conserve the feature's extent,	Component elements refers to the landforms which make up the feature, namely slide scars, whilst integrity relates to the collective assemblage of these landforms and their

Movement - *Slide scars*	component elements and integrity of the submarine mass movement feature.	inter-relationships. Slide scars within the pMPA delineate areas where large volumes of bedrock and sediment have moved downslope as part of submarine mass movement processes. They are found on or below the steep sided flanks of the subglacial tunnel valleys. Slide scars are a relict feature and, depending on the material they are formed in, can have a medium sensitivity to physical removal, changes in tidal flow, or activities causing obscuring. Assessments should focus on activities which may significantly alter water flow characteristics as well as those involving significant abrasion or disruption of seabed sediments. A consideration of the scale of the impact or activity in relation to individual component elements and to the full feature should be undertaken in assessments to conserve the integrity of the feature.

(b) Its structure and functioning are unimpaired		
Feature	**Site specific advice**	**Site specific information**
Quaternary of Scotland - *Subglacial tunnel valleys and moraines*	Conserve the structure and functioning of the feature so that they are unimpaired.	Structurally, the Quaternary of Scotland feature is cut through both Quaternary deposits and the underlying bedrock. The sides of subglacial tunnel valleys slope at up to >50°, with gradients commonly in the range of 6 - 22°. Arcuate scarps on the south wall have steep slopes of 50° or more in areas of seabed slumping (Bradwell *et al*., 2008). The moraines are composed of glacial till, i.e. poorly sorted boulders, gravels, sands and clays and are of variable consolidation. Subglacial tunnel valleys may offer some form of passive sediment stabilisation. In its entirety the feature also has a function of 'scientific importance' for furthering our understanding of ice sheet drainage (Brooks, 2013; Stoker *et al*., 2009). This is largely due to the feature being one of the largest and best preserved examples of an enclosed glacial seabed basin in UK waters. The feature's function of sediment stabilisation is likely to be robust, whilst it's function for scientific importance may be impaired by activities which are detrimental to its extent, component elements and integrity, as set

		out above under (a). Assessments should therefore focus on activities which have the potential to significantly alter water flow characteristics as well as those involving significant abrasion or disruption of seabed sediments.
Submarine Mass Movement - *Slide scars*	Conserve the structure and functioning of the feature so that they are unimpaired.	Structurally slide scars consist of relatively steep bedrock failure surface(s), transitioning downslope to large-scale accumulations of sediment. Slide deposits can consist of coherent bedrock blocks, some of which can be very large, mixed with debris flow deposits and with turbidites (Gordon *et al*., 2013). The structure of the feature is considered to have a medium sensitivity to physical removal, changes in tidal flow, or activities causing obscuring. Having already slumped or slid the structure of the Submarine Mass Movement feature is considered stable (Holmes, 2004). The slide deposits may however be sensitive to activities causing sub-surface abrasion/ penetration of the seabed, as well as water flow (tidal current changes). Given its static and relict status, the Submarine Mass Movement feature has few active functions. In its entirety the feature has a function of 'scientific importance' for furthering the identification of slope areas which could experience future slide events, potentially putting marine infrastructure and adjacent coastlines at risk (Brooks, 2013; Stoker *et al*., 2009). The feature's function of scientific importance may be impaired by activities which are detrimental to its extent, component elements and integrity, as set out above under (a). Assessments should therefore focus on activities which have the potential to significantly alter water flow characteristics as well as those involving significant abrasion or disruption of seabed sediments.

(c) Its surface remains sufficiently unobscured for the purposes of determining whether the criteria in paragraphs (a) and (b) are satisfied.		
Feature	**Site specific advice**	**Site specific information**
Quaternary of Scotland - *Subglacial tunnel valleys and moraines*	Conserve the surface of the feature so that it remains sufficiently unobscured for the purposes of determining whether the criteria in conservation objectives (a) and (b) are satisfied.	Assessments should focus on whether the activity or development has the potential to significantly obscure the surface of the *subglacial tunnel valleys and moraines* to the extent that conservation objectives (a) and (b) could not be fully assessed. Whilst the feature as a whole is of a size which is unlikely to be obscured, assessments should consider the degree to which any of the component landforms, might be obscured. This will vary greatly according to the size and nature of the component elements concerned. Therefore the type of data and/or assessment required will vary likewise.
Submarine Mass Movement - *Slide scars*	Conserve the surface of the feature so that it remains sufficiently unobscured for the purposes of determining whether the criteria in conservation objectives (a) and (b) are satisfied.	Assessments should focus on whether the activity or development has the potential to significantly obscure the surface of the *slide scars* to the extent that conservation objectives (a) and (b) could not be fully assessed. Whilst the feature as a whole is of a size which is unlikely to be obscured, assessments should consider the degree to which any of the component landforms might be obscured. This will vary greatly according to the size and nature of the component elements concerned. Therefore the type of data and/or assessment required will vary likewise.

