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Marine Scotland

Strategic Environment Assessment of proposed Marine Protected Areas Environmental Report

May 2019

marinescotland

Report prepared by:



For:



Non-Technical Summary

Introduction

The Scottish Government has made a long-term commitment to ensuring the sustainable management of the marine environment and to balancing the competing interests of use and protection of the sea. This includes the designation and management of new nature conservation sites, including Marine Protected Areas (MPAs).

Scottish Natural Heritage has advised that four additional MPAs should be included in the MPA network (Figure NTS1). Marine Scotland is proposing that these four proposed MPAs (pMPAs) now be considered for designation to supplement existing protected areas and to create a wider network of MPAs. As part of the process to determine whether these four pMPAs should be designated, Marine Scotland is now inviting views on the findings of the Strategic Environmental Assessment).

What is Strategic Environmental Assessment?

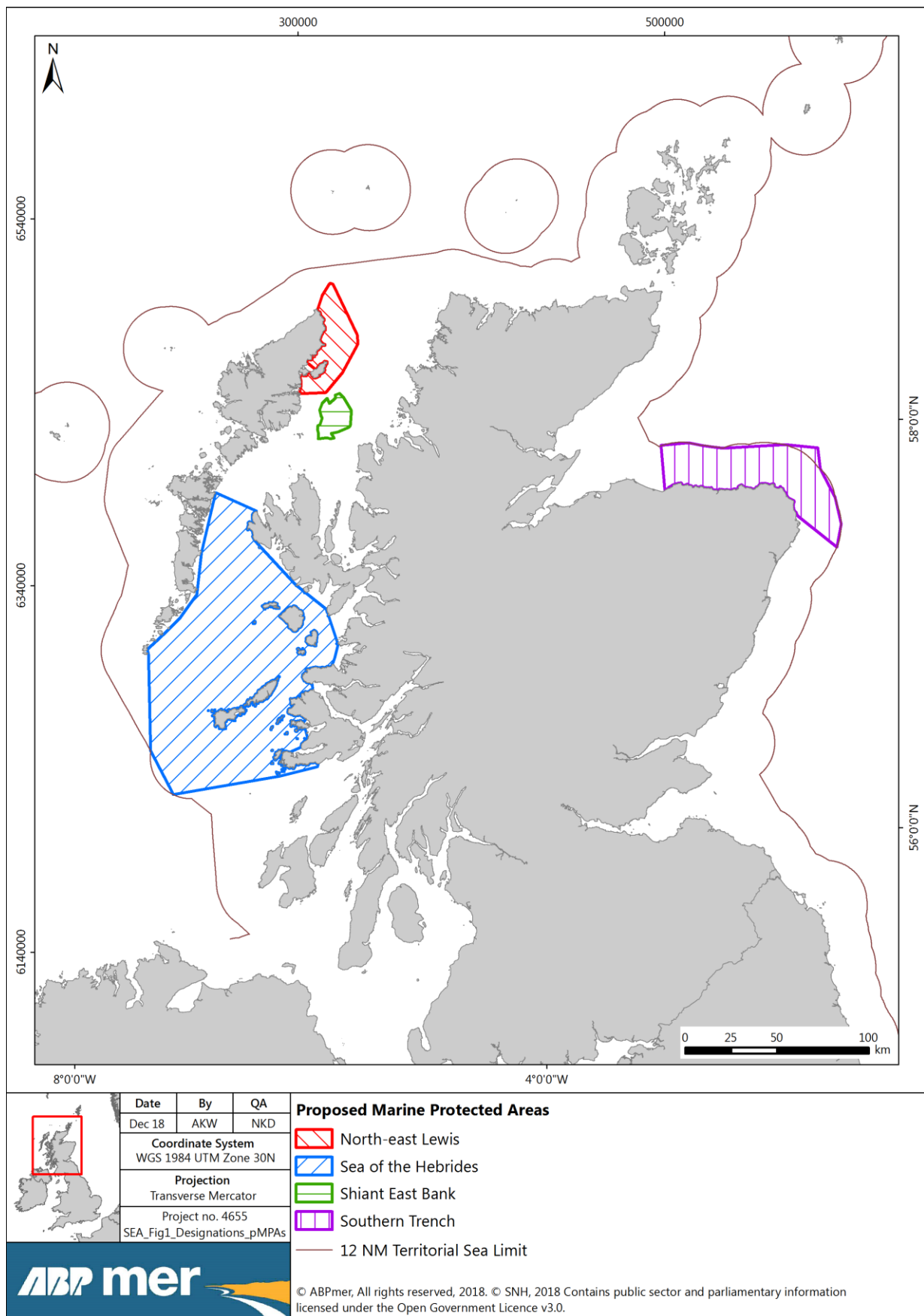
This Environmental Report summarises the findings from the Strategic Environmental Assessment (SEA) of the designation of four additional pMPAs. An SEA of the pMPAs is required by the Environmental Assessment (Scotland) Act 2005 ('the 2005 Act').

SEA identifies the likely significant environmental impacts of plans and policies, and proposed reasonable alternatives to them. SEA also identifies mitigation measures that are required to avoid or minimise any significant adverse effects and highlights opportunities for enhancements of beneficial effects. Taking place at an early stage in the plan or policy preparation process, it ensures that decision-making is informed by relevant environmental information. SEA provides opportunities for the public to consider this information and use it to inform their views on the draft plan or policy.

A screening and scoping exercise on the designation of the four additional pMPAs was undertaken by Marine Scotland, in accordance with the requirements of the 2005 Act. In response to the screening, Consultation Authorities¹ confirmed the need for a SEA due to the potential for significant environmental effects to occur. They also provided comment on the proposed scope and methodology of the assessment and the proposed consultation period for the Environmental Report. Their views are taken into account in this Environmental Report, as per the requirements of the 2005 Act.

¹ Historic Environment Scotland, Scottish Environment Protection Agency and Scottish Natural Heritage.

Figure NTS1 Map of four proposed Marine Protected Areas



What are the proposed Marine Protected Areas?

The Marine (Scotland) Act 2010² and the Marine and Coastal Access Act 2009³ gave Scottish Ministers powers to designate MPAs in Scottish territorial and offshore waters, respectively. The MPA network is intended to benefit the marine environment, historic features, coastal communities, marine industries and recreational users⁴. The network comprises Special Areas of Conservation (SACs), Special Protection Areas (SPAs), Sites of Special Scientific Interest (SSSIs) and MPAs (Nature Conservation, Historic, and Demonstration and Research)⁵.

Nature Conservation MPAs seek to ensure that nationally important marine wildlife, habitats, geology and undersea landforms receive adequate protection against disturbance and degradation. Specifically, they aim to either conserve features or remove pressures to allow them to recover. They also contribute to the survival and maintenance of species of international significance by complementing other systems of protection⁶.

The four additional pMPAs would extend the existing MPA network by seeking to protect a number of biodiversity and geodiversity features. Table NTS1 presents the proposed protected features and draft conservation objectives for each of the four pMPAs. Figure NTS1 provides a map of the location of the pMPAs.

Table NTS1 Characteristics of the four pMPAs under assessment

Proposed Marine Protected Areas	Proposed protected feature	Draft conservation objectives
North-east Lewis	Biodiversity: Risso's dolphins; sandeels	Conserve
	Geodiversity: marine geomorphology of the Scottish shelf bed (<i>longitudinal bedform field</i>); Quaternary of Scotland (<i>glaciated channels/troughs, landscape of areal glacial scour, megascale glacial lineations</i>)	
Sea of the Hebrides	Biodiversity: basking sharks; minke whales; fronts	Conserve
	Geodiversity: marine geomorphology of the Scottish shelf seabed (<i>Inner Hebrides Carbonate Production Area</i>)	

² Scottish Government (2017) Marine (Scotland) Act [online] Available at: <http://www.gov.scot/Topics/marine/seamanagement/marineact> (accessed 17/10/2018)

³ Scottish Government (2014) Marine and Coastal Access Act 2009 [online] Available at: <http://www.gov.scot/Topics/marine/seamanagement/marineact/ukbill> (accessed 17/10/2018)

⁴ Scotland's Environment (2014) Scotland's State of the Environment Report, 2014 [online] Available at: <https://www.environment.gov.scot/media/1170/state-of-environment-report-2014.pdf> (accessed 17/10/2018)

⁵ Scottish Government (2017) Marine Protected Areas (MPAs) [online] Available at: <http://www.gov.scot/Topics/marine/marine-environment/mpanetwork> (accessed 17/10/2018)

⁶ Scottish Government (2017) Marine Protected Areas (MPAs) [online] Available at: <http://www.gov.scot/Topics/marine/marine-environment/mpanetwork> (accessed 17/10/2018)

Proposed Marine Protected Areas	Proposed protected feature	Draft conservation objectives
Shiant East Bank	Biodiversity: circalittoral sands and mixed sediment communities; Northern sea fan and sponge communities; Shelf banks and mounds	Conserve
	Geodiversity: Quaternary of Scotland (<i>drumlinoid forms, glacial lineations, iceberg ploughmarks, streamlined bedrock</i>)	
Southern Trench	Biodiversity: burrowed mud; minke whales; fronts; shelf deeps	Conserve
	Geodiversity: Quaternary of Scotland (<i>subglacial tunnel valleys and moraines</i>); Submarine Mass Movement (<i>slide scars</i>)	

How was the Strategic Environmental Assessment undertaken?

The SEA provides a high-level and qualitative assessment of the potential environmental effects that are likely to result from the designation of the pMPAs. In addition, the potential effects that may result from managing the pMPAs in different ways (reasonable alternatives) are also assessed (see below).

The assessment identifies the individual and overall (cumulative) effects of the designation of the pMPAs on the SEA topics that are scoped into the assessment, specifically Biodiversity, Flora and Fauna; Soil; Water; and Climatic Factors. These SEA topics are collectively considered under the overarching topic Biodiversity, Flora and Fauna in recognition of the interlinkages between the topics. The assessment also considers the effects of the designation of the pMPAs on a series of key statements ('SEA objectives'). These SEA objectives reflect the scope of the assessment as well as the environmental protection objectives from relevant legislation.

Economic and social impacts, including those on other users of the marine environment, are assessed in a Socio-Economic Impact Assessment (SEIA) which is reported separately. The Sustainability Appraisal, which is also reported separately, considers the potential environmental, economic and social effects of designating the four pMPAs drawing on information contained in the SEA and SEIA.

Which reasonable alternatives have been assessed?

The scoping exercise identified some strategic alternative conservation measures to the designation of the four pMPAs that might achieve the same protection outcomes. However, these different conservation measures would not extend the existing MPA network and therefore would not help to fulfil a number of legislative and conservation requirements. They would also not direct developers to consider the proposed protected features in detail when they are siting projects and/or in any environmental assessments that are required in support of marine licence applications.

The different ways in which the four pMPAs might be managed in the future to support the achievement of site conservation objectives could be considered reasonable alternatives. Marine Scotland has developed a lower, intermediate and upper 'management scenario' for managing pressures/activities at each of the pMPAs based on advice provided by SNH and other sources of information.

The management scenarios are provided for indicative purposes and do not constrain future decisions or represent the final management measures that may be adopted by the Scottish Government for individual sites. Any specific management measures that are subsequently required to meet the objectives of the pMPAs will be subject to further consideration under the 2005 Act and are likely to require their own SEA.

What is the current state of the environment?

Scotland's marine environment supports a diverse complex of different habitats, which in turn support a wide range of marine plants and animals. The key habitat types that are protected by a range of European and national designations include estuaries, lagoons, large shallow inlets and bays, mudflats and sandflats not covered by seawater at low tide, reefs, sandbanks which are slightly covered by seawater all the time, submarine structures made by leaking gases, and submerged or partially submerged sea caves. The four pMPAs are characterised by a range of habitats, including mixed sediments, coarse sandy sediment, circalittoral mud, circalittoral rock and biogenic reef. There are also large-scale biodiversity features that form part of these pMPAs, such as fronts and shelf deeps. Some of these habitats and/or biodiversity features are proposed as protected features within the four pMPAs (Table NTS1).

There are a wide range of mobile species in Scottish Waters with several populations considered to be either of international or national importance. Key animal groups include cetaceans (whales, dolphins and porpoises), seals, birds, fish (including sharks, rays and skates) and otters. Risso's dolphin, minke whale, basking shark and sandeel are proposed as protected mobile features within the four pMPAs (Table NTS1).

The current health and condition of a number of habitats and species in Scotland's marine environment has been declining⁷. Existing and future pressures on marine biodiversity, flora and fauna are mainly from commercial fishing, invasive non-native species, marine litter, navigational dredging, marine transport, aquaculture, recreation, offshore renewable developments and climate change⁸.

Scotland's Marine Atlas reported that the condition of cetacean populations, where this can be assessed, is considered to be favourable. As a group, cetaceans are assessed as being in overall good condition in the North Sea, but in moderate condition in the Minches and Western Scottish waters. The Marine Atlas notes that whilst there is no longer an active fishery for basking shark in Scottish waters, populations are believed to

⁷ Marine Scotland (2011) Scotland's Marine Atlas: Information for The National Marine Plan.

⁸ The Scottish Government (2013) FEAST – Feature Activity Sensitivity Tool. [online] Available at: <http://www.marine.scotland.gov.uk/feast/> (accessed 20/12/18)

have declined due to historic fishing practices. As these animals are slow growing, late to reach maturity, and typically do not produce many offspring, populations take some time to recover from pressures such as overfishing.

Scotland has a wide range of geological (rocks, minerals, fossils and structures), geomorphological (landforms and processes) and soil features that make up the marine and coastal landscape. Key protected features include Quaternary of Scotland, submarine mass movement, marine geomorphology of the Scottish deep ocean seabed, seabed fluid and gas seep, Cenozoic structures of the Atlantic margin and marine geomorphology of the Scottish shelf seabed. A number of these geodiversity features are proposed as protected features within the four pMPAs (Table NTS1). The condition of these features influences the quality of habitats and in turn the viability and health of both flora and fauna populations⁹.

Scotland's seas are mostly classed as being of high or good ecological status under the Water Framework Directive. Within the four pMPAs, where there is overlap with coastal and transitional water bodies, these are classed as good or high status. The key pressures to the quality of the marine environment are from modifications to physical condition, rural diffuse pollution and waste water discharges¹⁰.

Within Scottish seas and coastal areas, multiple habitats are present that can be termed 'blue carbon sinks' due to their ability to convert carbon dioxide to solid carbon and incorporating or storing this carbon into living material. These include kelp forests, saltmarshes, seagrass beds, maerl beds and biogenic reefs¹¹. Their effectiveness as carbon sinks is highly dependent upon their long term capacity to store carbon. Climate change has the potential to affect the carbon regulating capacity of marine habitats.

What are the likely significant environmental effects of the proposed Marine Protected Areas?

Overall, the increased protection from the designation of the four additional pMPAs will provide environmental benefits for the overarching topic Biodiversity, Flora and Fauna, as well as contribute to the achievement of the SEA objectives. This is because the designation of the pMPAs will provide developers with a better understanding of the species and habitats that need to be protected, and will therefore help to ensure that more effective environmental assessments are undertaken as part of the marine licence applications for future developments. Alternatively, developers may look to locate their developments elsewhere to avoid these sites, which in turn would reduce future

⁹ SNH (2013) Assessing the sensitivity of geodiversity features in Scotland's seas to pressures associated with human activities. Report 590. Available at: http://www.snh.org.uk/pdfs/publications/commissioned_reports/590.pdf (accessed 20/12/18)

¹⁰ Scottish Government (2015) The river basin management plan for the Scotland river basin district: 2015–2027. <https://www.sepa.org.uk/media/163445/the-river-basin-management-plan-for-the-scotland-river-basin-district-2015-2027.pdf> (accessed 20/12/18).

¹¹ Burrows, M.T., Hughes, D.J., Austin, W.E.N., Smeaton, C., Hicks, N., Howe, J.A., Allen, C., Taylor, P. & Vare, L.L. (2017) Assessment of Blue Carbon Resources in Scotland's Inshore Marine Protected Area Network. Scottish Natural Heritage Commissioned Report No. 957.

pressures associated with regulated activities within the pMPAs and provide potential environmental benefits.

Although no specific management measures are proposed at present at the pMPAs, it is recognised that the way in which the sites are managed to ensure that the conservation objectives for the protected features are achieved could also result in potential environmental effects. In generic terms, management measures have the potential to result in beneficial effects on the overarching topic Biodiversity, Flora and Fauna, and contribute to the achievement of the SEA objectives where these target specific activities and pressures that currently, or might in the future, occur within the pMPAs. In turn, these may also result in the potential for marginal spillover benefits beyond pMPA site boundaries. For example, avoiding certain harmful activities in sensitive areas may result in the potential spillover of species from protected areas into unprotected areas if the maximum population size of the species that the protected area can sustain is exceeded. The implementation of management measures may also result in the potential displacement of an activity and its associated pressures outside the boundaries of the pMPAs resulting in potential adverse environmental effects in other areas, where such activities are not managed. It is also possible that management measures could result in increased levels of fishing activities that are not targeted by any measures within pMPAs. For example, removal of mobile fishing gear effort could facilitate greater use of some static gears.

What are the cumulative effects of the proposed Marine Protected Areas?

The designation of all four pMPAs will result in combined (cumulative) benefits to the overarching topic Biodiversity, Flora and Fauna, in terms of protection provided to the MPA features and wider environment. In addition to the benefits that will be provided by the designation of these sites, the lower management scenario will result in no overall additional immediate environmental impact across all four sites and the intermediate and upper scenarios will result in an overall moderate additional immediate beneficial environmental impact. The potential for greater future benefits exists under all management scenarios.

For regulated activities, environmental assessments would be required before an activity could take place, thus limiting the potential for any significant cumulative adverse effects from the displacement of existing activities. For other activities that are not subject to development consent, such as fishing, the lower management scenario will result in no potential displacement effects across all four sites. The intermediate and upper scenarios will result in minor and moderate displacement effects respectively. Overall, there is no potential for the displacement of fisheries activities from the pMPAs to overlap and therefore no potential for cumulative environmental effects to interact across the four sites.

In addition to the cumulative effects resulting from all four pMPAs working together and discussed above, the designation of the pMPAs will act in-combination with other plans, programmes and/or strategies, namely the wider MPA network and existing protection measures, to further benefit the overarching topic of Biodiversity, Flora and Fauna in Scottish waters and contribute to the achievement of SEA objectives.

The current proposals may work in-combination with previously assessed plans, leading to the potential for cumulative adverse effects on the environment from the displacement of fishing. The ongoing SEA on proposals for phase two management measures in MPAs identifies the potential for displacement of fishing activity from the Sound of Barra SAC. This site is adjacent to the Sea of the Hebrides pMPA and therefore any displacement of fishing activities may overlap and intensify pressures on the seabed. A more detailed assessment of cumulative effects will need to be undertaken should any specific management measures for the Sea of the Hebrides pMPA be proposed in future.

How do I respond to the consultation?

The consultation on the SEA Environmental Report is now open, along with the accompanying SEIA and Sustainability Appraisal. Views and opinions on this are now invited and should be provided by 30 August 2019.

Please respond to the consultation online at: <https://consult.gov.scot/marine-scotland/four-new-marine-protected-areas>

If you have any enquiries please contact: Marine_Conservation@gov.scot

Or send your inquiry by post to:

pMPA Consultation
Scottish Government
Marine Planning and Policy Division
Area 1-A South
Victoria Quay
Edinburgh
EH6 6QQ

What happens next?

Following the consultation period, the responses received will be analysed, and a Post-Adoption Statement will be prepared. The Post-Adoption Statement will explain how issues raised in the SEA, and associated views in response to the consultation, have been addressed.

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1 Introduction

1.1 Background

- 1.1.1 The Scottish Government has made a long-term commitment to ensuring the sustainable management of the marine environment by balancing the competing interests of use and protection of the sea. This has included developing and implementing a coherent network of Marine Protected Areas (MPAs) to benefit the conservation of vulnerable and characteristic marine species and habitats in Scottish waters. The designation of MPAs is a high policy priority and fulfils duties in domestic and European legislation, as well as contributing to wider UK and international networks of protected areas.
- 1.1.2 Currently, there are 18 Nature Conservation MPAs designated under the Marine (Scotland) Act 2010 located inshore or within territorial waters (i.e. within 12 nautical miles (NM) of the coast)¹². A further 13 Nature Conservation MPAs are designated in the offshore environment (i.e. from 12NM off the coast, or within non-territorial waters)¹³. One Demonstration and Research MPA is designated under the Marine (Scotland) Act 2010¹⁴. There are also eight Historic MPAs (HMPAs) that are designated for nationally important historic assets, predominately shipwrecks¹⁵.
- 1.1.3 Four additional MPAs are proposed to be designated to extend the existing MPA network. These were originally introduced for consideration as areas of search in 2012. However, at that time it was concluded that additional information and advice was required to inform the selection of MPAs from within these areas of search, and this was subsequently provided by SNH¹⁶. In light of that advice, all four areas are now being proposed for designation as MPAs. The designation of these four proposed MPAs (pMPAs) is the subject of this Environmental Report, produced as part of a Strategic Environmental Assessment (SEA).

¹² SNH (2017) Nature Conservation Marine Protected Areas [online] Available at: <http://www.snh.gov.uk/protecting-scotlands-nature/protected-areas/national-designations/mpas/> (accessed 17/10/2018)

¹³ JNCC (2015) Nature Conservation Marine Protected Areas (MPAs) [online] Available at: <http://jncc.defra.gov.uk/page-5269> (accessed 17/10/2018)

¹⁴ Marine Scotland (2016) Fair Isle Demonstration and Research MPA Consultation [online] Available at: <https://www.gov.scot/Topics/marine/marine-environment/mpanetwork/DandRMPAs/FairIsleDRMPA> (accessed 17/10/2018)

¹⁵ Historic Environment Scotland (2016). Scotland's Historic Marine Protected Areas 2016.

¹⁶ SNH (2014) Commissioned Report No. 780: Further advice to Scottish Government on the selection of Nature Conservation Marine Protected Areas for the development of the Scottish MPA network [online] Available at: <https://www.nature.scot/sites/default/files/2017-07/Publication%202014%20-%20SNH%20Commissioned%20Report%20780%20-%20Further%20advice%20to%20Scottish%20Government%20on%20the%20selection%20of%20Nature%20Conservation%20Marine%20Protected%20Areas%20for%20the%20development%20of%20the%20Scottish%20MPA%20network.pdf> (accessed 17/10/2018)

1.2 Strategic Environmental Assessment

- 1.2.1 The Environmental Assessment (Scotland) Act 2005 ('the 2005 Act') requires that certain public plans, programmes and strategies be assessed for their potential effects on the environment¹⁷. Strategic Environmental Assessment (SEA) is the process used to fulfil this requirement and includes consultation with both the public and the Consultation Authorities¹⁸. The 2005 Act also sets out the information that is required to be provided in this Environmental Report.
- 1.2.2 A screening and scoping exercise on the designation of a further four pMPAs was undertaken by Marine Scotland, in accordance with the requirements of the 2005 Act. A combined Screening and Scoping Report was published in June 2018, setting out the proposed approach to the SEA, including the proposed scope and level of detail. Comments were invited from the Scottish Consultation Authorities.
- 1.2.3 The four pMPAs were initially subject to screening and scoping in 2015, alongside a suite of proposed Special Protection Areas (SPAs). However, a decision was made not to progress the designation of the pMPAs at that time and as a result, the SEA did not progress further than the screening/scoping stage¹⁹. The combined Screening and Scoping Report prepared by Marine Scotland in June 2018 took this earlier work into account, including the views submitted by the Consultation Authorities at that time. This report also provided more up-to-date baseline and policy information, in recognition that the pMPAs now sit within a different context in terms of subsequent and concurrent marine conservation work undertaken by the Scottish Government.
- 1.2.4 The outcome of the screening exercise and the consultation responses confirmed the need for an SEA due to the likelihood for significant environmental effects to arise. The proposed scope of the assessment and methodology was broadly accepted by the Scottish Consultation Authorities (see Section 3).
- 1.2.5 Marine Scotland commissioned ABP Marine Environmental Research Ltd. (ABPmer) to undertake the assessment stage of the SEA and prepare this Environmental Report.

¹⁷ Scottish Government (2005) Environmental Assessment (Scotland) Act 2005, asp 15 [online] Available at: <https://www.legislation.gov.uk/asp/2005/15/introduction> (accessed 17/10/2018)

¹⁸ Historic Environment Scotland (HES), Scottish Environment Protection Agency (SEPA) and Scottish Natural Heritage (SNH).

¹⁹ This report can be located on the SEA Database: <http://www.gov.scot/Topics/Environment/environmental-assessment/sea/SEAG> (case number: 00823).

1.3 Purpose and structure of this report

- 1.3.1 The purpose of this Environmental Report is to document the findings of the SEA on the designation of a further four proposed MPAs. A Socio-Economic Impact Assessment (SEIA) has also been undertaken and is reported separately. The key findings of both the SEA and the SEIA are summarised in an overall Sustainability Appraisal (SA) document.
- 1.3.2 The views of the public and the Consultation Authorities on the pMPAs and the findings of this Environmental Report are now being sought.
- 1.3.3 The remainder of this Environmental Report is structured as follows:
- Section 2 provides information on the wider MPA network, the proposed designation of four additional pMPAs and their policy context;
 - Section 3 presents the approach to the SEA and the methods used;
 - Section 4 describes the relevant components of the environment that could be affected by the designation of the pMPAs;
 - Section 5 sets out the results of the assessment; and
 - Section 6 considers the next steps in the designation of the pMPAs and the SEA process.
- 1.3.4 The Non-Technical Summary precedes Section 1.

2 Marine Protected Areas

2.1 Background

- 2.1.1 Scotland's seas host an estimated 6,500 varieties of marine flora and fauna, making them among the most species rich in the world²⁰. Furthermore, several sites are strongholds for UK populations of particular species, such as marine mammals and sharks²¹. The long-term biological success of these species is heavily dependent on having assured access to high quality habitats. For highly mobile species such as cetaceans and sharks, such habitats are likely to be found across a range of geographical locations and environmental conditions, each supporting a different key life cycle activity such as breeding, feeding, courtship, or raising young²². However, Scotland's marine environment faces pressures to its health and productivity from climate change, commercial fishing, pollution and the loss of coastal and estuary habitat to development²³.
- 2.1.2 The MPA network is intended to benefit the marine environment, historic features, coastal communities, marine industries and recreational users²⁴. In total, it consists of more than 231 sites covering over 22% of Scotland's seas²⁵. The network comprises Special Areas of Conservation (SAC), Special Protection Areas (SPAs), Sites of Special Scientific Interest (SSSI) and MPAs (Nature Conservation, Historic, and Demonstration and Research)²⁶.
- 2.1.3 Nature Conservation MPAs seek to ensure that nationally important marine wildlife, habitats, geology and undersea landforms receive adequate protection against disturbance and degradation. Specifically, they aim to either conserve features or remove pressures in order to allow them to recover. They also contribute to the survival and maintenance of species of international

²⁰ ClimateXChange (2016) How is climate change impacting on Scotland's marine environment, infrastructure and industry? [online] Available at: https://www.climateexchange.org.uk/media/2346/marine_and_coastal_change.pdf (accessed 17/10/2018)

²¹ *ibid*

²² SNH (2014) Commissioned Report No. 780: Further advice to Scottish Government on the selection of Nature Conservation Marine Protected Areas for the development of the Scottish MPA network [online] Available at: <https://www.nature.scot/sites/default/files/2017-07/Publication%202014%20-%20SNH%20Commissioned%20Report%20780%20-%20Further%20advice%20to%20Scottish%20Government%20on%20the%20selection%20of%20Nature%20Conservation%20Marine%20Protected%20Areas%20for%20the%20development%20of%20the%20Scottish%20MPA%20network.pdf> (accessed 17/10/2018)

²³ Scotland's Environment (2014) Scotland's State of the Environment Report, 2014 [online] Available at: <https://www.environment.gov.scot/media/1170/state-of-environment-report-2014.pdf> (accessed 17/10/2018)

²⁴ *ibid*

²⁵ Scottish MPA Network – Parliamentary Report [online] Available at: <https://www.gov.scot/publications/marine-protected-area-network-2018-report-scottish-parliament/> (accessed 28/01/2019)

²⁶ Scottish Government (2017) Marine Protected Areas (MPAs) [online] Available at: <http://www.gov.scot/Topics/marine/marine-environment/mpanetwork> (accessed 17/10/2018)

significance by complementing other systems of protection, both spatially and through the alignment of conservation objectives²⁷.

2.2 Designation of the MPA network to date

- 2.2.1 The Marine (Scotland) Act 2010²⁸ and the Marine and Coastal Access Act 2009²⁹ gave Scottish Ministers powers to designate MPAs in Scottish territorial and offshore waters, respectively. To inform this process, the Scottish MPA Project was established to ensure MPAs are designated in the most appropriate locations for their particular objectives. SNH is responsible for providing advice on Nature Conservation MPAs in Scottish territorial waters, while the Joint Nature Conservation Committee (JNCC) advise on possible designations in the offshore environment³⁰.
- 2.2.2 In 2012, SNH and JNCC submitted advice to the Scottish Government on 33 proposed MPAs in both the inshore and offshore environment, as well as four areas of search³¹. The proposals were subject to public consultation in the summer of 2013 as part of Marine Scotland's integrated 'Planning Scotland's Seas' process, which sought views on marine planning, Sectoral Marine Plans for offshore renewable energy, MPAs and Priority Marine Features (PMFs)³². An SEA Environmental Report, which looked at the potential environmental effects of the designations, was among the suite of consultation documents made available at that time³³.
- 2.2.3 The Environmental Report noted that adverse environmental effects outside of the MPAs were most likely to arise from the introduction of fisheries management measures within the MPAs. Specifically, it was considered that these measures could potentially lead to the displacement of fishing activity³⁴ (namely the use of bottom-contact mobile, static and hydraulic fishing gear³⁵),

²⁷ Scottish Government (2017) Marine Protected Areas (MPAs) [online] Available at: <http://www.gov.scot/Topics/marine/marine-environment/mpanetwork> (accessed 17/10/2018)

²⁸ Scottish Government (2017) Marine (Scotland) Act [online] Available at: <http://www.gov.scot/Topics/marine/seamanagement/marineact> (accessed 17/10/2018)

²⁹ Scottish Government (2014) Marine and Coastal Access Act 2009 [online] Available at: <http://www.gov.scot/Topics/marine/seamanagement/marineact/ukbill> (accessed 17/10/2018)

³⁰ SNH/JNCC (2012) Commissioned Report No. 547: Advice to the Scottish Government on the selection of Nature Conservation Marine Protected Areas (MPAs) for the development of the Scottish MPA network [online] Available at: http://www.snh.org.uk/pdfs/publications/commissioned_reports/547.pdf (accessed 17/10/2018)

³¹ *ibid*

³² Scottish Government (2015) Planning Scotland's Seas [online] Available at: <http://www.gov.scot/Topics/marine/seamanagement/national/marine-consultation> (accessed 17/10/2018)

³³ Scottish Government (2013) Planning Scotland's Seas: 2013 - Possible Nature Conservation Marine Protected Areas Consultation Overview - Strategic Environmental Assessment Report [online] Available at: <http://www.gov.scot/Publications/2013/08/2591> (accessed 17/10/2018)

³⁴ Scottish Government (2013) Planning Scotland's Seas: 2013 – Possible Nature Conservation Marine Protected Areas Consultation Overview – Strategic Environmental Assessment Report [online] Available at: <http://www.gov.scot/Publications/2013/08/2591/0> (accessed 17/10/2018)

³⁵ Scottish Government (2014) Proposals for Fisheries Management Measures in Special Areas of Conservation – Screening and Scoping Report [online] Available at: <http://www.gov.scot/Topics/Environment/environmental-assessment/sea/SEAG> (accessed 17/10/2018)

introducing or intensifying pressures in other areas. However, due to a lack of detail regarding the potential nature and volume of displacement, the assessment was unable to reach a conclusion as to the likely significance of these effects³⁶. A commitment was therefore made to complete the SEA once this information became available.

- 2.2.4 Following on from this consultation and additional advice received from SNH and JNCC³⁷, 30 of the original 33 prospective Nature Conservation MPAs were formally designated by Scottish Ministers in July 2014: 17 in the inshore environment and 13 in the offshore environment.
- 2.2.5 Draft management measures were subsequently developed and an addendum to the original 2013 Environmental Report was published in November 2014³⁸. This built upon the findings of an accompanying fisheries displacement study to explore the potential environmental effects associated with the proposed management measures. The Environmental Report addendum and the outputs of additional consultations fed into the finalisation of the first phase of fisheries management measures, which were implemented in early 2016³⁹.
- 2.2.6 The SEA of the second phase of management measures commenced in October 2017 and work on both the development of the management measures and the SEA is ongoing. The consultation on the management measures is expected to take place in 2019.
- 2.2.7 In addition to the 30 MPAs designated in 2014, Ministers issued an Order to immediately designate an additional emergency MPA in Loch Carron following damage to the world's largest expanse of flame shell beds due to a dredging incident in 2017⁴⁰. This was the first such instance of Ministers invoking powers under the Marine (Scotland) Act 2010 to immediately designate an MPA⁴¹. However, the current designation is temporary and will expire in 2019⁴². The potential to designate Loch Carron as a permanent MPA was the subject of a recent public consultation which ran to 13 June 2018.

³⁶ *ibid*

³⁷ SNH (2014) SNH's advice on selected responses to the 2013 Marine Scotland consultation on Nature Conservation Marine Protected Areas (MPAs) [online] Available at: <https://www.nature.scot/sites/default/files/2017-07/Publication%202014%20-%20SNH%20Commissioned%20Report%20747%20-%20SNH%27s%20advice%20on%20selected%20responses%20to%20the%202013%20Marine%20Scotland%20consultation%20on%20Nature%20Conservation%20Marine%20Protected%20Areas%20%28MPAs%29.pdf> (accessed 17/10/2018)

³⁸ Scottish Government (2014) MPA/SAC Consultation Environmental Assessment [online] Available at: <http://www.gov.scot/Topics/marine/marine-environment/mpanetwork/MPAMGT/consultation2014/ManagementSEA> (accessed 17/10/2018)

³⁹ Scottish Government (2017) Inshore MPAs/SACs [online] Available at: <http://www.gov.scot/Topics/marine/marine-environment/mpanetwork/inshorempas> (accessed 17/10/2018)

⁴⁰ Scottish Government (2018) Protection for world's biggest plan shell bed [online] Available at: <https://news.gov.scot/news/protection-for-worlds-biggest-flame-shell-bed> (accessed 17/10/2018)

⁴¹ SNH (2017) Loch Carron Urgent Nature Conservation Marine Protected Area (NCMPA) [online] Available at: <https://www.nature.scot/professional-advice/safeguarding-protected-areas-and-species/protected-areas/national-designations/marine-protected-areas/nature-conservation-2> (accessed 17/10/2018)

⁴² SNH (2017) Loch Carron possible MPA [online] Available at: <https://www.nature.scot/loch-carron-possible-mpa> (accessed 17/10/2018)

- 2.2.8 A description of these 31 existing inshore and offshore Nature Conservation MPAs, including their respective protected features and conservation objectives, can be found in Table 1.
- 2.2.9 In addition to Nature Conservation MPAs, Fair Isle was designated in 2016 as a Demonstration and Research MPA under the Marine (Scotland) Act 2010⁴³. There are also eight Historic MPAs (HMPAs) that are designated for nationally important historic assets, predominately shipwrecks⁴⁴.

⁴³ Marine Scotland (2016) Fair Isle Demonstration and Research MPA Consultation [online] Available at: <https://www.gov.scot/Topics/marine/marine-environment/mpanetwork/DandRMPAs/FairIsleDRMPA> (accessed 17/10/2018)

⁴⁴ Historic Environment Scotland (2016). Scotland's Historic Marine Protected Areas 2016.

Table 1 Existing Nature Conservation MPAs in Scotland

Nature Conservation MPA	Year designated	Protected features	Draft conservation objectives
<i>Inshore</i>			
Loch Sunart	2014	Biodiversity: flame shell beds; northern feather star aggregations on mixed substrata; serpulid aggregations	Conserve
Lochs Duich, Long and Alsh	2014	Biodiversity: burrowed mud, flame shell beds	Conserve
Loch Creran	2014	Biodiversity: flame shell beds Geodiversity: Quaternary of Scotland	Conserve
Small Isles	2014	Biodiversity: black guillemot; burrowed mud; circalittoral sand and mud communities; fan mussel aggregations; horse mussel beds; northern feather star aggregations on mixed substrata; northern sea fan and sponge communities; shelf deeps; white cluster anemones Geodiversity: Quaternary of Scotland – glaciated channels/troughs, glacial lineations, meltwater channels, moraines, streamlined bedforms	Conserve
Wyre and Rousay Sounds	2014	Biodiversity: kelp and seaweed communities on sublittoral sediment; maerl beds Geodiversity: marine geomorphology of the Scottish shelf seabed	Conserve
East Caithness Cliffs	2014	Biodiversity: black guillemot	Conserve
Loch Sunart to the Sound of Jura	2014	Biodiversity: common skate Geodiversity: Quaternary of Scotland – glaciated channels/troughs	Conserve
Monach Isles	2014	Biodiversity: black guillemot Geodiversity: marine geomorphology of Scottish shelf seabed; Quaternary of Scotland – landscape of areal glacial scour	Conserve
Noss Head	2014	Biodiversity: horse mussel beds	Conserve
South Arran	2014	Biodiversity: burrowed mud; kelp and seaweed communities on sublittoral sediments; maerl beds; maerl or coarse shell gravel with burrowing sea	Recover maerl beds, conserve other features

Nature Conservation MPA	Year designated	Protected features	Draft conservation objectives
		cucumbers; ocean quahog aggregations; seagrass beds; shallow tide-swept coarse sands with burrowing bivalves	
Fetlar to Haroldswick	2014	Biodiversity: black guillemot; circalittoral sand and coarse sediment communities; horse mussel beds; kelp and seaweed communities on sublittoral sediment; maerl beds; shallow tide-swept coarse sands with burrowing bivalves	Conserve
		Geodiversity: marine geomorphology of the Scottish shelf seabed	
Clyde Sea Sill	2014	Biodiversity: black guillemot; circalittoral and offshore sand and coarse sediment communities; fronts	Conserve
		Geodiversity: marine geomorphology of the Scottish shelf seabed – sand banks; sand ribbon fields; sand wave fields	
Loch Sween	2014	Biodiversity: burrowed mud; maerl beds; native oysters; sublittoral mud and mixed sediment communities	Conserve
Mousa to Boddam	2014	Biodiversity: sandeels	Conserve
		Geodiversity: marine geomorphology of the Scottish shelf seabed	
Papa Westray	2014	Biodiversity: black guillemot	Conserve
		Geodiversity: marine geomorphology of the Scottish shelf seabed – sand wave field	
Upper Loch Fyne and Loch Goil	2014	Biodiversity: burrowed mud; flame shell beds; horse mussel beds; ocean quahog aggregations; sublittoral mud and specific mixed sediment communities	Recover flame shell beds, conserve other protected features
Wester Ross	2014	Biodiversity: burrowed mud; circalittoral muddy sand communities; flame shell beds; kelp and seaweed communities on sublittoral sediment; maerl beds; maerl or coarse shell gravel with burrowing sea cucumbers; northern feather star aggregations on mixed substrata	Recover maerl beds and flame shell beds, conserve other features
		Geodiversity: marine geomorphology of the Scottish shelf bed – banks of unknown substrate; Quaternary of Scotland – glaciated channels/troughs, megascale glacial lineations, moraines; seabed fluid and gas seep – pockmarks; submarine mass movement – slide scars	
Loch Carron (Urgent MPA)	2017	Biodiversity: flame shell beds	Recover

Nature Conservation MPA	Year designated	Protected features	Draft conservation objectives
Offshore			
Central Fladen	2014	Biodiversity: burrowed mud	Conserve
		Geodiversity: sub-glacial tunnel valley	
East of Gannet and Montrose Fields	2014	Biodiversity: offshore deep sea muds; ocean quahog aggregations	Conserve
Faroe-Shetland Sponge Belt	2014	Biodiversity: deep-sea sponge aggregations; offshore subtidal sands and gravels; continental slope	Conserve
		Geodiversity: continental slope channels; iceberg plough marks; prograding wedges and slide deposits	
Firth of Forth Banks Complex	2014	Biodiversity: ocean quahog aggregations; offshore subtidal sands and gravels; Shelf Banks and Mounds	Conserve
		Geodiversity: moraines	
Geikie Slide and Hebridean Slope	2014	Biodiversity: burrowed mud (seapens and burrowing megafauna); offshore subtidal sands and gravels; offshore deep-sea muds; continental slope	Conserve
		Geodiversity: slide deposit and slide scars	
Hatton-Rockall Basin	2014	Biodiversity: deep-sea sponge aggregations; offshore deep sea muds	Conserve
		Geodiversity: sediment drifts; polygonal faults	
North-east Faroe-Shetland Channel	2014	Biodiversity: deep-sea sponge aggregations; offshore deep-sea muds; offshore subtidal sands and gravels; continental slope	Conserve
		Geodiversity: range of features representative of the West Shetland Margin Palaeo-depositional, Miller Slide and Pilot Whale Diapirs Key Geodiversity Area	
North-west Orkney	2014	Biodiversity: sandeels	Conserve
		Geodiversity: sand banks, sand wave fields and sediment wave fields	
Norwegian Boundary Sediment Plain	2014	Biodiversity: ocean quahog aggregations (including sands and gravels as their supporting habitat)	Conserve

Nature Conservation MPA	Year designated	Protected features	Draft conservation objectives
Rosemary Bank Seamount	2014	Biodiversity: deep-sea sponge aggregations; seamount communities; seamount	Conserve
		Geodiversity: range of features representative of the Rosemary Bank Seamount (and adjacent sea floor) Key Geodiversity Area, including iceberg ploughmark fields, slide scars, sediment drifts, sediment wave fields and the seamount scour moat	
The Barra Fan and Hebrides Terrace Seamount	2014	Biodiversity: burrowed mud (seapen and burrowing megafauna communities); seamount communities; offshore deep-sea muds; offshore subtidal sands and gravels; orange roughy; continental slope; seamounts	Conserve
		Geodiversity: iceberg ploughmark field; prograding wedges; continental slope turbidite canyons; slide deposits; scour moat; continental slope; Hebrides Terrace Seamount	
Turbot Bank	2014	Biodiversity: sandeels	Conserve
West Shetland Shelf	2014	Biodiversity: offshore subtidal sands and gravels	Conserve

2.3 Proposals for four additional pMPAs

- 2.3.1 As stated earlier, the pMPAs were initially introduced for consideration as areas of search, with the expectation these would lead to four additional MPAs that, when designated, would extend the network. Specifically, the pMPAs would extend protection to basking shark, minke whale, Risso's dolphin, burrowed mud, shelf banks and mounds and shelf deeps. However, at the time MPA advice was provided in 2012, SNH concluded that additional assessment work would be needed before formal advice could be provided to Scottish Ministers⁴⁵.
- 2.3.2 Habitat modelling, basking shark tagging and additional seabed habitat surveying were carried out and presented in further advice to Scottish Ministers in 2014⁴⁶. The findings served to both corroborate and revise existing conclusions as to the presence and density of protected features as well as the extent to which they rely on particular areas to support key life cycle activities. In assessing the areas of search against the MPA Selection Guidelines, SNH looked at the following criteria: representation, replication, resilience, range and geographic variation of features, and any key linkages⁴⁷.
- 2.3.3 As a result of this additional research, the sites were eventually modified, either in terms of their boundaries or their proposed protected features, and a recommendation was made that all four sites be designated as MPAs⁴⁸.
- 2.3.4 The proposed designation of these MPAs is the subject of this present assessment. Table 2 below provides a description of the four pMPAs, including their general location, proposed protected features and draft conservation objectives. Figure 1 provides a map of the location of the pMPAs.

⁴⁵ SNH (2012) Commissioned Report No. 547: Advice to Scottish Government on the selection of Nature Conservation Marine Protected Areas (MPAs) for the development of the Scottish MPA network [online] Available at: <https://www.nature.scot/sites/default/files/2017-07/Publication%202012%20-%20SNH%20Commissioned%20Report%20547%20-%20SNH%20and%20JNCC%20MPA%20network%20advice.pdf> (accessed 17/10/2018)

⁴⁶ SNH (2014) Commissioned Report No. 780: Further advice to Scottish Government on the selection of Nature Conservation Marine Protected Areas for the development of the Scottish MPA network [online] Available at: <https://www.nature.scot/sites/default/files/2017-07/Publication%202014%20-%20SNH%20Commissioned%20Report%20780%20-%20Further%20advice%20to%20Scottish%20Government%20on%20the%20selection%20of%20Nature%20Conservation%20Marine%20Protected%20Areas%20for%20the%20development%20of%20the%20Scottish%20MPA%20network.pdf> (accessed 17/10/2018)

⁴⁷ Scottish Government (2011) Marine Protected Areas in Scotland's Seas: Guidelines on the selection of MPAs and the development of the MPA network [online] Available at: <http://www.gov.scot/Resource/0051/00515466.pdf> (accessed 17/10/2018)

⁴⁸ SNH (2017) Scottish Marine Protected Areas Project [online] Available at: <https://www.nature.scot/professional-advice/safeguarding-protected-areas-and-species/protected-areas/national-designations/marine-protected-areas/scottish-marine-protected-0> (accessed 17/10/2018)

Table 2 Characteristics of the four pMPAs under assessment

pMPA	Proposed protected feature	Draft conservation objectives
North-east Lewis (NEL)	Biodiversity: Risso's dolphins; sandeels	Conserve
	Geodiversity: marine geomorphology of the Scottish shelf bed (<i>longitudinal bedform field</i>); Quaternary of Scotland (<i>glaciated channels/troughs, landscape of areal glacial scour, megascale glacial lineations</i>)	
Sea of the Hebrides (SOH)	Biodiversity: basking sharks; minke whales; fronts	Conserve
	Geodiversity: marine geomorphology of the Scottish shelf seabed (<i>Inner Hebrides Carbonate Production Area</i>)	
Shiant East Bank (SEB)	Biodiversity: circalittoral sands and mixed sediment communities; Northern sea fan and sponge communities; Shelf banks and mounds	Conserve
	Geodiversity: Quaternary of Scotland (<i>drumlinoid forms, glacial lineations, iceberg ploughmarks, streamlined bedrock</i>)	
Southern Trench (STR)	Biodiversity: burrowed mud; minke whales; fronts; shelf deeps	Conserve
	Geodiversity: Quaternary of Scotland (<i>subglacial tunnel valleys and moraines</i>); Submarine Mass Movement (<i>slide scars</i>)	

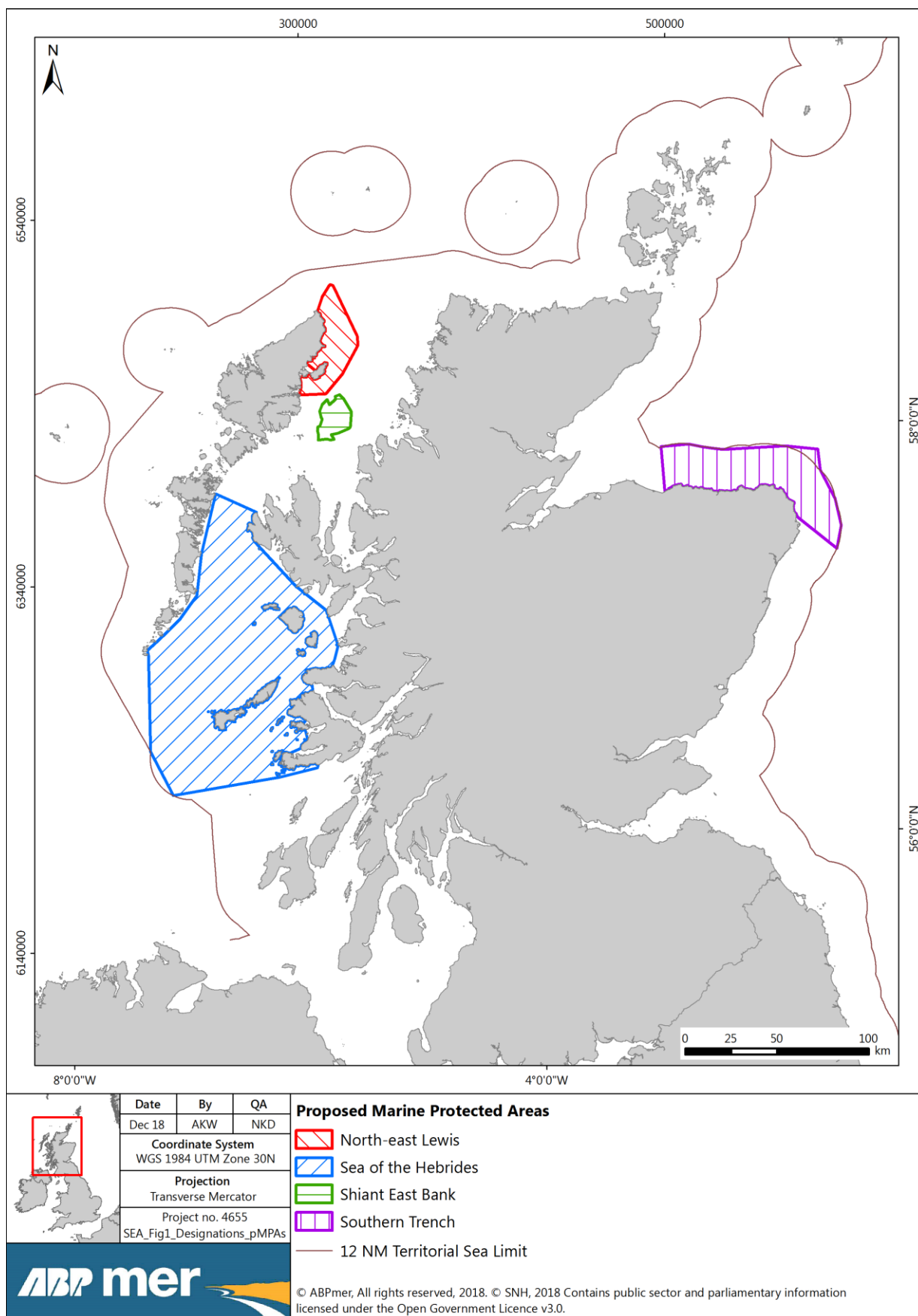


Figure 1 Map of four pMPAs

2.4 Policy context overview of the pMPAs

- 2.4.1 The 2005 Act requires Responsible Authorities to define the plan's broader policy context, particularly any relevant environmental protection objectives that will influence the plan's development and implementation.
- 2.4.2 This section sets out the immediate policy context in which the pMPAs, as a component of the greater MPA network, sit. This policy context is illustrated in **Error! Reference source not found.** Appendix A includes a detailed review of the overarching marine policy objectives and the environmental protection objectives covering the SEA topics that have been scoped into the assessment.

MPA network

- 2.4.3 Nature Conservation MPAs are one example of an MPA in Scotland, the others being SACs, SPAs, SSSIs, Historic MPAs, and Demonstration and Research MPAs⁴⁹. The overall MPA network is intended to help protect nationally and internationally important marine wildlife, habitats and underwater geodiversity, while also benefiting the greater marine environment, historic features, coastal communities, marine industries and recreational users⁵⁰.
- 2.4.4 The MPA network fulfils a number of legislative and conservation needs. They are a key element of the Scottish Government's commitment to ensuring the sustainable management of the marine environment and balancing the competing interests of use and protection of the sea. They contribute to progress towards Good Environmental Status (GES) as set out by the Marine Strategy Framework Directive 2008/56/EC⁵¹. They also form part of the OSPAR Convention network of protected sites found throughout the North East Atlantic Ocean⁵². In addition, they aim to maintain and enhance biodiversity, which is a focus of the Habitats (92/43/EEC)⁵³ and Birds (2009/147/EC)⁵⁴ Directives.

⁴⁹ Scottish Government (2017) Marine Protected Areas (MPAs) [online] Available at: <http://www.gov.scot/Topics/marine/marine-environment/mpanetwork> (accessed 17/10/2018)

⁵⁰ SNH (2017) Nature Conservation Marine Protected Areas [online] Available at: <http://www.snh.gov.uk/protecting-scotlands-nature/protected-areas/national-designations/mpas/> (accessed 17/10/2018)

⁵¹ Scottish Government (2011) Marine Protected Areas in Scotland's Seas – Guidelines on the selection of MPAs and development of the MPA network [online] Available at: <http://www.gov.scot/resource/doc/295194/0114024.pdf> (accessed 17/10/2018)

⁵² OSPAR Commission (2015) Marine Protected Areas [online] Available at: <https://www.ospar.org/work-areas/bdc/marine-protected-areas> (accessed 17/10/2018)

⁵³ European Commission (1992) The Habitats Directive [online] Available at: http://ec.europa.eu/environment/nature/legislation/habitatsdirective/index_en.htm (accessed 20/12/18)

⁵⁴ European Commission (2009) The Birds Directive [online] Available at: http://ec.europa.eu/environment/nature/legislation/birdsdirective/index_en.htm (accessed 20/12/18)

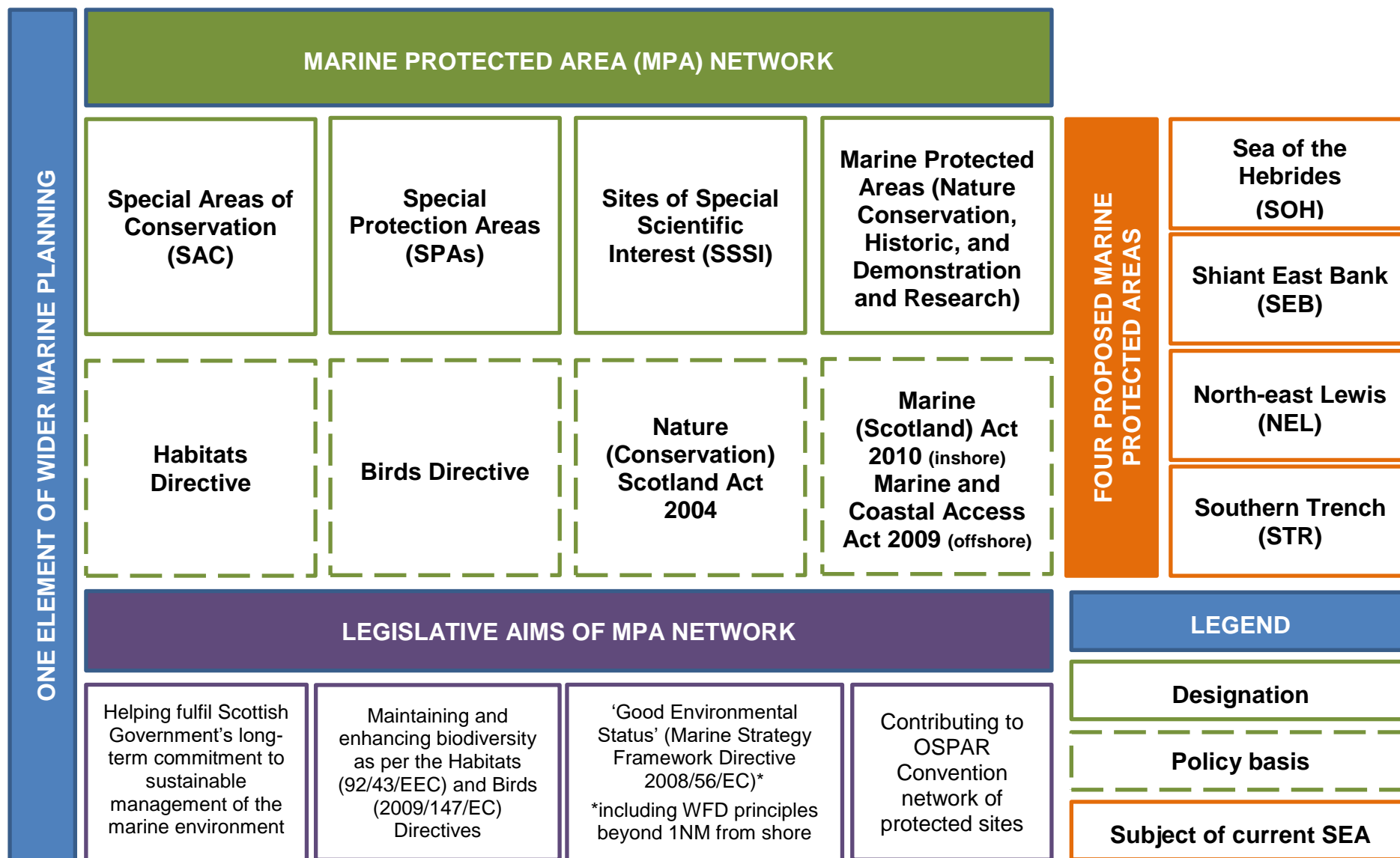


Figure 2 Policy context of the MPA network in Scotland

3 Approach to the Assessment

3.1 Purpose of the assessment

- 3.1.1 The purpose of this SEA is to assess the potential for likely significant environmental effects to arise from the designation of the pMPAs. This will allow corresponding mitigation measures to be identified where necessary and highlight opportunities for enhancement in cases where beneficial effects are likely.

3.2 Scope of the proposals

- 3.2.1 It is not considered within the scope of this SEA to evaluate the evidence base underlying the decision to designate the pMPAs. SNH has provided data confidence assessments for each pMPA that include a description and evaluation of the type, age, source and extent of the scientific data used to support each of the proposals⁵⁵. Similarly, it is not within the scope of this SEA to evaluate the pMPAs' effectiveness at conserving or recovering protected features. The pMPAs will have their own reporting and monitoring requirements, in line with the legislation from which they arise.
- 3.2.2 The potential economic and social impacts that may result from the implementation of the proposals does not form part of the scope of this SEA. The Socio-Economic Impact Assessment (SEIA) and overarching Sustainability Appraisal (SA), the latter of which this SEA is a part, will address any potential economic and social impacts. Business and Regulatory Impact Assessments (BRIAs) will also be undertaken for each pMPA based on the outcomes of the SEIA.

3.3 Scope of the assessment

- 3.3.1 The scope of any potentially significant environmental effects is largely limited to beneficial effects for species and habitats that fall within the pMPAs or regularly use them; spillover benefits beyond site boundaries; and potential adverse effects outwith pMPAs as a result of the displacement of activities and the intensification of activities in areas where they already occur. There may also be the potential for increased fishing effort in pMPAs from other gear types that are not targeted by any potential future management measures.
- 3.3.2 An initial review of both related assessment work (see Section 3.5) and the pMPAs' conservation objectives suggests that potentially significant environmental effects are likely to fall under the SEA topic of Biodiversity, Flora and Fauna. This could also include relevant aspects of Soil (geodiversity),

⁵⁵ SNH (2017) Scottish Marine Protected Area advice [online] Available at: <https://www.nature.scot/professional-advice/safeguarding-protected-areas-and-species/protected-areas/national-designations/marine-protected-areas/scottish-marine-protected> (accessed 18/10/2018)

Water (the ecological status of water bodies) and Climatic Factors (carbon cycling, storage and sequestration). The Screening and Scoping Report proposed that the SEA should combine and assess all these preceding topics under the Biodiversity, Flora and Fauna topic heading. This approach to defining the scope of the assessment reflects the approach taken during the SEAs of the MPA management measures and the proposals for an additional suite of marine Special Protection Areas (SPAs). The rationale for scoping in and out each of the SEA topics is provided in Table 3.

- 3.3.3 It should be noted that the potential impacts on the Inner Hebrides Carbonate Production Area in the SOH pMPA are not being considered in this assessment as they will be covered in the SEA that is currently being undertaken on the proposals for management measures applying to PMFs.

3.4 Reasonable alternatives

- 3.4.1 The Screening and Scoping Report identified some strategic reasonable alternatives to the designation of the four pMPAs that might achieve the same protection outcomes. For example, the development of an overarching conservation plan or action strategy could ensure the protection of some or all of the proposed protected features for the four pMPAs and the wider environment. The Scottish Government is currently leading on the development of a UK dolphin and porpoise conservation strategy which aims to ensure that cetaceans are maintained in favourable conservation status throughout the UK. In other marine plans of relevance, there has been the consideration of different sites as reasonable alternatives. However, as outlined in section 2.3, SNH has recommended each site based on data collection and habitat modelling specific to each protected feature. Therefore, the sites proposed represent the best available locations for protection of the selected features and there are no other sites which could be considered reasonable as alternatives to the four pMPAs for protecting these features. Furthermore, not designating the four pMPAs could also be considered a reasonable alternative as the existing legislation offers a degree of protection for some of the proposed protected features, specifically cetaceans and basking shark (see Section 4.2), which supports their continued conservation. However, neither of these alternatives would extend the existing MPA network and therefore would not help to fulfil a number of legislative and conservation requirements (see Section 2.4). While the conservation strategy will provide UK-wide management strategies for cetaceans, designating the sites as MPAs will provide localised protection and ensure that the impacts on the proposed protected features are considered in sufficient detail when granting permission for activities within the MPAs.
- 3.4.2 If it is assumed that the development of MPAs is required to fulfil the statutory duties of Marine Scotland and provide adequate protection to the proposed features, then the different ways in which the four pMPAs might be managed in the future to support the achievement of site conservation objectives could be

considered reasonable alternatives. As part of the development of the proposals for four further pMPAs, Marine Scotland has developed a lower, intermediate and upper 'management scenario' for managing pressures/activities at each pMPA based on advice provided by SNH and other sources of information. These management scenarios, or reasonable alternatives, are set out in Table 4. Maps showing the location of the protected features and zones referred to in Table 4 are included in Appendix B.

- 3.4.3 Where an indicative management scenario comprising one of the scenarios only applies to a particular pMPA, the relevant pMPA is noted in brackets. In some cases, the indicative management measures comprising the lower and intermediate scenarios are the same and the scenarios have therefore been combined. In each case, the indicative management measures comprising the scenarios are additive i.e. the upper scenario also includes the indicative management measures outlined under the lower and intermediate scenarios.
- 3.4.4 These reasonable alternatives are provided for indicative purposes and do not constrain future decisions or represent the final management measures that may be adopted by the Scottish Government for individual sites. Any specific management measures that are subsequently required to meet the objectives of the pMPAs will be subject to further consideration under the 2005 Act and are likely to require their own SEA.

Table 3 Proposed scoping in/out of SEA topics

SEA topic	In/out	Reasons for inclusion/exclusion
Biodiversity, Flora and Fauna	In	<p>As an area-based conservation measure, MPAs provide some degree of protection to all of the species and habitats that fall within or regularly use them, regardless of whether or not they are specified as protected features. There may also be spillover benefits to species and habitats outwith the boundaries of the MPAs. As such, the pMPAs will likely benefit not only the species for which they are intended, but marine biodiversity more generally. In addition to potential benefits, the designation and management of pMPAs may result in potential adverse effects on species and habitats outwith the boundaries of the pMPAs as a result of the displacement of certain activities.</p> <p>Although certain seabed features are protected features in their own right, it is felt that impacts on the SEA topic, Soil (specifically geodiversity), are intrinsically linked to the topic of Biodiversity, Flora and Fauna as any improvements to or decline in the condition of the seafloor will inevitably alter its suitability as a habitat. In recognition of these cross-cutting impacts, it is therefore proposed that Soil (geodiversity) be scoped in under Biodiversity, Flora and Fauna.</p> <p>Biodiversity is a key consideration underlying the water quality objectives of both the Water Framework Directive (WFD) and the Marine Strategy Framework Directive (MSFD). As such, it is proposed that impacts on Water as they relate to meeting these Directive requirements also be scoped in under Biodiversity, Flora and Fauna.</p> <p>In addition, it is proposed that the potential impacts of the pMPAs on the capacity of the marine environment to mitigate and adapt to climate change (i.e. the SEA topic of Climatic Factors) also receive consideration under this topic heading, as such impacts are likely to include marine flora that serve as 'blue carbon' stores.</p> <p>As noted previously, it is not within the scope of this SEA to assess the proposals' effectiveness at conserving or recovering protected features.</p>
Population and Human Health	Out	It is proposed that Population and Human Health be scoped out of the assessment as the designation of the pMPAs is unlikely to lead to any significant impacts on this receptor. As noted previously, the SEIA and overarching SA, the latter of which this SEA is a part, will address any potential economic and social impacts.
Soil	Out	The protected features on which the pMPAs are predicated include certain subsea geological features and seafloor landforms. However, given that the condition of such features is inherently linked to the condition of the overall ecosystem, it is proposed that impacts on Soil (geodiversity) be scoped in under the SEA topic of Biodiversity, Flora and Fauna.
Water	Out	Scotland has a commitment under the WFD to bring its water bodies to 'Good Ecological Status'. This classification is based on specific criteria that includes a measure of biodiversity. Similarly, achieving 'Good Environmental Status' under the MSFD involves satisfying several qualitative descriptors relating to biodiversity. Given this link, it is proposed that role of the pMPAs in working towards 'Good Ecological Status' and 'Good

SEA topic	In/out	Reasons for inclusion/exclusion
		Environmental Status' be covered under the topic of Biodiversity, Flora and Fauna. Effects on water quality and/or quantity are not anticipated and it is proposed that this subtopic therefore be scoped out of the present assessment.
Air	Out	It is proposed that Air be scoped out of the assessment as the designation of the pMPAs is unlikely to lead to impacts on this receptor.
Climatic Factors	Out	Shelf seas and 'blue carbon' features, such as saltmarshes, seagrass beds and kelp forests, may play a role in reducing and adapting to the effects of climate change by sequestering and storing carbon ^{56,57} . The pMPAs could extend indirect protection to these features and it is therefore proposed that the potential impact of the pMPAs on Climatic Factors as they relate to carbon sequestration and blue carbon be assessed within the context of Biodiversity, Flora and Fauna. This will include, as far as possible, a consideration of generic impacts on carbon stocks outwith the boundaries of the pMPAs as a result of the displacement of certain activities.
Material Assets	Out	The effects of the proposals on other users of the marine environment, both adverse and beneficial, will be assessed by the SEIA and overarching SA, the latter of which this SEA is a component.
Cultural Heritage	Out	The regulation of certain marine activities and forms of development is implicit to the designation of MPAs under the Marine (Scotland) Act 2010. In practice, this could mean that more environmentally damaging activities move out of the MPAs or else are never introduced, thereby indirectly benefiting cultural heritage by lessening development and fisheries pressures. However, this benefit is contingent upon the pMPAs overlapping cultural heritage resources, the true extent of which can be difficult to determine as some of these features remain undiscovered. Further, conservation and cultural heritage objectives would need to be compatible (e.g. some historic features may require excavation in order to ensure their preservation, which may be at odds with conservation interests). At this time, such impacts are not predicted to be significant and so it is proposed that Cultural Heritage be scoped out of the assessment.
Landscape/ Seascape	Out	As in the case of Cultural Heritage, it is possible that landscapes and seascapes may receive secondary benefits from the pMPAs as such designations inherently influence the kinds of activities that could feasibly operate within them. However, at this time, such impacts are not predicted to be significant and so it is proposed that Landscape/Seascape be scoped out of the assessment.

⁵⁶ Kröger S, Parker R, Cripps G & Williamson P (Eds.) 2018. Shelf Seas: The Engine of Productivity, Policy Report on NERC-Defra Shelf Sea Biogeochemistry programme. Cefas, Lowestoft. Available at: https://www.uk-ssb.org/shelf_seas_report.html (accessed 20/11/2018)

⁵⁷ Scottish Association for Marine Science (2012) Current status & knowledge about potential sequestration capacity for 'blue carbon' sinks in Scotland – A Report for ClimateXChange [online] Available at: https://www.climateexchange.org.uk/media/1707/blue_carbon_brief.pdf (accessed 20/12/18)

Table 4 Alternative management scenarios

Pressure/Activity	Site(s) affected	Scenarios		
		Lower	Intermediate	Upper
Aquaculture	SOH NEL	Follow current best practice guidelines.	50% of Acoustic Deterrent Devices (ADDs) to be replaced with basking shark/cetacean appropriate devices at end of their life.	Replacement of all Acoustic Deterrent Devices (ADDs) with antipredator nets.
Boat use ⁵⁸	SOH NEL STR	Follow Scottish Marine Wildlife Watching Code (SMWWC) and produce vessel management plans as required by licensing.		Vessel speeds ⁵⁹ restricted to <6 knots within the 'shark awareness zones' between June and October (SOH).
Cables/pipelines	SOH NEL STR SEB	Follow existing best practice and licensing process for installation of new cables/pipelines by minimising disturbance to sandeel habitat (SOH, NEL), burrowed mud (STR), circalittoral sand and mixed sediment communities, and northern sea fan and sponge communities (SEB).		New cable/pipeline routes should avoid northern sea fan and sponge communities (SEB).
Noisy activities ⁶⁰	SOH NEL STR	Follow existing best practice mitigation measures/guidance.		No noisy activities during minke whale and basking shark high season (April-October) (SOH). No noisy activities during Risso's dolphin high season (May-October) (NEL). No noisy activities during minke whale high season (June-October) (STR).

⁵⁸ MoD activities are reserved and therefore cannot be controlled or limited. MoD has its own best practice guidelines for meeting obligations.

⁵⁹ All vessels except lifeline ferry services.

⁶⁰ Noisy activities include all activities which produce underwater noise which may disturb the protected features (particularly basking sharks and cetaceans). This includes, but may not be limited to, construction activities (pile driving and blasting) and marine surveys (seismic, side-scan sonar, multibeam, sub-bottom profiling). MoD activities are reserved and therefore cannot be controlled or limited. MoD has its own best practice guidelines for meeting obligations.

Pressure/Activity	Site(s) affected	Scenarios		
		Lower	Intermediate	Upper
Coastal development (excluding noise)	STR NEL SOH	Follow existing best practice and licensing process.	Minimise footprints of development to limit disturbance to burrowed mud (STR) and sandeel habitats.	
Life line ferry services	All	No additional management.		
Fishing (bottom-contacting mobile gear)	SOH NEL STR SEB	Follow best practice to minimise risk of bycatch of basking shark (SOH).	Exclusion of hydraulic gear from sandeel habitat (SOH, NEL, STR). Exclusion of mobile/active gear from northern sea fan and sponge communities (SEB). Exclude targeted fishing for sandeels (SOH, STR, NEL). Exclude mobile gear from 20% of burrowed mud (STR) and circalittoral sand (SEB).	Exclude mobile gear from 40% of burrowed mud (STR) and circalittoral sand (SEB).
Fishing (static gear)	SOH STR NEL	Reduce risk of entanglement of basking shark (SOH), minke whale (SOH, STR) and Risso's dolphin (NEL) by following best practice.	Exclusion of drift nets and set nets between April and October in 'shark awareness zones' (SOH). Exclusion of drift nets and set nets in the southern half of site (NEL).	Exclusion of drift nets and set nets between April and October across site (SOH). Exclusion of drift nets and set nets between June and October (STR). Exclusion of drift nets and set nets between May and October (NEL).
Fishing (pelagic)	STR NEL SOH	Reduce risk of entanglement of minke whale (SOH, STR), basking shark (SOH) and Risso's dolphin (NEL) by following best practice.		Limit herring and sprat fishing effort to current levels (SOH, STR).

Pressure/Activity	Site(s) affected	Scenarios		
		Lower	Intermediate	Upper
Marine disposal sites	STR NEL SOH	Current best practice followed.		Siting of new marine disposal sites to minimise impacts on burrowed mud (STR) and sandeel habitat.
Ports and harbours	STR NEL SOH	See 'Coastal Development' and 'Noisy Activities' for relevant scenarios.		
Renewable energy	STR NEL SOH	Current best practice used to minimise impacts on burrowed mud (STR) and sandeel habitat.		Exclude development which could create a barrier to species movement in shark awareness zones (SOH).
Scientific survey/research	SOH STR NEL SEB	Survey work adhering to Scottish Marine Wildlife Watching Code (SMWWC) and current species licensing requirements (SOH, NEL, STR) Best practice adopted to minimise effects on burrowed mud (STR), sandeel habitat (NEL), sensitive sea fan and sponge communities, and circalittoral sand (SEB).		
Wildlife tour operators	STR NEL SOH	Follow existing best practice including Scottish Marine Wildlife Watching Code (SMWWC) and Wildlife Safe (WiSe) scheme.		Vessel speeds restricted to <6 knots within the 'shark awareness zones' between June and October (SOH).

3.5 Assessment methodology

- 3.5.1 The SEA has presented a high level and qualitative account of the potential environmental effects that might be expected to arise from the designation of the pMPAs alone. The SEA has also assessed the potential effects that could arise at each pMPA from the management scenarios that have been developed as reasonable alternatives (see Section 3.4).
- 3.5.2 The assessment has been informed by a desk-based review of available information on the existing environment within and around the pMPAs (e.g. GeMS, EMODNET habitat map). This baseline review is presented in Section 4.
- 3.5.3 The assessment has then identified potential changes in human pressures/activities that could result from each management scenario. This has involved reviewing available spatial data on existing levels of human pressures/activities within and around each of the pMPAs. This includes available information on the number of fishing vessels⁶¹ and relative fishing intensity of different targeted species and/or gear types⁶². The limitations of the fishing data that has been used to inform the SEA are reviewed in detail in the SEIA. Maps of available spatial data for a range of human activities are included in Appendix B.
- 3.5.4 The assessment has then considered the sensitivity (tolerance/recoverability) of key features identified as part of the baseline review to potential changes in human pressures/activities as a result of the management scenarios. This has been based on the latest understanding of the sensitivity of these marine features to disturbance, drawing on relevant SNH advice documents, management guidance, available databases on activity-pressure and Scottish Government's Feature Activity Sensitivity Tool (FEAST) and related resources⁶³.
- 3.5.5 For the purpose of this assessment, the indicative criteria set out in Table 5 have been used to help determine the type (beneficial or adverse) and magnitude (negligible, very minor, minor, moderate or major) of potential immediate effects that may result from the management scenarios at each pMPA. The potential for future effects has also been identified where relevant. However, the magnitude of these potential future effects has not been possible to predict based on available information.
- 3.5.6 An overall (cumulative) assessment of the potential effects from each of the management scenarios at each pMPA has been undertaken. For this, the

⁶¹ ScotMap data collected during face-to-face interviews with individual vessel owners and operators of the number of under-15m fishing vessels over the period 2007 to 2011.

⁶² 2009-2013 amalgamated Vessel Monitoring System (VMS) intensity data of relative fishing intensity of over-12m vessels.

⁶³ The Scottish Government (2018). Feature Activity Sensitivity Tool (FEAST). Available at: <https://www.marine.scotland.gov.uk/FEAST/Index.aspx> (accessed 15/11/2018).

magnitude of the overall (cumulative) impact was considered to be the highest magnitude of all potential beneficial effects minus the magnitude of all potential adverse effects. For example, where a management scenario is considered to result in potential moderate benefits to habitats and species within the pMPA and negligible spillover benefits beyond pMPA boundaries versus minor adverse displacement effects and negligible adverse effects from changes in gear types, the magnitude of the overall (cumulative) impact is considered to be minor beneficial.

Table 5 Indicative criteria of potential effects

Type	Magnitude	Indicative criteria
Adverse/Beneficial	Major	Large spatial scale (size/number); Major intensity (level/magnitude); Long-term (duration/frequency); High sensitivity of features; and/or Low tolerance/reversibility of features.
	Moderate	Medium spatial scale; Moderate intensity; Medium-term; Moderate sensitivity of features; and/or Moderate tolerance/reversibility of features.
	Minor	Small spatial scale; Low intensity; Short-term; Low sensitivity of features; and/or High tolerance/reversibility of features.
	Very minor	Very small spatial scale; Very low intensity; Very short-term; Very low sensitivity of features; and/or Very high tolerance/reversibility of features.
Adverse/Beneficial	Negligible	There is likely to be a change, but the level will be indiscernible from baseline conditions.
Neutral	None	No change from baseline conditions.

3.5.7 The potential implications of the designation of the pMPAs alone and the alternative management scenarios have also been assessed against SEA objectives. The SEA objectives that have been applied in this assessment are presented in Table 6. These have built on those used to inform recent related marine assessments (see Section 3.6). Those objectives reflected the scope of their respective assessments as well as environmental protection objectives

found across relevant legislation (Appendix A) and so remain applicable to the present assessment.

Table 6 SEA objectives

SEA Topics	SEA Objective
Biodiversity, Flora and Fauna	<ul style="list-style-type: none"> ▪ To safeguard and enhance marine and coastal ecosystems, including species, habitats, and their interactions; ▪ To maintain and protect the character and integrity of the seabed; ▪ To avoid the pollution of seabed strata and/or bottom sediments; ▪ To avoid pollution of the coastal and marine water environment; ▪ To maintain or work towards achieving 'Good Ecological Status' and 'Good Environmental Status' of water bodies; and ▪ To preserve and enhance existing marine carbon stocks and carbon sequestration potential.
Soil	▪ See Biodiversity, Flora and Fauna.
Water	▪ See Biodiversity, Flora and Fauna.
Climatic Factors	▪ See Biodiversity, Flora and Fauna.

3.6 Building on previous assessments

3.6.1 This SEA builds on the following SEAs of relevant marine conservation work undertaken by the Scottish Government:

- The designation of the first round of Nature Conservation MPAs (assessed in 2013)⁶⁴;
- Proposals for an additional suite of marine SPAs (currently under assessment)⁶⁵;
- Phase one (assessed in 2014)⁶⁶ and proposals for phase two (currently under assessment) of the implementation of MPA management measures; and

⁶⁴ Scottish Government (2013) Planning Scotland's Seas: 2013 – Possible Nature Conservation Marine Protected Areas Consultation Overview – Strategic Environmental Assessment Report [online] Available at: <http://www.gov.scot/Publications/2013/08/2591/0> (accessed 18/10/2018)

⁶⁵ Scottish Government (2018) SEA of Marine Proposed Special Protection Areas Strategic Environmental Assessment Environmental Report August 2018. Available at: https://consult.gov.scot/marine-scotland/sea-for-15-proposed-special-protection-areas/supporting_documents/Marine%20SPA%20SEA%20%20Consultation%20document%20%20September%202018.pdf (accessed 18/10/2018)

⁶⁶ Scottish Government (2014) Proposals for statutory management measures in Marine Protected Areas and Special Areas of Conservation Environmental Report Addendum. November 2014. Available at: <https://www2.gov.scot/Resource/0046/00464215.pdf> (accessed 18/10/2018)

- Proposals for management measures applying to PMFs (currently under assessment).
- 3.6.2 The assessment methodology applied in this SEA has been informed by these previous and ongoing assessments in order to help ensure a consistent approach is undertaken. The concurrent assessments that are being undertaken for the ongoing SEA work have been used to inform the current assessment as far as possible, providing a more complete understanding of cumulative effects in particular.
- 3.6.3 Other relevant sources of information include the SEAs undertaken on the draft Sectoral Marine Plans for Offshore Renewable Energy in Scottish Waters⁶⁷, the Offshore Wind Sectoral Marine Plan Scoping Report⁶⁸, Management Proposals of Inshore Fisheries Groups⁶⁹, the Seaweed Policy Statement⁷⁰ and Wild Seaweed Harvesting⁷¹.

⁶⁷ Scottish Government (2013) Planning Scotland's Seas: Draft Sectoral Marine Plans for Offshore Renewable Energy in Scottish Waters – Strategic Environmental Assessment: Environmental Report and Appendix A [online] Available at: <http://www.gov.scot/Publications/2013/07/2403/0> (accessed 18/10/2018)

⁶⁸ Scottish Government (2018) Offshore Wind Sectoral Marine Plan Scoping Consultation [online] Available at: <https://consult.gov.scot/marine-scotland/offshore-wind-scoping/> (accessed 18/10/2018)

⁶⁹ Scottish Government (2013) Management Proposals of Inshore Fisheries Groups – Strategic Environmental Assessment – Environmental Report [online] Available at: <http://www.gov.scot/Resource/0043/00430277.pdf> (accessed 20/12/18).

⁷⁰ Scottish Government (2013) Seaweed Policy Statement Consultation Document – Environmental Report – August 2013 [online] Available at: <http://www.gov.scot/Resource/0043/00432098.pdf> (accessed 20/12/18)

⁷¹ Scottish Government (2016) Wild Seaweed Harvesting Strategic Environmental Assessment Environmental Report [online] Available at: <http://www.gov.scot/Publications/2016/11/6869/0> (accessed 20/12/18).

4 Environmental Baseline

4.1 Introduction

- 4.1.1 This section of the Environmental Report describes the character of the environment which may be affected by the designation of the pMPAs. The focus of this baseline information is therefore on Biodiversity, Flora and Fauna; Soils (geodiversity); Water (the ecological status of water bodies); and Climatic Factors (carbon cycling, storage and sequestration), reflecting the scope of the assessment as described in Section 3.3.
- 4.1.2 Scotland's location at the edge of the continental shelf means that it is subject to both subpolar and subtropical influences. The North Atlantic current brings warm water from the Gulf of Mexico to the west coast of Scotland. These warm waters mix with cooler nutrient rich polar waters.
- 4.1.3 Scotland has over 18,000km of coastline and its inshore and offshore areas are among the largest of any EU country, representing 13% of all European seas.

4.2 Biodiversity, flora and fauna

- 4.2.1 Scotland's marine environment supports a diverse complex of different habitats, which in turn support a wide range of marine plants and animals. Estimates suggest that there are around 6,500 species of animals and plants (excluding microbial flora and seabirds) in Scotland's seas⁷².

Marine habitats

- 4.2.2 Benthic (seafloor) habitats are vital natural resources, as many marine species rely, directly or indirectly, on the seafloor to feed, hide, rest or reproduce. Generally benthic habitats are characterised by low mobility species⁷³. Marine habitats within the Scottish marine environment can be characterised into three broad groups: intertidal habitats; subtidal (inshore and shelf sea); and deep sea habitats. These broad groups can be further broken down by substrate type.
- 4.2.3 The latest information presented in Figure 3 on predicted seabed habitats is provided by National Marine Plan Interactive (NMPi)⁷⁴ and European Marine Observation and Data Network (EMODnet) Seabed Habitats Phase 2 mapping (EUSeaMap, 2016). The layer is a predictive European Nature Information System (EUNIS) seabed habitat map for the UK continental shelf, which has been created using five pre-processed input datasets: substrate, biological zone, energy, salinity and biogeographic region.

⁷² Marine Scotland (2011) Scotland's Marine Atlas: Information for The National Marine Plan.

⁷³ OSPAR. 2017. Condition of Benthic Habitat Communities: Subtidal habitats of the Southern North Sea. Available at <https://oap.ospar.org/en/ospar-assessments/intermediate-assessment-2017/biodiversity-status/habitats/condition-of-benthic-habitat-defining-communities/subtidal-habitats-southern-north-sea/> (accessed 20/12/18)

⁷⁴ National Marine Plan interactive (NMPi). Available at <http://www.scotland.gov.uk/topics/marine/seamanagement/nmpihome> (accessed 20/12/18)

- 4.2.4 Overall, mud, sand and coarse sediment are found in the North Sea and to the west of the Hebrides. The seabed in the far west and far north of Scotland is characterised by mud and fine clay, with coarser sediments in shallower water and on banks and seamounts⁷⁵ (Figure 3).
- 4.2.5 Each of the four pMPAs is characterised by a range of different habitat types. NEL comprises coarse sandy sediment in the northern extent and circalittoral mud in the southern extent. SOH is predominantly circalittoral mud in the northern extent, but there are areas of circalittoral rock and biogenic reef, particularly around Coll, Tiree and west of Canna, supporting important biodiversity, which is discussed below. The southern extent of SOH is characterised by coarser sediment, principally sand. SEB is characterised by circalittoral rock, and comprises areas of northern sea fan and sponge communities, bordered by areas of mixed sediment. STR, on the east coast of Scotland, has an area of mixed sediment bordering the coastline which graduates to areas of burrowed mud habitat further offshore (see Figure 3). The north-west and eastern segments of the STR pMPA comprise benthic habitats that support brittlestar populations⁷⁶.
- 4.2.6 The coarser mixed sediment habitats identified in NEL, SOH and STR support a key prey species, sandeel. These coarse sediment habitats and associated sandeel grounds are presented in the individual maps of the pMPAs included in Appendix B. Within NEL pMPA, sandeels have been proposed as a protected feature (Table 2).

⁷⁵ UK Marine Monitoring and Assessment Strategy (UKMMAS) (2010) Charting Progress 2: An assessment of the state of UK seas.

⁷⁶ Burrows, M.T., Hughes, D.J., Austin, W.E.N., Smeaton, C., Hicks, N., Howe, J.A., Allen, C., Taylor, P. & Vare, L.L. 2017. Assessment of Blue Carbon Resources in Scotland's Inshore Marine Protected Area Network. Scottish Natural Heritage Commissioned Report No. 957.

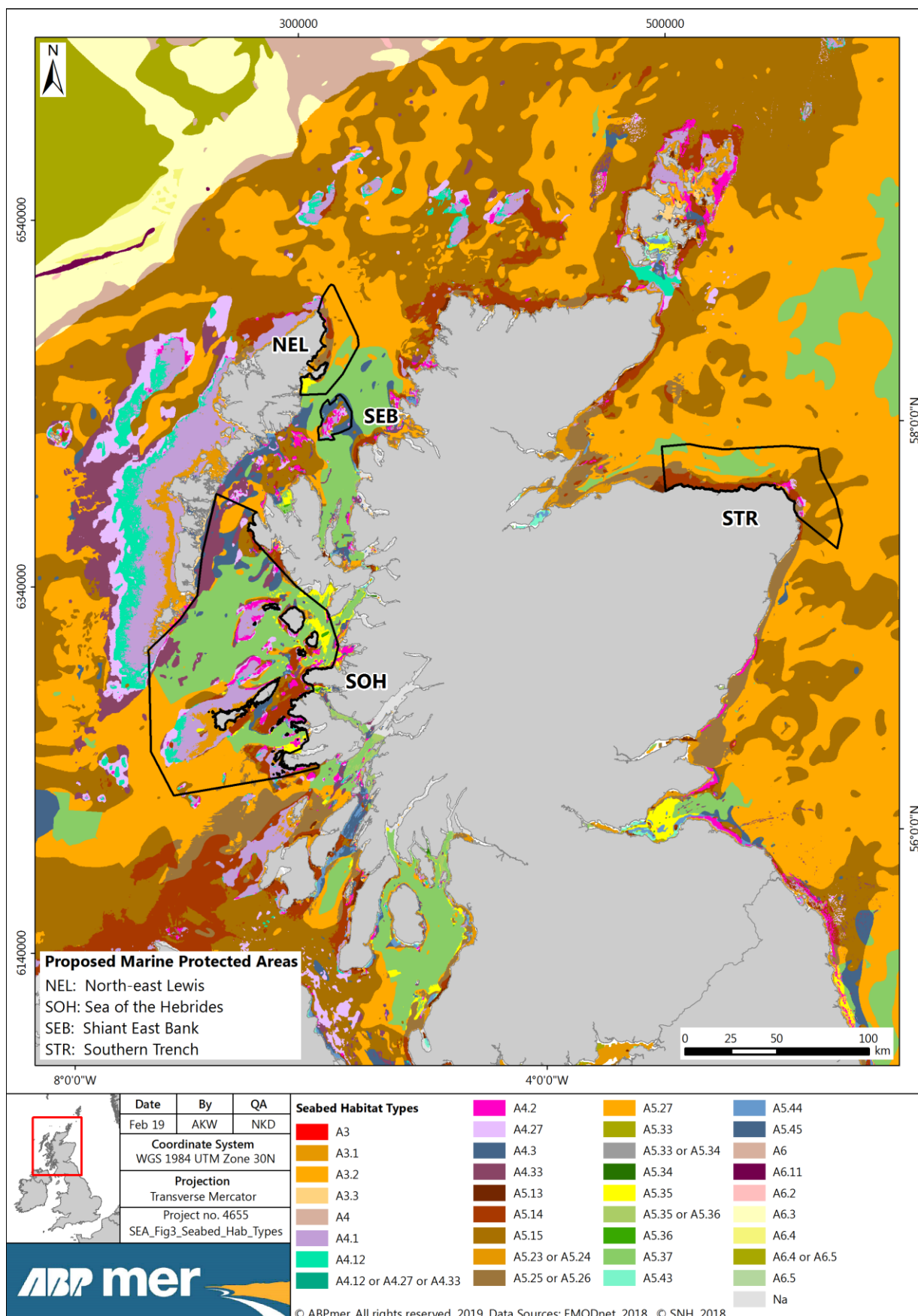


Figure 3 Seabed habitats in Scottish waters [Full key is provided below figure]

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Key			
A3	Infralittoral rock and biogenic reef	A5.33	Infralittoral mud
A3.1	Infralittoral rock and biogenic reef	A5.33 or A5.34	Infralittoral mud
A3.2	Infralittoral rock and biogenic reef	A5.34	Infralittoral mud
A3.3	Infralittoral rock and biogenic reef	A5.35	Circalittoral mud
A4	Circalittoral rock and biogenic reef	A5.35 or A5.36	Circalittoral mud
A4.1	Circalittoral rock and biogenic reef	A5.36	Circalittoral mud
A4.12	Offshore circalittoral rock and biogenic reef	A5.37	Offshore circalittoral mud
A4.12 or A4.27 or A4.33	Offshore circalittoral rock and biogenic reef	A5.43	Infralittoral mixed sediment
A4.2	Circalittoral rock and biogenic reef	A5.44	Circalittoral mixed sediment
A4.27	Offshore circalittoral rock and biogenic reef	A5.45	Offshore circalittoral mixed sediment
A4.3	Circalittoral rock and biogenic reef	A6	Upper bathyal sediment
A4.33	Offshore circalittoral rock and biogenic reef	A6.11	Upper bathyal rock and biogenic reef
A5.13	Infralittoral coarse sediment	A6.2	Upper bathyal sediment
A5.14	Circalittoral coarse sediment	A6.3	Upper bathyal sediment
A5.15	Offshore circalittoral coarse sediment	A6.4	Upper bathyal sediment
A5.23 or A5.24	Infralittoral sand	A6.4 or A6.5	Upper bathyal sediment
A5.25 or A5.26	Circalittoral sand	A6.5	Upper bathyal sediment
A5.27	Offshore circalittoral sand	Na	Not applicable (land)

Mobile species

4.2.7 Scotland's marine environment supports a wide range of mobile species with several populations considered to be either of international or national importance. Several mobile species within Scottish seas are already protected through designation or classification of areas within Scottish waters or around Scottish coastlines, some of which overlap with the pMPAs, as discussed below under 'Protected habitats and species'. Mobile species in Scottish seas include the following groups:

- Seals (grey and harbour seals);
- Cetaceans (23 species have been recorded in Scottish waters over the last 25 years; of these, 11 are regularly sighted);
- Birds (both breeding seabirds and overwintering waterbirds);
- Fish, including sharks, rays and skates; and
- European otter.

Marine mammals (cetaceans, seals and otters)

4.2.8 Marine mammals are widely distributed around the Scottish coastline. Species distributions are a function of prey availability and habitat distribution. Eleven species of cetacean are regularly sighted around Scottish seas. These comprise species with important resident populations, such as bottlenose dolphin, alongside more migratory species passing through Scottish seas, such as sperm whale. Key marine mammal species in Scottish seas include:

- Grey seal;
- Harbour seal;
- Harbour porpoise;
- Bottlenose dolphin;
- White-beaked dolphin;

- Fin whale;
- Minke whale;
- Short-beaked common dolphin;
- Atlantic white-sided dolphin;
- Risso's dolphin;
- Long-finned pilot whale;
- Killer whale;
- Sperm whale; and
- European otter.

4.2.9 All of the above species are considered to be PMFs, as discussed below under 'Priority Marine Features'.

4.2.10 Within NEL there is a high density of Risso's dolphin (Figure 4) and throughout SOH and STR, there are nationally important concentrations of minke whale (Figure 5). These marine mammal species have therefore been identified as protected features of NEL, SOH and STR pMPAs (Table 2). Key prey species for minke whale are small, schooling fish including sandeel and herring⁷⁷, whilst Risso's dolphin predate almost exclusively on cephalopods⁷⁸.

⁷⁷ Macleod, K., Fairbairns, R., Gill, A., Fairbairns, B., Gordon, J., & Blair-Myers, C., Parsons, E.C.M. 2004. Seasonal distribution of minke whales *Balaenoptera acutorostrata* in relation to physiography and prey off the Isle of Mull, Scotland. Marine Ecology-progress Series.

⁷⁸ D. MacLeod, C., Santos, M., Burns, F., Brownlow, A & Pierce, G. 2014. Can habitat modelling for the octopus *Eledone cirrhosa* help identify key areas for Risso's dolphin in Scottish waters?. Hydrobiologia.

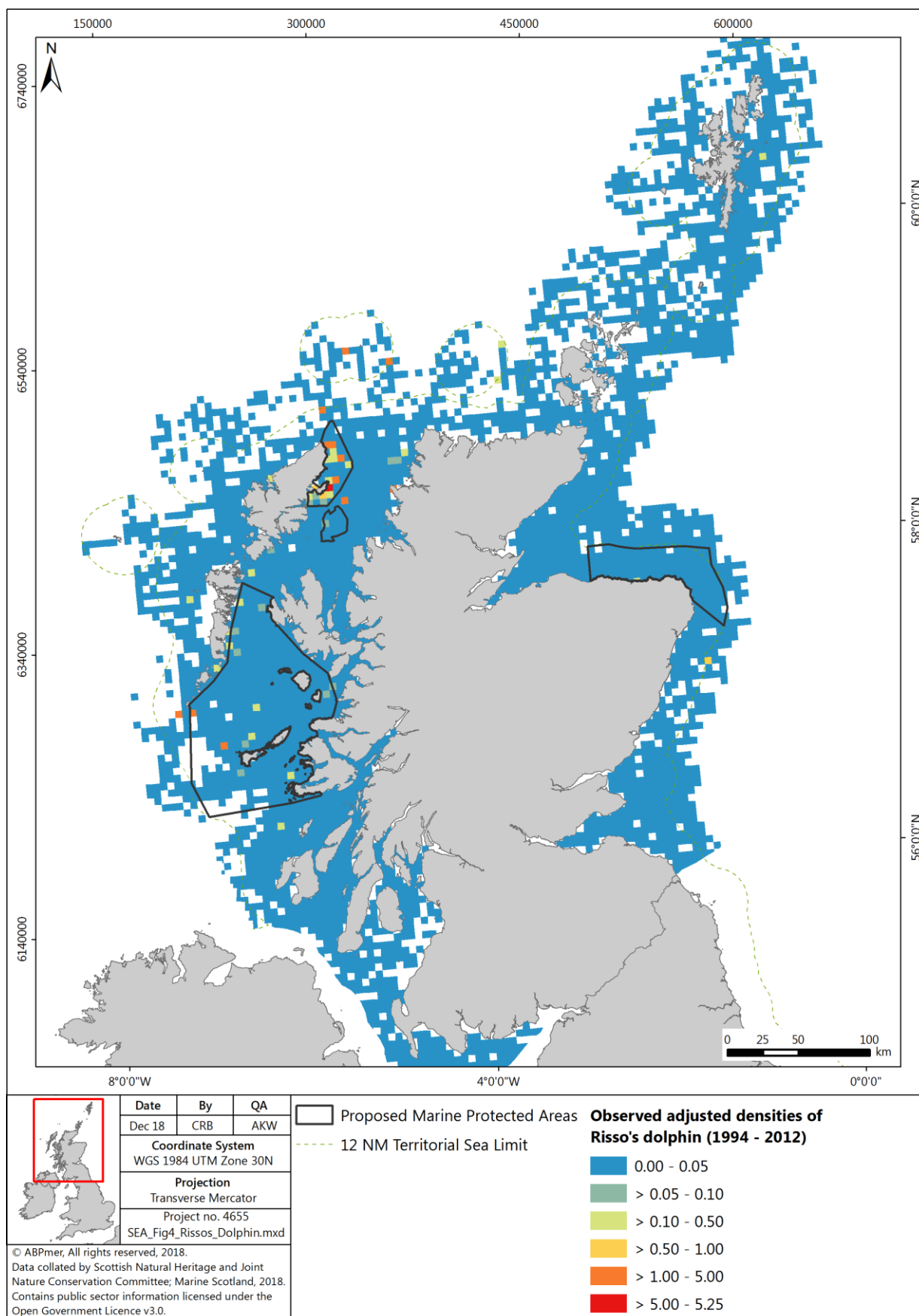


Figure 4 Risso's dolphin density in Scottish seas

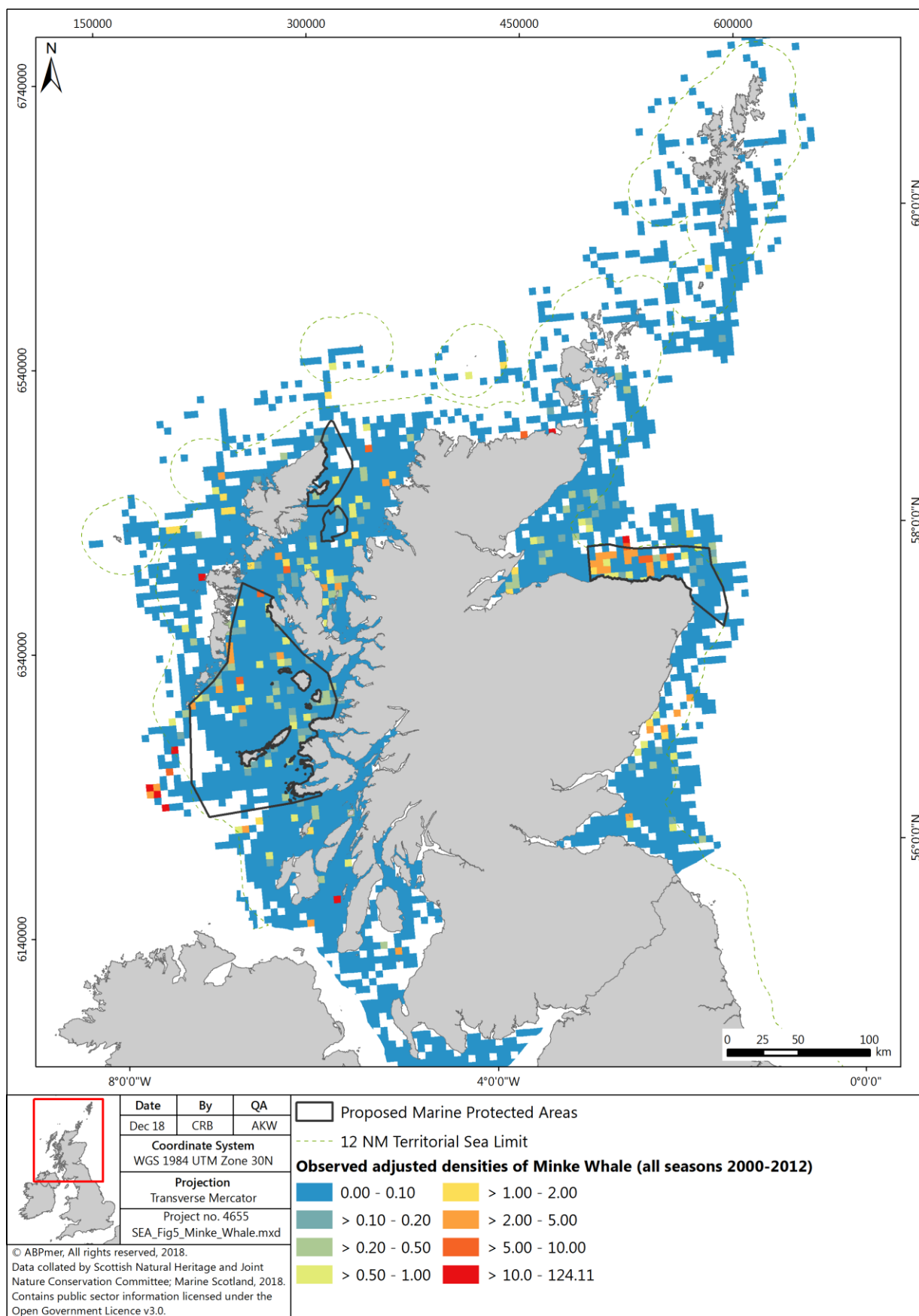


Figure 5 Minke whale density in Scottish seas

Birds

- 4.2.11 Scotland, and its coastline, is important for marine and coastal birds, including seabirds, seaducks, divers, grebes, waders and waterfowl. Scotland provides an essential feeding station for migrating birds; a safe winter haven for ducks, geese and shorebirds; and provides nesting sites for seabird species. It holds internationally significant numbers of 24 species of breeding seabirds, with additional migratory species of waterbird overwintering on Scotland's coasts.
- 4.2.12 The European Seabirds At Sea (ESAS) database⁷⁹ records high numbers of seabirds within the southern extent of NEL, indicating that this is an area of importance for seabird species, likely to be linked to large seabird colonies on the Eye Peninsula and the north-eastern coast of the Isle of Lewis. Seabird records are also high throughout STR, with high abundances recorded throughout the Moray Firth. These records are likely to be linked to numerous seabird colonies known to be present along the coastline within STR.

Fish

- 4.2.13 Scotland's territorial waters support approximately 250 different species of fish, with additional species occurring in deeper waters within the Scottish marine area. Some species are commercially important to the Scottish fishing industry, and others, such as sandeel, are key prey species for seabirds, marine mammals and larger fish species, including some shark species. There are several migratory anadromous fish species within Scottish waters which use Scottish rivers for spawning, including Atlantic salmon, shad, sea trout and lamprey. Thirty-one species of fish are identified as PMFs within Scottish waters⁸⁰.
- 4.2.14 Sandeel is a key prey species for seabirds around the Scottish coastlines, and declines of some species, particularly kittiwake and Arctic skua, have been linked to changes in sandeel populations within Scottish seas.
- 4.2.15 Of the 250 species of fish identified in Scottish waters, 40 are cartilaginous fish (Chondrichthyes), incorporating species of shark, rays and skates⁸¹. Within Scottish seas, there are nationally important populations of basking sharks. Significant numbers of sightings are concentrated around the Inner Hebridean islands of Coll, Tiree, Canna and Hyskeir and have been highlighted as potential breeding grounds⁸² (Figure 6). It should be noted that whilst the highest density of sightings is in this area, the data reproduced in Figure 6 has

⁷⁹ JNCC website. Seabirds at sea data. Available at: <http://jncc.defra.gov.uk/page-4469> (accessed 21/12/2018)

⁸⁰ Tyler-Walters, H., James, B., Carruthers, M. (eds.), Wilding, C., Durkin, O., Lacey, C., Philpott, E., Adams, L., Chaniotis, P.D., Wilkes, P.T.V., Seeley, R., Neilly, M., Dargie, J. & Crawford-Avis, O.T. 2016. Descriptions of Scottish Priority Marine Features (PMFs). Scottish Natural Heritage Commissioned Report No. 406. Available at <https://www.nature.scot/sites/default/files/Publication%202016%20-%20SNH%20Commissioned%20Report%20406%20-%20Descriptions%20of%20Scottish%20Priority%20Marine%20Features%20%28PMFs%29.pdf> (accessed 12/11/2018)

⁸¹ Davidson. 1996. An estimation of the total number of marine species that occur in Scottish coastal waters. Available at <https://www.nature.scot/sites/default/files/2017-06/063.pdf>. (accessed 12/11/2018)

⁸² *ibid*.

not been adjusted for effort, and therefore there may be further areas of high density for basking sharks that have not been identified. The importance of the Sea of the Hebrides for basking sharks is recognised as this species has been identified as a protected feature of SOH pMPA.

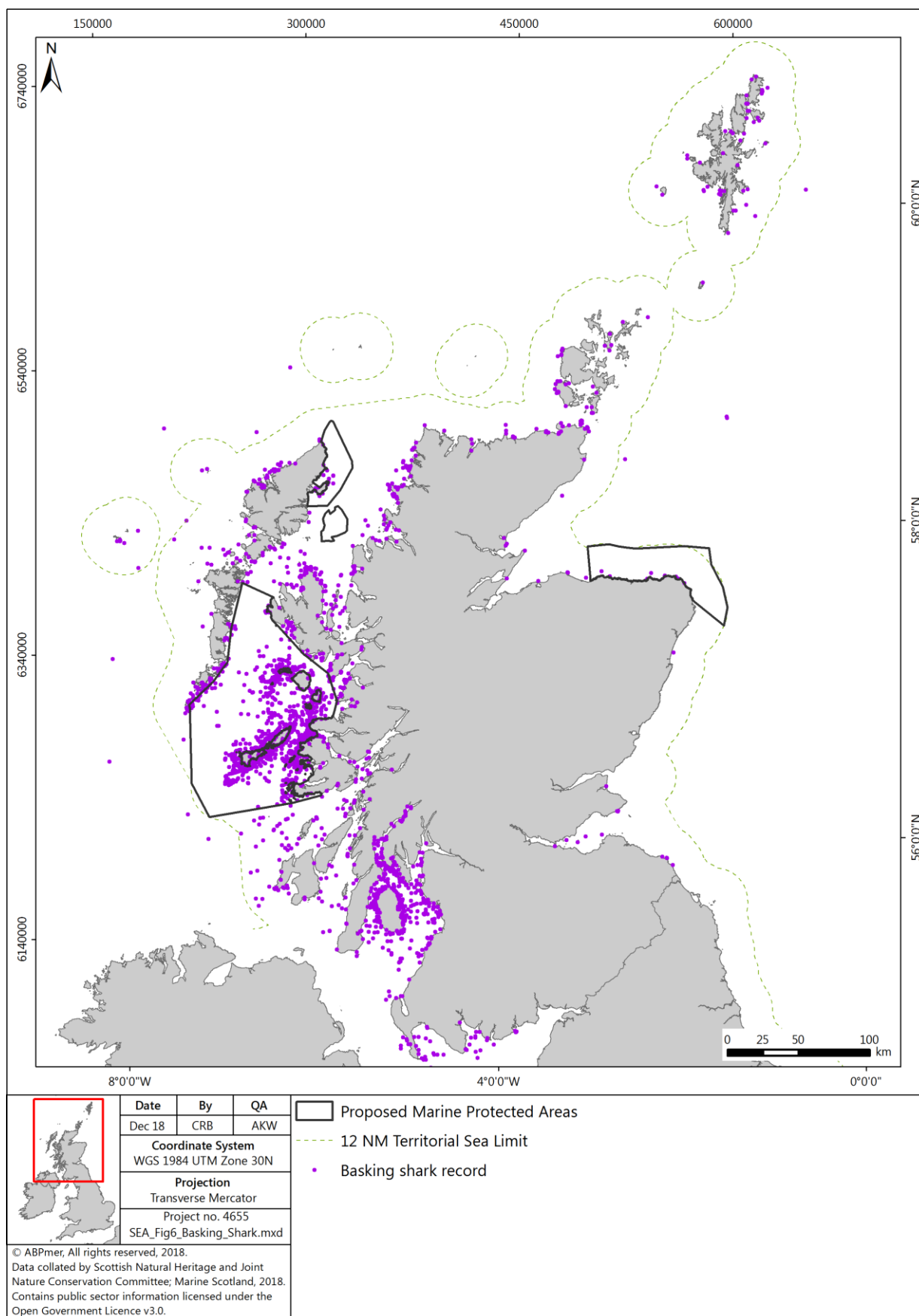


Figure 6 Records of basking shark in Scottish seas

Protected habitats and species

- 4.2.16 The importance of Scotland's marine ecosystems is reflected in the range of designations which protect them at the international and national levels. All designations are included and incorporated into Scotland's MPA network, covering approximately 20% of Scottish seas. The current designations for nature conservation purposes are:
- Special Areas of Conservation (SACs): These include both inshore and offshore SACs and cover eleven different marine habitat types which occur in Scotland, including reefs and submarine structures made by leaking gases. Seven marine species that occur in Scotland are also protected, including bottlenose dolphin, harbour porpoise, grey seal and harbour seal.
 - Special Protection Areas (SPAs): These protect and are of international importance for a number of bird species (e.g. seabirds, waders, ducks and geese).
 - Nature Conservation MPAs: These protect habitats and species such as maerl beds, coral gardens and common skate.
 - Sites of Specific Scientific Interest (SSSI): These are nationally designated sites which protect species, such as seabirds and seals, and habitats, such as sea caves and rocky shores.
- 4.2.17 In addition, Ramsar sites are designated for their internationally important wetlands. Each Ramsar site is also designated as either a SPA or SAC, depending on the features present.
- 4.2.18 Existing and proposed nature conservation MPAs, SACs and SPAs sites are shown in Figure 7.
- 4.2.19 Currently there are 18 MPAs designated for nature conservation purposes under the Marine (Scotland) Act 2010 and 37⁸³ SACs designated under the EU Habitats Directive located within territorial waters (i.e. within 12NM of the territorial baseline) (Figure 7). A further 13 MPAs and 11 SACs are designated in the offshore environment⁸⁴ (i.e. from 12NM from the territorial baseline, or within non-territorial waters) (Figure 7).
- 4.2.20 There are 47 current SPAs, of which 31 are extensions to seabird colony SPAs designated under the EU Birds Directive to protect a range of vulnerable or migratory bird species and 66 SSSI for the further protection of species such as seabirds and seals and habitats ranging from sea caves and rocky shores⁸⁵.

⁸³ Scottish Government (2018) Marine Protected Areas (MPAs) [online] Available at: <http://www.gov.scot/Topics/marine/marine-environment/mpanetwork> (accessed 20/12/18)

⁸⁴ Scottish Government (2018) Developing Fisheries Management Proposals for Offshore Special Areas of Conservation (SACs) and Marine Protected Areas (MPAs) Under the Common Fisheries Policy (CFP) [online] Available at: <http://www.gov.scot/Topics/marine/marine-environment/mpanetwork/SACmanagement> (accessed 20/12/18)

⁸⁵ Scottish Government (2018) Marine Protected Areas (MPAs) [online] Available at: <http://www.gov.scot/Topics/marine/marine-environment/mpanetwork> (accessed 20/12/18)

There are also 16 Ramsar sites designated as internationally important wetlands, covering a total area of about 313,000 hectares⁸⁶.

- 4.2.21 The Habitats Directive also affords protection to certain species of plants and animals (European Protected Species). In the marine environment these include cetaceans and otter.
- 4.2.22 The designation of the four pMPAs that are the subject of this SEA overlap with a number of nature conservation sites. NEL, SOH and SEB pMPAs overlap with the Inner Hebrides and the Minches candidate Special Area of Conservation (cSAC), which is designated for harbour porpoise.
- 4.2.23 Additionally, SOH pMPA also overlaps with Small Isles MPA (designated to protect the varied habitats around the Small Isles), a number of SPA sites (designated for seabird species and assemblages) and a number of smaller MPA and SAC sites (designated for a range of species and habitats largely within the sea lochs on the west coast of mainland Scotland). STR also overlaps with two SPA sites (Troup, Pennan and Lion's Heads SPA and the Moray Firth pSPA), in recognition of the importance of the area for wintering and breeding marine birds.

Priority marine features

- 4.2.24 In July 2014, Scottish Ministers adopted a list of 81 PMFs. PMFs are species and habitats which have been identified as being of conservation importance to Scotland⁸⁷. Most are a subset of species and habitats identified on national, UK or international lists. The National Marine Plan includes a policy (GEN 9 Natural Heritage) for safeguarding PMFs whereby '*Development and use of the marine environment must not result in significant impact on the national status of PMFs*'⁸⁸.
- 4.2.25 The list of 81 PMFs comprises 26 broad habitats (e.g. burrowed mud), seven low or limited mobility species (e.g. ocean quahog) and 48 mobile species, including fish (e.g. blue ling) and marine mammals (e.g. minke whale).
- 4.2.26 Although many PMFs are protected within the MPA network, there is a need to ensure adequate protection of PMFs outwith the MPA network. Management measures have therefore been proposed in 11 of the most vulnerable PMFs and these are currently being assessed as part of a separate SEA (see Section 3.6).

86 SNH (2018) Ramsar Sites [online] Available at: <https://www.nature.scot/professional-advice/safeguarding-protected-areas-and-species/protected-areas/international-designations/ramsar-sites> (accessed 19/11/2018)

87 Scottish Natural Heritage, 2018. Priority marine features in Scotland's seas. [online] Available at: <https://www.nature.scot/professional-advice/safeguarding-protected-areas-and-species/priority-marine-features-scotlands-seas> (accessed 02/05/2018)

88 The Scottish Government, 2015. Scotland's National Marine Plan. A single framework for managing our seas. [online] Available at: <http://www.gov.scot/Publications/2015/03/6517/5> (02/05/2018)

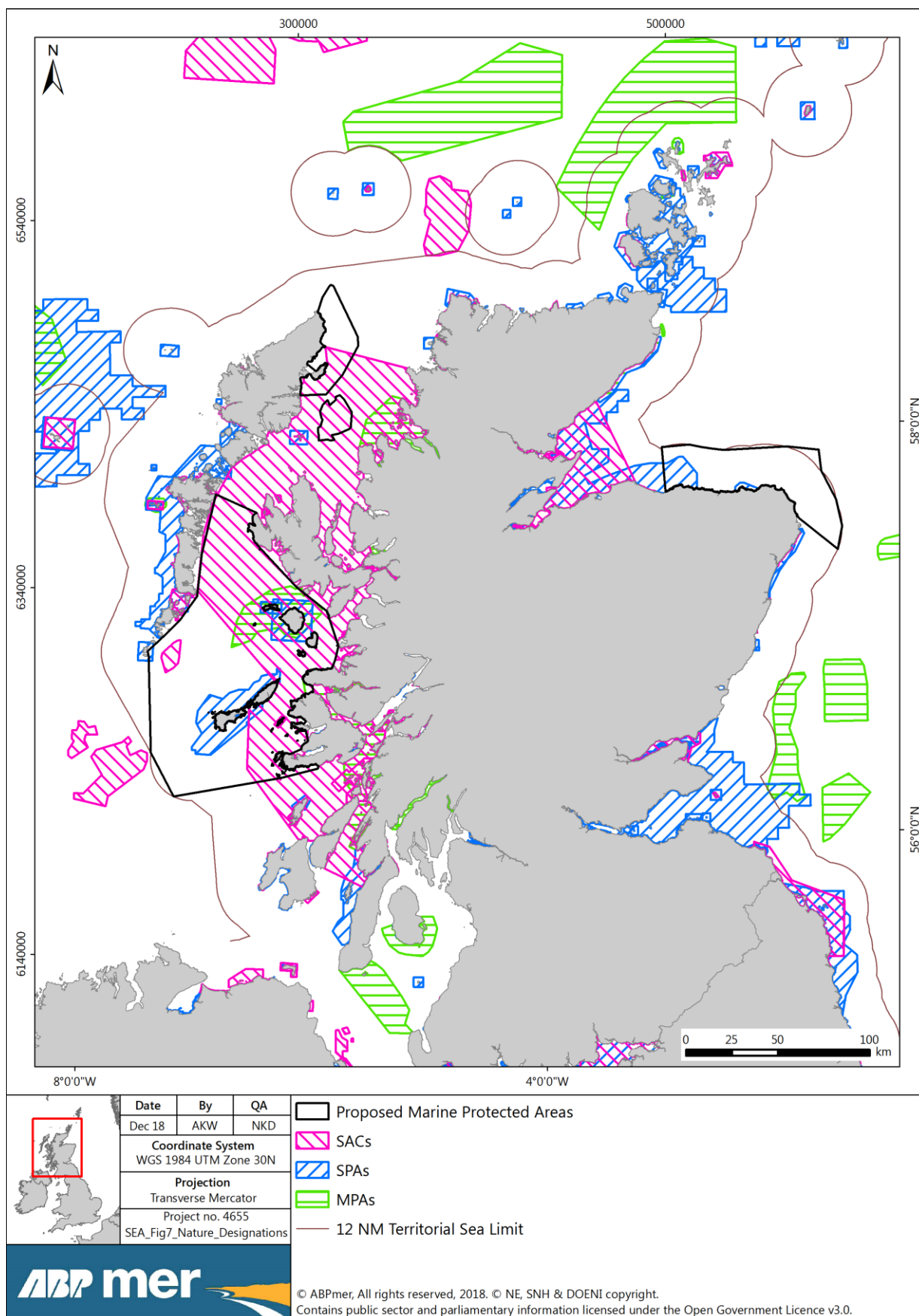


Figure 7 Nature conservation sites

Trends and pressures

- 4.2.27 Scotland's Marine Atlas presented an assessment of the condition of Scotland's seas and a summary of significant pressures and the impacts of human activity⁸⁹. It was based on scientific evidence from available data and analysis, supported by expert judgement and taking account of key data gaps⁹⁰.
- 4.2.28 The Marine Atlas reviewed the condition of the five major seabed habitat types in Scottish waters. There were few or no concerns about subtidal rock. Intertidal rock and sediments show evidence of deterioration, with one concern being the introduction of invasive non-native species such as wireweed (*Sargassum muticum*), a brown alga. The most significant level of concern related to the condition of shallow and shelf subtidal sediments, mainly as a result of fishing practices such as demersal fishing (trawling) and scallop dredging. There were also some concerns about the effects of trawling on deep sea habitat, although such activity has now been banned at depths greater than 800m under EU Deep Sea Fisheries Regulation 2016/2336⁹¹. Vulnerable marine ecosystems are also closed to bottom gear fishing at depths greater than 400m under this EU regulation.
- 4.2.29 The Marine Atlas also assessed the condition of a number of species groups. Those that are relevant to the assessment are summarised below together with other available data sources.

Cetaceans

- 4.2.30 There is limited information in the Marine Atlas with regards to the condition of cetacean populations within Scottish waters. However, where the condition can be assessed, the populations are considered to be favourable⁹² (namely harbour porpoise, bottlenose dolphin, minke whale, white-beaked dolphin and fin whale).

Seals

- 4.2.31 There has been a general decline in harbour seal numbers since 2001 in several regions of the north and east of Scotland, particularly Orkney and the Firth of Tay^{93,94}. However, the patterns of decline are not universal. For

⁸⁹ Marine Scotland (2011) Scotland's Marine Atlas: Information for The National Marine Plan.

⁹⁰ Marine Scotland (2013) Marine Atlas Data Sources: General & Overall Assessment. Available at: <http://www.gov.scot/Topics/marine/science/atlas/Annexes/Data> (accessed 20/12/18)

⁹¹ Regulation (EU) 2016/2336 of the European Parliament and of the Council of 14 December 2016 establishing specific conditions for fishing for deep-sea stocks in the north-east Atlantic and provisions for fishing in international waters of the north-east Atlantic and repealing Council Regulation (EC) No 2347/2002. Available at <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32016R2336> (accessed 20/12/18)

⁹² Baxter, J.M., Boyd, I.L., Cox, M., Donald, A.E., Malcolm, S.J., Miles, H., Miller, B., Moffat, C.F. 2011. Scotland's Marine Atlas: Information for the national marine plan. Marine Scotland, Edinburgh. Available at <https://www.gov.scot/Publications/2011/03/16182005/0> (accessed 20/12/18).

⁹³ *ibid*

⁹⁴ Arso Civil, M., Smout, S., Thompson, D., Brownlow, A., Davison, N., Doeschate, M., Duck, C., Morris, C., Cummings, C., McConnell, B. and Hall, A. J. (2018) Harbour Seal Decline – vital rates and drivers. Report to Scottish

example, the Moray Firth harbour seal count declined prior to 2005, remained relatively stable for four years, then increased by 40% in 2010 and has fluctuated ever since, showing no significant trend since 2000⁹⁵. The 2014 and 2015 surveys have identified an increasing harbour seal population on the west coast, although east coast populations remain low compared to historic levels⁹⁶.

- 4.2.32 Grey seal populations are considered to have a stable, albeit fluctuating population within Scottish waters⁹⁷.

Birds

- 4.2.33 Scotland's Marine Atlas⁹⁸ reported that seabird populations are increasing in some areas (Solway Firth and the Firth of Clyde, for example) and decreasing in others for certain species. In East and West Shetland and along the North Scotland coast, this decrease is most probably related to a shortage of prey species resulting from changes in oceanographic conditions. Like seabirds, waterbirds (wildfowl and waders) are also both increasing and decreasing year on year, depending on the species and location. The reasons for the changes remain to be fully explained but may in part be due to redistribution of wintering birds across northwest Europe due to climate change effects.
- 4.2.34 A more recent assessment of seabird trends between 1986 and 2016 found that the mean numbers of 12 species of breeding seabirds in Scotland had declined by 62% compared to the 1986 baseline level⁹⁹.

Fish

- 4.2.35 The Marine Atlas noted that populations of many commercial fish species are declining and that this is of particular concern in the Solway Firth, North Channel, Firth of Clyde, Minches and Malin Sea, North Scotland coast and West Shetland. The decline in the availability of sandeels associated with changes in oceanographic conditions has had a major influence on changes in seabird numbers on the east coast and in the Northern Isles¹⁰⁰.
- 4.2.36 No assessments have been made on trends in basking shark populations in Scottish waters, although the Marine Atlas¹⁰¹ notes that whilst there is no

Government HSD2. Available at [https://risweb.st-andrews.ac.uk/portal/en/researchoutput/harbour-seal-decline--vital-rates-and-drivers\(e63c0fbe-b5dd-44ef-b341-457c7bdda315\).html](https://risweb.st-andrews.ac.uk/portal/en/researchoutput/harbour-seal-decline--vital-rates-and-drivers(e63c0fbe-b5dd-44ef-b341-457c7bdda315).html).

⁹⁵ SCOS (2017) Scientific Advice on Matters Related to the Management of Seal Populations: 2017. Available at: <http://www.smru.st-andrews.ac.uk/files/2018/01/SCOS-2017.pdf>. Accessed 15/06/2018.

⁹⁶ *ibid*.

⁹⁷ Baxter, J.M., Boyd, I.L., Cox, M., Donald, A.E., Malcolm, S.J., Miles, H., Miller, B., Moffat, C.F. 2011. Scotland's Marine Atlas: Information for the national marine plan. Marine Scotland, Edinburgh. Available at <https://www.gov.scot/Publications/2011/03/16182005/0> (accessed 21/12/18)

⁹⁸ *ibid*

⁹⁹ SNH. 2018. Biodiversity Indicator: The numbers and breeding success of seabirds, S005, July 2018.

¹⁰⁰ Baxter, J.M., Boyd, I.L., Cox, M., Donald, A.E., Malcolm, S.J., Miles, H., Miller, B., Moffat, C.F. 2011. Scotland's Marine Atlas: Information for the national marine plan. Marine Scotland, Edinburgh. Available at <https://www.gov.scot/Publications/2011/03/16182005/0> (accessed 21/12/18)

¹⁰¹ *ibid*

longer an active fishery for basking shark in Scottish waters, populations are believed to have declined due to historic fishing practices. As these animals are slow growing, late to reach maturity and typically have low fecundity, populations take some time to recover from pressures such as overfishing.

Current and future pressures

4.2.37 Box 1 sets out some of the key current and future pressures on marine biodiversity, flora and fauna. The Feature Activity Sensitivity Tool (FEAST) provides more comprehensive information on the relevant pressures associated with a range of marine activities and the sensitivity of MPA protected features to these activities and pressures¹⁰².

Box 1 Pressures on marine biodiversity, flora and fauna

Commercial fishing:

- Removal of target fish species may affect the sustainability of fish stocks, particularly where catches are above the level consistent with achieving maximum sustainable yield;
- Discards of fish are a waste of the resource, and also encourage scavenger species;
- Bycatch inadvertently catches both non-target fish and other species, generally leading to the death of individuals and subsequent declines in populations;
- The seabed and its benthic habitat may be damaged by mobile fishing gear, with the consequent loss of marine plants and animals; and
- Removal of target species may also decrease the availability of prey species, leading to declines in populations of other species (e.g. birds).

Non-native invasive species:

- May outcompete native species, thereby displacing them from the marine environment.

Marine litter:

- Can result in the injury and/or death of marine animals through entanglement, ingestion of litter (including plastic microparticles in particular), or both.

Navigation dredging:

- Can result in loss of and/or damage to the seabed and the habitat that it supports, increasing pressure on biodiversity using that habitat and potentially decreasing the availability of prey species, leading to declines in populations (e.g. of birds);
- May give rise to suspended sediments, resulting in decreased water quality, reduced visibility for foraging fauna and/or smothering of the seabed if these sediments settle out in a different area; and
- May disturb marine animals, including through increased noise levels.

Marine transport:

- Risk of collision of vessels with marine animals, resulting in their injury and/or death, with subsequent population declines;
- May result in increased coastal erosion through the action of vessel wakes; and
- Vessel noise can impact marine animal behaviour and result in disturbance and/or displacement, including displacement of bird species from the water.

Aquaculture:

¹⁰² The Scottish Government (2013) FEAST – Feature Activity Sensitivity Tool. [online] Available at: <http://www.marine.scotland.gov.uk/feast/> (accessed 20/12/18)

- May give rise to elevated nutrient levels in and on the seabed from fish faeces and excess animal feed, which can result in changes to community composition and/or smothering of the seabed;
- Elevated concentrations of contaminants used in sea lice treatment, fish health and anti-fouling;
- Nets associated with aquaculture can result in the injury and/or death of marine animals through entanglement;
- Can damage the seabed and its habitat through anchoring of infrastructure;
- May affect wild salmonids through transmission of sea lice; and
- May disturb marine animals, including through increased noise levels associated with Acoustic Deterrent Device (ADD) operations at finfish aquaculture sites.

Marine wildlife watching:

- May result in increased disturbance and displacement of populations of marine animals such as whales, dolphins and bird species; and
- May give rise to collision risk of mobile species with vessels (e.g. birds, mammals etc.).

Recreation:

- May result in loss of and/or damage to the seabed and its habitat through anchoring
- May give rise to increased levels of marine litter;
- May disturb marine animals through human and/or vessel presence if the Scottish Marine Wildlife Watching Code is not adhered to; and
- May give rise to collision risk of mobile species with vessels (e.g. birds, mammals etc.).

Offshore renewables:

- May result in loss of and/or damage to the seabed and its habitat, through anchoring of infrastructure;
- May give rise to collision risk (e.g. with birds, mammals, etc.);
- Could result in changes to sediment transport through changes in energy levels in the water; and
- May disturb marine animals, particularly through increased noise levels associated with construction activities (e.g. percussive piling) and survey activities.

Climate change (increasing sea temperatures, acidification, changes to rainfall patterns, increased extreme weather events etc.):

- May result in populations of marine animals and plants moving further north;
- May result in increased levels of seabird mortality (including large scale events such as seabird wrecks), due to increased levels of extreme weather events;
- May give rise to population decline; and
- May result in new competitors arriving in Scottish waters, including non-native invasive species.

Survey Activities

- May disturb marine animals, through increased noise levels in the marine environment associated with the use of acoustic survey equipment; and
- May give rise to collision risk of mobile species with vessels (e.g. birds, mammals etc.).

Coastal Development

- May disturb marine animals, through increased noise levels in the marine environment associated with construction activities.

4.3 Geodiversity

Seafloor geodiversity

- 4.3.1 Geodiversity is defined as the natural range (diversity) of geological features (rocks, minerals, fossils and structures), geomorphological features (landforms and processes) and soil features that make up the landscape both on land and below water. The condition of underlying geodiversity features such as sand banks and seabed influence the quality of habitats which in turn affects the viability and health of both flora and fauna populations.
- 4.3.2 There are six features of Scottish geodiversity that are protected by Nature Conservation MPAs:
- Quaternary of Scotland;
 - Submarine Mass Movement;
 - Marine Geomorphology of the Scottish Deep Ocean Seabed;
 - Seabed Fluid and Gas Seep;
 - Cenozoic Structures of the Atlantic Margin; and
 - Marine Geomorphology of the Scottish Shelf Seabed.
- 4.3.3 Each feature is in turn comprised of a variety of components, such as continental slope channels, iceberg ploughmark fields, moraines, slide deposits, sand wave fields, pockmarks, seamounts, sand banks and mega-scale glacial lineation. Major physiographical features of the Scottish marine environment are shown in Figure 8.
- 4.3.4 There are elements of protected geodiversity features identified within the pMPAs (see Table 2).
- 4.3.5 Scottish waters are geomorphologically distinct between the east and west coasts. The east coast presents mostly uniform depths and shallow inclines interspersed with localised trenches, while the seabed off Scotland's west coast shelves steeply away from the coast, and deep waters occur relatively close to the land.
- 4.3.6 Data from the British Geological Society (BGS) demonstrates that Scottish waters display a wide range of seabed habitats, ranging from scoured rock or coarse sediment to muddy gravel or fine sand in some areas. A description of the key habitat types in Scottish waters is provided in the section on 'Marine Habitats' above.
- 4.3.7 In general, marine sediments are sandy or gravelly and originate from deposits from the Quaternary glaciation. Muddy sediments occur principally nearshore or, further offshore, in depressions on the sea floor, where currents may be relatively weak, particularly to the east of Scotland. They also occur beyond the shelf break (200m water depth) to the west of Scotland. The concentration of

calcareous material varies greatly in seabed sediments, reflecting the amount of shell material in different areas, and can locally be very high¹⁰³ (Figure 9).

Coastal geodiversity

- 4.3.8 Much of Scotland's landscape and coastline was initially formed through the processes of glacial erosion and deposition. Today the coast continues to change as a result of coastal processes such as wave action, sediment movement, erosion and accretion. The 2004 European Initiative for Sustainable Coastal Erosion Management (Eurosion) survey of Scotland's coastline reported that it comprises predominantly hard coasts of rocks and cliffs (70%); soft coasts that are potentially susceptible to erosion impacts, consisting of unconsolidated gravels, sand and silts (29%); and artificial coasts such as harbours and sea walls (less than 1%) (Figure 10).

¹⁰³ Taken from Marine Scotland (2008) Scotland's Seas: Towards Understanding their State, Chapter 2.

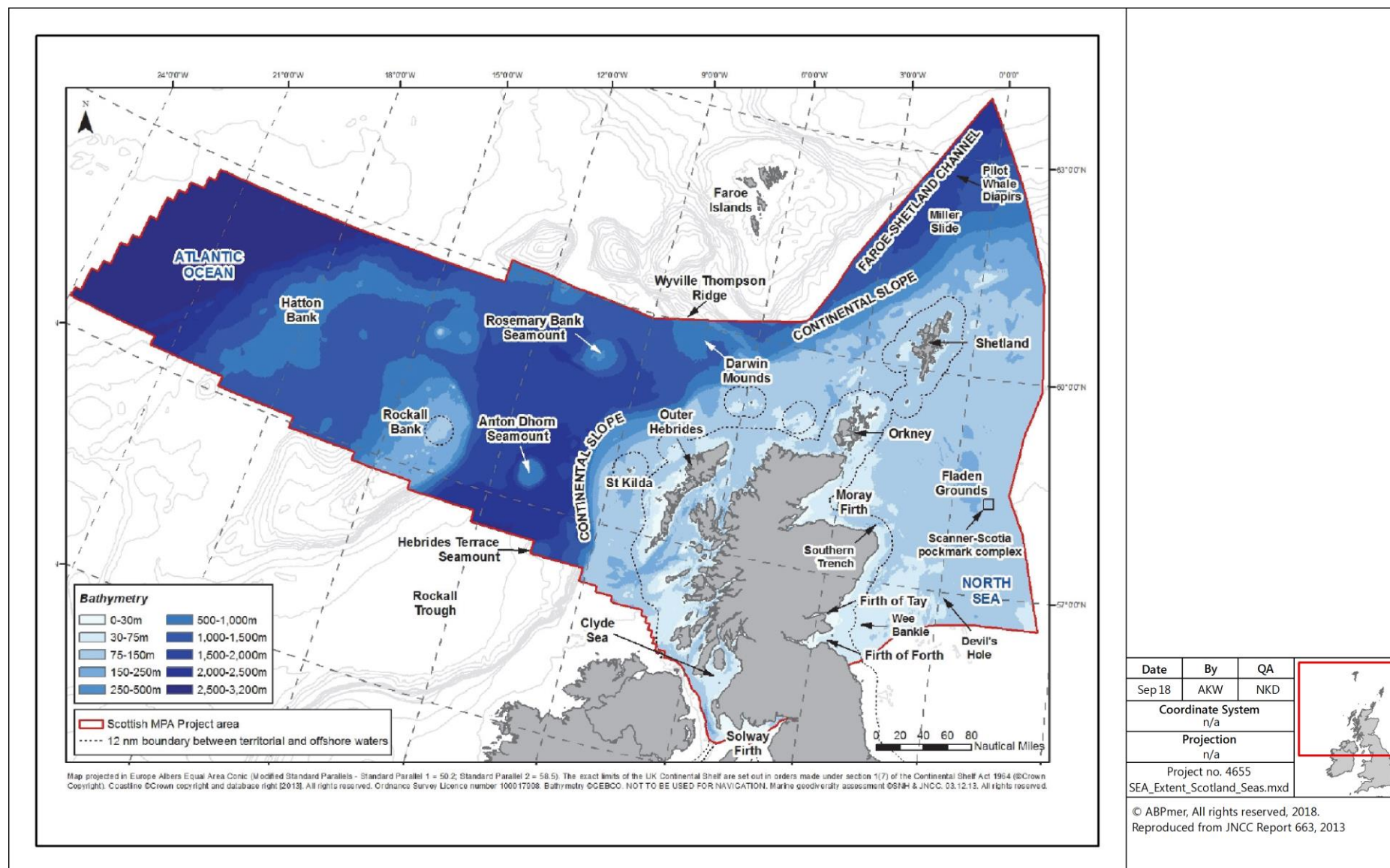


Figure 8 Extent of Scotland's seas, showing bathymetry and locations of major physiographical features

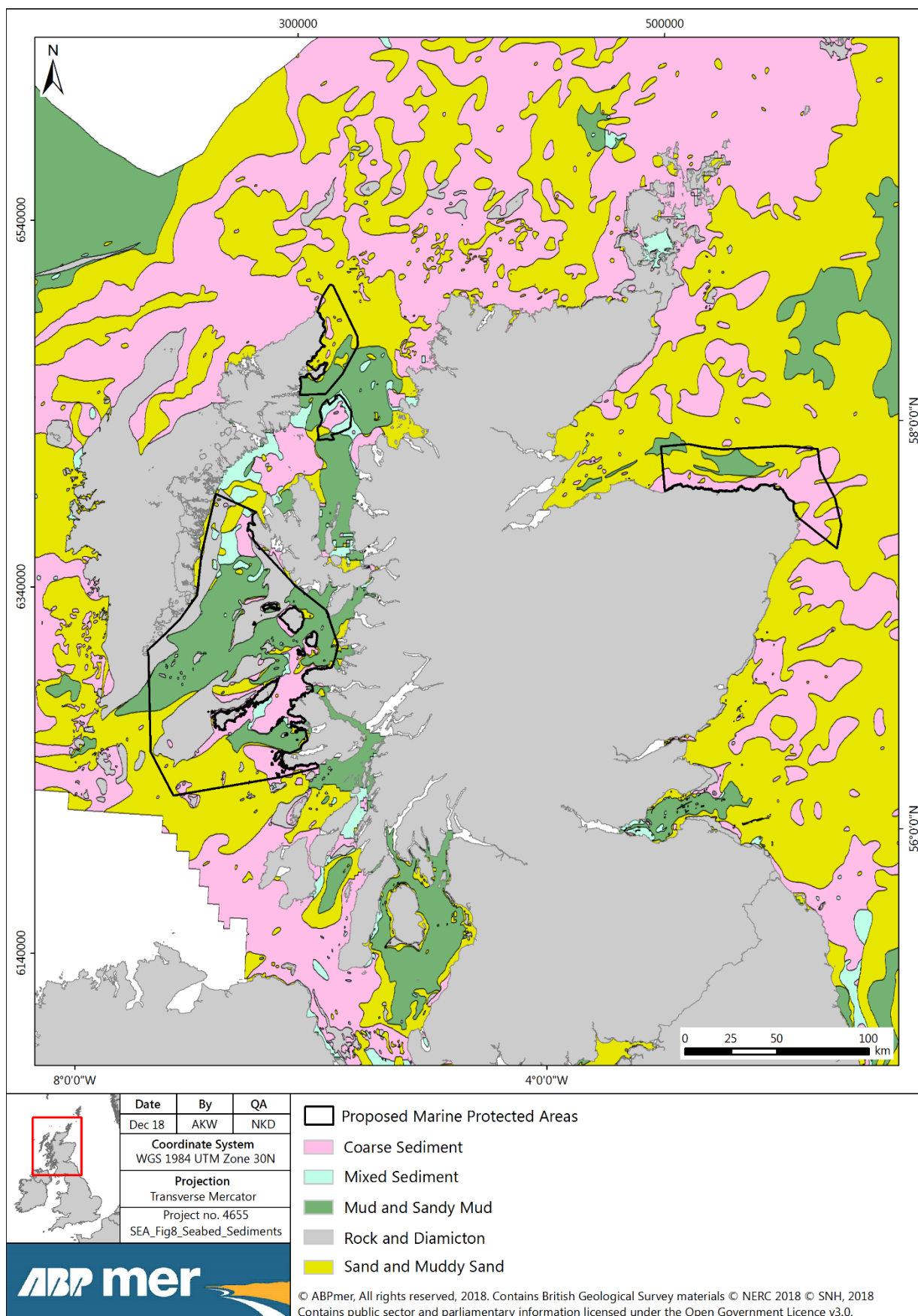


Figure 9 Seabed sediments

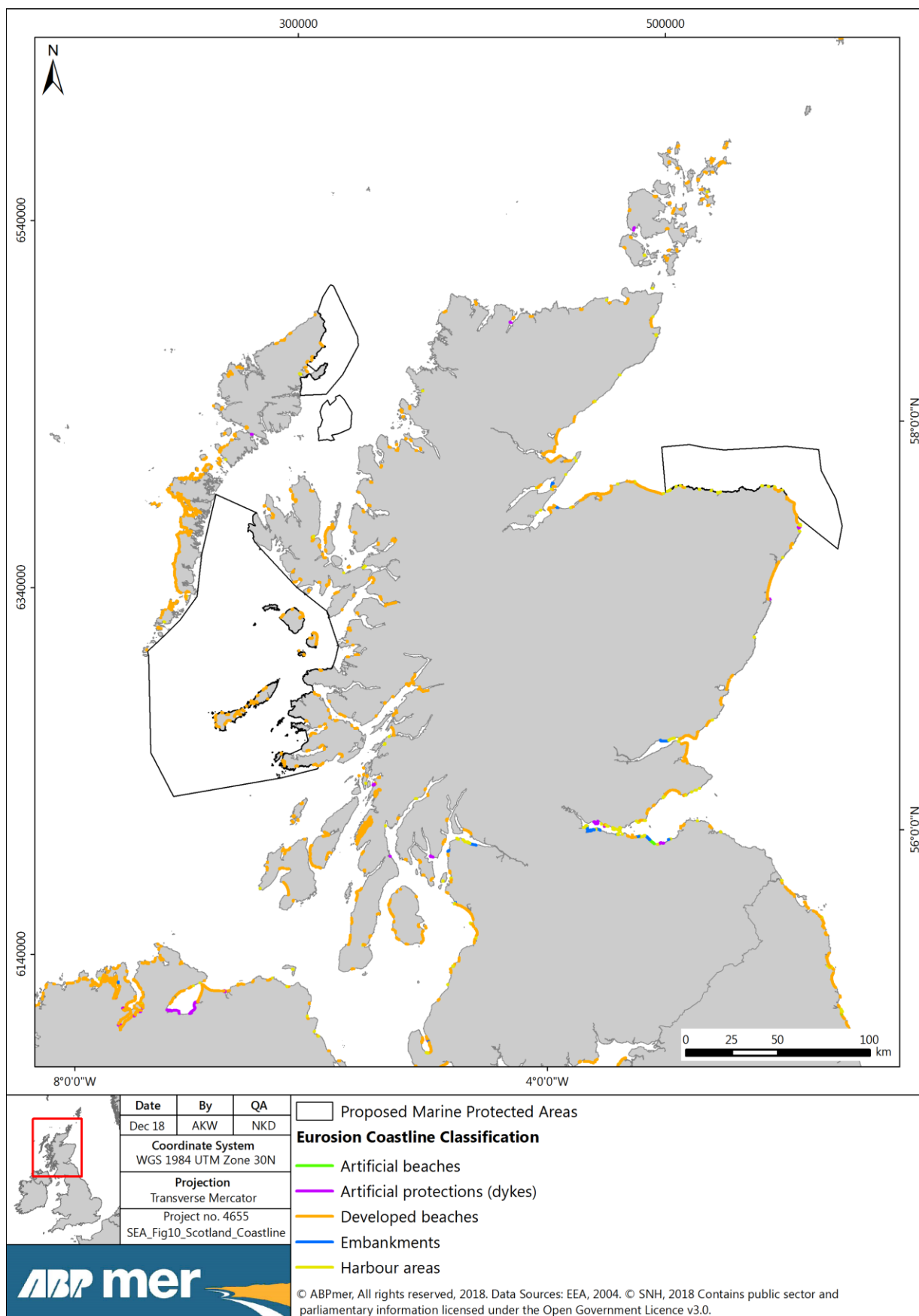


Figure 10 Euroasion coastline classification

Trends and pressures

- 4.3.9 Coasts are dynamic environments, continually changing in response to variations in weather, land use and the supply of sediment. This capacity for change encourages landholders to try to design schemes to restrict and control this natural dynamism. Restricting coasts affects water and sediment flows, which can impact wildlife habitat and landscape value and diversity. Intervention at one point on a coastline can have a knock-on effect at another point in this dynamic landscape.
- 4.3.10 Pressures on geodiversity features in Scottish seas arise from multiple activities, including renewable energy scheme development, seafloor exploration activities and fishing¹⁰⁴.

4.4 Ecological status of water bodies

- 4.4.1 There are various mechanisms in place for monitoring and managing the quality of Scottish waters. Each takes a different focus and approach:
- The Water Framework Directive (WFD) establishes a framework for the protection of inland surface waters (rivers and lakes), transitional waters (estuaries), coastal waters and groundwater, with the aim of ensuring that all aquatic ecosystems meet 'good status'; and
 - River Basin Management Plans (on) have been prepared for the Scotland and Solway Tweed River Basin Districts to address the requirements of the WFD in relation to the management of Scotland's river systems. Both plans also provide an overview of the state of the water environment for their districts. The plans have been updated since the first cycle (2009 – 2015) and are currently in the second cycle (2015 – 2027).
- 4.4.2 Scotland's coastal waters are monitored by the Scottish Environment Protection Agency (SEPA) to measure performance and compliance with targets for coastal water quality status under the WFD.
- 4.4.3 Coastal and transitional water bodies are classified in terms of their ecological and chemical quality. For those water bodies not designated as heavily modified or artificial, this ecological quality is described in terms of 'ecological status', which defines how much ecological quality deviates from natural conditions. The quality elements used to assess ecological status are:
- Biological quality elements (water, plants and animals);
 - Chemical and physicochemical elements (e.g. oxygen and nutrient levels); and
 - Hydromorphological quality elements (water flows and levels; the condition of beds, banks and shores; and the continuity of rivers for fish migration).

¹⁰⁴ SNH (2013) Assessing the sensitivity of geodiversity features in Scotland's seas to pressures associated with human activities. Report 590. Available at: http://www.snh.org.uk/pdfs/publications/commissioned_reports/590.pdf (accessed 20/12/18)

- 4.4.4 For 'good status', the chemical, physicochemical and hydromorphological quality of the water body must achieve the standards and conditions necessary for the biological quality elements to be in good condition. The ecological status of a water body is determined by the lowest-classed quality element.
- 4.4.5 Scotland's coastal and transitional water bodies are mostly classed as being of 'high' or 'good' ecological status under the WFD as part of the latest assessment in 2017 (Figure 11).
- 4.4.6 The majority of the 505 coastal and transitional water bodies in Scottish waters, as represented in Figure 11, are classified as either good status (342) or high status (155). However some areas have been classified as moderate (7) or poor (1)¹⁰⁵. There are 86 designated bathing areas in Scotland, of which 59 are assessed as excellent or good status, 16 are assessed as at target objective, and 11 are assessed as poor status¹⁰⁶. There are 80 designated shellfish waters in Scotland. Twenty-nine are assessed as at target objective, with the remaining 51 assessed as not at target objective¹⁰⁷. Within the four pMPAs, where there is overlap with coastal and transitional water bodies, these are classed as good or high status.
- 4.4.7 NEL, SOH and STR pMPAs overlap with the MSFD North-East Atlantic Ocean marine region where they extend beyond the limit of the WFD water bodies (Figure 11). Achieving Good Environmental Status under the MSFD involves satisfying several qualitative descriptors relating to biodiversity and ensuring the sustainable use of the marine environment, for example Descriptor 1 (D1) for biological diversity, D6 for seafloor integrity and D8 for contaminant effects.

Trends and pressures

- 4.4.8 Since the first RBMPs in Scotland were published in 2009, the condition of water bodies has generally improved. However, a wide range of pressures are continuing to impact on the condition of specific water bodies and protected areas. The most widespread pressures on the marine environment in the Scotland RBMP are modifications to physical condition, rural diffuse pollution and waste water discharges¹⁰⁸.
- 4.4.9 Where water bodies within Scotland are identified as moderate or poor, this is principally due to pressures on morphology and macro-invertebrates¹⁰⁹. These

¹⁰⁵ Scottish Environmental Protection Agency. 2018. Water Classification Hub. Available at <https://www.sepa.org.uk/data-visualisation/water-classification-hub/> (accessed 02/11/2018)

¹⁰⁶ *ibid*

¹⁰⁷ *ibid*

¹⁰⁸ Scottish Government. 2015. The river basin management plan for the Scotland river basin district: 2015–2027. <https://www.sepa.org.uk/media/163445/the-river-basin-management-plan-for-the-scotland-river-basin-district-2015-2027.pdf> (accessed 20/12/18)

¹⁰⁹ SEPA. 2018. SEPA Water Classification Hub. Available at <https://www.sepa.org.uk/data-visualisation/water-classification-hub/> (accessed 04/10/2018).

sites are within the Firth of Forth, the Firth of Clyde and Solway Firth (i.e. outwith the four pMPAs).

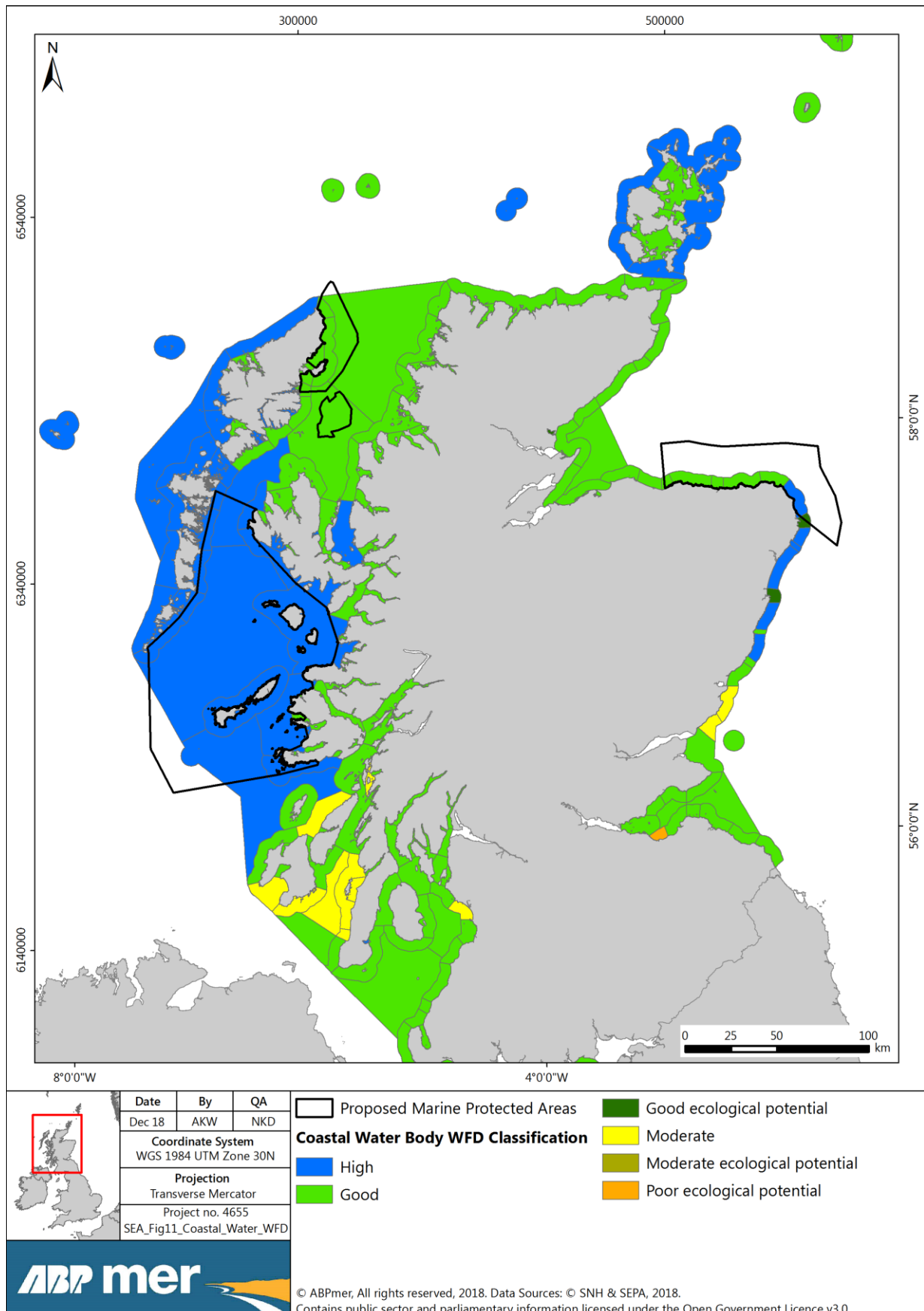


Figure 11 Coastal water body WFD classification

4.5 Climatic factors (including carbon cycling, storage and sequestration)

- 4.5.1 The term ‘carbon cycle’ refers to the circulation of carbon in the environment. In the context of this report, it focusses on the exchange of carbon between the ocean and the atmosphere. The proportion of carbon incorporated into biomass is said to be ‘stored’; thus, marine ecosystems such as kelp forests, maerl beds and marine sediments are able to store carbon. The addition of solid carbon to these long-term stocks is referred to as sequestration, and the conversion of atmospheric carbon dioxide to solid carbon in living material is referred to as fixation. The stored carbon is removed from the environment; however, physical disturbance, bacterial decomposition of organic matter or respiratory processes within the food chain may release the stored carbon back into the environment.
- 4.5.2 Over half of global carbon sequestration occurs through fixation during oceanic photosynthesis and the subsequent long-term storage of the produced organic material¹¹⁰. In addition to carbon being sequestered within the oceanic sediments, a significant portion is stored within living marine organisms. These organisms include taxa that possess calcium carbonate skeletons and shells such as coral and molluscs, with other carbon captured and stored in plant dominated habitats such as seagrass beds, kelp forests and maerl.
- 4.5.3 Within the marine environment, habitats and processes capable of carbon fixation and sequestration are defined as ‘blue carbon sinks’. Multiple habitats across Scottish seas and coastal areas can be termed blue carbon sinks due to their fixation and sequestration ability. Their effectiveness as carbon sinks is highly dependent upon their long-term capacity to store carbon. Habitats present in Scottish waters and classed as blue carbon sinks are¹¹¹:
- Kelp forests;
 - Intertidal and sub-canopy macroalgae;
 - Saltmarshes;
 - Seagrass beds;
 - Maerl beds;
 - Horse mussel beds (*Modiolus modiolus*);
 - Flame shell beds (*Limaria hians*);
 - *Lophelia pertusa* reef;
 - Tubeworm (*Serpula vermicularis*) reef;

¹¹⁰ Azam F. and Jiao N. (2011). Preface: Revisiting the Ocean’s Carbon Cycle. In: Microbial Carbon Pump in the Ocean. Science/AAAS Business Office. Supplement to Science. Available at: https://www.sciencemag.org/site/products/scor_aaas.pdf (accessed 05/02/2019)

¹¹¹ Burrows, M.T., Hughes, D.J., Austin, W.E.N., Smeaton, C., Hicks, N., Howe, J.A., Allen, C., Taylor, P. & Vare, L.L. 2017. Assessment of Blue Carbon Resources in Scotland’s Inshore Marine Protected Area Network. Scottish Natural Heritage Commissioned Report No. 957.

- Blue mussel beds (*Mytilus edulis*);
 - Brittlestar beds;
 - Sediment; and
 - Phytoplankton.
- 4.5.4 The largest contribution to carbon fixation and sequestration in Scottish waters comes from phytoplankton, via photosynthesis and subsequent deposition of the produced organic matter in seabed sediments. This may occur either directly through the export of phytoplankton or indirectly through the consumption of phytoplankton by other organisms and subsequent export of this organic matter through the food chain¹¹².
- 4.5.5 Carbon stored in shallow shelf sediment is ephemeral and constantly exchanged due to the dynamic nature of this habitat. Therefore, the potential for shallow shelf sediments to provide a long term carbon storage is a function of sedimentation rates and the degree of recycling of organic carbon. The rate of recycling of organic carbon is driven by the level of oxygen available for bacterial and chemical breakdown of organic matter¹¹³, which is primarily influenced by disturbance of seabed sediments and the oxygen content of the seawater above the seabed. The STR pMPA is identified as having the highest carbon store (13.5 million tonnes of carbon within the top 10cm of sediment) of any inshore MPA in Scotland, although it is also has the largest area. The majority of this carbon is stored within shelf sediments¹¹⁴.
- 4.5.6 Deeper sediments are less mobile and dynamic and therefore are able to store carbon to a greater extent, but the rate of uptake into the sediment is slower as sedimentation rates in deeper waters are reduced.
- 4.5.7 Kelp forests, ubiquitous along the rocky shore common around Scotland (for example within the SOH pMPA¹¹⁵), are identified as a significant carbon store. However, the fate of carbon within kelp (i.e. whether it is eventually sequestered permanently) is not quantified, and the majority of stored carbon in kelp is understood to be recycled rather than sequestered¹¹⁶. In addition, the brittlestar beds within the STR pMPA are identified as one of the largest elements of inorganic carbon fixation (18,000 tonnes per year) within the Scottish MPA network¹¹⁷.

¹¹² Kröger S, Parker R, Cripps G & Williamson P (Eds.) 2018. Shelf Seas: The Engine of Productivity, Policy Report on NERC-Defra Shelf Sea Biogeochemistry programme. Cefas, Lowestoft. DOI: 10.14465/2018.ssb18.pbd. Available at: https://www.uk-ssb.org/shelf_seas_report.html (accessed 21/11/2018)

¹¹³ *ibid*

¹¹⁴ Burrows, M.T., Hughes, D.J., Austin, W.E.N., Smeaton, C., Hicks, N., Howe, J.A., Allen, C., Taylor, P. & Vare, L.L. 2017. Assessment of Blue Carbon Resources in Scotland's Inshore Marine Protected Area Network. Scottish Natural Heritage Commissioned Report No. 957.

¹¹⁵ *ibid*

¹¹⁶ Kröger S, Parker R, Cripps G & Williamson P (Eds.) 2018. Shelf Seas: The Engine of Productivity, Policy Report on NERC-Defra Shelf Sea Biogeochemistry programme. Cefas, Lowestoft. DOI: 10.14465/2018.ssb18.pbd

¹¹⁷ Burrows, M.T., Hughes, D.J., Austin, W.E.N., Smeaton, C., Hicks, N., Howe, J.A., Allen, C., Taylor, P. & Vare, L.L. 2017. Assessment of Blue Carbon Resources in Scotland's Inshore Marine Protected Area Network. Scottish Natural Heritage Commissioned Report No. 957.

- 4.5.8 Several of the other habitats listed, including maerl beds, are more efficient at carbon fixation and sequester a larger proportion of carbon as compared to their physical extent, but as their total extent across Scotland is low, they do not contribute as much to the Scottish estimate.

Trends and pressures

- 4.5.9 Climate change has the potential to affect the carbon sequestration capacity of marine habitats. Kelps and seagrasses are likely to be vulnerable to increases in the frequency of severe storms which have the potential to cause physical damage and reduce habitat extents and hence reduce carbon storage potential. For seagrasses, reductions in canopy density resulting from physical damage may also decrease this habitat's ability to trap sediment and deflect wave energy away from the bed. Carbon-storing sediments are therefore likely to be more vulnerable to wave scour and subsequent resuspension during severe storms. Resuspension events increase the opportunity for organisms to recycle any biologically available carbon from the sediment, reducing sequestration in the sediment once it re-settles on the seabed.
- 4.5.10 Such storm events are also likely to increase the turbidity of the water through increased sediment resuspension, which could potentially reduce available light for photosynthesis, reducing growth rates and therefore reducing the overall carbon sequestration capacity of marine habitats.
- 4.5.11 Several methods of fishing physically disturb the seafloor. As previously stated, any physical damage caused to a habitat has the potential to disturb, remove or release any carbon held within that store. However, it may also increase other nutrient levels, which could in turn increase the levels of primary production. The level of impact will depend on the specific area affected. For example, the trawling of ephemeral, gravelly areas will release negligible amounts of carbon, but a trawl through a kelp forest has potentially larger implications. In general, direct pressure from fishing activity has the potential to affect how Scotland's marine environments regulate atmospheric carbon levels.
- 4.5.12 Shelf seas around the UK are predicted to be 1.5°C to 4°C warmer by the end of the 21st century¹¹⁸. Warmer sea temperatures could result in a shift in distribution of certain habitats and species. Climate change may also favour some species, leading to a potential increase in the diversity of seabed marine life¹¹⁹.
- 4.5.13 An increase in atmospheric carbon dioxide will lead to a subsequent increase in dissolved CO₂ concentrations within the ocean, increasing ocean acidity. This has the potential to hinder calcium carbonate producing organisms, therefore reducing their ability to sequester carbon in the long term. In addition,

¹¹⁸ UKCIP (2010) UK Climate Projections science report: Climate change projections. Available at: <http://ukclimateprojections.metoffice.gov.uk/media.jsp?mediaid=87893&filetype=pdf> (accessed 20/12/18)

¹¹⁹ Hiscock, K., Southward, A., Tittley, I., Hawkins, S., 2001 The impact of climate change on subtidal and intertidal benthic species in Scotland. Report to Scottish Natural Heritage from the Marine Biological Association of the UK.

following mortality of such organisms, there is increased potential for carbonate shells or skeletons to dissolve faster and therefore recycle greater amounts of carbon before they can be sequestered in seabed sediments.

4.6 Future trends in marine industry

- 4.6.1 Within the marine environment it is expected that pressures associated with industry have the potential to increase or decrease, depending on larger scale trends within that industry.
- 4.6.2 Where marine industry activities require licensing, the designation of the pMPAs increases the protection afforded to the features through increased assessment requirements in the form of Environmental Impact Assessments (EIAs) and under the Marine (Scotland) Act 2010.
- 4.6.3 Within the scope of this SEA, this applies principally to aquaculture and marine renewables, both of which have aspirations to expand in Scottish waters within the foreseeable future.

Aquaculture

- 4.6.4 Under the Aquaculture Growth Strategy¹²⁰ the industry aims, supported by the Scottish Government¹²¹, to double the economic contribution of the sector by 2030.
- 4.6.5 In order to achieve this goal there will be a requirement to increase the number of aquaculture farms within Scottish waters, and therefore a respective increase in the number of licence applications for aquaculture farm developments, potentially within the pMPAs.
- 4.6.6 The development of additional aquaculture sites has the potential to introduce or increase pressure on the receptors identified above, as described in Box 1.
- 4.6.7 It should also be noted that whilst a recent Scottish Parliamentary Rural Economy and Connectivity Committee inquiry into the current state of the salmon farming industry in Scotland acknowledged the economic and social value that the salmon farming industry brings to Scotland, it recommended that urgent action was needed to be taken to address regulatory deficiencies, fish health and environmental issues, before the industry expands¹²². The report also recommended siting farms away from MPAs and re-siting farms which are currently in MPAs.

¹²⁰ Scotland Food & Drink, Aquaculture Growth to 2030, 2016 [online] Available at: <http://scottishsalmon.co.uk/wp-content/uploads/2016/10/aquaculture-growth-to-2030.pdf> (accessed 20/12/18)

¹²¹ Scottish Government Aquaculture Website, [online] Available at <https://www.gov.scot/Topics/marine/Fish-Shellfish> (accessed 20/12/18)

¹²² The Scottish Parliament Rural Economy and Connectivity Committee, Salmon farming in Scotland, November 2018, <https://digitalpublications.parliament.scot/Committees/Report/REC/2018/11/27/Salmon-farming-in-Scotland> (accessed 14/12/2018)

Renewable energy

- 4.6.8 Scottish seas have a high potential for the continued development of renewable energy. This includes wave energy, tidal stream energy and the more developed offshore wind sector.
- 4.6.9 As a result, a number of projects have already been consented for development within coastal waters, and the draft plans for wind¹²³, wave¹²⁴ and tidal¹²⁵ energy development identify future opportunities for expansion. Marine Scotland is currently in the early planning stages for a new sectoral marine plan for offshore wind energy¹²⁶. The current, planned and potential future areas for hosting offshore energy generation around Scottish coasts are shown in Figure 12. The Offshore Wind Plan Areas of Search (AoS) will be superseded by Draft Plan Options (DPOs) in early 2019.
- 4.6.10 An increase in applications for the development of new offshore wind farms and associated infrastructure within Scottish waters could therefore be expected, potentially close to or within pMPAs.
- 4.6.11 The development of additional renewable energy infrastructure has the potential to introduce or increase pressure on the receptors identified above, as described in Box 1.

¹²³ Scottish Government; Sectoral Marine Plan for Offshore Wind Energy (encompassing Deep Water Plan Options) – Context Report, June 2018, ISBN 9781788519595.

¹²⁴ Scottish Government, Wave Energy in Scottish Waters, Initial Plan Framework, May 2013.

¹²⁵ Scottish Government, Tidal Energy in Scottish Waters, Initial Plan Framework, May 2013.

¹²⁶ Marine Scotland (2018). Offshore Wind Sectoral Marine Plan Scoping Consultation and Supporting Documents. Available at: <https://consult.gov.scot/marine-scotland/offshore-wind-scoping/> (accessed 20/12/18)

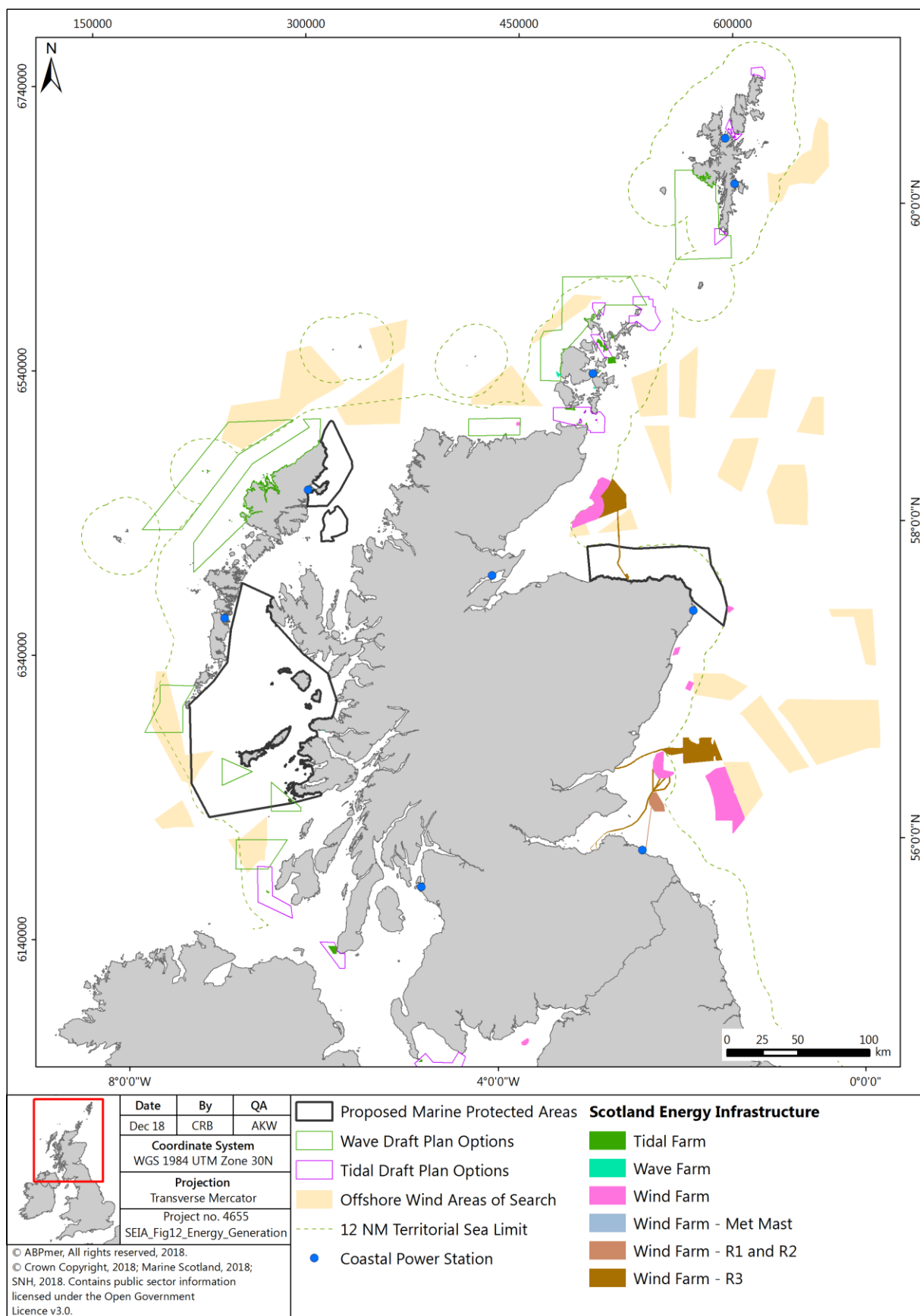


Figure 12 Current, planned and potential future offshore energy generation around Scottish coasts

5 Results of SEA

- 5.1.1 The purpose of this section is to report the results of the SEA.
- 5.1.2 The designation of MPAs places duties on public bodies under the Marine (Scotland) Act 2010 which in practice influences the types of activities and development that could eventually be permitted within the boundaries of the MPA network. Furthermore, there are provisions which ensure that protected features are protected from damage, removal, or death from general use of the areas. As such, it is considered that the designation process alone, irrespective of whether or not any corresponding management measures are introduced, has the potential to lead to significant beneficial environmental effects.
- 5.1.3 An overview of the implications of the designation of the pMPAs on the environment, namely the Biodiversity, Flora and Fauna headline topic and component topics (see Section 3.3) and SEA objectives, is provided in this section.
- 5.1.4 Any specific management measures that are subsequently required to meet the objectives of the pMPAs could exacerbate or introduce additional environmental effects. Consideration has therefore also been given in this section to the potential impacts that could arise from the implementation of different management scenarios at each of the pMPAs as part of the consideration of reasonable alternatives which is a requirement of the 2005 Act. These management scenarios do not necessarily reflect any management measures that may eventually be adopted by the Scottish Government for individual sites. Any specific management measures will be subject to further consideration under the 2005 Act and are likely to require their own SEA.

5.2 Environmental effects

- 5.2.1 Environmental Impact Assessments (EIAs) are required to be undertaken on regulated activities such as aquaculture or marine renewables. EIAs assess the significant environmental effects of a project, including on current and proposed nature conservation sites such as pMPAs. The designation of the pMPAs will provide developers with a better understanding of the species and habitats that need to be protected. This greater clarity and confidence will help to ensure that developers undertake more effective EIAs for future developments. This in turn may reduce pressures associated with regulated activities in pMPAs. This is particularly the case for pMPAs with protected features that are not currently protected (e.g. fronts and shelf deeps).
- 5.2.2 Alternatively, developers may look to avoid progressing consented developments that have not been built and re-locating regulated activities away from pMPAs as they will require further assessment and the consideration of appropriate mitigation measures. The avoidance of these sites by potentially

harmful activities would therefore result in future environmental benefits within pMPAs.

- 5.2.3 Overall, the increased protection that will result from the designation of the four pMPAs will provide potential environmental benefits for the overarching topic Biodiversity, Flora and Fauna, and contribute to the achievement of the SEA objectives (Table 7).

Table 7 Impact on SEA objectives

SEA objective	Met/ not met	Rationale
1. To safeguard and enhance marine and coastal ecosystems, including species and habitats, and their interactions	Yes	Protection of marine species and habitats (e.g. minke whale and circalittoral sands and mixed sediment communities) could contribute to the achievement of this objective by minimising or avoiding the disturbance and/or damage of marine species and habitats.
2. To maintain and protect the character and integrity of the seabed	Yes	Protection of habitats and benthic prey species (e.g. sandeel and burrowed mud) could contribute to the achievement of this objective by reducing or preventing destruction of the seafloor.
3. To avoid the pollution of the seabed strata and/or bottom sediments	Yes	Protection of habitats and benthic prey species (e.g. sandeel and burrowed mud) could contribute to the achievement of this objective by reducing or preventing the potential disturbance and re-settling of sediment-bound contaminants.
4. To avoid the pollution of the coastal and marine water environment	Yes	Protection of habitats and benthic prey species (e.g. sandeel and burrowed mud) could contribute to the achievement of this objective by reducing disturbance of the seabed and potential for increased suspended sediment levels and sediment-bound contaminants in the water column.
5. To maintain or work towards achieving 'good ecological status' and 'good environmental status' of water bodies	Yes	Protection of habitats and benthic prey species (e.g. sandeel and burrowed mud) could contribute to the achievement of this objective by minimising or avoiding pressures that could result in a change to quality elements used to assess ecological status under the WFD and environmental status under the MSFD.
6. To preserve and enhance existing marine carbon stocks and carbon sequestration potential	Yes	Protection of areas that include habitats that are blue carbon sinks due to their fixation and sequestration ability could contribute to the achievement of this objective by reducing or preventing damage of these habitats.

- 5.2.4 In addition to the potential benefits afforded by the designation of the sites described above, the manner in which the sites are managed to ensure that the conservation objectives for the protected features are achieved has the potential to result in significant environmental changes.
- 5.2.5 In generic terms, management measures have the potential to result in beneficial effects on the overarching topic Biodiversity, Flora and Fauna and contribute to the achievement of the SEA objectives where these target specific activities and pressures that currently, or might in the future, occur within the pMPAs. In turn, these may also result in the potential for marginal spillover benefits beyond pMPA site boundaries. For example, avoiding certain harmful activities in sensitive areas may result in the potential spillover of species from protected areas into unprotected areas if there is a population surplus and the carrying capacity of the protected area is surpassed^{127,128}.
- 5.2.6 The implementation of management measures may also result in the potential displacement of an activity and its associated pressures outwith the boundaries of the pMPA resulting in potential adverse environmental effects in other areas, where such activities are not managed. It is also possible that management measures could result in increased levels of non-targeted fishing activities within pMPAs. For example, removal of mobile fishing gear effort could facilitate greater use of some static gears.

5.3 Reasonable alternatives

- 5.3.1 Further to the potential benefits afforded by the designation of the pMPAs described in Section 5.2, a detailed assessment of all the potential additional environmental effects that might arise from the lower, intermediate and upper management scenarios that have been identified as reasonable alternatives (see Section 3.4) has been undertaken at each site and is included in Appendix C. This has included an assessment of the contribution of each management scenario to the achievement of individual SEA objectives. A summary of the overall (cumulative) environmental effects on the overarching topic of Biodiversity, Flora and Fauna is included in Table 8. A full justification for the outcomes of this assessment is provided in Appendix C.
- 5.3.2 In addition to the potential environmental benefits that will result from the designation of the four pMPAs (see Section 5.2), the lower management scenario will have no further overall impact at SEB and the potential to result in future additional benefits at NEL, SOH and STR (see Table 8). The intermediate management scenario will have an overall negligible to very minor additional immediate beneficial impact on the environment at NEL, a minor additional immediate beneficial impact at SOH and STR, and a moderate

¹²⁷ Buxton, C.D., Hartmann, K., Kearney, R. and Gardner, C., 2014. When is spillover from marine reserves likely to benefit fisheries?. *PloS One*, 9(9), p.e107032.

¹²⁸ Kerwath, S.E., Winker, H., Götz, A. and Attwood, C.G., 2013. Marine protected area improves yield without disadvantaging fishers. *Nature Communications*, 4, p.2347.

additional immediate beneficial impact at SEB, with a greater potential for further future benefits at all sites. The upper management scenario will have an overall negligible to minor additional immediate beneficial impact on the environment at NEL, a minor additional immediate beneficial impact at SEB and STR, and a moderate additional immediate beneficial impact at SOH, with greater potential for future benefits at all sites.

5.4 Mitigation and monitoring

- 5.4.1 No significant adverse environmental effects have been identified by the SEA and therefore no mitigation or monitoring measures are proposed as part of the assessment process. Any specific management measures that are subsequently developed at each pMPA will be subject to a separate SEA which will build on the outcomes of the current assessment. Should any significant adverse effects be identified there will be a need to consider appropriate mitigation measures and monitoring proposals.

5.5 Cumulative effects

- 5.5.1 The 2005 Act requires that the cumulative environmental effects of the pMPAs are identified and evaluated. The cumulative effects of the pMPAs have been considered, in terms of:
- Their combined effects (all the pMPAs working together); and
 - In combination with other plans, programmes and/or strategies.
- 5.5.2 The overall (cumulative) effects of the designation and potential management at each of the individual pMPAs has been assessed as part of the consideration of reasonable alternatives (see Section 5.3).
- 5.5.3 Taken together, the designation and management of the pMPAs are likely to result in cumulative benefits to the overarching topic Biodiversity, Flora and Fauna, in terms of protection provided to the MPA features and wider environment. In addition to the benefits that will be provided by the designation of the pMPAs, the lower management scenario will result in no overall additional immediate environmental impact across all four sites. The intermediate and upper scenarios will result in an overall moderate additional immediate beneficial environmental impact. The potential for greater future benefits exists under all management scenarios.
- 5.5.4 The management of the pMPAs also has the potential to result in cumulative adverse effects on the overarching Biodiversity, Flora and Fauna topic from the displacement of existing activities to other areas, where such activities are not managed. For regulated activities, such as renewable energy or aquaculture developments, environmental assessments would be required before an activity could take place, thus limiting the potential for significant cumulative adverse effects to occur.

- 5.5.5 In terms of activities not subject to development consent, such as fishing, the lower management scenario will result in no potential cumulative adverse environmental effects across all four sites from the displacement and intensification of fishing activity. The intermediate and upper scenarios will result in minor and moderate cumulative adverse effects respectively from the displacement of fishing activities. The combined scale of effort displaced will range from moderate for the intermediate scenario to major for the upper scenario. However, the areas into which effort is likely to be displaced are already fished and thus have a community composition that is already characterised by fishing pressures. Overall, there is no potential for the displacement of fisheries activities from the pMPAs to overlap and therefore no potential for cumulative environmental effects to interact across the four sites.

Table 8 Overall assessment of management scenarios

Site name	Management scenario	Assessment
NEL	Lower	The lower management scenario for NEL pMPA will have no immediate impact on the environment but a greater potential for future benefits . Assuming that best practice is being followed by existing activities there will be no immediate benefits to habitat and species within the pMPA. The lower management scenario will not limit or restrict any human pressures/activities and therefore there will be no potential spillover benefits, no potential adverse environmental effects resulting from the displacement of activities and no potential adverse environmental effects resulting from increased fishing effort from other gear types that are not targeted.
	Intermediate	The intermediate management scenario for NEL pMPA will have an overall negligible to very minor immediate beneficial impact on the environment and a greater potential for future benefits . The existing scale of activities that will be prohibited by the measures (namely hydraulic gear fishing in sandeel grounds and targeted fishing for sandeels) are very small, but their exclusion will potentially provide benefits to some habitats and associated species. The scale of benefit of reducing the number of Acoustic Deterrent Devices (ADDs) at finfish aquaculture sites operating at mid or high frequencies is negligible in the immediate term given that there are currently no active finfish aquaculture sites within NEL pMPA, however, there is the potential for future benefits should any new finfish aquaculture sites be proposed at this site. The scale of benefits from the measures is unlikely to result in significant spillover benefits outside the boundaries of NEL pMPA. The adverse impacts on the environment will be negligible as a direct impact of displacement as the amount of effort displaced will be very small and the areas into which effort is likely to be displaced are already fished and thus have a community composition that is already characterised by fishing pressures. Furthermore, a change in fishing effort from targeted to non-targeted fishing gears (e.g. from hydraulic gear to creeling) is considered unlikely given that there would still be areas within and outwith NEL pMPA that are available for targeted fisheries to fish. Therefore, the benefit of protection is likely to be greater than the negative impacts associated with displacement.
	Upper	The upper management scenario for NEL pMPA will have an overall negligible to minor immediate beneficial impact on the environment and a greater potential for future benefits . The existing scale of activities that will be prohibited or restricted by the measures (namely hydraulic gear fishing in sandeel grounds, targeted fishing for sandeels, exclusion of drift nets and set nets between May and October, and noisy activities during Risso's dolphin high season) are small, but their regulation will provide some benefits to habitats and species. The scale of benefit of replacing all Acoustic Deterrent Devices (ADDs) at finfish aquaculture sites with antipredator nets is negligible in the immediate term given that there are currently no active finfish aquaculture sites within NEL pMPA, however, there is the potential for future benefits should any new finfish aquaculture sites be proposed at this site. The scale of benefits from the measures is unlikely to result in significant spillover benefits outside the boundaries of NEL pMPA. The adverse impacts on the environment will be negligible as a direct impact of displacement as the amount of

Site name	Management scenario	Assessment
		fishing effort displaced will be very small and the areas into which effort is likely to be displaced are already fished and thus have a community composition that is already characterised by fishing pressures. Furthermore, a change in fishing effort from targeted to non-targeted fishing gears (e.g. from hydraulic gear to creeling) is considered unlikely given that there would still be areas outwith NEL pMPA that are available for targeted fisheries to fish. Therefore, the benefit of protection is likely to be greater than the negative impacts associated with displacement.
SOH	Lower	The lower management scenario for SOH pMPA will have no immediate impact on the environment but a greater potential for future benefits . Assuming that best practice is being followed by existing activities there will be no immediate benefits to habitat and species within the pMPA. The lower management scenario will not limit or restrict any human pressures/activities and therefore there will be no potential spillover benefits, no potential adverse environmental effects resulting from the displacement of activities and no potential adverse environmental effects resulting from increased fishing effort from other gear types that are not targeted.
	Intermediate	The intermediate management scenario for SOH pMPA will have an overall minor immediate beneficial impact on the environment and a greater potential for future benefits . There are currently six active finfish aquaculture sites within SOH pMPA and therefore reducing the number of Acoustic Deterrent Devices (ADDs) at these sites that operate at mid or high frequencies would result in an immediate minor benefit to the environment. There are two harbours located close to sandeel habitat and therefore the scale of immediate benefits associated with reducing disturbance to sandeel habitat is considered minor. The existing scale of activities that will be prohibited by the measures (namely hydraulic gear fishing in sandeel grounds, targeted fishing for sandeels and exclusion of drift nets and set nets between April and October in 'shark awareness zones') is negligible to low, but their exclusion will potentially provide some negligible to minor benefits to habitats and associated species. The scale of these benefits is unlikely to result in significant spillover benefits outside the boundaries of SOH pMPA. The adverse impacts on the environment will be negligible as a direct impact of displacement as the amount of effort displaced will be very small and the areas into which effort is likely to be displaced are already fished and thus have a community composition that is already characterised by fishing pressures. Furthermore, a change in fishing effort from targeted to non-targeted fishing gears (e.g. from hydraulic gear to creeling) is considered unlikely given that there would still be areas within and outwith SOH pMPA that are available for targeted fisheries to fish. Therefore, the benefit of protection is likely to be greater than the negative impacts associated with displacement.
	Upper	The upper management scenario for SOH pMPA will have an overall moderate immediate beneficial impact on the environment and a greater potential for future benefits . There are currently six active finfish aquaculture sites operating within SOH pMPA and therefore replacing all Acoustic Deterrent Devices (ADDs) with antipredator nets has the potential to result in an immediate moderate benefit to the environment if these follow best practice. There are four harbours located in the 'shark awareness zones' and therefore reducing vessel speeds within these

Site name	Management scenario	Assessment
		<p>zones during sensitive periods will result in an immediate moderate benefit to basking sharks and the wider environment. There are two harbours located close to sandeel habitat and therefore the scale of immediate benefits associated with reducing disturbance to sandeel habitat is considered minor. The existing scale of activities that will be prohibited or restricted by the measures (namely noisy activities during basking shark high season, hydraulic gear fishing in sandeel grounds, targeted fishing for sandeel, exclusion of drift nets and set nets between April and October across site, and limiting herring and sprat fishing effort to current levels) are negligible to low, but their regulation will provide some negligible to minor benefits to habitats and species. The scale of these benefits is unlikely to result in significant spillover benefits outside the boundaries of SOH pMPA. The adverse impacts on the environment will be negligible as a direct impact of displacement as the amount of fishing effort displaced will be very small and the areas into which effort is likely to be displaced are already fished and thus have a community composition that is already characterised by fishing pressures. Furthermore, a change in fishing effort from targeted to non-targeted fishing gears (e.g. from hydraulic gear to creeling) is considered unlikely given that there would still be areas outwith SOH pMPA that are available for targeted fisheries to fish. Therefore, the benefit of protection is likely to be greater than the negative impacts associated with displacement.</p>
SEB	Lower	<p>The lower management scenario for SEB pMPA will have no impact on the environment. Assuming that best practice is being followed by existing activities there will be no benefits to habitat and species within the pMPA. The lower management scenario will not limit or restrict any human pressures/activities and therefore there will be no potential spillover benefits, no potential adverse environmental effects resulting from the displacement of activities and no potential adverse environmental effects resulting from increased fishing effort from other gear types that are not targeted.</p>
	Intermediate	<p>The intermediate management scenario for SEB pMPA will have an overall moderate immediate beneficial impact on the environment and a greater potential for future benefits. The existing scale of activities that will be prohibited by the measures (namely excluding mobile/active gear from northern sea fan and sponge communities and from 20% of circalittoral sand) is low, but their exclusion will potentially provide some moderate environmental benefits given the sensitivity of habitats and associated species that will be protected. These moderate environmental benefits have the potential to result in minor spillover benefits outside the boundaries of SEB pMPA given the nature and scale of existing human pressures/activities in the area and also the fact that the site supports spawning and nursery grounds for several fish species. The adverse impacts on the environment will be negligible as a direct impact of displacement as the amount of effort displaced will be small and the areas into which effort is likely to be displaced are already fished and thus have a community composition that is already characterised by fishing pressures. Furthermore, a change in fishing effort from targeted to non-targeted fishing gears (e.g. from hydraulic gear to creeling) is considered unlikely given that there is a low level of fishing by non-targeted gear types and there</p>

Site name	Management scenario	Assessment
		would still be areas outwith SEB pMPA that are available for targeted fisheries to fish. Therefore, the benefit of protection is likely to be greater than the negative impacts associated with displacement.
	Upper	The upper management scenario for SEB pMPA will have an overall minor immediate beneficial impact on the environment and a greater potential for future benefits . The existing scale of activities that will be prohibited or restricted by the measures (namely new cable/pipeline routes that avoid northern sea fan and sponge communities, excluding mobile/active gear from northern sea fan and sponge communities and from 40% of circalittoral sand) is moderate. Their regulation will therefore provide some moderate benefits to habitats and species. These moderate environmental benefits have the potential to result in minor spillover benefits outside the boundaries of SEB pMPA given the nature and scale of existing human pressures/activities in the area and also the fact that the site supports spawning and nursery grounds for several fish species. The environmental effect of the displacement of cables/pipelines is considered to be minor given the nature and scale of impacts on the seabed and sensitivity of habitats. The effect of displacement of fishing activities is considered negligible as the amount of existing fishing effort displaced will be small and the areas into which effort is likely to be displaced are already fished and thus have a community composition that is already characterised by fishing pressures. Furthermore, a change in fishing effort from targeted to non-targeted fishing gears (e.g. from hydraulic gear to creeling) is considered unlikely given that there is a low level of fishing of non-targeted gear types and there would still be areas outwith SEB pMPA that are available for targeted fisheries to fish. Therefore, the benefit of protection is likely to be greater than the negative impacts associated with displacement.
STR	Lower	The lower management scenario for STR pMPA will have no immediate impact on the environment but a greater potential for future benefits . Assuming that best practice is being followed by existing activities there will be no immediate benefits to habitat and species within the pMPA. The lower management scenario will not limit or restrict any human pressures/activities and therefore there will be no potential spillover benefits, no potential adverse environmental effects resulting from the displacement of activities and no potential adverse environmental effects resulting from increased fishing effort from other gear types that are not targeted.
	Intermediate	The intermediate management scenario for STR pMPA will have an overall minor immediate beneficial impact on the environment and a greater potential for future benefits . There are currently three minor ports, several harbours and four licensed disposal grounds located within and/or close to sandeel habitat and therefore the scale of immediate benefits associated with reducing disturbance to sandeel habitat is considered minor. The existing scale of activities that will be prohibited by the measures (namely hydraulic gear fishing in sandeel grounds, targeted fishing for sandeel and exclusion of mobile gear from 20% of burrowed mud) is low to high, and their exclusion will potentially provide some moderate benefits to habitats and associated species. The scale of these benefits is likely to result in minor spillover benefits outside the boundaries of STR pMPA. The adverse impacts on the environment

Site name	Management scenario	Assessment
		will be minor as a direct impact of displacement as the amount of effort displaced will be low to moderate and the areas into which effort is likely to be displaced are already fished and thus have a community composition that is already characterised by fishing pressures. A change in fishing effort from targeted to non-targeted fishing gears (e.g. from hydraulic gear to creeling) is considered unlikely given that there would still be areas within and outwith STR pMPA that are available for targeted fisheries to fish. Therefore, the benefit of protection is likely to be greater than the negative impacts associated with displacement.
	Upper	The upper management scenario for STR pMPA will have an overall minor immediate beneficial impact on the environment and a greater potential for future benefits . There are currently three minor ports, several harbours and four licensed disposal grounds located within and/or close to sandeel habitat and therefore the scale of immediate benefits associated with reducing disturbance to sandeel habitat is considered minor. The existing scale of activities that will be prohibited or restricted by the measures (namely noisy activities during minke whale high season, hydraulic gear fishing in sandeel grounds, targeted fishing for sandeel, mobile gear from 40% of burrowed mud, drift nets and set nets between June and October across site, and limiting herring and sprat fishing effort to current levels) are low to high, and their regulation will provide some major benefits to habitats and species. The scale of these benefits is likely to result in minor spillover benefits outside the boundaries of STR pMPA. The adverse impacts on the environment will be moderate at most as a direct impact of displacement as the amount of fishing effort displaced will be moderate to major and the areas into which effort is likely to be displaced are already fished and thus have a community composition that is already characterised by fishing pressures. A change in fishing effort from targeted to non-targeted fishing gears (e.g. from hydraulic gear to creeling) is considered unlikely given that there would still be areas within and outwith STR pMPA that are available for targeted fisheries to fish. Therefore, the benefit of protection is likely to be greater than the negative impacts associated with displacement.

- 5.5.6 The pMPAs will, together with the wider MPA network and existing protection measures (see Appendix A), further benefit the overarching topic of Biodiversity, Flora and Fauna in Scottish waters and contribute to the achievement of SEA objectives.
- 5.5.7 There may be cumulative adverse effects on the environment from the displacement of fishing activities resulting from previous plans in-combination with the designations and management of the four additional pMPAs. The previous plans which could lead to cumulative effects and have been assessed are the Phase 1 fisheries management measures in MPAs¹²⁹ and proposals for Phase 2 fisheries management measures in MPAs.
- 5.5.8 The SEA for the Phase 1 fisheries management measures identified displacement from only one site (Luce Bay and Sands SAC) is likely to cause significant environmental impact. This site is not located close to any of the four additional pMPAs and their alternative fishing grounds and therefore there is no potential for cumulative adverse effects.
- 5.5.9 The SEA that has been undertaken on the Phase 2 fisheries management measures assessed the environmental impact at the displacement locations to be negligible in most cases, and at most minor (specifically at Fetlar and Haroldswick MPA and Sound of Barra SAC). There is no potential for the displacement of fishing activity at Fetlar and Haroldswick MPA to overlap with any of the four additional pMPAs and their alternative fishing grounds but the Sound of Barra SAC is located adjacent to SOH pMPA and therefore there is potential for displacement of fishing to overlap and lead to greater adverse environmental effects. A more detailed assessment of cumulative effects will be undertaken should any management measures for the pMPAs be proposed in future.
- 5.5.10 The assessment of management measures for PMFs is ongoing and is yet to be fully consulted upon. In consequence, it is not possible at this stage to ascertain whether there may be cumulative effects arising from interactions between the designation of four additional pMPAs and these proposals. This possibility will be assessed by the forthcoming Environmental Report component of the SEA for the PMF fisheries management measures.

5.6 Conclusion

- 5.6.1 Overall, this assessment considers that the increased protection that will result from the designation of the four additional pMPAs will provide environmental benefits for the overarching topic 'Biodiversity, Flora and Fauna' and contribute to the achievement of the SEA objectives. This is because the designation of the sites will provide developers with a better understanding of the species and

¹²⁹ Scottish Government (2014) Proposals for statutory management measures in Marine Protected Areas and Special Areas of Conservation Environmental Report Addendum. November 2014. Available at: <https://www2.gov.scot/Resource/0046/00464215.pdf> (accessed 20/12/18)

habitats that need to be protected. This will help to ensure that developers undertake more effective EIAs that consider appropriate mitigation where necessary and therefore potentially reduce pressures associated with regulated activities in pMPAs. Alternatively, developers may look to site their projects some distance from the pMPAs to avoid undertaking further assessment and mitigation. This in turn would result in reduced harmful activities and potential environmental benefits within these sites.

- 5.6.2 The manner in which the sites are managed in the future to ensure that the conservation objectives for the protected features are achieved also has the potential to result in significant environmental changes. Consideration has therefore also been given to the potential impacts that could arise from different management scenarios at each of the pMPAs as part of the consideration of reasonable alternatives.
- 5.6.3 Across all four pMPAs, the lower management scenario will result in no overall immediate environmental impact but the intermediate and upper scenarios will result in an overall moderate immediate beneficial environmental impact. The potential for greater future benefits exists under all management scenarios.
- 5.6.4 The pMPAs will work together with the wider MPA network and existing protection measures to provide protection to the overarching topic of Biodiversity, Flora and Fauna in Scottish waters. Taken together, this will be of benefit to this topic and will contribute to the achievement of SEA objectives. The potential for cumulative adverse effects on the environment from the displacement of fishing activities have been identified as a result of the Phase 2 fisheries management measures at the Sound of Barra SAC which is adjacent to the SOH pMPA. A more detailed assessment of cumulative effects will need to be undertaken should any management measures for the pMPAs be proposed in future.
- 5.6.5 The management scenarios that have been considered as reasonable alternatives do not constrain future decisions and any management measures that may be adopted by the Scottish Government for individual sites. Should any specific management measures be subsequently required to meet the objectives of the pMPAs, these will be subject to further consideration under the 2005 Act.

6 Next Steps

- 6.1.1 The consultation on the SEA Environmental Report is now open, along with the accompanying SEIA and Sustainability Appraisal. Views and opinions on this are now invited and should be provided by 30 August 2019.
- 6.1.2 Please respond to the consultation online at: <https://consult.gov.scot/marine-scotland/four-new-marine-protected-areas>.
- 6.1.3 Following the consultation period, the responses received will be analysed, and a Post-Adoption Statement will be prepared. The Post-Adoption Statement will explain how issues raised in the assessments, and associated views in response to the consultation, have been addressed.
- 6.1.4 If you have any enquiries please contact: Marine_Conservation@gov.scot
- 6.1.5 Or send your inquiry by post to:

pMPA Consultation
Scottish Government
Marine Planning and Policy Division
Area 1-A South
Victoria Quay
Edinburgh
EH6 6QQ

Appendix A Wider Policy Context of pMPAs

This appendix sets out the wider policy context in which the pMPAs sit, beginning with a summary of relevant marine policies and followed by an overview of policies relating to the SEA topics that have been scoped into the assessment: Biodiversity, Flora and Fauna; Soil (assessed under Biodiversity, Flora and Fauna); Water (assessed under Biodiversity, Flora and Fauna); and Climatic Factors (assessed under Biodiversity, Flora and Fauna)¹³⁰.

Overarching marine policy

Species and habitat conservation is one of several key areas of interest underlying greater marine policy in Scotland. Additional policy areas relate to topics such as aquaculture, marine renewable energy, and the management of commercial and recreational fisheries¹³¹. In recent years, Scotland has also embarked on a programme of national marine planning in accordance with national and EU legislation and a growing international recognition of the need to balance competing interests and aims in the marine environment, including conservation. Examples of this wider marine policy are presented below, beginning with the most international policies and moving down to UK and domestic policies.

At an international level, the **OSPAR Convention for the Protection of the Marine Environment of the North-East Atlantic** integrated and updated the 1972 Oslo and 1974 Paris Conventions on land-generated sources of marine pollution¹³². Specifically, it added an annex covering the protection and conservation of marine ecosystems and biodiversity¹³³. In 2003, Recommendation 2003/3 was adopted, relating to the establishment of an ecologically coherent network of MPAs in the North-East Atlantic¹³⁴.

The **EU Marine Strategy Framework Directive** (MSFD) obligates Member States to develop programmes of measures or marine strategies to bring their marine environments to 'Good Environmental Status' (GES) by 2020 as well as to safeguard the marine resources that underlie key economic and social activities¹³⁵. It distributes responsibility for

¹³⁰ Although it is proposed that Soil, Water and Climatic Factors be scoped in under 'Biodiversity, Flora and Fauna', relevant policies relating to each are presented under their own headings for ease of reading.

¹³¹ Scottish Government (2017) Marine & Fisheries [online] Available at: <http://www.gov.scot/Topics/marine> (accessed 20/12/18)

¹³² OSPAR Commission (2017) OSPAR Convention [online] Available at: <https://www.ospar.org/convention> (accessed 20/12/18)

¹³³ *ibid*

¹³⁴ OSPAR Commission (2018) Marine Protected Areas [online] Available at: <https://www.ospar.org/work-areas/bdc/marine-protected-areas> (accessed 20/12/18)

¹³⁵ European Commission (2017) Our Oceans, Seas and Coasts [online] Available at: http://ec.europa.eu/environment/marine/eu-coast-and-marine-policy/marine-strategy-framework-directive/index_en.htm (accessed 20/12/18)

the marine environment via a regional approach that makes use of the existing cooperative framework of the OSPAR Convention¹³⁶. The Directive is implemented within the UK via a three-part **Marine Strategy**¹³⁷.

European Directive 2014/89/EU (on maritime spatial planning) serves as a common framework across EU Member States¹³⁸. It recognises that a comprehensive and consistent approach to maritime spatial planning can prevent conflicts between sectors, increase cross-border cooperation, and protect the environment by identifying potential impacts early and pursuing opportunities for multiple uses of space¹³⁹. Within Scotland, the principles of the Directive are delivered through the **National Marine Plan**.

The **UK Marine Policy Statement** provides a vision of ‘clean, healthy, safe, productive and biologically diverse oceans and seas’ that is shared by all UK countries and used to guide their respective marine management strategies¹⁴⁰.

The **Marine (Scotland) Act 2010** acts as a framework to help balance competing demands on Scotland’s inshore seas¹⁴¹. It introduced a duty to protect and enhance the marine natural and historic environment while at the same time streamlining the marine planning and licensing system¹⁴². Among its conservation objectives is a provision for the establishment of MPAs¹⁴³.

The **Marine and Coastal Access Act 2009** devolved marine planning and conservation powers to Scottish Ministers in the offshore region (beyond 12NM) including the power to designate offshore MPAs, providing a framework for the cooperative management of the marine environment between Scottish Ministers and UK Government¹⁴⁴.

Scotland’s **National Marine Plan** fulfils joint requirements under the Marine (Scotland) Act 2010 and Marine and Coastal Access Act 2009 to prepare marine plans, providing a

¹³⁶ JNCC (2013) The Convention for the Protection of the Marine Environment of the North-East Atlantic (the OSPAR Convention) [online] Available at: <http://jncc.defra.gov.uk/page-1370> (accessed 20/12/18)

¹³⁷ JNCC (2016) EU Marine Strategy Framework Directive [online] Available at: <http://jncc.defra.gov.uk/page-5193> (accessed 20/12/18)

¹³⁸ European Commission (2014) Directive 2014/89/EU of the European Parliament and of the Council of 23 July 2014 establishing a framework for marine spatial planning [online] Available at: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2014.257.01.0135.01.ENG%20 (accessed 20/12/18)

¹³⁹ European Commission (2017) Maritime spatial planning [online] Available at: https://ec.europa.eu/maritimeaffairs/policy/maritime_spatial_planning_en (accessed 20/12/18)

¹⁴⁰ Scottish Government (2015) UK Marine Policy Statement [online] Available at: <http://www.gov.scot/Topics/marine/seamanagement/international/MPS> (accessed 20/12/18)

¹⁴¹ Scottish Government (2017) Marine (Scotland) Act [online] Available at: <http://www.gov.scot/Topics/marine/seamanagement/marineact> (accessed 20/12/18)

¹⁴² *ibid*

¹⁴³ *ibid*

¹⁴⁴ Scottish Government (2014) Marine and Coastal Access Act 2009 [online] Available at: <http://www.gov.scot/Topics/marine/seamanagement/marineact/ukbill> (accessed 20/12/18)

cohesive approach to the management of both inshore and offshore waters¹⁴⁵ in accordance with **EU Directive 2014/89/EU¹⁴⁶ (on maritime spatial planning)**. It strives to promote development in a way that is compatible with the protection and enhancement of the marine environment¹⁴⁷.

In terms of enforcement, the **Marine (Scotland) Act 2010** covers the enforcement of protective measures within MPAs¹⁴⁸. In addition, the **Inshore Fisheries (Scotland) Act 1984** includes the power to restrict fishing or prohibit the use of certain kinds of fishing gears in order to conserve the natural beauty or amenity, flora and fauna of a marine area¹⁴⁹, applying to any protected area.

Biodiversity, flora and fauna policy

International policies provide a framework for the conservation, protection and sustainable use of biodiversity, flora and fauna. In relation to the marine and coastal environment, this includes planning for sustainable fisheries and mariculture, the protection of migratory species including birds and fish stocks, the protection of marine and coastal habitats, and the management of non-native invasive species. European and Scottish policy reflect the objectives of an ecosystem approach and emphasise action for priority species and habitats, with particular reference to the protection of seals and the sustainable management of fish stocks. Building resilience to climate change is also a cross-cutting theme.

At an international level, the **OSPAR Convention for the Protection of the Marine Environment of the North-East Atlantic** is an important driver in the protection and conservation of marine ecosystems and biodiversity¹⁵⁰, including the establishment of an ecologically coherent network of MPAs in the North East Atlantic¹⁵¹. The OSPAR List of Threatened and/or Declining Species and Habitats¹⁵² identifies species and habitats that are considered to be priorities for protection.

¹⁴⁵ Scottish Government (2014) Scotland's National Marine Plan – A Single Framework for Managing Our Seas [online] Available at: <http://www.gov.scot/Resource/0047/00475466.pdf> (accessed 20/12/18)

¹⁴⁶ European Commission (2014) Directive 2014/89/EU of the European Parliament and of the Council of 23 July 2014 establishing a framework for maritime spatial planning [online] Available at: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2014.257.01.0135.01.ENG%20 (accessed 20/12/18)

¹⁴⁷ Scottish Government (2014) Scotland's National Marine Plan – A Single Framework for Managing Our Seas [online] Available at: <http://www.gov.scot/Resource/0047/00475466.pdf> (accessed 20/12/18)

¹⁴⁸ Scottish Government (2017) Marine (Scotland) Act [online] Available at: <http://www.gov.scot/Topics/marine/seamanagement/marineact> (accessed 20/12/18)

¹⁴⁹ Inshore Fishing (Scotland) Act 1984, Chapter 26 [online] Available at: <http://www.legislation.gov.uk/ukpga/1984/26/introduction> (accessed 20/12/18)

¹⁵⁰ *ibid*

¹⁵¹ OSPAR Commission (2018) Marine Protected Areas [online] Available at: <https://www.ospar.org/work-areas/bdc/marine-protected-areas> (accessed 21/11/2018)

¹⁵² OSPAR Commission (2018) List of Threatened and/or Declining Species & Habitats. Available at: <https://www.ospar.org/work-areas/bdc/species-habitats/list-of-threatened-declining-species-habitats> (accessed 20/11/2018)

At the European level, the Natura 2000¹⁵³ network is the primary vehicle for meeting the aims of the **Habitats (92/43/EEC)**¹⁵⁴ and **Birds (2009/147/EC)**¹⁵⁵ Directives. Both Directives focus on the maintenance and enhancement of biodiversity, with an emphasis on protecting rare and endangered wild species and natural habitats of European significance. The Natura 2000 network comprises terrestrial and marine SPAs and SACs. Many terrestrial and marine sites are also underpinned by the Site of Special Scientific Interest (SSSI) designation¹⁵⁶.

At the national level, the **Marine (Scotland) Act 2010**¹⁵⁷ and the **Marine and Coastal Access Act 2009**¹⁵⁸ gave Scottish Ministers powers to designate MPAs in Scottish territorial and offshore waters, respectively.

The 2020 Challenge for Scotland's Biodiversity¹⁵⁹ is Scotland's response to the international UN Aichi Targets for 2020¹⁶⁰ and the EU Biodiversity Strategy to 2020¹⁶¹. The 2020 Challenge supplements the 2004 Scottish Biodiversity Strategy¹⁶² and together they comprise the overall Scottish Biodiversity Strategy. Key aims include preserving and restoring the health of Scotland's ecosystems at a catchment-scale and promoting climate change resilience.

A Strategy for Marine Nature Conservation in Scotland's Seas is the main tool for enacting the principles of the 2020 Challenge within the marine environment¹⁶³. It supports the development of an ecologically coherent network of MPAs in support of strategic aims such as meeting GES under the Marine Strategy Framework Directive and satisfying the requirements of the Birds and Habitats Directives¹⁶⁴. It also proposed the Priority Marine Features (PMFs) system to guide the identification of MPAs and provide focus for marine planning and other activities.

¹⁵³ Scottish Government (2016) Natura 2000 [online] Available at: <http://www.gov.scot/Topics/Environment/Wildlife-Habitats/protectedareas/NATURA> (accessed 20/12/18)

¹⁵⁴ European Commission (1992) The Habitats Directive [online] Available at: http://ec.europa.eu/environment/nature/legislation/habitatsdirective/index_en.htm (accessed 20/12/18)

¹⁵⁵ European Commission (2009) The Birds Directive [online] Available at: http://ec.europa.eu/environment/nature/legislation/birdsdirective/index_en.htm (accessed 20/12/18)

¹⁵⁶ SNH (2016) Sites of Special Scientific Interest [online] Available at: <http://www.snh.gov.uk/protecting-scotlands-nature/protected-areas/national-designations/sssisi/> (accessed 20/12/18)

¹⁵⁷ Scottish Government (2017) Marine (Scotland) Act [online] Available at: <http://www.gov.scot/Topics/marine/seamanagement/marineact> (accessed 17/10/2018)

¹⁵⁸ Scottish Government (2014) Marine and Coastal Access Act 2009 [online] Available at: <http://www.gov.scot/Topics/marine/seamanagement/marineact/ukbill> (accessed 17/10/2018)

¹⁵⁹ Scottish Government (2013) 2020 Challenge for Scotland's Biodiversity: A Strategy for the conservation and enhancement of biodiversity in Scotland [online] Available at: <http://www.gov.scot/Resource/0042/00425276.pdf> (accessed 20/12/18)

¹⁶⁰ Convention on Biological Diversity (2010) Aichi Biodiversity Targets [online] Available at: <https://www.cbd.int/sp/targets/default.shtml> (accessed 20/12/18)

¹⁶¹ European Commission (2011) The European Biodiversity Strategy to 2020 [online] Available at: <http://ec.europa.eu/environment/nature/info/pubs/docs/brochures/2020%20Biod%20brochure%20final%20lowres.pdf> (accessed 20/12/18)

¹⁶² Scottish Government (2004) Scotland's Biodiversity Strategy: It's in Your Hands – A strategy for the conservation and enhancement of biodiversity in Scotland [online] Available at: <http://www.scotland.gov.uk/Publications/2004/05/19366/37239> (accessed 20/12/18)

¹⁶³ Scottish Government (2011) A Strategy for Marine Nature Conservation in Scotland's Seas [online] Available at: <http://www.gov.scot/Resource/Doc/295194/0115590.pdf> (accessed 20/12/18)

¹⁶⁴ *ibid*

Soil (marine geology and sediments) policy

At present, there is no legislative or policy tool developed specifically for the protection of soil¹⁶⁵. However, designations and their associated management agreements and operations often extend protection to soil as a means of enhancing the biodiversity, geodiversity, landform value and cultural resources of the site¹⁶⁶. For example, marine geology forms part of the basis for the designation of **MPAs** within Scottish waters¹⁶⁷. Specifically, MPAs strive to protect rare and representative marine species, habitats and geodiversity, the latter defined as the variety of landforms and natural processes that underpin the marine landscape. Similarly, **SSSI**¹⁶⁸ are those areas of land and water that best represent Scotland's natural heritage in terms of its flora, fauna, geology, geomorphology, and/or a mixture of these natural features, as designated by SNH under the **Nature Conservation (Scotland) Act 2004**¹⁶⁹.

At the European level, the **Marine Strategy Framework Directive** includes Annex I, comprising a list of eleven qualitative descriptors, and Annex III, comprising a list of characteristics, pressures and impacts in the marine environment. The Commission Decision establishes criteria and methodological standards to help Member States interpret what GES means in practice¹⁷⁰. In terms of seafloor characteristics, GES is achieved where 'the sea floor integrity ensures functioning of the ecosystem and benthic ecosystems, in particular, are not adversely affected'. 'Sea-floor integrity' is defined in terms of physical (i.e. depth), chemical (i.e. substrate type) and biological (i.e. species composition) characteristics¹⁷¹. Meeting this indicator is regarded as crucial to achieving the Strategy's overarching aims of protecting biodiversity and ensuring the sustainable use of the marine environment¹⁷².

EU Directive 2014/89/EU (on maritime spatial planning) consolidated and expanded upon the fundamental aspects of the Council Recommendation on Integrated Coastal Zone Management of 2002 and the Protocol to the Barcelona Convention on Integrated Coastal Zone Management of 2010¹⁷³, obligating Member States to develop coastal management strategies. It aims to coordinate the development and delivery of policies across

¹⁶⁵ Scottish Government (2009) The Scottish Soil Framework [online] Available at: <http://www.gov.scot/Publications/2009/05/20145602/0> (accessed 20/12/18)

¹⁶⁶ *ibid*

¹⁶⁷ Scottish Government (2016) Nature Conservation MPAs [online] Available at: <http://www.gov.scot/Topics/marine/marine-environment/mpanetwork/ncmpas> (accessed 20/12/18)

¹⁶⁸ SNH (2017) Sites of Special Scientific Interest [online] Available at: <https://www.nature.scot/professional-advice/safeguarding-protected-areas-and-species/protected-areas/national-designations/sites-special-scientific-interest> (accessed 20/12/18)

¹⁶⁹ *ibid*

¹⁷⁰ European Commission (2016) Our Oceans, Seas and Coasts – Descriptor 6: Sea-floor Integrity [online] Available at: http://ec.europa.eu/environment/marine/good-environmental-status/descriptor-6/index_en.htm (accessed 20/12/18)

¹⁷¹ *ibid*

¹⁷² European Commission (2016) Our Oceans, Seas and Coasts – Descriptor 6: Sea-floor Integrity – Why should we pay attention to the sea-floor integrity? [online] Available at: http://ec.europa.eu/environment/marine/good-environmental-status/descriptor-6/index_en.htm (accessed 20/12/18)

¹⁷³ European Commission (2016) Integrated Coastal Management [online] Available at: http://ec.europa.eu/environment/iczm/index_en.htm (accessed 20/12/18)

a wide spectrum of both marine and terrestrial activities in a way that is mindful of the natural limits of the coastal environment¹⁷⁴.

In Scotland, **Integrated Coastal Zone Management** is achieved via the work of seven **Local Coastal Partnerships**¹⁷⁵. In addition, Marine Scotland Science is responsible for the monitoring, research and regulation of certain coastal activities.

Water policy

The EU's **Water Framework Directive (2000/60/EC) (WFD)** was introduced as a more comprehensive approach to managing and protecting Europe's water bodies which in Scotland includes rivers, lochs, transitional waters, coastal waters and groundwater resources¹⁷⁶. It sets out a goal of bringing all European waters to 'good' chemical and ecological status.

Scotland fulfils its water protection obligations under the WFD primarily through the **Water Environment and Water Services (Scotland) Act 2003**¹⁷⁷, which defines the establishment of **River Basin Management Plans**¹⁷⁸ and the **Water Environment (Controlled Activities) (Scotland) Regulations 2011**¹⁷⁹. Other relevant legislation includes the **Pollution Prevention and Control (Scotland) Regulations 2012**, which applies specifically to pollution originating from industry discharges¹⁸⁰.

The **EU Floods Directive (2007/60/EC)**¹⁸¹ is implemented at the national level through the **Flood Risk Management (Scotland) Act 2009**¹⁸². The Directive mandates the creation of flood risk management plans for all inland and coastal areas at risk of flooding, integrating their development and deployment with existing River Basin Management Plans. Flood risk management plans are designed to minimise negative impacts due to flooding on a range of receptors, including human health, the environment and cultural heritage.

Climatic factors policy

¹⁷⁴ European Commission (2014) Directive 2014/89/EU of the European Parliament and of the Council of 23 July 2014 establishing a framework for maritime spatial planning [online] Available at: <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32014L0089> (accessed 20/12/18)

¹⁷⁵ Scottish Government (2014) Managing Scotland's Coastline [online] Available at: <http://www.gov.scot/Topics/marine/marine-environment/coast> (accessed 20/12/18)

¹⁷⁶ European Commission (2000) Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy [online] Available at: <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32000L0060> (accessed 20/12/18)

¹⁷⁷ Water Environment and Water Services (Scotland) Act 2003, asp 3 [online] Available at: http://www.legislation.gov.uk/asp/2003/3/pdfs/asp_20030003_en.pdf (accessed 20/12/18)

¹⁷⁸ SEPA (2016) River Basin Management Planning [online] Available at: <http://www.sepa.org.uk/environment/water/river-basin-management-planning/> (accessed 20/12/18)

¹⁷⁹ The Water Environment (Controlled Activities) (Scotland) Regulations 2011, SSI No. 206 [online] Available at: http://www.legislation.gov.uk/ssi/2011/209/pdfs/ssi_20110209_en.pdf (accessed 20/12/18)

¹⁸⁰ The Pollution Prevention and Control (Scotland) Regulations 2012, SSI No. 360 [online] Available at: <http://www.legislation.gov.uk/ssi/2012/360/introduction/made> (accessed 20/12/18)

¹⁸¹ European Commission (2007) The EU Floods Directive [online] Available at: http://ec.europa.eu/environment/water/flood_risk/ (accessed 20/12/18)

¹⁸² Flood Risk Management (Scotland) Act 2009, asp 6 [online] Available at: http://www.legislation.gov.uk/asp/2009/6/pdfs/asp_20090006_en.pdf (accessed 20/12/18)

In November 2016, the United Nations Framework Convention on Climate Change (UNFCCC) **Paris Agreement** came into force¹⁸³. The Paris Agreement is the first legally binding global climate deal and sets out aims to limit global warming to well below 2°C as well as pursue further efforts to limit it to 1.5°C¹⁸⁴. A further long-term goal is to achieve net-zero levels of global greenhouse gas emissions by the second half of this century. The Agreement also covers a range of other issues such as mitigation through reducing emissions, adaptation, and loss and damage¹⁸⁵.

The **Climate Change (Scotland) Act 2009** provides the statutory framework for Greenhouse Gas (GHG) emissions reductions in Scotland. It sets a target for a reduction in emissions of the basket of Kyoto Protocol GHGs¹⁸⁶ of 80% by 2050 as compared to the 1990/1995 baseline levels, alongside an interim target of a 42% reduction by 2020. These targets are currently being revisited through the **Climate Change Bill** which recently underwent both SEA and public consultation¹⁸⁷. Proposals include increasing the ambition of the 2050 target to a 90% GHG emissions reduction from baseline and an interim 2040 target of at least a 78% reduction in GHG emissions from baseline levels.

The **Marine (Scotland) Act 2010** specifies a duty for Ministers and the public sector to manage and progress actions within the marine environment in a way ‘best calculated to mitigate and adapt to climate change so far as is consistent with the proper exercise of that function’¹⁸⁸. Scotland’s **National Marine Plan**¹⁸⁹ considers climate change in terms of how actions undertaken within the Plan can help to mitigate GHG emissions, in addition to how these actions need to be adapted to take into account the effects of climate change. The Plan also stipulates that the development and use of the marine environment should not have a significant impact on the national status of PMFs. Many of these are known for their role in carbon sequestration, including within MPAs.

¹⁸³ UNFCCC (2016) The Paris Agreement [online] Available at: http://unfccc.int/paris_agreement/items/9485.php (accessed 20/12/18)

¹⁸⁴ European Commission (2016) Paris Agreement [online] Available at: http://ec.europa.eu/clima/policies/international/negotiations/paris/index_en.htm (accessed 20/12/18)

¹⁸⁵ European Commission (2016) Paris Agreement [online] Available at: http://ec.europa.eu/clima/policies/international/negotiations/paris/index_en.htm (accessed 20/12/18)

¹⁸⁶ The basket of Kyoto Protocol greenhouse gases comprises carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O), for which the baseline is 1990; and hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF₆), for which the baseline is 1995. Nitrogen trifluoride (NF₃) has subsequently been added and applies to the second commitment period of 2013-20.

¹⁸⁷ Scottish Government (2017) Climate Change Bill – Consultation Paper [online] Available at: <http://www.gov.scot/Publications/2017/06/8208/0> (accessed 20/12/18)

¹⁸⁸ Marine (Scotland) Act 2010, asp 5 [online] Available at: http://www.legislation.gov.uk/asp/2010/5/pdfs/asp_20100005_en.pdf (accessed 20/12/18)

¹⁸⁹ Scottish Government (2015) Scotland's National Marine Plan [online] Available at: <http://www.gov.scot/Publications/2015/03/6517> (accessed 20/12/18)

Scotland's Climate Change Adaption Programme¹⁹⁰ is a direct requirement of the Climate Change (Scotland) Act 2009, replacing the Climate Change Adaptation Framework¹⁹¹ and accompanying Sector Action Plans¹⁹². Among its proposals and policies for meeting adaptation objectives are actions around conserving marine carbon stores and conducting additional research into the role of blue carbon ecosystems in carbon sequestration¹⁹³. The role of marine planning and MPAs in protecting these ecosystems is also noted¹⁹⁴.

¹⁹⁰ Scottish Government (2014) Climate Ready Scotland Scottish Climate Change Adaptation Programme – Part 2 – The Adaptation Programme [online] Available at: <http://www.gov.scot/Publications/2014/05/4669/4> (accessed 20/12/18)

¹⁹¹ Scottish Government (2009) Scotland's Climate Change Adaptation Framework [online] Available at: <http://www.gov.scot/Resource/Doc/295110/0091310.pdf> (accessed 20/12/18)

¹⁹² Scottish Government (2011) Sector Action Plans [online] Available at: <http://www.gov.scot/Topics/Environment/climatechange/scotlands-action/adaptation/AdaptationFramework/SAP> (accessed 20/12/18)

¹⁹³ Scottish Government (2014) Climate Ready Scotland Scottish Climate Change Adaptation Programme [online] Available at: <http://www.gov.scot/Resource/0045/00451392.pdf> (accessed 20/12/18)

¹⁹⁴ *ibid*

Appendix B Maps of pMPAs

Figure B1 North-East Lewis (NEL) pMPA and activities excluding fishing

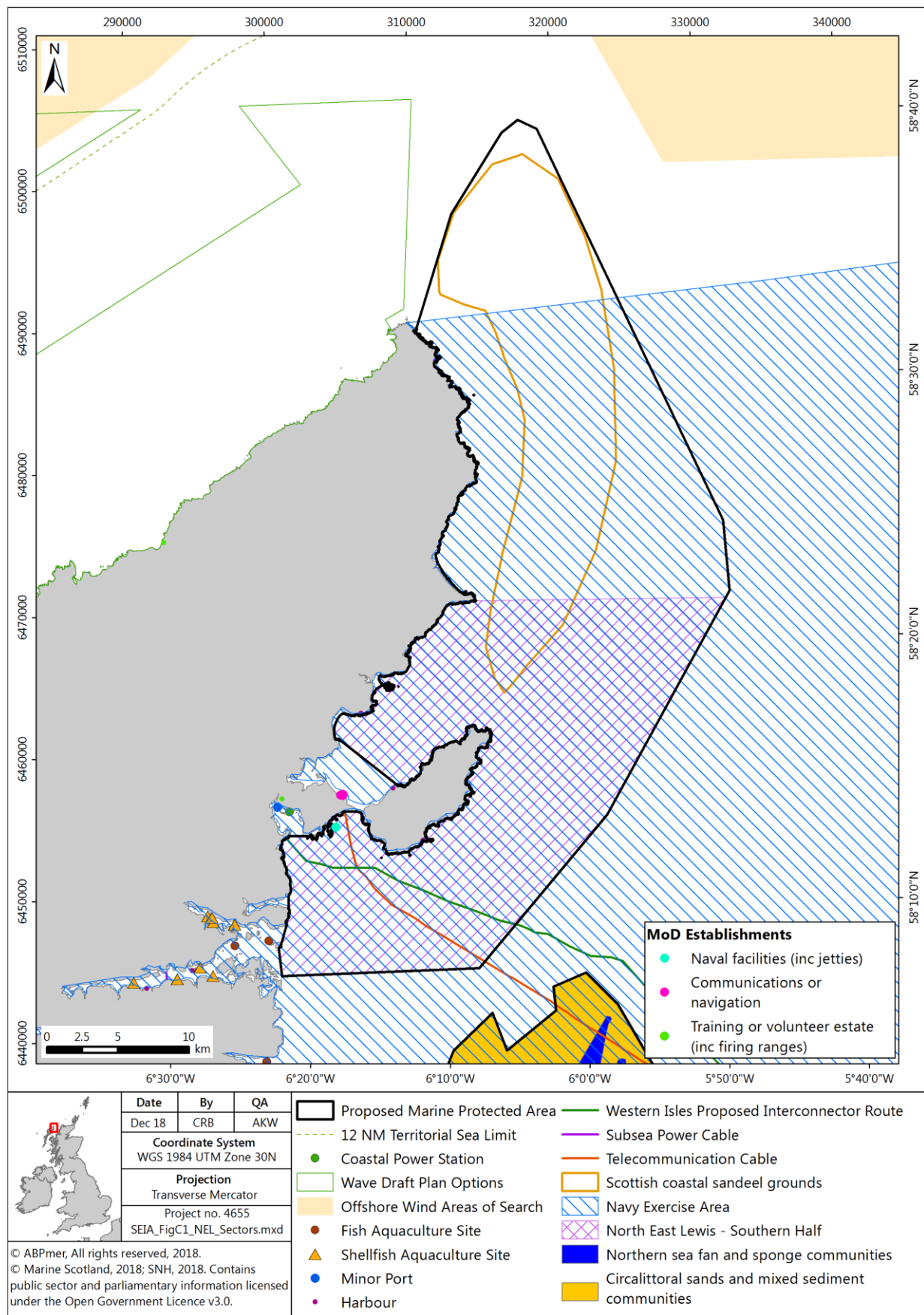


Figure B2 North-East Lewis (NEL) pMPA and commercial fishing activities

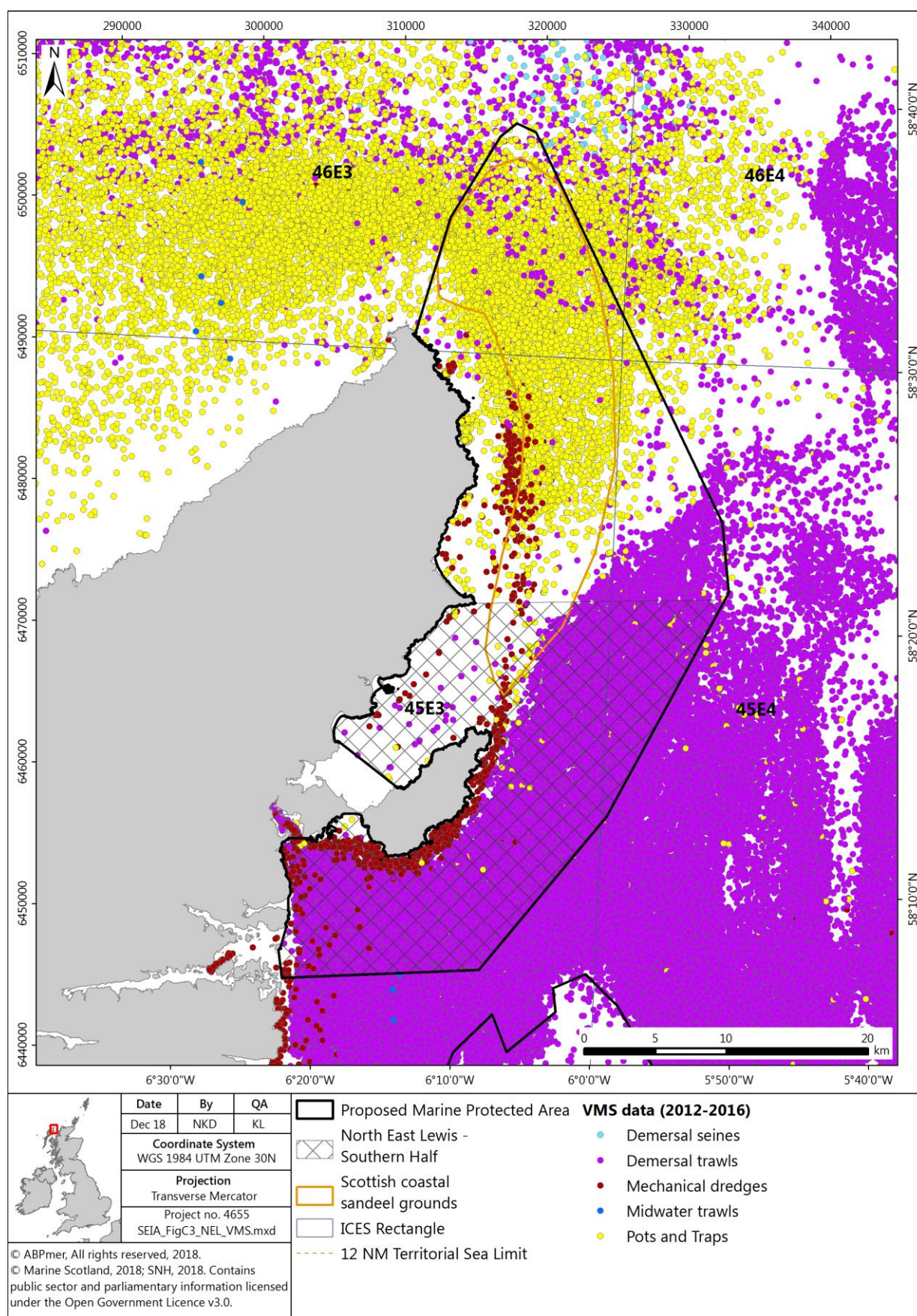


Figure B3 Sea of the Hebrides (SOH) pMPA and activities excluding fishing

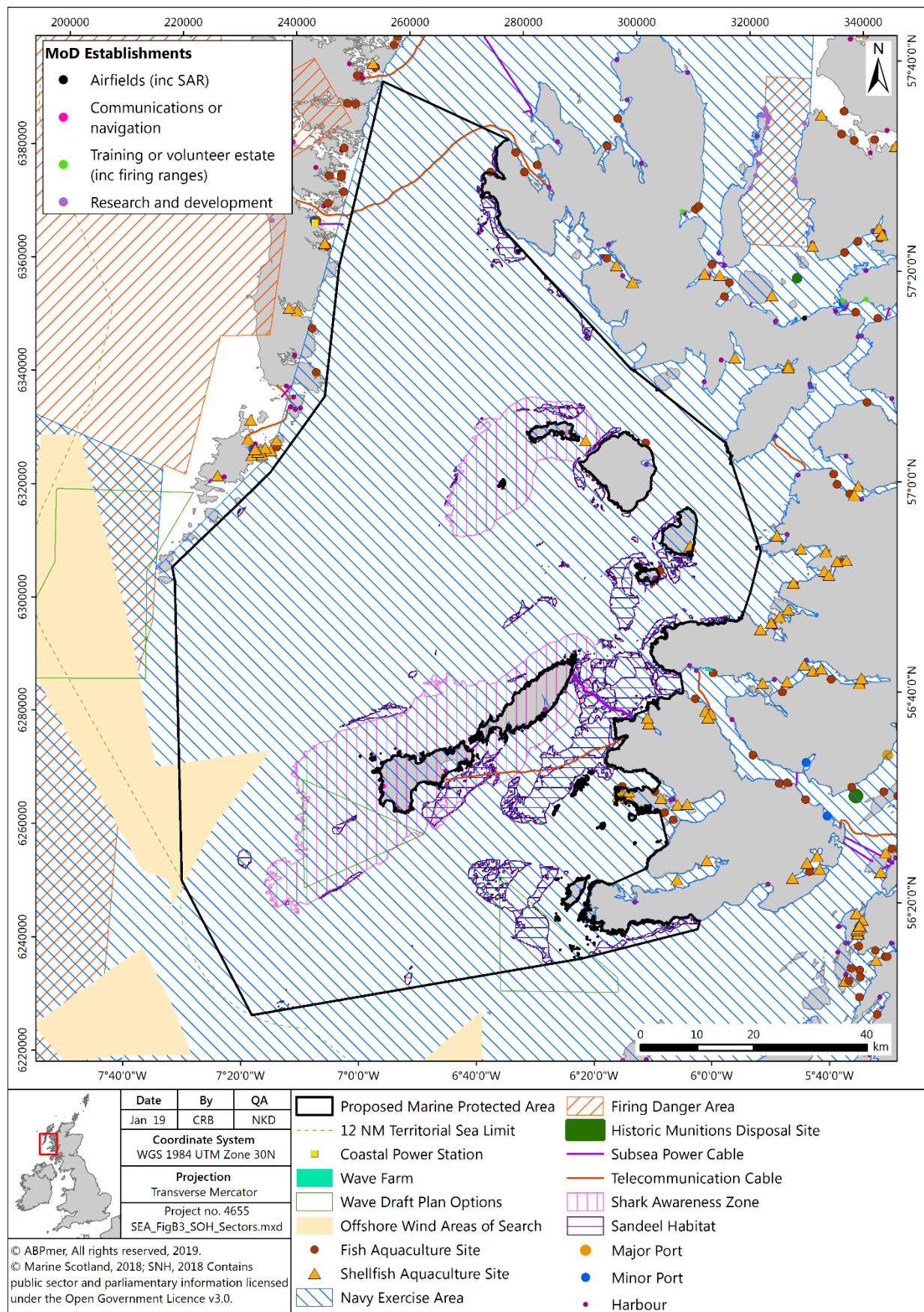


Figure B4 Sea of the Hebrides (SOH) pMPA and commercial fishing activities

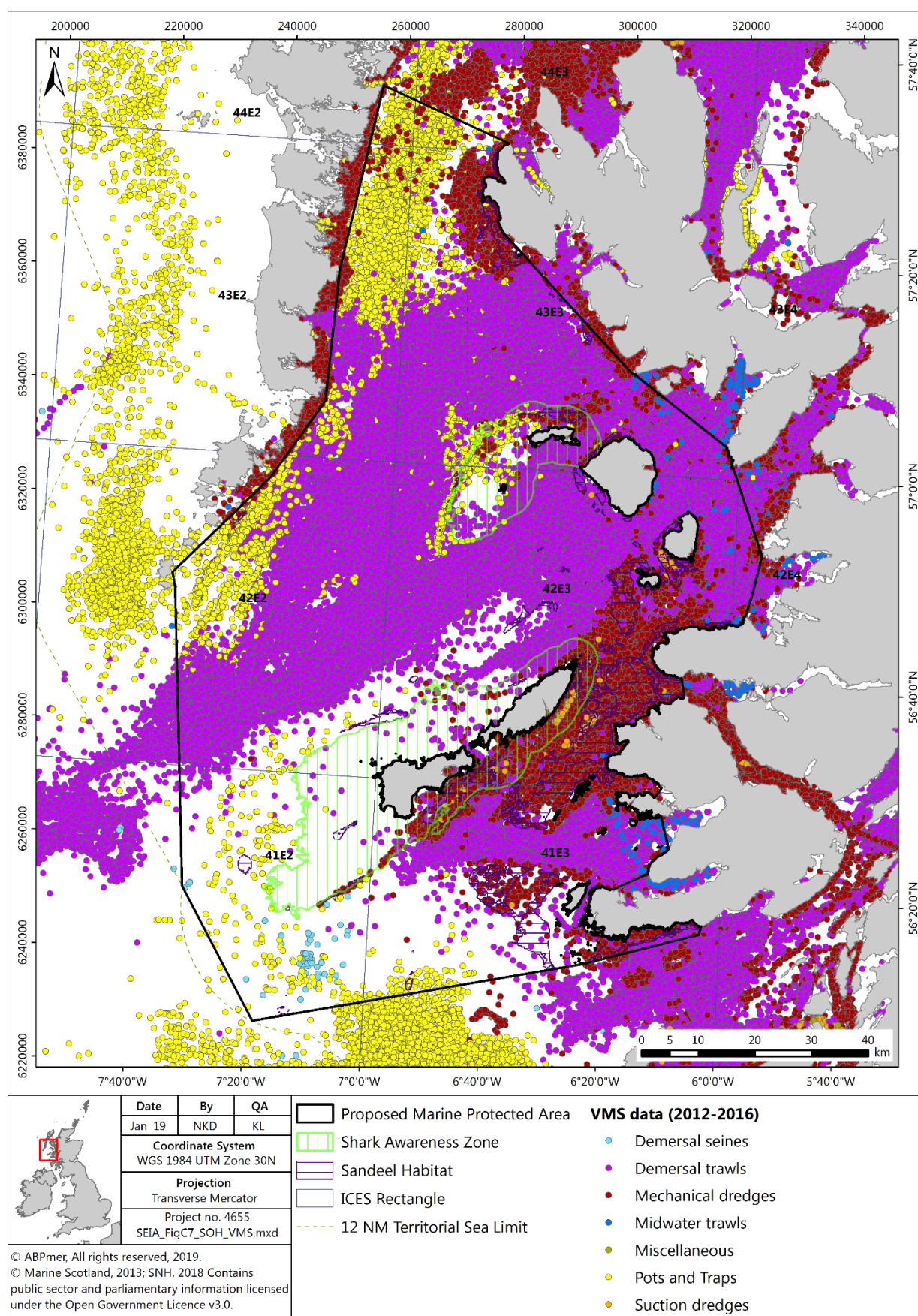


Figure B5 Shiant East Bank (SEB) pMPA and activities excluding fishing

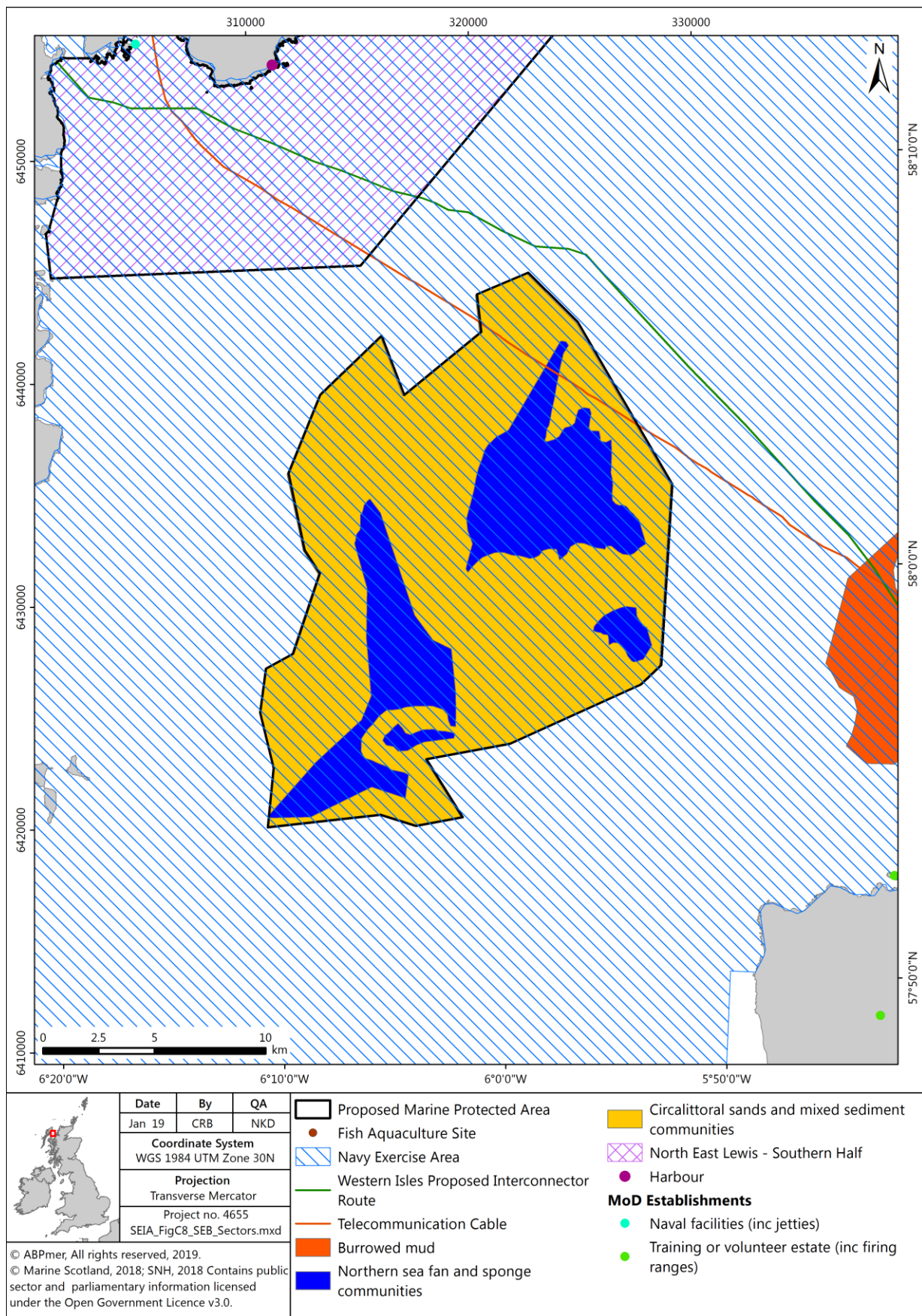


Figure B6 Shiant East Bank (SEB) pMPA and commercial fishing activities

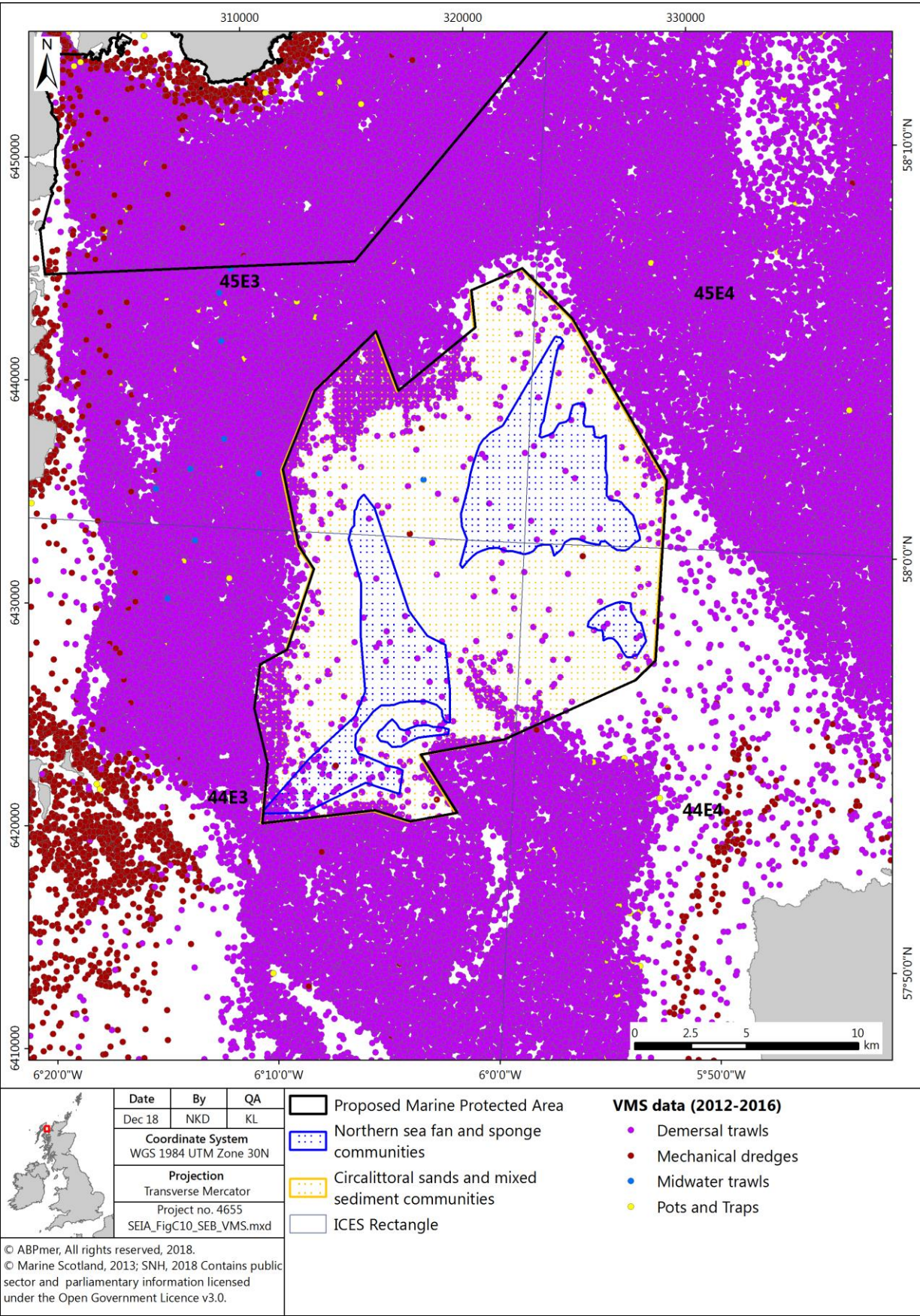


Figure B7 Southern Trench (STR) pMPA and activities excluding fishing

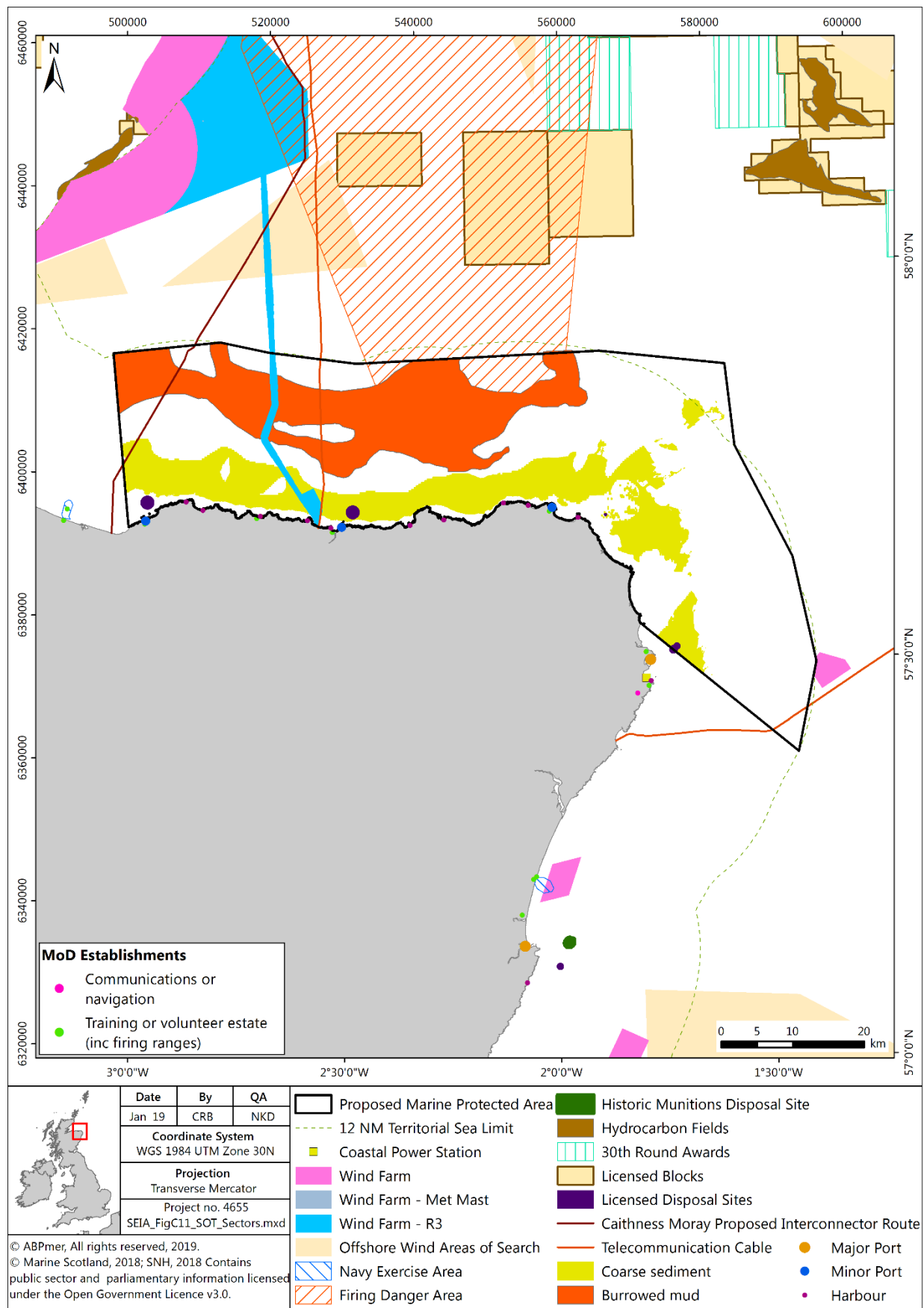
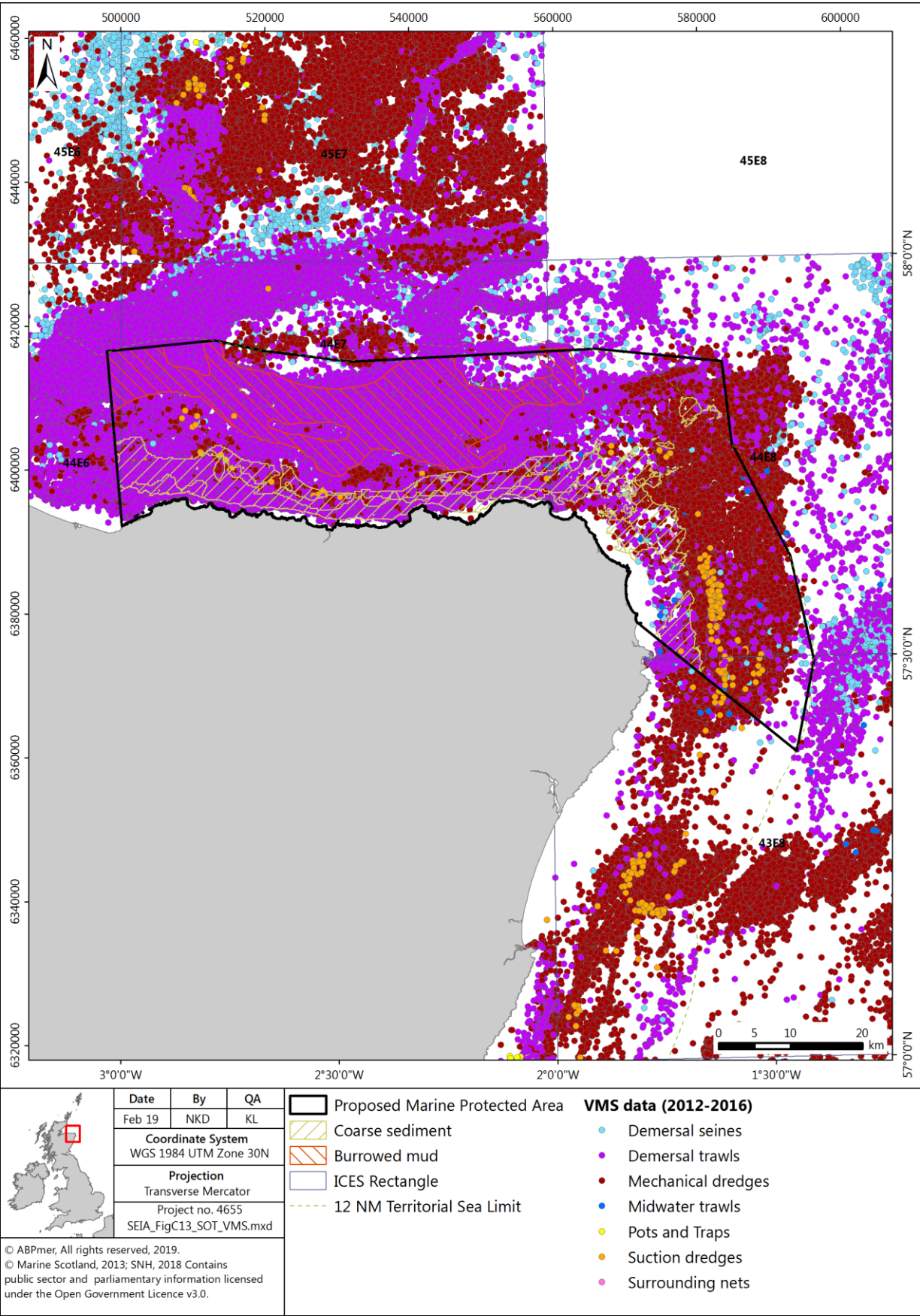


Figure B8 Southern Trench (STR) pMPA and commercial fishing activities



Appendix C Assessment Tables

Table C1 North-east Lewis (NEL) assessment

Proposed protected features			
Biodiversity: Risso's dolphins; sandeels			
Geodiversity: marine geomorphology of the Scottish shelf bed – longitudinal bedform field; Quaternary of Scotland (<i>glaciated channels/troughs, landscape of areal glacial scour, megascale glacial lineations</i>)			
Pressure/ activity/ impact pathway ¹⁹⁵	Management scenario		
	Lower	Intermediate	Upper
Aquaculture	Follow current best practice guidelines.	Follow current best practice guidelines. 50% of Acoustic Deterrent Devices (ADDs) to be replaced with basking shark/cetacean appropriate devices at end of their life.	Follow current best practice guidelines. Replacement of all Acoustic Deterrent Devices (ADDs) with antipredator nets.
Boat use ¹⁹⁶	Follow Scottish Marine Wildlife Watching Code (SMWWC) and produce vessel management plans as required by licensing.		
Cables/pipelines	Follow existing best practice and licensing process for installation of new cables/pipelines by minimising disturbance to sandeel habitat.		
Noisy activities ¹⁹⁷	Follow existing best practice mitigation measures/guidance.		Follow existing best practice mitigation measures/guidance. No noisy activities during Risso's dolphin high season (May-October).
Coastal development (excluding noise)	Follow existing best practice and licensing process.	Follow existing best practice and licensing process. Minimise footprints of development to limit disturbance to sandeel habitats.	
Fishing (bottom-contacting mobile gear)	No additional management	Exclusion of hydraulic gear from sandeel habitat. Exclude targeted fishing for sandeels.	
Fishing (static gear)	Reduce risk of entanglement of Risso's dolphins by following best practice.	Reduce risk of entanglement of Risso's dolphins by following best practice. Exclusion of drift nets and set nets in the southern half of site.	Reduce risk of entanglement of Risso's dolphins by following best practice. Exclusion of drift nets and set nets across site between May and October.
Fishing (pelagic)	Reduce risk of entanglement of Risso's dolphins by following best practice.		
Marine disposal sites	Current best practice followed.		Current best practice followed. Siting of new marine disposal sites to minimise impacts on sandeel habitat.
Ports and harbours	See 'Coastal development' and 'Noisy activities' for relevant scenarios.		
Renewable energy	Current best practice used to minimise impacts on sandeel habitat.		
Scientific survey/research	Survey work adhering to Scottish Marine Wildlife Watching Code (SMWWC) and current species licensing requirements. Best practice adopted to minimise effects on sandeel habitat.		
Wildlife tour operators	Follow existing best practice including Scottish Marine Wildlife Watching Code (SMWWC) and Wildlife Safe (WiSe) scheme.		

¹⁹⁵ Further to the potential benefits afforded by the designation of the pMPAs described in Section 5.2 of the main report, this table presents a detailed assessment of all the potential additional environmental effects that might arise from the lower, intermediate and upper management scenarios that have been identified as reasonable alternatives.

¹⁹⁶ MoD activities are reserved and therefore cannot be controlled or limited. MoD has its own best practice guidelines for meeting obligations.

¹⁹⁷ Noisy activities include all activities which produce underwater noise which may disturb the protected features. This includes, but may not be limited to, construction activities (pile driving and blasting) and marine surveys (seismic, side-scan sonar, multibeam, sub-bottom profiling). MoD activities are reserved and therefore cannot be controlled or limited. MoD has its own best practice guidelines for meeting obligations.

Proposed protected features			
Biodiversity: Risso's dolphins; sandeels			
Geodiversity: marine geomorphology of the Scottish shelf bed – longitudinal bedform field; Quaternary of Scotland (<i>glaciated channels/troughs, landscape of areal glacial scour, megascale glacial lineations</i>)			
Pressure/ activity/ impact pathway ¹⁹⁵	Management scenario		
	Lower	Intermediate	Upper
Potential benefits to habitats and species within the pMPA	In addition to the proposed protected features listed above, there are several other mobile features that occur within and around NEL pMPA, including harbour porpoise, basking shark, a high number of seabirds and a low number of grey and harbour seals ^{198,199} . The European spiny lobster which is a PMF has also been recorded in the site ²⁰⁰ .		
	<p>The implementation of current best practice guidelines across a number of sectors (e.g. the development of Acoustic Deterrent Device (ADD) deployment plans at aquaculture sites) is unlikely to affect the environment as these guidelines are already followed in the management of existing licensed activities and are required to be followed as part of the licensing of new projects.</p> <p>The implementation of the Scottish Marine Wildlife Watching Code (SMWWC) for all boat use as part of the licensing process and for scientific survey work and wildlife tour operators will potentially reduce the future risk of collisions with and disturbance of cetaceans and basking shark.</p> <p>There is no demersal static fishing (including by drift nets and set nets) within the pMPA boundary that has been reported in the ScotMap or VMS data. This suggests that this management scenario will not result in an immediate benefit in terms of reducing the risk of entanglement. VMS analysis indicates that there is some low intensity herring fishing in the southern part of NEL pMPA and some moderate to high intensity mackerel fishing across the site. Assuming that these pelagic fisheries are already following best practice in terms of reducing risk of entanglement there will be no immediate environmental benefit. There is the potential for future environmental benefits as any fishers that use nets in this pMPA in future will need to adhere to best practice.</p> <p>Overall, if the lower management scenario were to be implemented there will be no immediate benefit to habitats and species within the pMPA, but a greater potential for future benefits.</p>	<p>The implementation of current best practice guidelines across a number of sectors is unlikely to affect the environment as these guidelines are already followed in the management of existing licensed activities and are required to be followed as part of the licensing of new projects.</p> <p>Reducing the number of Acoustic Deterrent Devices (ADDs) at finfish aquaculture sites operating at mid or high frequencies would reduce the level of underwater noise disturbance to cetaceans and basking sharks. The scale of this benefit is negligible in the immediate term given that there are currently no active finfish aquaculture sites within NEL pMPA; however, there is the potential for future benefits should any new finfish aquaculture sites be proposed at this site.</p> <p>The implementation of the Scottish Marine Wildlife Watching Code (SMWWC) for all boat use as part of the licensing process and for scientific survey work and wildlife tour operators will potentially reduce the future risk of collisions with and disturbance of cetaceans and basking shark.</p> <p>In terms of coastal development, the only port located near to this pMPA is Stornoway and the dredging and disposal requirements for this port do not overlap with the sandeel grounds and are therefore unlikely to disturb sandeel habitat. The sandeel grounds within NEL pMPA are located offshore and therefore future coastal development is unlikely to overlap and result in disturbance to sandeel habitat.</p>	<p>The implementation of current best practice guidelines across a number of sectors is unlikely to affect the environment as these guidelines are already followed in the management of existing licensed activities and are required to be followed as part of the licensing of new projects.</p> <p>The replacement of all Acoustic Deterrent Devices (ADDs) at aquaculture sites with antipredator nets would remove any underwater noise disturbance to marine fauna. The scale of this benefit is negligible in the immediate term given that there are currently no active finfish aquaculture sites within NEL pMPA, however, there is the potential for future benefits should any new finfish aquaculture sites be proposed at this site.</p> <p>The implementation of the Scottish Marine Wildlife Watching Code (SMWWC) for all boat use as part of the licensing process and for scientific survey work and wildlife tour operators will potentially reduce the future risk of collisions with and disturbance of cetaceans and basking shark.</p> <p>The cessation of all noisy activities within NEL pMPA during the Risso's dolphin high season (May-October) will avoid any underwater noise disturbance to marine fauna from construction activities and marine surveys during this period. The scale of these benefits will depend on the nature and location of noisy activities. In terms of marine survey sources, side-scan and multibeam generate the lowest estimated sensation levels for all marine mammal species groups and sub-bottom profiling and seismic airguns generate levels that mysticetes (i.e. baleen whales such as minke whales) are most likely to hear²⁰¹. Overall, marine</p>

¹⁹⁸ Dunn, T., 2012. JNCC seabird distribution and abundance data (all trips) from ESAS database.

¹⁹⁹ Marine Scotland, 2018. The Marine Scotland MAPS NMPI (National Marine Plan interactive). Available at: <https://www2.gov.scot/Topics/marine/seamanagement/nmpihome> (accessed 01/11/2018)

²⁰⁰ ibid

²⁰¹ MacGillivray, A.O., Racca, R. and Zizheng, L., 2014. Marine mammal audibility of selected shallow-water survey sources. Available at: <https://asa.scitation.org/doi/10.1121/1.4838296> (accessed 02/11/2018)

Proposed protected features			
Biodiversity: Risso's dolphins; sandeels			
Geodiversity: marine geomorphology of the Scottish shelf bed – longitudinal bedform field; Quaternary of Scotland (<i>glaciated channels/troughs, landscape of areal glacial scour, megascale glacial lineations</i>)			
Pressure/ activity/ impact pathway ¹⁹⁵	Management scenario		
	Lower	Intermediate	Upper
		<p>ScotMap data indicate that up to 14 under-15m vessels trawl for <i>Nephrops</i> within NEL pMPA. The majority of this trawling takes place outside of the sandeel grounds on more muddy habitat that supports <i>Nephrops</i>. VMS analysis indicates there is some relatively high intensity mobile gear fishing of <i>Nephrops</i>, some moderate intensity dredging for scallops and some very low intensity demersal mobile fishing by over-12m vessels within the pMPA. The exclusion of hydraulic gear from sandeel habitat may result in a negligible to very minor immediate benefit to the environment as there is only a negligible to very low intensity of demersal mobile fishing that may use hydraulic gear and overlaps with the sandeel grounds in NEL pMPA. There is potential for future benefits as fishers will be restricted from using this gear on sandeel habitat.</p> <p>There is no sandeel fishery within the pMPA boundary that has been reported in the ScotMap or VMS data. This suggests that there will not be any initial benefit if target fishing for sandeels were excluded. However, there is potential for future benefits as any fishers will be restricted from setting up a fishery or targeting sandeels within the pMPA.</p> <p>Assuming that existing pelagic fisheries are already following best practice in terms of reducing risk of entanglement there will be no immediate environmental benefit. There is potential for future environmental benefits as any fishers that use nets in this pMPA in future will need to adhere to best practice.</p> <p>There is no demersal static fishing within the pMPA boundary that has been reported in the ScotMap or VMS data. This suggests that this management scenario will not result in an immediate benefit in terms of exclusion of drift nets and set nets in the southern half of site. There is the potential for future environmental benefits as any fishers that use nets in this pMPA in future will need to avoid fishing in sensitive areas.</p>	<p>surveys generate shorter periods of relatively low levels of noise and therefore will only provide minor and localised benefits to the environment. In terms of construction activities, an Offshore Wind Plan Area of Search (AoS) is located less than 10km from the northeast boundary of NEL pMPA. There is potential for future environmental benefits if offshore wind farm development is restricted from undertaking noisy activities during this sensitive period.</p> <p>In terms of coastal development, the only port located near to this pMPA is Stornoway and the dredging and disposal requirements for this port do not overlap with the sandeel grounds and are therefore unlikely to disturb sandeel habitat. The sandeel grounds within NEL pMPA are located offshore and therefore future coastal development is unlikely to overlap and result in disturbance to sandeel habitat.</p> <p>The exclusion of hydraulic gear from sandeel habitat may result in a negligible to very minor immediate benefit to the environment as there is only a negligible to very low intensity of demersal mobile fishing that may use hydraulic gear and overlaps with the sandeel grounds in NEL pMPA. There is potential for future benefits as fishers will be restricted from using this gear on sandeel habitat.</p> <p>There is no sandeel fishery within the pMPA boundary that has been reported in the ScotMap or VMS data. This suggests that there will not be any initial benefit if target fishing for sandeel were excluded. However, there is potential for future benefits as any fishers will be restricted from setting up a fishery or targeting sandeel within the pMPA.</p> <p>Assuming that existing pelagic fisheries are already following best practice in terms of reducing risk of entanglement there will be no immediate environmental benefit. There is potential for future environmental benefits as any fishers that use nets in this pMPA in future will need to adhere to best practice.</p>

Proposed protected features			
Biodiversity: Risso's dolphins; sandeels			
Geodiversity: marine geomorphology of the Scottish shelf bed – longitudinal bedform field; Quaternary of Scotland (<i>glaciated channels/troughs, landscape of areal glacial scour, megascale glacial lineations</i>)			
Pressure/ activity/ impact pathway ¹⁹⁵	Management scenario		
	Lower	Intermediate	Upper
		<p>Overall, if the intermediate management scenario were to be implemented there will be a negligible to very minor immediate benefit to habitats and species within the pMPA, and a greater potential for future benefits.</p>	<p>There is no demersal static fishing within the pMPA boundary that has been reported in the ScotMap or VMS data. This suggests that this management scenario will not result in an immediate benefit in terms of exclusion of drift nets and set nets between May and October. There is the potential for future environmental benefits as any fishers that use nets in this pMPA in future will need to avoid fishing in sensitive areas.</p> <p>The siting of any new marine disposal sites will need to minimise impacts on sandeel habitat. The sandeel grounds are located more than 10km from the nearest harbour at Brevig and more than 20km from the nearest port at Stornoway and therefore the licensing of new disposal sites within or close to these sandeel grounds is considered unlikely. However, this management scenario does provide greater direction and enhanced protection should any new marine disposal sites be licensed in NEL pMPA in future.</p> <p>Overall, if the upper management scenario were to be implemented there will be a negligible to minor immediate benefit to habitats and species within the pMPA, and a greater potential for future benefits.</p>
Potential spillover benefits beyond pMPA site boundaries	<p>The lower management scenario will not limit or restrict any human pressures/activities and therefore there will be no potential spillover benefits.</p> <p>Overall, if the lower management scenario were to be implemented there will be no spillover benefits.</p>	<p>Restricting certain harmful activities in sensitive areas may result in the potential spillover of species from protected areas into unprotected areas if there is a population surplus and the carrying capacity of the protected area is surpassed^{202,203}. There is, however, variation in the level of effectiveness and scale of benefits that restrictions can have and these are site dependent²⁰⁴. The current conditions encountered within a site (e.g. current stock level, species present, and nursery and spawning areas for those species) need to be characterised in order to be able to undertake a detailed assessment of the potential for spillover benefits to occur.</p> <p>There is evidence to suggest that NEL pMPA supports spawning and/or nursery grounds for</p>	<p>Same as intermediate management scenario.</p>

²⁰² Buxton, C.D., Hartmann, K., Kearney, R. and Gardner, C., 2014. When is spillover from marine reserves likely to benefit fisheries?. PloS One, 9(9), p.e107032.

²⁰³ Kerwath, S.E., Winker, H., Götz, A. and Attwood, C.G., 2013. Marine protected area improves yield without disadvantaging fishers. Nature Communications, 4, p.2347.

²⁰⁴ Starr, R.M., Wendt, D.E., Barnes, C.L., Marks, C.I., Malone, D., Waltz, G., Schmidt, K.T., Chiu, J., Launer, A.L., Hall, N.C. and Yochum, N., 2015. Variation in responses of fishes across multiple reserves within a network of marine protected areas in temperate waters. PloS one, 10(3), p.e0118502.

Proposed protected features			
Biodiversity: Risso's dolphins; sandeels			
Geodiversity: marine geomorphology of the Scottish shelf bed – longitudinal bedform field; