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Conservation and Management Advice

SEA OF THE HEBRIDES POSSIBLE MPA

JUNE 2019

DRAFT

This document provides advice to Public Authorities and stakeholders about the activities that may affect the protected features of Sea of the Hebrides possible Marine Protected Area (MPA). 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

Document version control			
Version	**Date**	**Author**	**Reason / Comments**
1	15/01/19	Sam Black, Sarah Cunningham, Fiona Manson	Initial drafting of document
2	18/01/2019	Sam Black, Chris Leakey, Tamara Lawton	Adding/editing ecosystem function, natural resources and wider benefits information
3	30/01/19	Suz Henderson	Adding basking shark text to Annex 1
4	07/02/19	Sarah Cunningham, Fiona Manson	Refining minke whale text Annex 1
5	04/03/19	Sarah Cunningham	Refining fronts text Annex 1 and general review of Annex 1
6	15/03/2019	Lisa Kamphausen	Completion of research and survey requirements
7	18/02/2019	Sam Black, Nick Everett, Ness Kirkbride	Geodiversity conservation objectives and ecosystem services infographic
8	21/03/2019	Sarah Cunningham	Update to species licensing references in Annex 1 and cleared some comments that were dealt with.
9	29/03/2019	Sarah Cunningham	Final QA
10	03/04/2019	Sarah Cunningham, David Donnan, Tracey Begg, 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 maps for minke whale and basking shark following SAC comments.
11	04/04/2019	Sarah Cunningham, Suz Henderson	Review of track changes from Katie Gillham for basking shark and incorporation of additional references. Adding text on military activities
12	14/05/2019	Sarah Cunningham, Suz Henderson, Sam Black	Revision following comments from Marine Scotland.
13	05/06/2019	Sarah Cunningham, Suz Henderson, Sam Black	Final revisions following additional comments from Marine Scotland.
14	06/06/2019	Sarah Cunningham	Accepting final amendments

Distribution list			
Format	**Version**	**Issue date**	**Issued to**
Electronic	8	21/03/2019	Gayle Holland, Marine Scotland LOT Lily Burke, Elaine Tait, Finlay Bennet – Marine Scotland
Electronic	9	29/03/2019	Katie Gillham for review
Electronic	11	05/04/2019	Marine Scotland officials.
Electronic	12	15/04/2019	Marine Scotland officials.
Electronic	13	06/06/2019	Marine Scotland officials.
Electronic	14	06/06/2019	Marine Scotland officials.

Contents

1 Overview of document

This document provides details of the Conservation and Management Advice for Sea of the Hebrides possible Marine Protected Area (pMPA) and it is divided into eight main sections. The introduction in section 2 gives an overview of Sea of the Hebrides 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 Sea of the Hebrides pMPA has been proposed to protect basking shark, minke whale, fronts and a geodiversity feature, Marine Geomorphology of the Scottish Shelf Seabed (Inner Hebrides Carbonate Production Area). 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 Sea of the Hebrides 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

Sea of the Hebrides pMPA provides conservation benefits by affording protection to basking shark, minke whale, fronts and the geodiversity feature. In summary the conservation benefits of this designation are:

- Protecting high densities of basking sharks and minke whales, compared to other parts of Scottish territorial waters, particularly during the months of April to October.
- Protection of important areas where basking sharks, an OSPAR threatened and declining species, feed and show social, group and courtship-like behaviours.
- Recognition of fronts as an important feature that provides benefits to both basking shark and minke whale by enhancing primary productivity and prey availability.
- Conservation of the Inner Hebrides Carbonate Production Area (the geodiversity feature) ensures that important biogenic habitats such as maerl beds and seagrass are protected and that vital processes, such as the production and supply of shell-rich sands to beaches and machair, are maintained.

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 Sea of the Hebrides 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 Sea of the Hebrides 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. 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.

In terms of resources, the pMPA encapsulates the waters between a number of islands that are home to an array of wildlife. Between the islands, strong tidal currents interact with Atlantic water drawn inshore, a process which creates turbulence and contributes to extensive blooms of plankton. This abundant food source draws a wide variety of marine predators into the pMPA, most notably high densities of basking shark and minke whale in the summer months. The area is also held in high regard for its wildlife and fish and shellfish resources. Throughout the pMPA highly productive seabed communities such as maerl and mussels capture carbon from the seawater to produce their hard carbonate shells. Over time these shells are broken down into shell rich sediment in shelf areas, some of which is transported onshore to create stunning white-shell beaches and dune-machair systems, forming a valuable product of the Inner Hebrides Carbonate Production Area.

The rich and varied natural resources present within the pMPA contribute to a wide range of benefits for people. The wildlife within the pMPA and the unique seascapes within it help provide opportunities for tourism, recreation and wildlife watching, all of which encourage local jobs and businesses. Fisheries and supporting businesses from local communities within and around the pMPA utilise and benefit from the wildlife and the area's fish and shellfish resources. Further benefits relating to health and well-being, food and nutrition also arise from the site's natural resources, resulting in a place where communities and visitors can spend time connecting with and enjoying nature.

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.

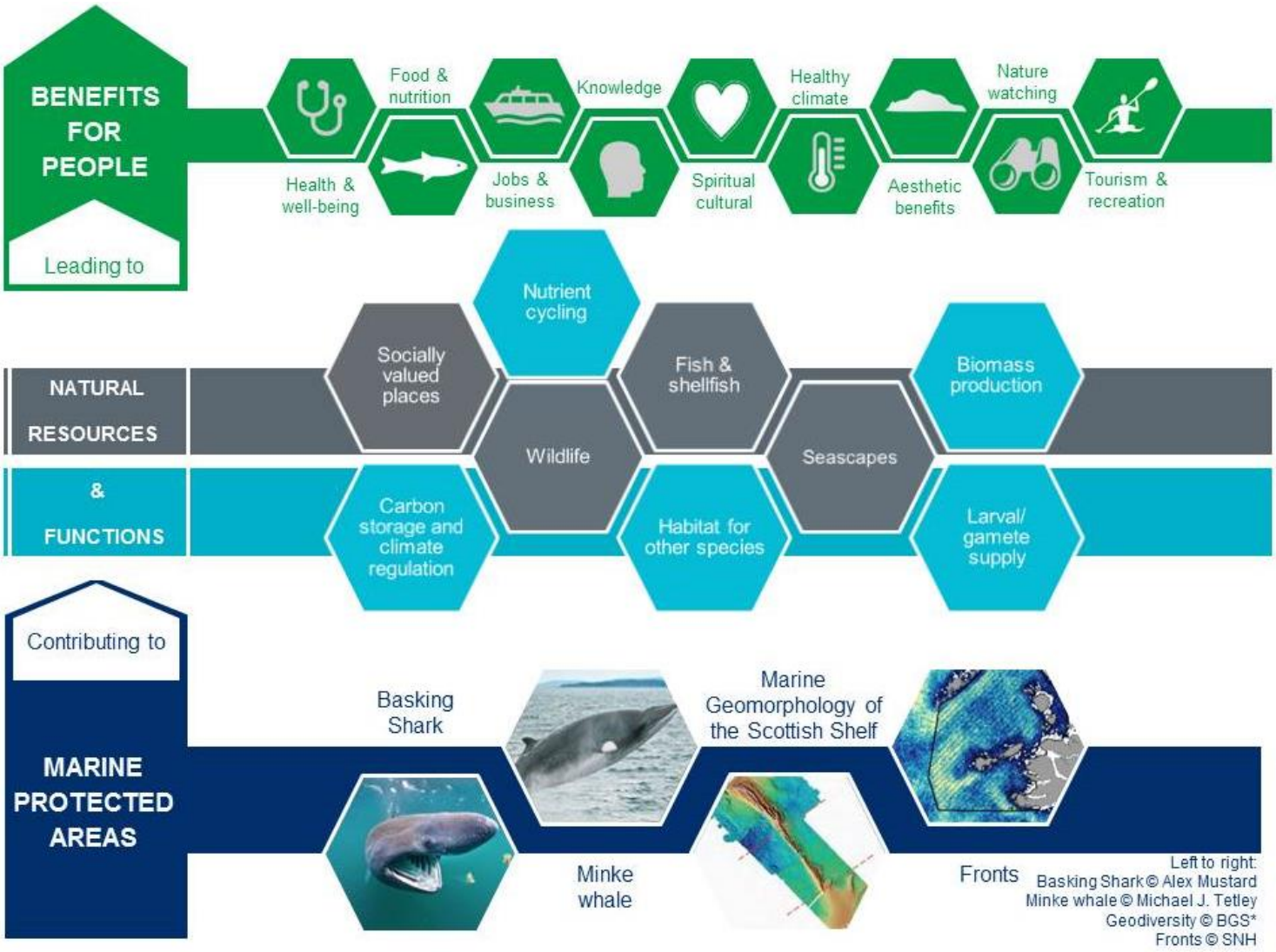


Figure 1 *Benefits to people associated with protected features of the Sea of the Hebrides pMPA.*
**Imagery prepared by the British Geological Survey, with bathymetry data provided courtesy of the Maritime and Coastguard Agency's UK Civil Hydrography Programme © Crown copyright.*

2.4 Community aspirations

This section will be completed in the future following discussions with communities that come through the MarPAMM project[1] in the Outer Hebrides and Argyll.

2.5 Contribution to policy commitments

Managing this MPA to conserve basking shark, minke whale, fronts and the Marine Geomorphology of the Scottish Shelf Seabed geodiversity feature 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 basking shark which are an OSPAR threatened and declining species.
- Progress towards achieving Good Environmental Status in relation to biological diversity, marine food webs, underwater noise and seafloor integrity.
- 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 habitats and species.

3 Roles

This document provides advice for Sea of the Hebrides 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 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 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 Sea of the Hebrides 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.

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

4 Protected features and status

The Sea of the Hebrides 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 MPA, their condition within the site, and the broader conservation status of the protected features.

The locations and extent of the protected features within the Sea of the Hebrides 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[2].

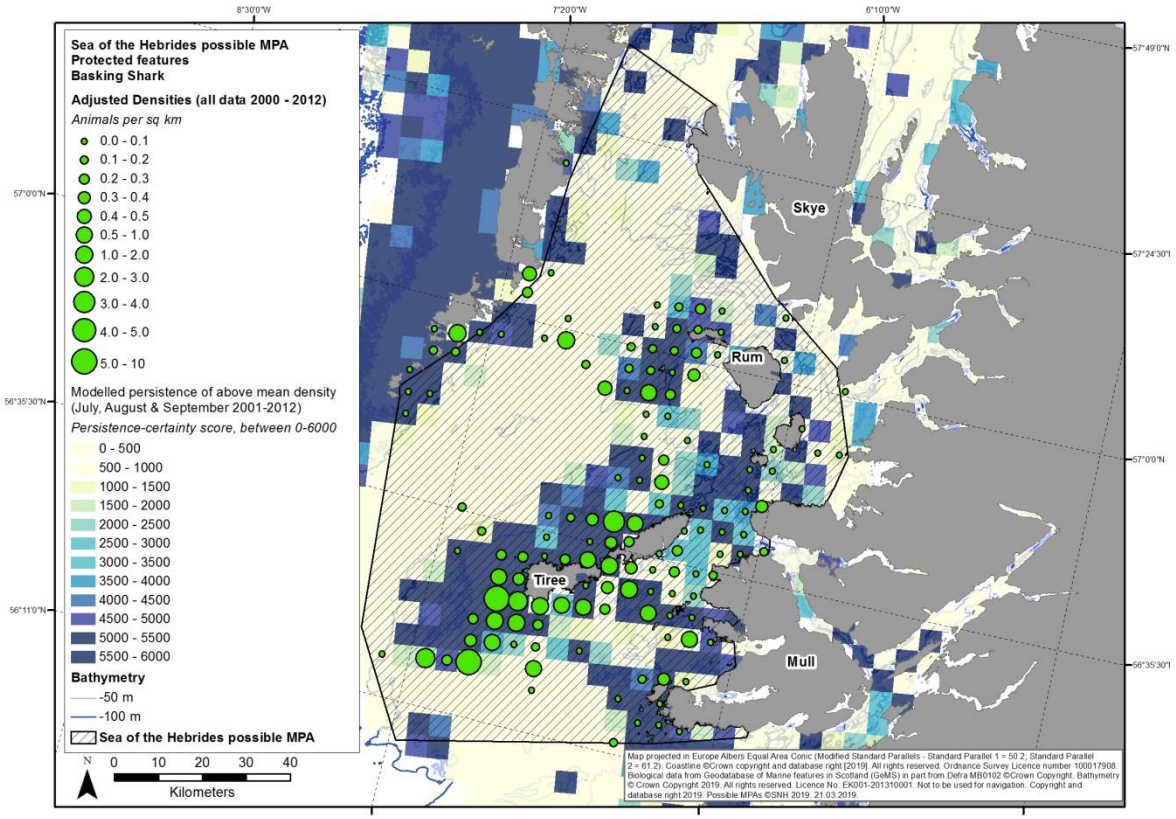
Table 1. Protected features and condition for the Sea of the Hebrides pMPA. Feature condition refers to the condition of the protected feature assessed at a site level. Broader conservation status is the overall condition of the feature throughout its range as outlined by the footnotes.

Protected Features	Feature condition	Assessment date	Broader conservation status
Basking shark	Favourable	2019	*OSPAR: Threatened and/or Declining IUCN: Endangered in NE Atlantic)
Minke whale	Favourable	2019	#UK: Favourable European Region: Favourable
Fronts	Favourable	2019	N/A
Marine Geomorphology of the Scottish Shelf Seabed (Inner Hebrides Carbonate Production Area)	Favourable	2019	N/A

*For basking shark this is their status for the NE Atlantic under OSPAR Convention and the International Union for the Conservation of Nature (IUCN) Red List.
#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.

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

Figure 2i-iii *Location of the Sea of the Hebrides pMPA and distribution of the proposed protected features*



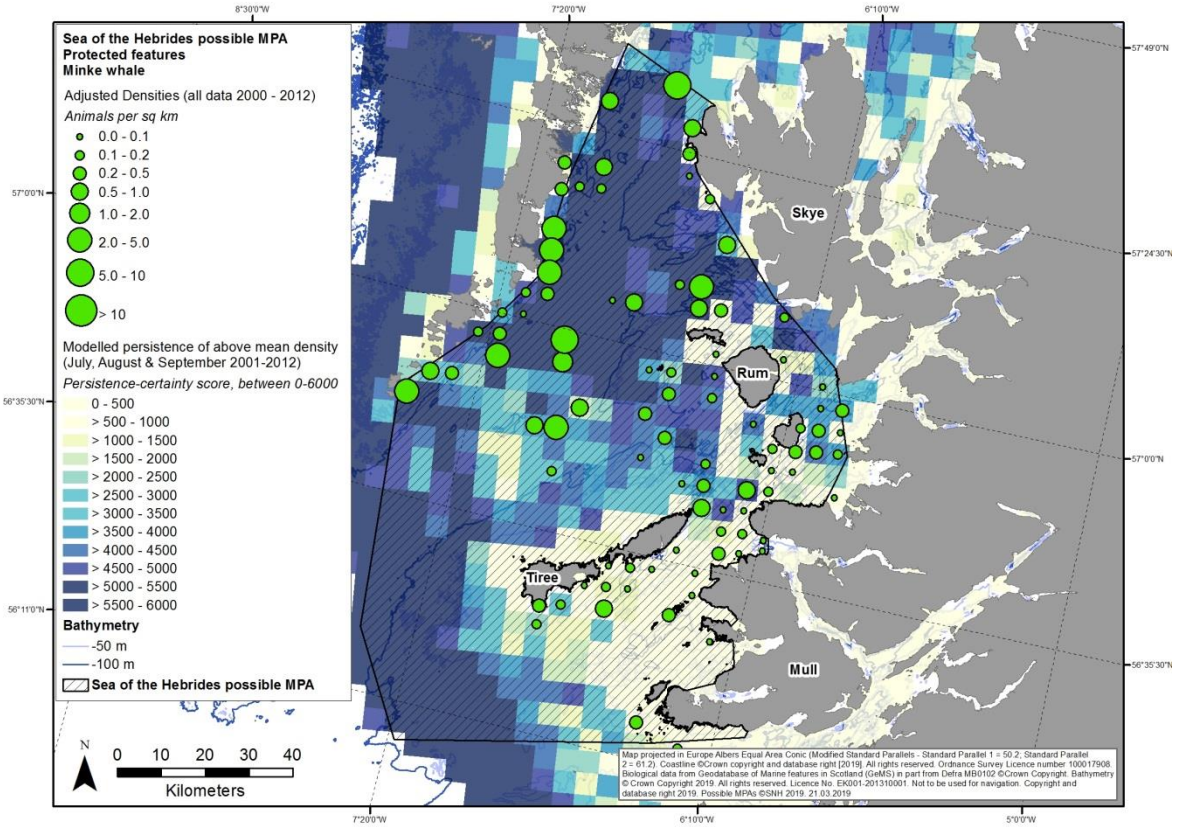
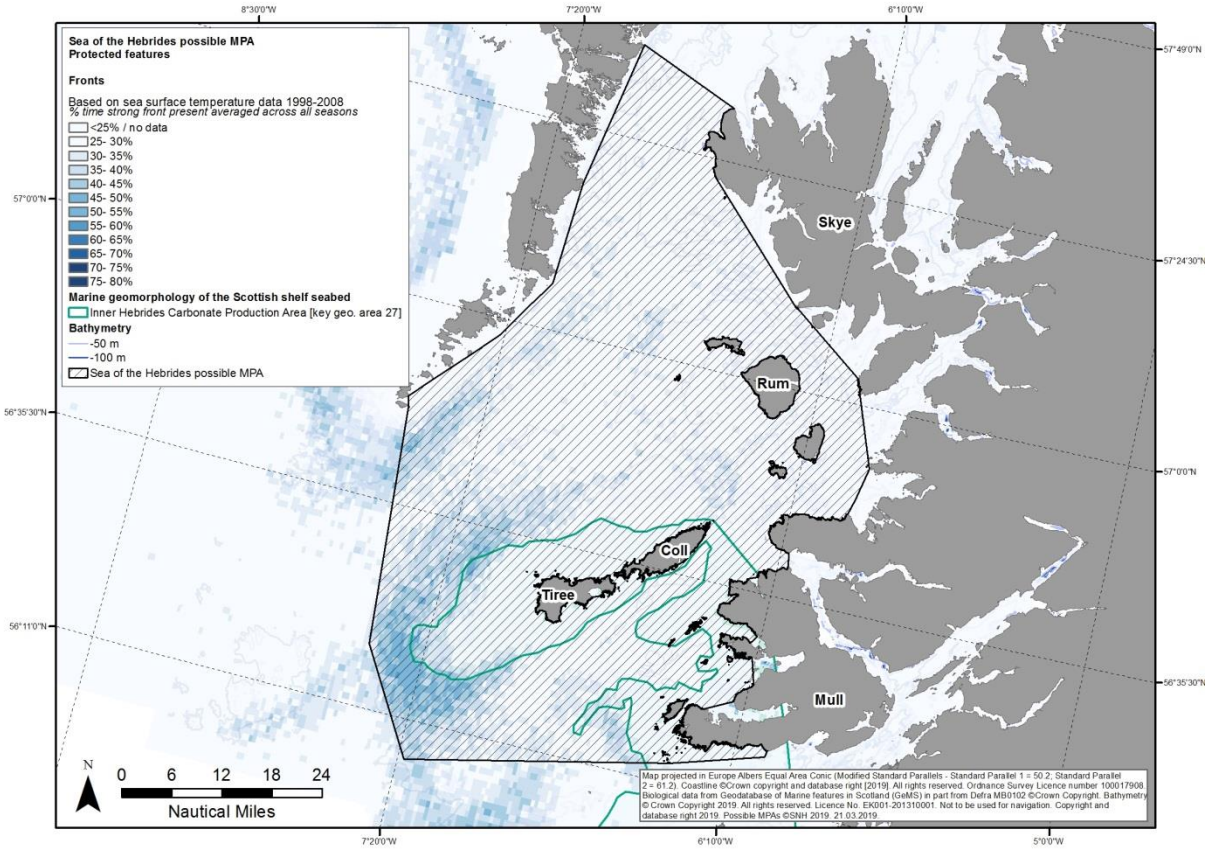


Figure 2i-iii *Location of the Sea of the Hebrides pMPA and distribution of the proposed protected features*



5 Conservation objectives

5.1 Background

Conservation objectives set out the desired quality of the protected features within the Sea of the Hebrides 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 Sea of the Hebrides 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)[3] and also for the features not covered by FEAST, Marine Evidence based Sensitivity Assessment (MarESA)[4]. 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 Basking Shark

Basking sharks are considered to have a medium sensitivity to collision and a low sensitivity to noise. There is evidence of basking sharks with injuries that could have been caused by collision with boat propellers (Bloomfield and Solandt, 2008, Speedie *et al*., 2009). There are also a limited number of accounts of basking shark being caught accidently in nets or ropes (Bloomfield and Solandt, 2008, Scottish Creel Fishermen's Federation[5], SNH and JNCC Fisheries Guidance Note[6]) although the extent and frequency of this is unknown within the pMPA. Basking sharks are considered vulnerable due to their surface feeding habits, slow growth rate, lengthy maturation time (Sims and Quale, 1998) and site-faithfulness.

[3] http://www.marine.scotland.gov.uk/feast/
[4] https://www.marlin.ac.uk/sensitivity/sensitivity_rationale
[5] http://www.scottishcreelfishermensfederation.co.uk/entanglement.htm
[6] https://www.nature.scot/2019-possible-nature-conservation-marine-protected-areas-consultation

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. 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 are considered unlikely to cause significant risk of impact on the fronts feature within the pMPA.

6.4 Marine Geomorphology of the Scottish Shelf Seabed - Inner Hebrides Carbonate Production Area

The individual components which make up the geodiversity area, namely shelves, banks and sand wave fields composed of carbonate rich gravels and sands, are known to be sensitive to a range of pressures. Banks and sand wave fields are considered to be highly sensitive to tidal flow changes whereby small scale changes to hydrodynamic regimes can cause widespread disruption of sediment supply. These features also have a medium sensitivity to both the physical change and removal of sediment within the immediate area as well as water clarity changes, all of which have the potential to affect the long-term rates of biogenic sediment supply. Lastly, the geodiversity feature is also considered to have a medium sensitivity to temperature changes on a national level and an accompanying low resilience.

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 the 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] https://marinescotland.atkinsgeospatial.com/nmpi/

7.2 Best Practice

In our management advice for activities in Table 2 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 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. Further research to investigate social interactions and potential breeding of basking sharks, cumulative disturbance issues and to improve understanding of the role that smaller scale local fronts play in their life cycle.
2. Finer resolution benthic sampling to help define the extent of the biogenic features of the Inner Hebrides Carbonate Production Area, e.g. maerl beds and seagrass beds.

Table 2. SNH's advice to support management for Sea of the Hebrides 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 are a proposed protected feature of the pMPA, 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 basking sharks and 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. In relation to the **Inner Hebrides Carbonate Production Area** (IHCPA) the most sensitive carbonate producing habitats within the area, e.g. maerl beds and horse mussel beds are all Priority Marine Features and are included within the MS-led project *Improving protection to Priority Marine Features within the Marine Protected Area network*. The Areas for Management Consideration and Knowledge Gaps identified by SNH as part of this work reflect our most up-to-date understanding of the distribution of these most-sensitive habitats and can be viewed on NMPi. (https://marinescotland.atkinsgeospatial.com/nmpi/). They reflect the locations where management for the IHCPA should be focused.

Activities considered capable of affecting the proposed protected features	**Advice to support management**		
	Basking Shark	**Minke Whale**	**Inner Hebrides Carbonate Production Area**
Aquaculture*	**Reduce or limit pressures** Minimise the risk of disturbance[8] to basking sharks and minke whales 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 Town and Country Planning consent process. These plans should include consideration of the potential for cumulative impacts of noise. Reduce risk of entanglement for basking sharks and minke whales through the adherence to existing best practice[10] in the deployment and maintenance of fish farm equipment.		**Reduce or limit pressures** Minimise the potential impact on the Inner Hebrides Carbonate Production Area. This should focus on appropriate siting of new farms to avoid impacts on the most sensitive carbonate-producing habitats within the Area e.g. maerl beds and horse mussel beds.

[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

Activities considered capable of affecting the proposed protected features	Advice to support management		
	Basking Shark	**Minke Whale**	**Inner Hebrides Carbonate Production Area**
Anchorages and Moorings*	**No additional management required**		**Reduce or limit pressures** Minimise the likely effects of new anchorages and moorings within the Inner Hebrides Carbonate Production Area. This should focus on appropriate siting to avoid impacts on the most sensitive carbonate-producing habitats within the Area e.g. maerl beds and horse mussel beds.
Boat use associated with both commercial and recreational activities (with the exception of **Commercial shipping and ferries** and **Wildlife tour boats** – see separate advice below.)	**Reduce or Limit Pressures** Reduce risk of collisions with and disturbance of basking sharks and minke whales from boats when watching or attempting to watch marine wildlife by following the SMWWC (Scottish Marine Wildlife Watching Code[11]). Further reduce risk in areas with high aggregations of basking sharks between June and October by developing and adopting best practice for skippers e.g. shark awareness zones[12]. 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.		**No additional management required**

[10] As set out in *A Technical Standard for Scottish Finfish Aquaculture* that farms should be working towards by 2020 (https://www.gov.scot/Resource/0047/00479005.pdf) and the Scottish Salmon Producers Organisation *Code of Good Practice* (http://thecodeofgoodpractice.co.uk/wp-content/uploads/2015/02/cogp-chapter-4-seawater-lochs2.pdf.)

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

[12] These zones and the best practice associated with them are proposed as voluntary measures to be developed and agreed with boat users (Figure 3).

Activities considered capable of affecting the proposed protected features	Advice to support management		
	Basking Shark	**Minke Whale**	**Inner Hebrides Carbonate Production Area**
Cables and pipelines*	**Reduce or limit pressures** Early discussion of siting, design and construction is recommended to reduce the risks of disturbance to basking shark caused by the development and installation of new cable and pipeline infrastructure.	**Reduce or limit pressures** Early discussion of siting, design and construction is recommended to reduce potential impact on the habitat of sandeels. Key details which should be discussed are siting and installation techniques to avoid key sandeel habitat and to minimise the footprint.	**Reduce or limit pressures** Minimise the likely effects of new cables and pipelines within the Inner Hebrides Carbonate Production Area. This should focus on appropriate siting to avoid impacts on the most sensitive carbonate-producing habitats within the Area e.g. maerl beds and horse mussel beds.
Coastal development e.g. construction of piers, slipways, jetties etc.*	**Reduce or limit pressures** Reduce the risks of disturbance to basking sharks and 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.[13]		**Reduce or limit pressures** Minimise the likely effects of coastal development within the Inner Hebrides Carbonate Production Area. This should focus on avoiding impacts on the most sensitive carbonate-producing habitats within

[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		
	Basking Shark	**Minke Whale**	**Inner Hebrides Carbonate Production Area**
		Reduce or limit pressures Minimise the potential impact of coastal development on the habitat of sandeels. This will be best 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.	the Area e.g. maerl beds and horse mussel beds.
Commercial shipping and ferry routes[14]	**Reduce or limit pressures** Whilst no additional management is required for existing routes, further discussion is recommended during the establishment of new routes or amendments to existing routes if vessels would be transiting through areas used by basking sharks between June and October to reduce risk of collision and disturbance e.g. as defined by shark awareness zones[15].	**No additional management required**	

[14] This category refers to commercial vessels and ferries that pass through the possible MPA following pre-defined routes.
[15] These zones and the best practice associated with them are proposed as voluntary measures to be developed and agreed with boat users (Figure 3).

Activities considered capable of affecting the proposed protected features	Advice to support management		
	Basking Shark	**Minke Whale**	**Inner Hebrides Carbonate Production Area**
Fishing - demersal mobile/active gear*	**Reduce or limit pressures** The development and adoption of best practice to reduce or limit the risk of incidental catch of basking sharks ***should be considered***.	**Remove or avoid pressures** The exclusion of hydraulic fishing[16] methods from the habitat of sandeels (as a key prey species of minke whales) within the site ***is recommended.***	**Reduce or limit pressures** Management measures to reduce or limit demersal mobile/active fishing within the Inner Hebrides Carbonate Production Area ***are recommended.*** This should focus on avoiding impacts on the most sensitive carbonate-producing habitats within the Area e.g. maerl beds and horse mussel beds.
Fishing – static gear*	**Reduce or limit pressures** The further development and adoption of existing best practice[17] to reduce or limit the risk of entanglement of basking sharks and 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) from areas used by basking sharks and minke whales between April and October due to the risk of entanglement ***is recommended***.		**Reduce or limit pressures** Management measures to reduce or limit the intensity of static gear fishing within the Inner Hebrides Carbonate Production Area ***should be considered***. This should focus on impacts on the most sensitive carbonate-producing habitats within the Area e.g. maerl beds and horse mussel beds.
Fishing – pelagic*	**Reduce or limit pressures** The development and adoption of best practice to reduce or limit the risk of incidental catch of basking sharks and minke whales ***should be considered***.		**No additional management required**

[16] 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.
[17] 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		
	Basking Shark	**Minke Whale**	**Inner Hebrides Carbonate Production Area**
		Reduce or limit pressures Management 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.	
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 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.	**Reduce or limit pressures** Minimise the potential impact on the Inner Hebrides Carbonate Production Area. Early pre-application discussions are recommended and these should focus on appropriate siting of new disposal sites and any pre-submission surveys to avoid impacts on the most sensitive carbonate-producing habitats within the Area e.g. maerl beds and horse mussel beds.

Activities considered capable of affecting the proposed protected features	Advice to support management		
	Basking Shark	**Minke Whale**	**Inner Hebrides Carbonate Production Area**
Military – planned exercises*	**Reduce or limit pressures** Reduce the risks of disturbance to basking sharks and 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)[18].		**No additional management required**
Ports and harbours*[19]	**Reduce or limit pressures** Reduce the risks of disturbance to basking sharks and minke whales from activities associated with high source levels of underwater noise (e.g. pile-driving and blasting) between April 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.[20].		**No additional management required**

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

[19] The advice on boat use (see activity 'Boat use associated with both commercial and recreational activities ') in relation to Ports and Harbours 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.

[20] 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		
	Basking Shark	**Minke Whale**	**Inner Hebrides Carbonate Production Area**
Renewable energy*	**Reduce or limit pressures** Reduce the risk of renewable energy development acting as a barrier to species movement e.g. siting of renewables development, with a particular focus on the basking shark awareness zones[21].	**Reduce or limit pressures** Minimise the potential impact of renewable energy development on the habitat of sandeels. Early discussions on siting, design, construction and any pre-submission surveys are recommended to reduce the potential impacts on the habitat of sandeels to minimise the impact to a key prey species of minke whale.	**Reduce or limit pressures** Minimise the likely effects of new renewable energy developments within the Inner Hebrides Carbonate Production Area. Early discussions on siting, design, construction and any pre-submission surveys are recommended with a focus on avoiding impacts on the most sensitive carbonate-producing habitats within the Area e.g. maerl beds and horse mussel beds.
	Reduce or limit pressures Activities associated with renewable energy development that increase the risk of disturbance, acoustic injury, collisions and entanglement of basking sharks and minke whales, such as piling and blasting and the deployment of mooring lines, should be minimised. Early pre-application discussion will assist with the development of key mitigation techniques such as piling strategies etc.		

[21] These zones and the best practice associated with them are proposed as voluntary measures to be developed and agreed with boat users (Figure 3).

Activities considered capable of affecting the proposed protected features	Advice to support management		
	Basking Shark	**Minke Whale**	**Inner Hebrides Carbonate Production Area**
Scientific survey/research*	**Reduce or limit pressures** Pressures associated with scientific acoustic surveys should be minimised through existing best practice measures[22] to ensure that basking sharks and minke whales within the possible MPA are not disrupted between April and October. Survey work that is targeted on basking sharks and 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[23] should be sought from SNH and appropriate mitigation agreed.[24]		**Reduce or limit pressures** Minimise the potential impact of scientific surveys within the Inner Hebrides Carbonate Production Area. Early discussion siting, design and construction are recommended with a focus on avoiding impacts on the most sensitive carbonate-producing habitats within the Area e.g. maerl beds and horse mussel beds[Error! Bookmark not defined.].
Seismic and other broadscale acoustic surveys*	**Reduce or limit pressures** Minimise the impact of seismic or other acoustic surveys which may cause injury or disturbance to basking sharks or minke whales through following the JNCC Guidelines for minimising the risk of injury and disturbance to marine mammals from seismic surveys[22].		**No additional management required**
Wildlife tour operators	**Reduce or limit pressures** Reduce risk of collisions with and disturbance of basking sharks and minke whales from boats and 'swim-with' operations by following the SMWWC and the WiSe (Wildlife Safe[25]) accreditation scheme.		**No additional management required**

[22] 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.
[23] https://www.nature.scot/professional-advice/safeguarding-protected-areas-and-species/licensing/licensing-forms-and-guidance
[24] Any sampling or tagging of minke whale or basking shark also requires a Home Office Licence (https://www.gov.uk/guidance/research-and-testing-using-animals).
[25] https://www.wisescheme.org/

Table 3. Activities that are considered not likely to affect the proposed protected features (other than insignificantly)[26]

Activity	Comments
Cables and pipelines - existing	Existing cable and pipeline infrastructure is considered unlikely to affect the features of the pMPA. New developments would be subject to assessment on a case by case basis.

[26] 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. Sea of the Hebrides 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.

Sea of the Hebrides possible MPA

Protected features:
Mobile species – Basking shark and minke whale
Geomorphological features – Marine Geomorphology of the Scottish Shelf Seabed - Inner Hebrides Carbonate Production Area
Large scale features - fronts

The Conservation Objectives of the Sea of the Hebrides possible MPA, are that the protected features

- so far as already in favourable condition, remain in such condition; and
- 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 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 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.

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 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 habitats 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 are to be disregarded when assessing against the Conservation Objectives.

In relation to the Sea of the Hebrides 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 Sea of the Hebrides pMPA as additional pressures may reduce the protected feature's resilience to climate change, and additionally climate change impacts may start to hinder their ability to recover from human activities.

Basking Shark	Basking sharks feed on zooplankton and there is evidence to show they selectively forage for higher densities of larger *Calanus* species with high lipid content. The more boreal *C. finmarchicus* is declining in the northern North Sea, as their distribution shifts north, with *C. helgolandicus* increasing in abundance and these trends are linked to climate change (MSS, 2010; Edwards *et al.*, 2013). This trend is primarily influenced by temperature although may also be due to the lack of a diapause phase (overwintering sinking behaviour) being reported in *C. helgolandicus* (Wison *et al.*, 2014). Monitoring of zooplankton in Loch Ewe (north of the Sea of the Hebrides) shows that *C. helgolandicus* is more dominant than *C. finmarchicus* year round, with peaks in abundance during August and September (Bresnan *et al.*, 2016), suggesting the trend seen in the North Sea is already evident in some of the west coast sea lochs. Large reductions in overall zooplankton abundance may be influenced by larger oceanographic process and linked to climate change and may have an effect on basking shark foraging behaviour and energy requirements. Historical trends of declines in zooplankton abundance have been documented in the past to the west of Ireland (Colebrook *et al.*, 1984) which may have played a role in exacerbating historical downward trends in basking shark catches (Sims and Reid, 2002). Reduction in the overall abundance of zooplankton and in particular *Calanus* sp. is more likely to have an effect on basking sharks than changes towards a dominance of *C. helgolandicus*. Environmental change influencing the fronts feature, which has a role in supporting and concentrating the zooplankton, is discussed below.
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.*, 2004; 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 and their distribution elsewhere in Scottish waters.
Fronts	The persistent thermal fronts in this pMPA are heavily influenced by large differences in water depth and topography as well as tidal currents (Xing and Davies, 2001). Climate change may lead to fundamental shifts in oceanic and atmospheric circulation patterns (Harley *et al.,* 2006) such as changes to the North-Atlantic Oscillation and the North Atlantic Current (Hurrel *et al.,* 2003). Alterations in these two current patterns may result in changes to the overall salinity and nutrient load on the outer continental shelf and subsequently influence the formation of fronts in the Sea of the Hebrides pMPA (Inall *et al.,* 2009, Mark Inall and Andy Dale pers. comm., 2012). The predicted

	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, could lead to changes in the seasonal mixing of water bodies (Holt *et al.,* 2016, Dominicis *et al.,* 2018, Beth Scott pers. comm., 2019). This and changes in nutrient levels could alter the levels of plankton productivity which is important for supporting animals higher up the food chain e.g. basking sharks (Wakelin *et al.,* 2015, Beth Scott pers. comm., 2019). 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.
Inner Hebrides Carbonate Production Area	Projected increases in seawater temperatures, availability of CO_2 for photosynthesis, ocean acidification, the frequency and strength of storm events, and changes in sea level associated with climate change all have implications for the continued extent, distribution, and structure of the biogenic component elements of the feature (Gormley *et al.*, 2014).

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**
Basking Shark	Basking shark within the Sea of the Hebrides pMPA are not at significant risk from injury or killing.	Higher numbers of shark are present are particularly notable during the months of June to October when they spend most of their time close to the surface feeding and often in aggregations (Speedie, 2009, Witt *et al.*, 2016, Doherty *et al.*, 2017). The areas in which these aggregations occur more frequently have been termed basking shark awareness zones[27]. There are tentative estimates of basking shark numbers from smaller areas within the pMPA (Booth *et al.,* 2003, Gore, *et al.,* 2016), but there are no population assessments for basking sharks that could be used for assessments in relation to this Conservation Objective at present. This Objective seeks to conserve basking shark by minimising the risk to the animals from injury or killing. For the purposes of pMPA assessments basking shark are only protected when they are within the site. Any activities that take place within or outside the pMPA that could potentially kill or injure minke whale in the pMPA should be considered in assessments. The interpretation of 'significant' risk from killing or injury 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. Basking sharks are classed as Endangered in the North East Atlantic region. The pMPA is one of very few areas in this region which attract consistent

[27] The basking shark awareness zone (see Figure 3) is an area that basking sharks use more often during June to October, where they also occur in groups or aggregations and display courtship-like behaviour. Basking shark presence in these zones appears to be driven by the availability of prey resources.

		and significant aggregations of individuals. Significant levels of killing or injury within the pMPA therefore could affect basking shark numbers at a wider scale due to importance of the pMPA for feeding, aggregating and potentially breeding. The pMPA complements existing protection of basking shark provided by Schedule 5 of the Wildlife and Countryside Act 1981 (as amended). It is an offence to intentionally or recklessly kill, injure or take basking sharks. Licences can be granted for certain activities (under Section 16 (3) of the legislation) that may otherwise be an offence, but only where there is no other satisfactory solution[28]. Incidental killing and injury is the risk of mortality and injury that remains after mitigation has been put in place through licensing to avoid intentional or reckless killing and injury. Incidental killing and injury is not covered through the licensing process. Therefore assessments for both licensing under the Wildlife and Countryside Act 1981(as amended) and the pMPA need to be undertaken for basking shark for relevant activities. Unregulated activities (e.g. not subject to licensing or consenting) should still be considered against this conservation objective.
Minke whale	Minke whale in the Sea of the Hebrides pMPA are not at significant risk from injury or killing.	Sightings of minke whale within the pMPA are highest during the late summer months, however, there is evidence that minke whale are present throughout the year, albeit in lower numbers (Anderwald and Evans 2007, Paxton *et al.*, 2014). 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

[28] http://www.legislation.gov.uk/ukpga/1981/69/contents

		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 (EPS) 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 or 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 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 to 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**
Basking Shark	Conserve the access to resources provided by the pMPA for feeding, courtship-like behaviour and breeding. ***and*** Conserve the distribution of basking shark 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 basking shark in the pMPA. Resources in this context are zooplankton prey (discussed here) and the fronts that influence the presence and concentration of zooplankton. The areas where zooplankton are concentrated are particularly important as they offer efficient feeding grounds for basking sharks. There are two main ways in which access to resources could be restricted and basking shark distribution affected: 1. Large scale physical barriers or 2. Significant disturbance which alters their distribution within the site or disrupts important behaviours.

		Assessments should focus on these two factors. 1. <u>Physical barriers</u> Only large-scale physical barriers or obstructions within basking shark awareness zones[29] are likely to prevent or restrict access to resources to an extent that may result in significant impacts on feeding, courtship-like behaviour and potentially breeding. High abundances of zooplankton are needed to support basking shark growth. Large cumulative obstructions perhaps in combination with significant disturbance (discussed below) would be of most concern. 2. <u>Disturbance</u> Disturbance may arise from activities causing underwater noise and possibly close physical presence of e.g. boats (Galpin, 2009) and swim with operations (Inman *et al.* 2016). Disturbance to basking sharks during feeding may reduce the time spent feeding or cause them to move to different areas that are less profitable for foraging. Continued access to preferred profitable feeding grounds is important for basking sharks to meet their energetic demands. Disturbance may also disrupt social behaviours, courtship-like behaviour and breaching. These behaviours may be critical to the life history of basking sharks, being a prerequisite for breeding for example as in other sharks (Pratt and Carrier, 2001). Courtship-like behaviours have been observed where groups of basking sharks occur and there is recent evidence of social groups forming close to the seabed within the basking shark awareness zones[29] (SNH, 2018). The duration of disturbance and area over which basking sharks are potentially impacted are important considerations as well as cumulative disturbance. Interpretation of significant disturbance will depend on the context, but particular focus should be on cumulative disturbances from multiple or repeated activities that prevent or significantly restrict shark behaviours occurring without interruption or that alter the distribution of

[29] Basking shark awareness zone (see Figure 3) is an area that basking sharks use more often during June to October, where they also occur in groups or aggregations and display courtship-like behaviour. Basking shark presence in these zones appears to be driven by the availability of prey resources.

		basking sharks within the pMPA. Disturbance is of particular relevance within basking shark awareness zones[29]. It is considered that 'significant disturbance' may result in the following effects: • contributes to long-term decline in the use of the site by basking sharks. • changes to the distribution of basking sharks within the site, with particular emphasis on the basking shark awareness zones, on a continuing or sustained basis. • changes to basking shark behaviour such that it reduces the ability of the species to feed efficiently, breed or survive. In addition to this disturbance to basking sharks is also covered by provisions within the Wildlife and Countryside Act 1981 (as amended). This means it is an offence to intentionally or recklessly disturb a basking shark when using or occupying a place for shelter or protection. Licences can be granted for certain activities (under Section 16 (3) of the legislation) that may otherwise be an offence under the legislation, but only where there is no other satisfactory solution. Assessments for species 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.
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	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 (Anderwald and Evans 2007, Paxton *et al.*, 2014). However, the areas within the pMPA which may be more important to the species are not fully understood at present.

	by avoiding significant disturbance.	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> Only 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 (Anderwald and Evans 2007). • <u>Disturbance</u> 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 which last 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 within the site 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 minke whale is also covered by the European Protected Species legislation and is defined *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 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**
Basking Shark	Conserve the extent and distribution of any supporting feature upon which basking are dependent ***and*** Conserve the structure and function of supporting features, including processes to ensure basking shark are healthy	The main supporting features for basking sharks are zooplankton, the sole food source for basking sharks, and fronts – a large scale feature that helps to influence the presence and concentration of zooplankton. Zooplankton are linked closely with the fronts feature, and therefore the two supporting features and their conservation objectives should be considered together. The fronts conservation objectives are discussed below. Other supporting features that may also be important for facilitating basking shark social interactions, courtship-like behaviours and potentially breeding and resting include seabed habitats, particularly kelp beds or shallower water. Assessments should focus on activities that can significantly alter water flow, currents, topography or nutrient availability within basking shark awareness zones[4] which support

	and not deteriorating	aggregations of feeding basking sharks, as these are most likely to affect the species composition, abundance or concentration and distribution of zooplankton available to basking sharks. Although most pressures are considered unlikely to pose a significant threat to supporting features and processes, large scale activities that could have effects on these aspects across the site should be considered. <u>Zooplankton</u> The extent of zooplankton is taken to mean the presence and concentration or abundance, whilst the structure and function relate to the zooplankton species assemblage present and their nutritional value in terms of prey (biomass production) for basking sharks. Basking sharks selectively forage in areas that support high densities of zooplankton (Sims and Quayle, 1997) and specifically where *Calanus helgolandicus* (a large copepod) is more numerous and larger in size (Sims and Merrett, 1997). *Calanus* sp. have a high lipid content and are larger than many other zooplankton and are therefore of higher calorific value. Basking sharks have been shown to stop feeding and leave patches when zooplankton thresholds are around 0.6 g/m^3 and spend significantly more time feeding in zooplankton densities of > 3 g/m^3 (Sims, 1999). Actively selecting areas with higher densities of prey offer a more efficient feeding strategy for basking sharks, which may be critical for their energetic needs. The extent and distribution of zooplankton may be altered by changes in parameters that affect physical factors and hydrodynamics e.g. water flow, tidal currents, and topography. Such changes may result from large scale structures which may reduce the abundance, concentration or location of prey (Cox *et al.,* 2018), making it more difficult for basking sharks to feed efficiently. Near shore coastal water structures such as channels, headlands and island wakes can concentrate foraging behaviour that coincide with tidal phases (Cox *et al*., 2018 for review). Basking sharks appear to move north and south with the tides through Gunna Sound whilst feeding (pers. comm. Colin Speedie, James Fairbairns, Shane Wasik, 2019). This may indicate tidal movements have an influence on the distribution and density of zooplankton in this location and in turn foraging basking

		sharks. The structure and function of zooplankton (species composition and biomass produced) are more likely to be affected by nutrient availability (influenced by tidal velocities and tidal mixing) or changes in temperature and salinity. It is not clear at present the scale of impact to zooplankton that could cause deterioration in basking shark health, and some changes may only affect the localised distribution of zooplankton and not the overall availability. In addition separating any localised anthropogenic changes in zooplankton from environmental changes may be difficult. Trends of declines in zooplankton abundance have been documented in the past to the west of Ireland (Colebrook *et al.* 1984) which have been suggested as potentially playing a role in exacerbating historical downward trends in basking shark catches (Sims and Reid, 2002). There has been a decline in zooplankton density at the Loch Ewe station since 2013, which might be reflective of larger scale oscillating trends off the west coast (Marine Scotland Science SCoBS data). <u>Supporting features potentially facilitating key basking shark behaviours</u> Additional habitats may be important for basking shark social interactions, courtship-like behaviour and resting. It has been suggested that aggregations or groups of feeding basking sharks may facilitate secondary behaviours such as courtship-like behaviour (Sims *et al.* 2000). Recent tagging work has shown groups of sharks forming close to the seabed e.g. swimming in close groups just above kelp beds and sandy substrates, groups that are nearly stationary, close to the seabed, and sometimes in contact with each other (SNH, 2018).
Minke whale	Conserve the extent and distribution of any supporting feature upon which minke whale is dependent. ***and***	The pMPA provides good foraging habitat and it may also be used for other parts of their life cycle (Macleod *et al.,* 2004). Our understanding of the supporting features for minke whale 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, particularly upwelling areas and strong currents around

	Conserve the structure and function of supporting features, including processes to ensure minke whale are healthy and not deteriorating.	headlands and small islands, and those that affect the composition of the substrate, e.g. hydraulic dredging, aggregate extraction, dumping (ICES 2016, 2018). These activities are most likely to affect species composition, abundance or concentration of prey species available to minke whale. In particular activities that could affect sandeels in the spring (May to July), herring spawning habitats in July and sprat between July and September should be assessed due to evidence suggesting minke whale target these species during these periods (Gill *et al.,* 1999; Macleod *et al.,* 2004; Anderwald *et al.*, 2006; Anderwald and Evans, 2007). <u>Prey species</u> Minke whales are known to take a wide range of pelagic shoaling small fish species, and the main prey species in this region are the lesser sandeel (*Ammodytes marinus*), sprat (*Sprattus sprattus*), herring (*Clupea harengus*) and mackerel (*Scomber scombrus*). Minke whales appear to target these species at different times of the year. In the spring (May to July) minke whales are predominantly target sandeels (Gill *et al.*, 1999; Macleod *et al.*, 2004; Anderwald *et al.* 2012), whilst in July the minke whales move to the pre-spawning habitats of the herring (Macleod *et al.,* 2004). During the second half of the season (July to September), sprat become more important in the minke whale's diet (Anderwald *et al.*, 2006; Anderwald and Evans, 2007; Anderwald *et al.* 2012). 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 relevant fisheries is considered in relatively large units (e.g. ICES area VIa, West of Scotland 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, favoured feeding locations are thought to include upwelling areas around headlands and small islands where strong currents flow (Evans, 2008). The condition of the seabed and water column inhabited by the main prey species for minke whale is also a relevant consideration. Sandeels (*Ammodytes marinus*) bury into coarse sand with low silt content between depths of 20 and 80m (Holland *et al.,* 2005, Wright *et al.,* 2000; Wright *et al*., 2019) and *A. tobianus* is found in similar sediments but usually shallower areas. 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. They tend to aggregate around their spawning grounds for some time before spawning (Maravelias *et al*., 2000).

GEOMORPHOLOGICAL FEATURES

a) Extent, component elements and integrity		
Feature	**Site specific advice**	**Site specific information**
Marine geomorphology of the Scottish shelf seabed - *Inner Hebrides Carbonate Production Area*	Conserve the features extent, component elements and integrity of the Marine Geomorphology of the Scottish Shelf Seabed feature.	Component elements of this feature refer to the landforms which make up the feature, namely the carbonate rich sands and gravels, whilst integrity relates to the collective assemblage of these landforms and their inter-relationships. Within the pMPA the Inner Hebrides Carbonate Production Area encompasses the shelf areas around the islands of Coll and Tiree and on the west coast of Mull. The outer/seaward extent of the feature is closely related to the 50 m depth contour and is characterised by sands and gravels with very high carbonate content. Banks of coralline algal gravels (maerl beds) are interspersed amongst these mollusc rich sediment banks alongside other biogenic component elements such as blue mussel beds, horse mussel beds and seagrass beds. Studies show that the carbonate sand and gravels are transported shorewards by near-bed currents produced by wind and waves in storm events (Light and Wilson, 1998). The extent of these sediments may be sensitive to large scale changes in water flow, wave exposure and activities involving the physical removal of sediments and sub-surface abrasion/ penetration of the seabed. The biogenic component elements of the feature, namely maerl beds, blue mussel beds, horse mussel beds and seagrass beds are generally fragile, slow-growing and long-lived. Therefore they are sensitive to physical disturbance, particularly in the form of abrasion and habitat removal / change, organic enrichment, siltation and changes in water flow (Perry and Tyler-Walters, 2018). Activities associated with these pressures include bottom-contacting fishing, aquaculture (Hall-Spencer *et al.*, 2006) and coastal development (Mazik *et al.*, 2015). Assessments should focus on activities which may significantly alter water flow characteristics as well as those involving significant abrasion or disruption of the carbonate rich 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**
Marine geomorphology of the Scottish shelf seabed - *Inner Hebrides Carbonate Production Area*	Conserve the structure and functioning of the feature so that they are unimpaired.	The structure of the Inner Hebrides Carbonate Production Area is considered here to relate to the composition of the shelf carbonate system and the physical structure of the feature's biogenic component elements. The structure of the shelf carbonate system is characterised by banks of carbonate rich sediments composed of broken mollusc and echinoid shells. This high carbonate content is maintained by the structure of the features biogenic component elements, which are attached to the substratum and aggregated in dense beds. Silt, organic waste and other shell material accumulated within the bed also contributes to the element's structure through which seawater is able to percolate. Given the brittle nature of calcium carbonate, the structure of the feature is sensitive to physical disturbance, particularly in the form of abrasion and habitat removal / change, organic enrichment, siltation and changes in water flow (Perry and Tyler-Walters, 2018). The feature has several functions including nutrient cycling, sediment supply, carbon storage, biomass production, the provision of habitat for other species and larval/ gamete supply. These functions are closely related to the feature's high calcium carbonate production and sequestration rates through the continued growth of biogenic features and the sediment pathways which drive carbonate rich sediments ashore where they are a key component for dune-machair landform systems (Brooks *et al.*, 2013). These key functions are underpinned by the structure of the feature and are therefore sensitive to the same pressures. Wider functions such as sediment stabilisation, coastal protection and the supply of sediment to dune-machair systems may also be sensitive to large scale changes in water flow, wave exposure and sedimentation deposition. Assessments should focus on activities which may significantly alter water flow characteristics as well as those involving significant abrasion or disruption of the carbonate rich seabed sediments. 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**
Marine geomorphology of the Scottish shelf seabed - *Inner Hebrides Carbonate Production Area*	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 Inner Hebrides carbonate production area 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 the fronts feature.	There are two types of fronts that can be recognised within the pMPA; seasonal persistent thermal fronts and smaller frontal areas resulting from local water movements and influenced by topography and tidal currents. A thermal front forms persistently to the south-west of Tiree particularly during the spring and summer. The front forms at the boundary between the tidally-mixed zone on the relatively shallow inner shelf of Skerryvore and deeper, more stratified waters further away from the inner shelf. The formation of the front in this location is heavily influenced by the local bathymetry in the area and is therefore relatively stable between years. The thermal front in this area has occurred in the same location over a period of 10-years based on satellite derived sea surface temperature data (Miller *et al.*, 2010). Smaller-scale persistent fronts are present around other headlands and areas with complex topography within the pMPA, evidenced by the presence of basking sharks and other predators such as minke whales and birds using these productive areas for foraging. Assessments should focus on activities that may cause changes in topography, or water flow. Construction and developments can affect coastal hydrodynamics (Cox *et al.,* 2018, Dominicis *et al.,* 2018) but their effect will be dependent on their size, range, and location. Influences from developments and activities on smaller frontal areas and the productivity they provide is currently less understood but also have the potential to affect fronts (Cox *et al.,* 2018) and their productivity and should be considered on a case-by-case basis.

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 fronts to ensure that they continues to support the characteristic biological communities of the pMPA 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) • Nutrient cycling • Formation of physical barrier	The key functions of fronts are of particular importance within the pMPA but also to the wider marine environment. Fronts form where there is mixing between two different water bodies, causing elevated and concentrated nutrients which in turn elevate plankton, zooplankton and predator species, subsequently resulting in high biomass production. Fronts have a key role in concentrating zooplankton-rich waters (Kiorboe and Johnson, 1986; Maravelias and Reid, 1997). High concentrations of zooplankton presence and their distribution within the pMPA are linked to both large scale persistent thermal fronts (Miller et al, 2010) and smaller frontal areas. These elevated levels of zooplankton attract fish, including the basking shark and predators such as minke whale and birds. 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 and salinity changes at fronts may lead to separation and/ or influence local recruitment, resulting in areas of larval retention where larvae can't cross the boundary created (Hill et al., 2008). The gradient may also delineate boundaries for some species and provide migration corridors for some species, nutrients and sediment, or they can result in the retention of these. Fronts enable the circulation and transport of nutrients and oxygen from primary production. Activities that have potential to cause substantial changes to either water flow or to the seabed topography 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. 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 (Dominicis *et al.,* 2018) and this may have knock on affects to fronts and their associated biological communities.

Processes supporting the feature		
Feature	**Site specific advice**	**Site specific information**
Fronts	Conserve the processes that support fronts, in particular more localised tidal currents, freshwater input and local topography.	The underlying processes influencing the overall extent and distribution of the fronts feature in the Sea of the Hebrides are poorly studied. It is however likely that wider oceanic current patterns, tidal currents, freshwater input and local topography are important for conserving the processes that support fronts in this pMPA. It is likely that the northwards flowing European Slope Current plays a role in the formation of the front as it transports Atlantic water onto the inner continental shelf between Tiree and Barra (Inall *et al.,* 2009). It is also likely that the Scottish Coastal Current (SCC) plays a role as it flows northward along the west coast of Scotland composed of a mixture of Clyde and Irish Sea waters (Knight and Howarth, 1999). These currents are known to vary seasonally and temporally due to variations in the quantity of North Atlantic water and strength of the North Atlantic Oscillation (NOA) (Holliday, 2003), freshwater runoff (the SCC current is influenced by minor dilution from freshwater run off from Scottish sea lochs), as well as wind speed and tide. The extent to which these currents influence the extent and distribution of the fronts feature is difficult to determine. It is also probable that complex bathymetry in the area is also an important factor in the fronts' extent, distribution and structure. The fronts to the south-west of Tiree are thought to be primarily driven by current flow and local topography of the seabed. In

		addition the distribution of smaller scale local topographic fronts may be influenced in part by the habitats that are part of the headlands and complex bathymetry driving the fronts. As kelp beds have a role in wave damping and attenuation in certain circumstances (Lovas and Torum, 2001), they may also influence the local distribution of smaller scale fronts. Activities such as marine energy production or other large-scale development, with the potential to substantially alter tidal flow or seabed topography, or potentially large scale kelp removal could affect the structure and /or distribution of fronts within the pMPA and the functions provided (Cox *et al.,* 2018, Dominicis *et al.,* 2018). However, most pressures associated with human activities are currently considered unlikely to influence these wider oceanic current patterns or pose a significant risk to the fronts feature within the pMPA.

Annex 2. Supporting information

Factors determining the potential for features to recover

Basking shark

Life history characteristics of basking sharks make them vulnerable and limit their ability to recover: they have low fecundity (potentially 6 pups), a high gestation period estimate of up to 3.5 years (Parker and Stott, 1965) and high estimates of ages of sexual maturity of between 12-20 years (Compagno, 1984). Their vulnerability is evidenced from historical fishing practices and their current status of endangered in the North East Atlantic (IUCN), and their inclusion on the OSPAR list of threatened and/ or declining species and habitats. Also being a migratory species there may be other pressures outside of the pMPA that are not managed and may affect stages of their life cycle. In addition, their full life cycle is not fully understood, and this should be recognised in assessments.

Minke whale

Like other cetaceans, minke whale is long-lived and slow to reach maturity. Based on this and the recoverability of populations of other cetaceans, recovery of minke whale populations is likely to be slow. 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. Being a migratory species there may be other pressures outside of the pMPA that are not managed and may affect stages of their life cycle.

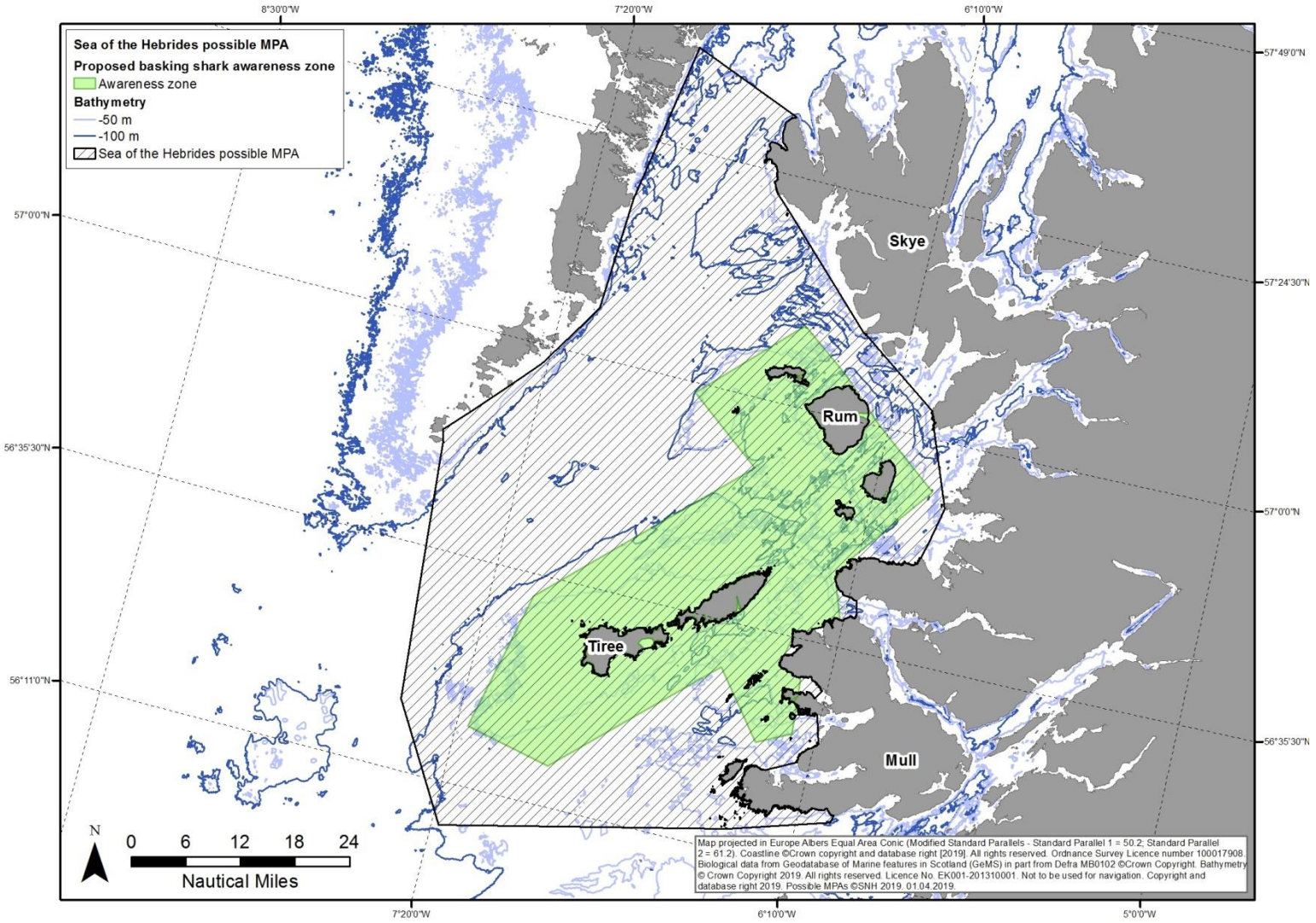
Inner Hebrides Carbonate Production Area

The recoverability of the Inner Hebrides Carbonate Production Area is influenced by a range of factors. Recoverability of the feature's overall function for carbon sequestration is likely to be robust or high given the scale of damage. This function is dependent on the individual biogenic habitats affected, the recoverability of which varies from species to species. For example, current evidence suggests that if removed, fragmented or killed, maerl has almost no ability to recover. However, blue mussel populations are considered to have a strong ability to recover from environmental disturbance although annual recruitment cannot always be guaranteed (i.e. it is episodic). With respect to seagrass beds, recovery depends mainly on vegetative growth of rhizomes from perennial beds rather than natural seedling production. Once lost, seagrass beds take considerable time to re-establish and may potentially not recover if all rhizomes are lost or damaged and sediment dynamics change (d'Avack *et al.*, 2014).

Fronts

As a large-scale dynamic feature the recoverability of fronts 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.

Figure 3. Map showing location of a proposed basking shark awareness zone within the Sea of the Hebrides pMPA (from Witt *et al.* 2019). This is the recommended area for further discussion with stakeholders in relation to conservation management to support reducing risks from boat collisions, cumulative disturbance and potentially entanglement in fishing gear.



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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.

Conservation Objective term	Definition
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.