LARGE-SCALE FEATURES

Extent, distribution and structure		
Feature	**Site specific advice**	**Site specific information**
Fronts	Conserve the extent, distribution and structure of fronts.	The fronts within this pMPA are determined by a pronounced thermal gradient as well as tidal currents and salinity. The structure of the front varies both spatially and temporally primarily because the strength of the thermal gradient can vary on a seasonal and annual basis. The pMPA encompasses an area where fronts are expected to be present year round. The extent of the front corresponds to a relatively narrow, shallow, inner shelf area that is associated with enhanced tidal mixing (Miller *et al*., 2014). As this feature varies spatially and temporally, this extent represents a proportion of the overall extent and distribution of the wider fronts feature in the pMPA. For example, in spring and summer, stratification driven by summer warming generates additional surface thermal fronts which extend over a much wider area. Although most prevalent and widespread in the summer months, frontal mapping indicates the persistence of a front close to the coastline throughout winter. As tidal currents run parallel to the coastline, it is likely that freshwater outflow from rivers contribute to stratification of the water column and the production of the thermal gradient. Assessments should focus on activities that may cause changes in hydrography (water flow). Activities (such as marine energy production or other large-scale development), have potential to cause changes to either water flow (Cox *et al.,* 2018, De Dominicis *et al.,* 2018) could have implications for the extent, distribution and structure of the feature within the pMPA and should be considered on a case-by-case basis.
Shelf deeps	Conserve the extent, distribution and structure of the shelf deeps feature.	The Southern Trench shelf deep is the longest of a series of closed basins in the outer Moray Firth. This feature is >58 km in length, has a maximum depth of at least 250 m and has a total seabed area below 100 m water depth of ~550 km^2. The sides of the shelf deeps vary in slope from horizontal on the trench axis to >50° on the flanks, with gradients commonly in the range of 6 - 22°. Arcuate scarps on the south wall have steep

		slopes of 50° or more in areas of seabed slumping. Sediments in the shelf deeps are well- to moderately-sorted muddy and sandy sediments with low carbonate content and a modal grain size of ~200 µm (Bradwell *et* al., 2008; Holmes *et al*., 2004). The extent, distribution and structure of the shelf deeps are considered to be robust and are either considered not sensitive or to have a low sensitivity to pressures arising from human activities.

Function of the feature is maintained so as to ensure that it continues to support its characteristic biological communities and their use of the site including, but not restricted to, feeding, spawning, courtship or use as nursery grounds			
Feature	**Site specific advice**		**Site specific information**
Fronts	Conserve the function of the fronts feature so as to ensure that it continues to support its characteristic biological communities and their use of the site including, but not restricted to, feeding, spawning, courtship or use as nursery grounds.	<u>Key functions:</u> • Biomass production • Habitat for other species (supporting biodiversity) •Larvae/gamete supply (supporting connectivity) Formation of physical barrier • Nutrient cycling	The key functions of fronts are of particular importance within the pMPA but also to the wider marine environment. Fronts cause elevated and concentrated nutrients which in turn concentrate zooplankton-rich waters (Kiorboe and Johnson, 1986; Maravelias and Reid, 1997) attracting fish and predators such as minke whale and birds. For example, the early life stages of fish including sandeel larvae have been associated in waters near haline fronts elsewhere in the North Sea (Munk *et al.* 2002). A high concentration of prey in the site underpins the use of the site by minke whales in the summer season when the animals can build up sufficient energy reserves to enable them to migrate to winter breeding grounds (SNH, 2012). Additionally the distribution of minke whale has been related to the presence of warm water plumes extending out of the inner firth (Tetley *et al*., 2008), which are thought to generate increased productivity. Fronts also support larval and gamete supply and transport by providing connectivity at various stages of species' life histories, facilitating transport of larvae to suitable habitats elsewhere and retaining larvae as prey for other species. Fronts can act as a physical barrier, for example the sharp temperature changes at fronts may provide migration corridors for some species or act as transport routes

