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Conservation and Management Advice

NORTH EAST LEWIS POSSIBLE MPA

JUNE 2019

DRAFT

This document provides advice to Public Authorities and stakeholders about the activities that may affect the protected features of North-east Lewis possible Marine Protected Area (pMPA). It provides advice from Scottish Natural Heritage (SNH) under Section 80 of the Marine (Scotland) Act 2010 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

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Contents

1 Overview of document

This document provides details of the Conservation and Management Advice for North-east Lewis possible Marine Protected Area (pMPA) and it is divided into eight main sections. The introduction in section 2 gives an overview of North-east Lewis 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 North-east Lewis pMPA has been selected to protect two biodiversity features: Risso's dolphins and sandeels[1] as well as two geodiversity features: Quaternary of Scotland and Marine Geomorphology of the Scottish Shelf Seabed. 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 North-east Lewis pMPA is to conserve the protected features in favourable condition. This is makes a contribution to the OSPAR MPA network in the North-East Atlantic.

2.2 Conservation benefits

North-east Lewis pMPA provides conservation benefits by affording protection to Risso's dolphins, sandeels and two geodiversity features. In summary the conservation benefits of this designation are:

- To protect Risso's dolphin in one of only two locations in the UK where they are recorded in high numbers.
- Maintenance of a high density of sandeel larvae with significant potential to export larvae beyond the boundary of the MPA to other grounds on the north-west coast of Scotland.
- Conservation of sandeel aggregations which represent an important food source for a wide range of marine predators.
- Preservation of the site's geodiversity features for their functional links with sandeel grounds and their importance for our understanding of climate change.

[1] Note that this includes more than one species of sandeel. Both *A. marinus* and *A. tobianus* have been recorded within the pMPA.

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 North-east Lewis 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 North-east Lewis pMPA are described in Annex 1 as part of the site's Conservation Objectives. 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.

The North-east Lewis pMPA encompasses an area of sea where the Minch meets the Atlantic Ocean. In terms of resources the sea of this area is home to a range wildlife including fish, birds and mammals, most notably Risso's dolphin and sandeels which are proposed as protected features of the site. The seabed landforms that make up the geodiversity features provide the necessary substrate for fish and shellfish throughout the pMPA, including sandeels, which in turn are an important prey resource that support marine wildlife in the area.

Within the pMPA a range of benefits can be derived from the natural resources. The combination of stunning seascapes and wildlife contributes towards benefits such as tourism and recreation, nature watching and health and well-being. Activities such as whale and dolphin watching, sailing and kayaking are particularly popular in and around the pMPA, all of which allow locals and visitors to spend time connecting and enjoying nature. At a much wider scale, the glaciated channels/ troughs, landscape of areal glacial scour and mega-scale glacial lineations that 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 highly relevant to future predictions.

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 pMPA 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.

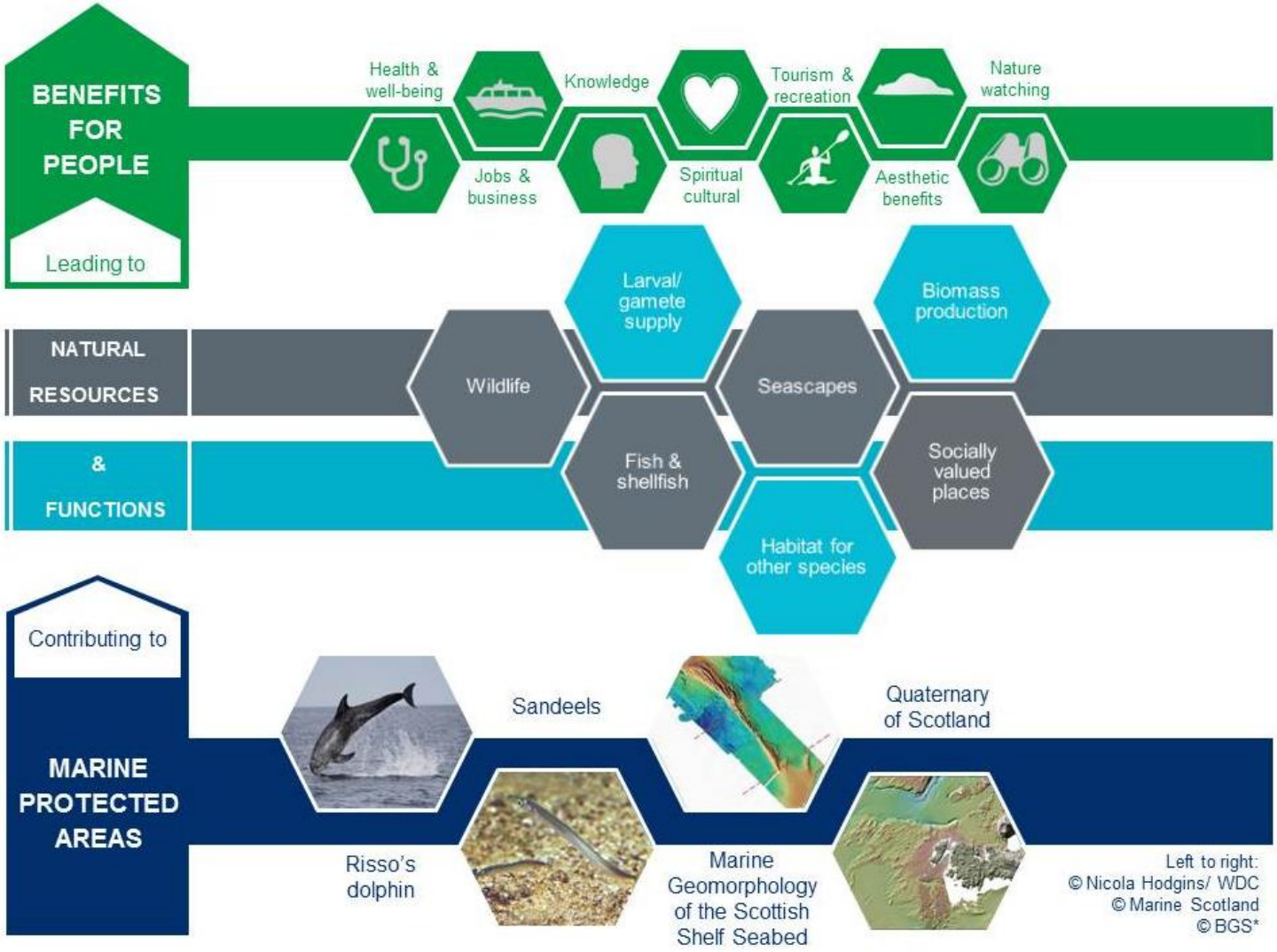


Figure 1 *Benefits to people associated with protected features of the North-east Lewis pMPA.*
*Imagery prepared by the British Geological Survey, with bathymetry data provided courtesy of the Maritime and Coastguard Agency's UK Civil Hydrography Programme © Crown copyright.