			for nutrients and sediment. The gradient may also delineate boundaries for some species or result in retention of nutrients, sediment or planktonic species. Fronts may also lead to separation and/ or influence local recruitment, for example where they result in areas of retention (Hill *et al*., 2008). Fronts also enable the circulation and transport of nutrients and oxygen from primary production. Activities that have potential to cause substantial changes to either water flow could have implications for the various functions of the fronts feature within the pMPA and therefore effects on the species that depend on it (Cox *et al.,* 2018). Assessments should focus on those areas where persistent thermal fronts form and the warm water plumes. Most human activities are considered unlikely to cause significant risk of impact on the fronts feature within the pMPA. However very large-scale activities e.g. underwater turbines may affect tidal velocities and mixing by removing tidal energy (De Dominicis *et al*., 2018) and this may have knock on effects potentially causing changes to the fronts and their associated biological communities.
Shelf deeps	Conserve the function of the shelf banks and mounds feature so as to ensure that it continues to support its characteristic biological communities (in particular burrowed mud).	<u>Key functions</u> • Biomass production • Habitat for other species (supporting biodiversity) • Carbon storage and climate regulation • Sediment stabilisation	Like the majority of shelf deeps, the Southern Trench is a depositional sink for fine sediments (Murray, 2004). Sediments within the trench are largely composed of burrowed mud, a habitat which supports highly productive infaunal communities and notable epifaunal communities. Characteristic species are described in conservation objective 'composition of its characteristic biological communities' section above. Burrowed mud communities also provide an important source of prey for many fish, including commercial species such as haddock, cod, skate and dogfish. The fine sediments that accumulate in shelf depressions will also play a role in carbon storage and climate regulation because burrowed mud habitats have high sequestration rates for organic carbon. Furthermore, the shelf deep is a low energy environment that draws down sediment where it settles, stabilises and largely remains.

			The functions described above are dependent on the low intensity of water movement present within the shelf deep, which enables the settlement of fine sediments. These functions are therefore likely to be sensitive to activities leading to large changes in water movements that affect the shelf deep. Assessments should focus on activities which may significantly alter water flow characteristics as well as those involving significant abrasion or disruption of seabed sediments. A consideration of the scale of the impact or activity in relation to each individual function should be a key component of any assessment.

Processes supporting the feature		
Feature	**Site specific advice**	**Site specific information**
Fronts	Conserve the processes which support the fronts feature, in particular current patterns, freshwater input and local topography.	The underlying processes influencing the overall extent and distribution of the fronts feature in the Southern Trench are not fully understood. It is however likely that wider oceanic current patterns, tidal currents, freshwater input and local topography are important processes supporting fronts in this MPA. The wider oceanic currents supporting the fronts feature are an extension of the northern, cold water Fair Isle currents and a warm-water plume extending out from the inner Moray Firth (Tetley, 2004). These currents are known to vary seasonally and temporally due to variations in the degree of Atlantic water inflow to the North Sea, the volume of freshwater runoff, as well as wind and tide. Within some parts of the pMPA tidal speeds are very fast, flowing at a rate of up to ~1 ms^{-1}. These high speeds help to drive the formation of a tidal front, the presence of which is most evident during summer. It is also likely that the front is influenced by freshwater run off. This is because tidal currents running parallel to the coast typically spread freshwater along the coast, resulting in an overlying cap of freshwater lying above denser, more saline water masses which in turn influences stratification and the formation of the fronts feature. Activities such as marine energy production or other large-scale development with

		the potential to substantially alter tidal flow could affect fronts within the pMPA and the functions provided (Cox *et al.,* 2018, De Dominicis *et al.,* 2018). However, most pressures associated with human activity in the marine environment are currently considered unlikely to pose a significant risk to the fronts feature within the pMPA.
Shelf deeps	Conserve the processes which support the shelf deeps feature, particularly deep water currents.	Having been originally formed by glacial scouring over hundreds of thousands of years during periods of lower sea level, the processes which shaped the shelf deeps feature are relict. However as a topographically enclosed depression in the seabed the feature is maintained to some extent by deep water currents. These currents are of variable velocity and deposit sediments on the sides of the trench as opposed to its main axis. Should such currents be altered it is likely that the sediment characteristics of the shelf deeps may be altered (Holmes *et al.,* 2004). Assessments should focus on activities which may significantly alter water flow characteristics within or nearby the shelf deep to ensure that the process of active sediment supply and removal is conserved.

Annex 2. Supporting information

Factors determining the potential for features to recover

Burrowed mud
Recovery is dependent on the physical presence and structure of the habitat and its colonisation by burrowing fauna. Edwards and Moore (2008) examined the reproduction of the seapen *Pennatula phosphorea* which may have a prolonged residence in the planktonic phase, resulting in greater dispersal and recovery potential. Newell *et al*., (1998) examined benthic macrofauna following dredging operations. Recovery ranged from 1-3 years in areas of high current velocity and 5-10 years in areas of low current velocity. Dernie *et al*., (2003) also found that communities from muddier habitats had the slowest physical and biological recovery rates when compared to habitats dominated by coarse sediments. These findings were also found earlier by the meta-analysis undertaken by Collie *et al*., (2000). Macleod *et al*., (2004) examined the recovery of a soft mud sediment habitat following the removal of fin fish aquaculture cages and the cessation of associated organic enrichment. Benthic data for the site indicated an impacted community even 36 months after the removal of the fish cages. The recovery of burrowed mud depends on the type of initial impact and to what extent that pressure is removed during the recovery phase.

Minke whale
Like other cetaceans, minke whale is long-lived and slow to reach maturity. Minke whale generation time is 22.1 years and their population growth rate is 0.09 (Taylor *et al.* 2007). Factors that may limit minke whale recovery include the timing and duration of the activity, with the summer months in particular being a sensitive time, the ability of minke whale to access sufficient food, the size of the area of restricted access and any additional cumulative factors such as significant disturbance.

Fronts
As a large-scale dynamic feature the recoverability of front within the pMPA is likely to occur on the same or similar spatial and temporal scale as wider oceanic current patterns. Although variable on a seasonal and annual basis, large-scale oceanic current patterns are very stable and therefore the recovery potential of the fronts feature is likely to be high if these current patterns persist.

Shelf deeps
The processes which formed the component elements of the Quaternary of Scotland geodiversity feature no longer exist and therefore the feature has no recovery potential.

Quaternary of Scotland (subglacial tunnel valleys and moraines)
The processes which formed the component elements of the Quaternary of Scotland geodiversity feature no longer exist and therefore the feature has no recovery potential.

Submarine Mass Movement (slide scars)
The processes which formed the component elements of the Submarine Mass Movement geodiversity feature no longer exist and therefore the feature has no recovery potential.

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Glossary for Conservation Objectives

Conservation Objective term	Definition
Composition of characteristic biological communities	This should include a reference to the diversity and abundance of species forming part of, or inhabiting, that habitat. In particular this includes those species that are especially relevant to the habitat's definition, e.g. species that form the structure of a bivalve bed, or sea pens on burrowed mud. In ecological terms, "community composition" means the number and abundance of flora and fauna included in the habitat. This is also referred to as biodiversity - the variety of life in a particular habitat.
Extent (and distribution)	The "extent" of a feature is the total area that it covers. This should also include consideration of the "distribution" i.e. how it is spread out within the MPA. A feature could be continuous and contained within one area, dispersed in smaller patches over a wider area, or as a mosaic with other habitats/features. Indeed, it could also be a combination of these.
Favourable condition	Favourable condition for each protected feature type for NC MPAs is defined in the box at the start of Annex 1 which summarises the conservation objectives for the site.
Function	The habitat must be able to be maintained in terms of the growth and reproduction of the habitat-forming species (e.g. through self-recruitment of larvae) and also help to maintain the provision of essential ecosystem services that the habitat provides. The text within the supplementary advice explains function in relation to both of these factors for the feature concerned where information is available.
Integrity (geodiversity)	For geodiversity features, integrity is the way the component elements make up the full extent of the feature. Integrity relates to the relationship between the component elements, where the whole is greater than the sum of the parts. In other words integrity refers to the full assemblage of component elements.
Quality / Processes	Quality outlines the processes relevant to the habitat/feature and include but are not limited to hydrography and supporting water currents, chemical water quality parameters, suspended sediment levels, radionuclide levels.
Supporting environment	This includes the following environmental conditions (but is not limited to) which are important for maintaining/restoring the protected features, e.g. hydrography and supporting water currents, chemical water quality parameters, suspended sediment levels, radionuclide levels.
Structure	The structure of a habitat/feature includes what it is created from and what it requires to exist, e.g. habitat forming species, geological features or sediment; the depth of the substrate or thickness or height of the biogenic structures from the seabed; biogenic material forming the structure should still retain a live component where this exists at baseline.