2.4 Community aspirations

This section will be completed in the future following discussions with communities that come through the MarPAMM project[2] in the Outer Hebrides.

2.5 Contribution to policy commitments

Managing this pMPA to conserve Risso's dolphins, sandeels and the two geodiversity features: Quaternary of Scotland and Marine Geomorphology of the Scottish Shelf Seabed, 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.
- Progress towards achieving Good Environmental Status in relation to biological diversity, marine food webs, underwater noise and seafloor integrity.
- The protection, enhancement and health of the marine area under the Marine (Scotland) Act.
- 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 the North-east Lewis 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 gives Scottish Natural Heritage (SNH) 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 pMPAs, how the conservation objectives of the site may be furthered or their achievement hindered and how the effects of activities on pMPAs 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 the North-east Lewis 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.

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.

[2] http://www.mpa-management.eu/

4 Protected features and status

The North-east Lewis pMPA has been selected to become part of Scotland's pMPA 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 North-east Lewis 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[3].

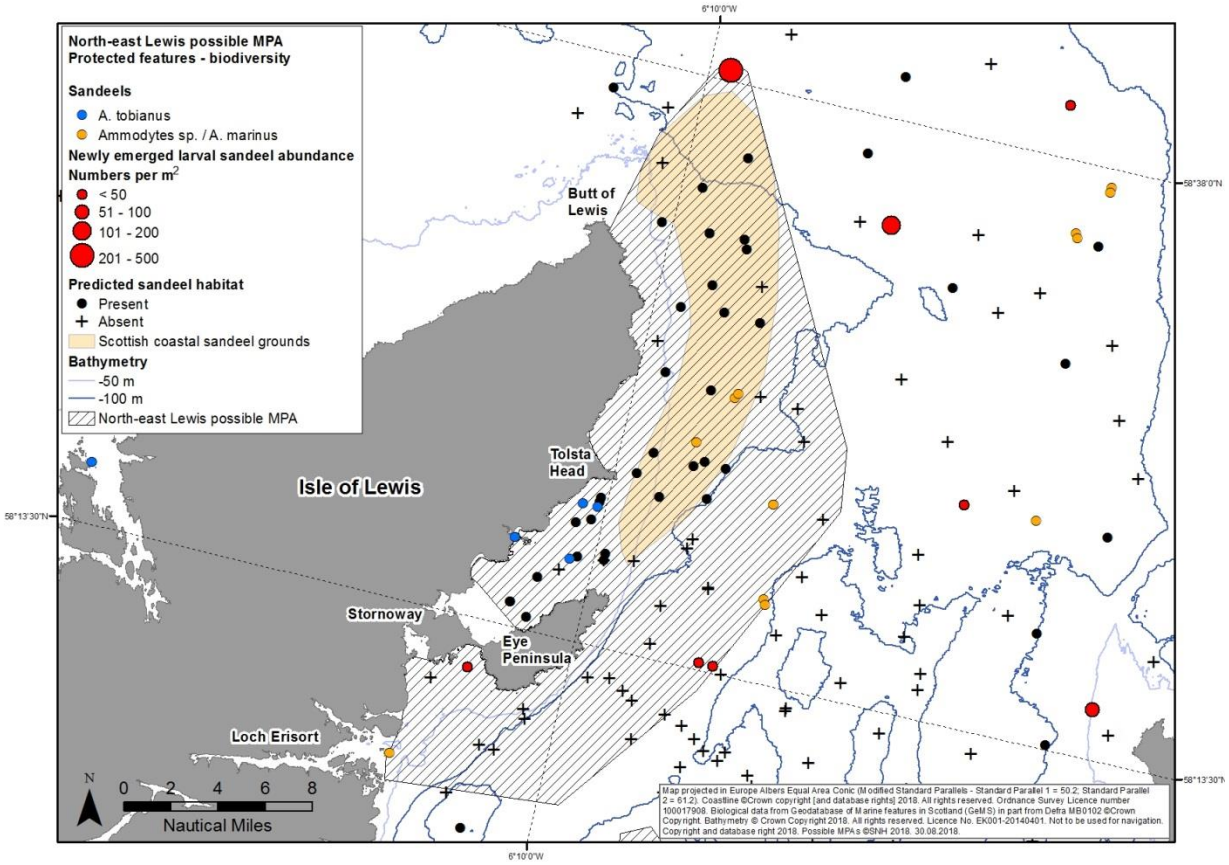
Table 1. Protected features and condition for the North-east Lewis pMPA. Feature condition refers to the condition of the protected feature assessed at a site level. Broader conservation status is the overall condition of the feature throughout its range as outlined by the footnotes.

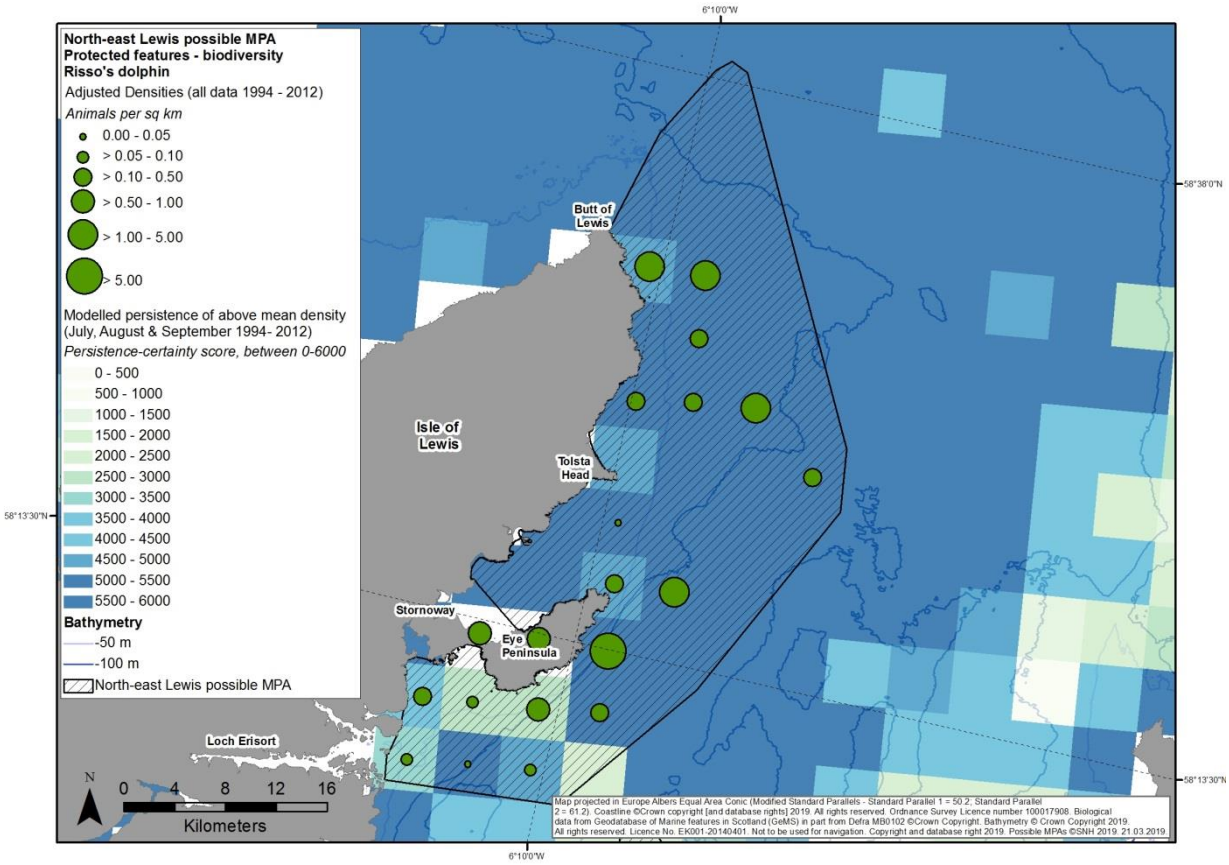
Protected Features	Feature condition	Assessment date	Broader conservation status
Risso's dolphin	Favourable	2019	UK: Unknown European Region: Unknown*
Sandeels	Favourable[4]	2019	N/A[#]
Quaternary of Scotland	Favourable	2019	N/A
Marine Geomorphology of the Scottish Shelf Seabed	Favourable	2019	N/A

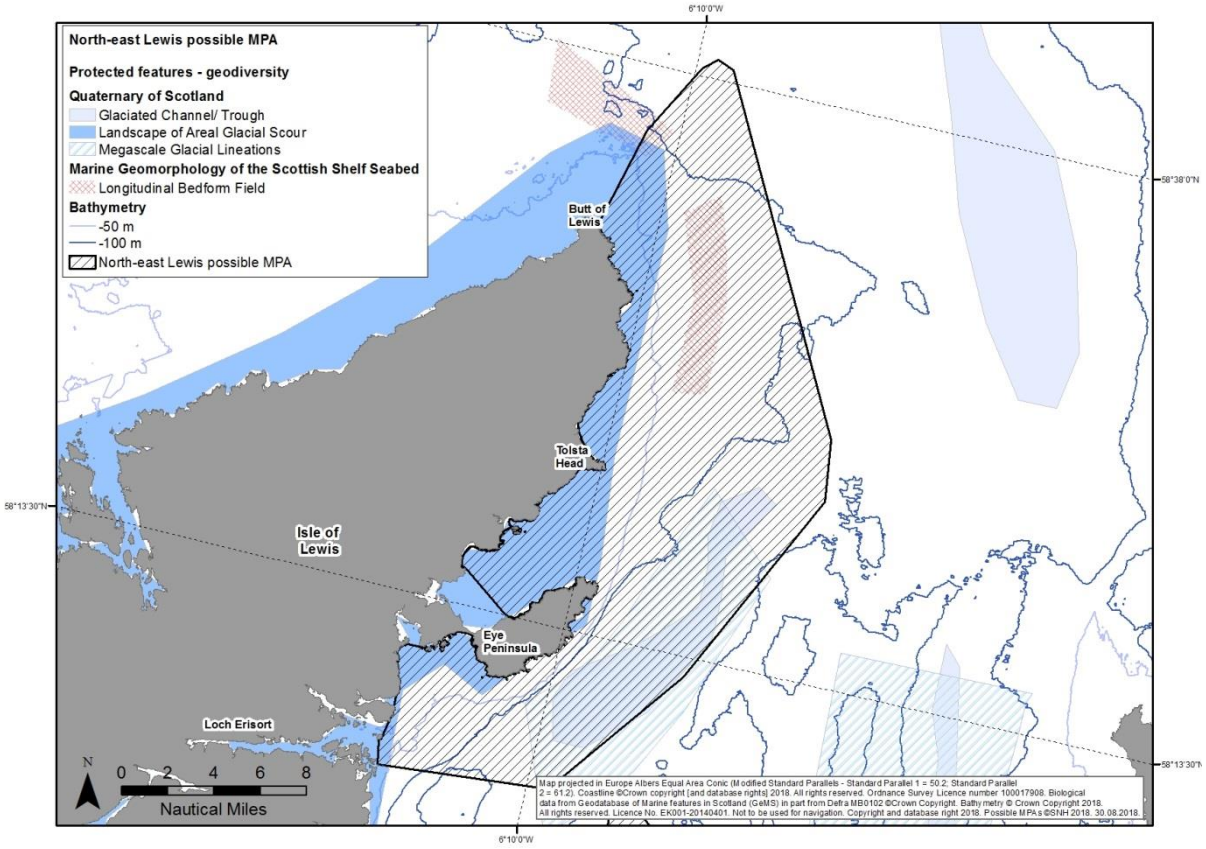
* For Risso's dolphin this is their Favourable Conservation Status for the UK and the Marine Atlantic Biogeographic Region (MATL) in Europe as reported under Article 17 of the Habitats Directive in 2013. Note there is an update to this due in 2019.
[#]For sandeels this is their stock and exploitation status as reported by ICES for the Celtic Seas Ecoregion in Division 6.a (West of Scotland) but this is currently unknown due to inadequate data to evaluate the stock.

Figure 2 *Location of the North-east Lewis pMPA and distribution of the proposed protected features*

[3] https://marinescotland.atkinsgeospatial.com/nmpi/
[4] This has been judged to be favourable because a conserve conservation objective has been set for this feature in the pMPA (see section 5.2). However this is an assumption as there have been no specific surveys in the site, there have been no landings and there is inadequate data from ICES VIa.


North-east Lewis possible MPA
Protected features - biodiversity
Sandeels
A. tobianus
Ammodytes sp. / A. marinus
Newly emerged larval sandeel abundance
Numbers per m2
< 50
51 - 100
101 - 200
201 - 500
Predicted sandeel habitat
Present
Absent
Scottish coastal sandeel grounds
Bathymetry
-50 m
-100 m
North-east Lewis possible MPA
Butt of Lewis
Isle of Lewis
Tolsta Head
Stornoway
Eye Peninsula
Loch Erisort
0 2 4 6 8
Nautical Miles
6°10'0"W
58°38'0"N
58°13'30"N


North-east Lewis possible MPA
Protected features - biodiversity
Risso's dolphin
Adjusted Densities (all data 1994 - 2012)
Animals per sq km
0.00 - 0.05
> 0.05 - 0.10
> 0.10 - 0.50
> 0.50 - 1.00
> 1.00 - 5.00
> 5.00
Modelled persistence of above mean density
(July, August & September 1994- 2012)
Persistence-certainty score, between 0-6000
0 - 500
500 - 1000
1000 - 1500
1500 - 2000
2000 - 2500
2500 - 3000
3000 - 3500
3500 - 4000
4000 - 4500
4500 - 5000
5000 - 5500
5500 - 6000
Bathymetry
-50 m
-100 m
North-east Lewis possible MPA
Butt of Lewis
Isle of Lewis
Tolsta Head
Stornoway
Eye Peninsula
Loch Erisort
0 4 8 12 16
Kilometers
6°10'0"W
58°38'0"N
58°13'30"N


North-east Lewis possible MPA
Protected features - geodiversity
Quaternary of Scotland
Glaciated Channel/ Trough
Landscape of Areal Glacial Scour
Megascale Glacial Lineations
Marine Geomorphology of the Scottish Shelf Seabed
Longitudinal Bedform Field
Bathymetry
-50 m
-100 m
North-east Lewis possible MPA
Butt of Lewis
Tolsta Head
Isle of Lewis
Eye Peninsula
Loch Erisort
N
0 2 4 6 8
Nautical Miles
6°10'0"W
58°38'0"N
58°13'30"N
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 rights] 2018. 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 2018. All rights reserved. Licence No. EK001-20140401. Not to be used for navigation. Copyright and database right 2018. Possible MPAs ©SNH 2018. 30.08.2018.

5 Conservation objectives

5.1 Background

Conservation objectives set out the desired quality of the protected features within the North-east Lewis 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 North-east Lewis 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)[5] and also for the features not covered by FEAST, Marine Evidence based Sensitivity Assessment (MarESA)[6]. 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 Risso's dolphin

Risso's dolphins are known to be sensitive to underwater noise. There is potential for auditory injury and disturbance as a result of activities which produce underwater noise. This can lead to displacement from foraging areas, reduced foraging success, disruption of communication, increased energy expenditure and physiological changes due to stress. Risso's dolphins are considered to be sensitive to collision with vessels and to entanglement in ropes or nets. There is evidence of Risso's dolphins with injuries that could have been caused by collision with boat propellers; if severe, these types of injuries can result in death (Deaville, 2015). There is also evidence which indicates that entanglement has been the cause of death of Risso's dolphins in a number of cases (Bearzi *et al*., 2011). Risso's dolphins are sensitive to water pollution through exposure to bioaccumulated contaminants such as cadmium,

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

copper and zinc found in their prey (Storelli *et al*., 1999). Whilst there is little information available regarding the recovery potential of Risso's dolphins to such pressures, the risk of exposure to these pressures can be minimised through the adoption of best practice and relevant mitigation.

6.2 Sandeels

Sandeels are sensitive to pressures associated with targeted fishing and activities that can affect seabed habitat, such as physical disturbance, siltation changes and surface/sub-surface abrasion. Sandeels have specific sediment requirements which if changed, buried or removed can heavily influence sandeel presence and density. In addition to direct impacts sandeels are highly sensitive to local temperature changes. Temperature variations can influence sandeel metabolic rates thereby affecting reproductive investment and mortality. Little is known about the recovery potential of sandeel populations in this area, however modelling of larval transport (Proctor *et al*., 1998) and evidence from otolith chemistry (Gibb *et al*., 2017) have indicated that the area has high connectivity to adjacent grounds in the north-west of Scotland.

6.3 Quaternary of Scotland (glaciated channels/troughs, landscape of areal glacial scour, mega-scale glacial lineations)

Glaciated channels/troughs, landscapes of areal glacial scour and mega-scale glacial lineations are highly resistant to human activities (having been formed originally by glacial scouring) 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 marine anthropogenic activities will not be sufficient to impact geological and geomorphological seabed features unless the feature is preserved in unconsolidated sediment (Brooks, 2013). All of the landforms comprising this feature are relicts of past processes and are considered to have no recovery potential.

6.4 Marine Geomorphology of the Scottish Shelf Seabed (longitudinal bedform field)

This feature, comprising sandy deposits actively maintained by hydrodynamic processes, is sensitive to activities causing changes in local water flow and those involving physical change/ and or removal of seabed sediment. The recovery potential of the feature is dependent on the duration and scale of the activity in question, as well as any potential permanent changes to local hydrodynamics.

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.

In relation to fisheries management, we have also stated where we think the advice 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 that 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[7] (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

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

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 pMPA. This is referred to as an assessment under Section 82 or Section 83 of the Marine (Scotland) Act 2010.

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

Further information relevant to management of this MPA will be available in the Outer Hebrides Regional MPA Management Plan to be developed with stakeholders through the MarPAMM project and added to this document as required.

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.

1. Continued collection of data and observation of Risso's dolphin to further understand the species use of the site for key life-cycle stages.
2. Finer resolution benthic sampling to help define the extent of the sandeel grounds to the north of the pMPA.

Table 2. SNH's advice to support management for North-east Lewis 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. The potential for cumulative effects (e.g. related to noise, disturbance and collision) needs to be taken into account, particularly when considering management for Risso's dolphins. 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**	
	Risso's dolphins	**Sandeels**
Aquaculture*	**Reduce or limit pressures** Minimise the risk of disturbance[8] to Risso's dolphins relating to the use of ADDs. This should include adoption of existing best practice[9] e.g. development of ADD deployment plans as part of the licence process. These plans should include a consideration of the potential for cumulative impacts of noise.	**Reduce or limit pressures** Minimise the potential impact on the habitat of sandeels. This should focus on appropriate siting of new farms to ensure that the habitat of sandeels is maintained in extent and suitability.
Boat use associated with both commercial and recreational activities (with the exception of **Wildlife tour boats** – see separate advice below.)	**Reduce or Limit Pressures** Reduce risk of collisions with and disturbance of Risso's dolphins from boats when watching or attempting to watch marine wildlife by following the SMWWC (Scottish Marine Wildlife Watching Code[10]). Reduce risks of collisions and disturbance from licensable activities that result in increased vessel traffic for defined periods, for example through the use of	**No additional management required**

[8] 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.'
[9] Current SNH advice is for farms to include an ADD deployment plan as part of their EIA within designated sites containing features sensitive to ADDs http://jncc.defra.gov.uk/pdf/report_615_web.pdf.
[10] 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	
	Risso's dolphins	**Sandeels**
	vessel management plans as part of the consenting/licensing process. This may include agreed routes and potential speed restrictions.	
Cables and pipelines*	**Reduce or limit pressures** Early discussion of siting, design and construction is recommended to reduce the risks of disturbance to Risso's dolphin 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.	**Reduce or limit pressures** Minimise the potential impact of new cables and pipelines on the habitat of sandeels. 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 particularly for sandeel habitat.
Coastal development e.g. construction of piers, slipways, jetties etc.*	**Reduce or limit pressures** Reduce the risks of disturbance to Risso's dolphins 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.[11]	**Reduce or limit pressures** Minimise the potential impact of coastal development on the sandeel habitat. 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.
Fishing - demersal mobile/active gear*	**No additional management**	**Remove or avoid pressures** The exclusion of hydraulic fishing methods from habitat supporting sandeels within the site ***is recommended.***
Fishing – static gear*	**Reduce or limit pressures** Exclusion of the use of drift nets and nets set on the seabed (tangle, trammel, gill) due to the risk of	**No additional management required**

[11] 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	
	Risso's dolphins	**Sandeels**
	entanglement ***is recommended***.	
Fishing – pelagic*	**Reduce or limit pressures** The development and adoption of best practice to reduce or limit the risk of incidental catch of Risso's dolphins ***should be considered***.	**Remove or avoid pressures** The exclusion of targeted fishing for sandeels ***is recommended***.
Marine disposal sites*	**No additional management required**	**Reduce or limit pressures** Minimise the potential impact of new disposal sites on the habitat of sandeels. Early pre-application discussions are recommended if any new marine disposal sites are required and these should focus on 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.
Military – planned exercises*	**Reduce or limit pressures** Reduce the risks of disturbance to Risso's dolphins 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)[12].	**No additional management required**
Ports and harbours*[13]	**Reduce or limit pressures** Reduce the risks of disturbance to Risso's dolphins from activities associated with high source levels of underwater noise (e.g. pile-driving and blasting). We	**No additional management required**

[12] See: http://jncc.defra.gov.uk/pdf/011113_MOD_SNCB_SOI_final.pdf

[13] 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	
	Risso's dolphins	**Sandeels**
	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.[14]	
Renewable energy*	**Reduce or limit pressures** Activities associated with renewable energy development that increase the risk of disturbance, acoustic injury, collisions and entanglement of Risso's dolphins 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.	**Reduce or limit pressures** 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.
Scientific survey/research*	**Reduce or limit pressures** Pressures associated with scientific acoustic surveys should be minimised through existing best practice measures[15] to ensure that key life-cycle activities of Risso's dolphins within the possible MPA are not disrupted. Survey work that is targeted on Risso's dolphins should abide by the SMWWC[16] to reduce or limit the risks of	**Reduce or limit pressures** Minimise the potential impact of scientific surveys on the habitat of sandeels. This should focus on avoiding impacts that would lead to a decrease in the extent and suitability of habitat of sandeels.

[14] 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).
[15] 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.
[16] 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	
	Risso's dolphins	**Sandeels**
	collision and disturbance. If this is not achievable then further discussion and a species licence[17] should be sought from SNH and appropriate mitigation agreed.[18]	
Seismic and other broad scale acoustic surveys*	**Reduce or limit pressures** Minimise the impact of seismic or other acoustic surveys which may cause injury or disturbance to Risso's dolphins through following the JNCC Guidelines for minimising the risk of injury and disturbance to marine mammals from seismic surveys[19].	**No additional management required**
Wildlife tour operators	**Reduce or limit pressures** Reduce risk of collisions with and disturbance of Risso's dolphins from boats by following the SMWWC[20] and the WiSe (Wildlife Safe[21]) accreditation scheme.	**No additional management required**

[17] https://www.nature.scot/cetaceans-licence-forms-and-guidance-documents
[18] Any sampling or tagging of Risso's dolphins also requires a Home Office Licence (https://www.gov.uk/guidance/research-and-testing-using-animals).
[19] 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.
[20] https://www.nature.scot/professional-advice/land-and-sea-management/managing-coasts-and-seas/scottish-marine-wildlife-watching-code
[21] https://www.wisescheme.org/

Table 3. Activities that are considered not likely to affect the proposed protected features (other than insignificantly)[22]

Activity	**Comments**
Anchorage Areas	Although there are various locations used infrequently as anchorage areas in the summer, there are no marked recreational anchorages or moorings within the pMPA.
Cables and pipelines - existing	The existing telecommunications cable is not considered to affect the proposed protected features within the pMPA.
Ferry routes	The site boundary overlaps with the Ullapool to Stornoway ferry route but this is not considered to affect the proposed protected features of the pMPA.
Discharges - Sewage	There are numerous sewage outlets along the western 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.
Moorings	There are no marked recreational moorings within the pMPA.

[22] 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. North-east Lewis possible MPA Conservation Objectives

The box below provides the high-level Conservation Objective statements. The full Conservation Objectives, including 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.

North-east Lewis possible MPA
Protected features(s): Mobile species – Risso's dolphin and Sandeel Geomorphological features – Quaternary of Scotland (glaciated channels/troughs, landscape of areal glacial scour, mega-scale glacial lineations) and Marine Geomorphology of the Scottish Shelf Seabed (longitudinal bedform field).
The Conservation Objectives of the North-east Lewis 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 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.

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.

Consideration of minor changes to 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. Mobile species are exposed to a wide range of drivers of change. This may include changes to the habitat or resources that they rely on during their natural life cycle 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 entirely by natural processes is to be disregarded when assessing against the Conservation Objectives. In relation to the North-east Lewis 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 the North-east Lewis pMPA as additional pressures may reduce the habitat's resilience to climate change and additionally climate change impacts may start to hinder the habitat's ability to recover from human activities.	
Risso's dolphin	Risso's dolphins have a wide distribution within the north-east Atlantic and globally and they are part of a complex, dynamic and multi-dimensional marine environment and are therefore potentially exposed to a range of drivers of change. Ecosystem change involving the loss or the disturbance of megafauna species such as Risso's dolphins can lead to alteration in ecosystem functioning and can have implications for conservation objectives and management advice (Macleod *et al*., 2005; Lambert *et al*., 2011). Climate change is expected to produce a shift in the range

	of cetacean species, potentially including Risso's dolphin. It is expected that cetaceans will track water temperature changes in order to remain within their ecological niches. However, as their distribution is currently constrained by cooler water, rising sea temperatures may help Risso's dolphin to expand their geographic range as it may enable them to move north to waters previously too cool to inhabit (Macleod, 2009). Environmental variability and climate change have a role to play in determining the stock status of the cephalopods that Risso's dolphins prey upon. General cephalopod populations are subject to large inter-annual variations in abundance which is probably driven by environmental factors including temperature. Sea temperature changes and other climate change pressures therefore could result in a change in the abundance and distribution of prey within and outside the site and subsequently affect Risso's dolphins using this pMPA.
Sandeels	Sandeel populations around Scotland experience natural change, showing variations in both mean length (Wanless *et al*., 2004) and total stock biomass in different periods (Bailey *et al*., 1991). Various studies have suggested this variation is driven by fluctuations in the abundance of zooplankton species such as *Calanus finmarchicus* (van Deurs *et al.,* 2013) and *C. helgolandicus* (Planque and Taylor, 1998). Sandeels are and will continue to be, impacted by climate change. For example, several studies document lower sandeel recruitment in the North Sea in response to increasing water temperature (Heath *et al*., 2012; Wright *et al*., 2017). Local ocean temperature increases also affect their metabolic rate and the energy available to sustain them over winter, thereby affecting reproductive success and increasing mortality. Warmer ocean temperatures can also have a direct impact on the reproductive timing of sandeels and their prey leading to poor recruitment of sandeels (Wright *et al*., 2017; Regnier *et al*., 2017; Eerkes-Medrano *et al*., 2017). This in turn, leads to limited prey availability for seabirds, marine mammals and other fish that depend on sandeels (MCCIP, 2018). A 2 °C temperature increase could cause substantial changes in wider community structure, affecting ecosystem structure and trophodynamics (Fredericksen *et al*., 2007).
Quaternary of Scotland	As erosional features formed by ice over millennia, the glaciated channel/troughs and landscape of areal glacial scour that make up this feature are likely to be highly resistant to environmental change. The resilience of the mega-scale glacial lineations is highly variable and depends upon the composition and level of consolidation of the sediment. Lineations formed in well-consolidated sediment can be considered highly resistant. Those preserved in poorly-consolidated sediment may be sensitive to large-scale changes in water flow, wave exposure and sediment deposition driven by climate change, such as an increase in mean annual maximum wave height and a change in wind speed (Palmer *et al.*, 2018).

Marine Geomorphology of the Scottish Shelf Seabed	This feature is comprised of geologically active formations and is mobile by nature. It is likely that the feature will change to some degree in response to variations in current speed and sediment supply driven by both natural changes over time and climate change.

MOBILE SPECIES

Species is conserved		
The boxes below provide the site specific advice on the '*species is conserved'* element of the high level 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**
Risso's dolphin	Risso's dolphin in North-east Lewis 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 Risso's dolphin, backed up by effort-corrected sightings data and photo identification. Sightings of Risso's dolphin within the pMPA are highest during the late summer months, however there is evidence that Risso's dolphins are present throughout the year, albeit in lower numbers (SNH, 2012). Boat-based photo identification surveys in the southern half of the site between 2010 and 2017 identified a minimum population size of 117 animals (Weir *et al*., 2017). This Objective seeks to conserve Risso's dolphin by minimising the risk to the animals from injury or killing. For the purposes of the pMPA assessments Risso's dolphin are only protected when they are within the site. Any activities that take place within or outside the pMPA that could kill or injure Risso's dolphin 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 risk.. An important consideration is whether any killing or injury would result in reduced numbers of Risso's dolphin within the site, from which recovery cannot be expected. The pMPA complements existing protection of Risso's dolphin 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 Risso's dolphin 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. Assessments for both EPS and the pMPA need to be undertaken for Risso's dolphin for relevant activities. Unregulated activities (e.g. not subject to licensing or consenting) should still be considered against this conservation objective.
Sandeels	Conserve the sandeel aggregation in the site, particularly the locally high density of larvae to ensure its continued contribution towards the wider population.	The site has been selected on the basis of long-term research studying sandeel ecology and population connectivity. The pMPA contains a former sandeel fishing ground that had the largest annual landings for the west coast fishery and this highlights the importance of the area. Larval data and fishery landings indicate that the sandeel aggregation within the site forms part of a larger population with other areas also known to be important for sandeels. Spawning in the pMPA has been confirmed from densities of newly emerged larvae in plankton surveys (MSS, 2012). The pMPA is particularly important on the west coast of Scotland for its locally high density of sandeel larvae and the potential for export of these to other sandeel grounds in the north-west of Scotland (Proctor *et al*., 1998). Landings of sandeels have been close to zero since 2001 in the West of Scotland area and therefore, there is no assessment for the status of the stock or abundance estimate within the site (ICES, 2018). Assessments against this part of the Conservation Objective should focus on activities that have the potential to cause a reduction in the aggregation of sandeels in the pMPA which would subsequently cause a reduction in larval production. At the site level the most significant threat to sandeels is from targeted fisheries, however there is currently no active sandeel fishery within the pMPA. Little information exists as to the sensitivity of these species to other types of demersal fishing, but the development of any new targeted fishery is likely influence sandeels within the pMPA. Should a fishery for sandeels be re-established within (and/or in the vicinity of) the pMPA management should ensure that localised depletion of sandeels within the pMPA is avoided.

Continued access by the species to resources provided by the MPA for, but not restricted to, feeding, courtship, spawning or use as nursery grounds.		
The boxes below provide the site specific advice on the '*continued access…'* element of the Conservation Objectives. Information on '*The species is conserved'* is provided separately above.		
Feature	**Site specific advice**	**Site specific information**
Risso's dolphin	Conserve the access to resources provided by the pMPA for feeding, socialisation and breeding. ***and*** Conserve the distribution of Risso's dolphin 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 Risso's dolphin in the pMPA. Resources in this context are their prey (cephalopods such as squid, octopus and cuttlefish) and particular areas of the pMPA or habitats that may be used during feeding, socialisation and breeding. Risso's dolphins are present throughout the site during the whole year, with a seasonal increase in numbers between May and October (Weir *et al*., 2017). However, the areas within the pMPA that may be more important to the species are not fully understood at present. Very little is known about the population structure of Risso's dolphins in Scottish waters. Life history parameters for this species are not well studied and important breeding and resting sites are largely unknown. The pMPA has however been identified as a potential calving and nursery area due to records of mother-calf associations between March and November (Atkinson *et al*., 1999; Pollock *et al*., 2000) and frequently observed juveniles and calves during boat-based surveys between 2010 and 2017 (Weir *et al*., 2017). There are two main ways in which Risso's dolphin'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 important behaviours. i) <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 feeding, socialisation and breeding. Large cumulative obstructions perhaps in combination with significant disturbance (discussed below) would be of most concern. ii) <u>Disturbance</u> Disturbance of Risso's dolphins 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 the separation of mother and calf, increased energy expenditure, or reduced surfacing time between dives. Indirect and cumulative responses can also occur, including decreased reproductive success, stress and the disruption of key activities such as feeding and breeding. For example, disturbance to Risso's dolphins 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 Risso's dolphins 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 the population of Risso's dolphin within the site such that recovery cannot be expected. Effects of activities lasting beyond the average generation time of Risso's dolphin are more likely to constitute significant disturbance. It is considered that 'significant disturbance' may result in the following effects: • contribution to a long-term decline in the use of the site by Risso's dolphin. • changes to the distribution of Risso's dolphin 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, disturbance of Risso's dolphin is also covered by European Protected Species legislation and is defined as it applies in Scottish waters 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 the assessments for the pMPA. Unregulated activities (e.g. not subject to licensing or consenting) should still be considered against this conservation objective.
Sandeel	Conserve the distribution of sandeel within the site by retaining access to resources provided by the pMPA, specifically that suitable habitat (coarse sand substrates) remains available and ensuring the processes supporting their prey (plankton) are not significantly altered.	Resources in this context are the availability of suitable seabed sediment to live and spawn in and adequate prey, which is influenced by environmental processes. <u>Suitable habitat</u> Sandeels utilise coarse sand with low silt content (Holland *et al.,* 2005, Wright *et al.,* 2000) between depths of 20 and 80 m (Lynam *et al.,* 2013; MacLeod *et al.,* 2004; Wright et al., 2000) and they may use these areas all year. Tagging studies and differences in growth rates indicate that once they have settled on the seabed sandeels remain within a small area (Jensen *et al*., 2011; Wright et al., 2019). This requirement for a highly specific sediment type and depth range results in a patchy distribution. Continued access to suitable habitat may be restricted by large-scale physical barriers or obstructions associated with coastal development or renewable energy developments. Continued access would also be compromised by a significant reduction in the extent and distribution of suitable sediment. Activities with the potential to cause such degradation are those which involve the physical removal of sediments, sub-surface abrasion/ penetration of the seabed and water flow changes to local tidal currents. <u>Prey species</u> Sandeels are known to primarily feed on zooplankton in the water column. Young sandeels predominantly feed on copepod eggs and nauplii whilst older individuals prefer larger items such as copepods (van Deurs *et al*., 2013). Prey availability during the larval hatching period in the spring heavily influences larval growth rate, affecting

		recruitment and survival rates (Gurkan *et al*., 2012; Regnier *et al*., 2017). The distribution of such prey items is naturally variable temporally and spatially (van Deurs *et al*., 2013; Planque and Taylor, 1998). Continued access to sandeel prey resources may be restricted by large-scale physical barriers or obstructions associated with coastal development or renewable energy developments. These activities have the potential to alter water hydrodynamics e.g. water flow, tidal currents and topography, (De Dominicis *et al.,* 2018) which may change planktonic abundance and restrict access to the resource. Assessments should therefore focus on activities which may significantly alter water flow characteristics as well as those involving significant abrasion or disruption of seabed sediments.

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**
Risso's dolphin	Conserve the extent and distribution of any supporting feature upon which Risso's dolphin is dependent. ***and*** Conserve the structure and function of supporting features, including processes to ensure Risso's dolphin are healthy and not deteriorating	Our understanding of the supporting features for Risso's dolphin within the site is currently limited, but these include their prey species and the habitats and processes that support these. Assessments should focus on activities with the potential to significantly alter the hydrography of the area as they are most likely to affect species composition, abundance or concentration of cephalopods available to Risso's dolphins. At the site level, the most significant threat to the extent and distribution and structure of these prey species is from targeted fisheries. A fishery could influence the abundance and distribution of cephalopods and would require assessment if one emerged. However there is currently no active octopus or squid fishery within the pMPA. Little information exists as to the sensitivity of these cephalopod species to disturbance from other demersal fisheries. <u>Prey species</u> Risso's dolphins forage in the water column and on the seabed (Bloch *et al*., 2012). They primarily feed on squid (*Todarodes sagittatus*) and octopus (*Eledone cirrhosa)* in UK

		waters (Evans, 2013, MacLeod, 2014), although they can also feed on cuttlefish and fish. The extent and distribution of Risso's dolphin prey and their supporting habitats within the pMPA are unknown. Risso's dolphins tend to increase in number within the pMPA when prey species, particularly squid, are at their most abundant. A reduction in prey items in the pMPA has the potential to reduce the food resource available to Risso's dolphin. It is unknown to what degree Risso's dolphins are able to respond to a reduction in prey, e.g. through switching to other prey species or moving to new foraging areas. However, Risso's dolphins have a predominantly cephalopod-based diet, so they may have limited ability to change prey species. <u>Supporting habitats and processes</u> The condition of the seabed and water column inhabited by cephalopods and fish species is also a relevant consideration. Cephalopods such as squid and octopus are short-lived and grow rapidly (Rodhouse, 1989). Adults of these species have been found on a wide variety of sediment types from boulders and cobbles to fine-grained mud. Activities with the potential to cause significant degradation or abrasion of these seabed habitats may result in the local depletion of these prey species and ultimately affect Risso's dolphin using the site. Additionally, the assemblage of cephalopod species present, i.e. the key species and their abundance, appears to be linked to fronts within the site and surrounding area. The structure and function of cephalopods within the site may be altered by changes in physical parameters such as topography, water flow and tidal currents. Areas of active mixing between Atlantic and coastal waters seem to be highly related to prey aggregations associated with fronts, in particular squid and octopus populations (Thompson and Frey, 1975; Wharam and Simmonds, 2008).
Sandeel	Conserve the extent and distribution of any supporting feature upon which sandeels are dependent. ***and***	The supporting features for sandeels within the site are suitable habitat and prey species. Assessments should focus on activities with the potential to significantly alter the hydrography of the area or create large-scale physical barriers as they are most likely to the composition, abundance or concentration of prey species available to sandeels. <u>Suitable habitat</u>

	Conserve the structure and function of supporting features, including processes to ensure sandeels are healthy and not deteriorating	Within the pMPA suitable habitat is indicated by specific sediment characteristics (outlined below), appropriate water depths between 20 and 80 m (Wright et al., 2000) and the presence of locally high densities of sandeel larvae. Sediment data from British Geological Survey and Marine Scotland Science, larval density studies and trawl surveys show that suitable sandeel habitat within the pMPA is distributed primarily in the north and west of the site. The structure and function of suitable sandeel habitat refers to the structural characteristics of the sediment and its function as habitat for sandeel. Suitable sandeel habitat is comprised of coarse sand with low silt content, which is important for facilitating oxygen permeability of the sediment (Wright *et al.,* 2000). The structure of the sediment is also related to the Marine Geomorphology of the Scottish Shelf Seabed geodiversity feature. Sand/ sediment banks and wave fields are often composed of coarse sand, partially mobile and in depths of between 20 to 80 m, all of which contributes providing a habitat for sandeels. The extent and distribution, structure and function of suitable sandeel habitat may be altered by activities which involve the physical removal of sediments, sub-surface abrasion/ penetration of the seabed and water flow changes to local tidal currents. <u>Sandeel's prey species</u> The extent and distribution of sandeel's prey species should be interpreted as the presence and concentration or abundance of zooplankton. This may be altered by changes in parameters that affect the hydrodynamics (water flow, tidal currents and topography), nutrient availability (influenced by tidal velocities and tidal mixing) and changes in temperature, salinity etc.

GEOMORPHOLOGICAL FEATURES

(a) Extent, component elements and integrity		
Feature	**Site specific advice**	**Site specific information**
Quaternary of Scotland - *glaciated channel/troughs, landscape of areal glacial scour, mega-scale glacial lineations*	Conserve the features extent, component elements and integrity of the Quaternary of Scotland feature.	Component elements refers to the landforms which make up the feature, namely glaciated channel/troughs, landscape of areal glacial scour and mega-scale glacial lineations, whilst integrity relates to the collective assemblage of these landforms and their inter-relationships. The glaciated channels/troughs and landscapes of areal glacial scour within the pMPA were created by the channelled flow of ice over bedrock and are characterised by elongated grooves and ridges in erosion resistant geology (Summerfield, 1991). As a result, glaciated channels/troughs and landscapes of areal glacial scour 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. Mega-scale glacial lineations are also formed by the channel flow of ice and may be formed in both bedrock (Bradwell *et al*., 2008) and glacial sediments (Stokes and Clark, 1999). Seismic and side-scan sonar surveys in the area show both exposed and partially buried mega-scale glacial lineations across the layered sediment sequences. The majority of these features are 5-15 m in height and spaced roughly 100-500 m apart, creating a corrugated appearance over the sea floor (Stoker and Bradwell, 2005). As mega-scale glacial lineations are preserved in both consolidated and unconsolidated sediment, their resistance to pressures causing seabed abrasion and water flow changes is likely to be highly variable. Activities involving the physical removal of sediments, sub-surface abrasion/ penetration of the seabed or changes to local tidal currents may lead to a loss in the extent of component landforms. 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.
Marine Geomorphology of the Scottish Shelf Seabed - *longitudinal bedform field*	Conserve the features extent, component elements and integrity of the Marine Geomorphology of the Scottish Shelf Seabed feature.	Component elements refer to the landforms which make up the feature, namely the longitudinal bedform field, whilst integrity relates to the collective assemblage of these landforms and their inter-relationships. Longitudinal bedform field is a generic term given to areas which contain sand streaks, sand ribbons and/or longitudinal sand patches (Brooks, 2013). These component elements are mobile by nature and respond to changes in current speed and sediment supply. A relatively high current velocity is required to produce and maintain these component elements. Generally they are found in sediment starved environments with strong tidal flows and are around 1m in height, 200 m wide and up to 15 km long (Kenyon, 1970). As an active feature maintained by hydrodynamic processes, significant alterations to the features extent, component elements and integrity may arise from activities causing changes in local water flow and those involving physical change/ and or removal of seabed sediment. The degree of change is response to these pressures is dependent on the duration and scale of the activity in question, as well as any potential permanent changes to local hydrodynamics. 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 featureshould be undertaken inassessments to conserve the integrity of the feature.

(b) Its structure and functioning are unimpaired		
Feature	**Site specific advice**	**Site specific information**
Quaternary of Scotland - *glaciated channel/troughs, landscape of areal glacial scour, mega-scale glacial lineations*	Conserve the structure and functioning of the feature so that they are unimpaired.	Structurally the Quaternary of Scotland feature is preserved in unsorted mixed sediment and in bedrock. The structure of the Quaternary of Scotland feature is considered not sensitive where the landforms are in bedrock. In contrast, the structure of landforms consisting of sediment is likely to have a highly variable sensitivity to pressures arising from human activities. Activities involving the physical removal of sediments, sub-surface abrasion/penetration of the seabed or changes to local tidal currents may lead to a loss of structure in such landforms. In its entirety the feature has a function of 'scientific importance' for the understanding of Quaternary ice sheet dynamics and late glacial climate change (Brooks, 2013; Stoker *et al*., 2009). This is largely due to the exceptional quality and continuity in which the Quaternary of Scotland feature is preserved. 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. 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.
Marine geomorphology of the Scottish shelf seabed - *longitudinal bedform field*	Conserve the structure and functioning of the feature so that they are unimpaired.	The landforms which make up the longitudinal bedform field are generally comprised of sands and gravels and can be rich in carbonate material. The structure of the bank feature is mobile at the surface yet mostly stationary with respect to its overall position. Areas adjacent to the feature are swept clean of sediments (Brooks *et al*., 2013). The structure of the feature is considered to have a medium sensitivity to physical disturbance and a high sensitivity to local tidal current changes. The feature has the function of being scientifically important for furthering the understanding of shelf bedform systems (Brooks, 2012). The feature also has a sediment supply function, where storm-driven currents can drive carbonate-rich

		sands onshore. This function is important for maintaining the supply of carbonate to coastal dune and machair systems (Brooks *et al.,* 2013). Lastly, the feature has a critical function in maintaining habitat suitable for sandeels and other fauna. The feature's function of scientific importance, sediment supply and for habitat provision 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 the hydrodynamic processes. Maintaining the ability of the feature to generate and supply sediments should also be an important consideration.

(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 - *glaciated channel/troughs, landscape of areal glacial scour, mega-scale glacial lineations*	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 glaciated channel/troughs, landscape of areal glacial scour or mega-scale glacial lineations 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 landformsmight 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.
Marine geomorphology of the Scottish shelf seabed - *longitudinal bedform field*	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 longitudinal bedform field 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.

Annex 2. Supporting information

Factors determining the potential for features to recover

Risso's dolphin
Risso's dolphin, like other cetaceans, are long-lived and slow to breed, reaching sexual maturity at age 8-10 years for females and 10-12 years for males (Baird, 2008). The generation time for Risso's dolphin is estimated at 19.6 years (Taylor *et al*., 2007). The gestation period is also lengthy, estimated to be 13-14 months (Wharam and Simmonds, 2008). With regards to feeding activity, it is unknown to what degree Risso's dolphins are able to respond to a reduction in prey, e.g. through prey switching or moving to new foraging areas. However, considering Risso's dolphins have a cephalopod-based diet, they may have limited ability to switch prey. Recovery of Risso's dolphin populations is likely to be slow.

Sandeels
The recovery potential of sandeels is dependent on fishing and natural mortality, local secondary production, habitat area and hydrographic isolation. While locally large, the sandeel grounds on the Scottish west coast are comparatively small and more hydrographically isolated than grounds in the central and southern North Sea (Proctor et al., 1998; Freeman *et al*., 2004; Jensen et al., 2011). Sandeel aggregations inhabiting small and hydrographically isolated grounds like those around the Shetland Isles have collapsed without any human pressure, although the addition of fishing mortality makes local collapse more likely (Poloczanska *et al*., 2004).

Quaternary of Scotland (glaciated channels/troughs, landscape of areal glacial scour, mega-scale glacial lineations)
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.

Marine Geomorphology of the Scottish Shelf Seabed (longitudinal bedform field)
As a feature maintained by strong tidal currents and a low sediment supply, the recovery of the Marine Geomorphology of the Scottish Shelf Seabed geodiversity feature may be limited by reduced local water flow, or increases in sediment transport and availability. With respect to activities reducing local water flow and increasing sediment supply, recoverability of the feature is likely to be influenced by the scale and duration of the activity in question. As dynamic processes which can reach new states of equilibrium, activities of greater scale and longer duration are more likely to limit the recovery of the feature.

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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

Conservation Objective term	Definition
	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.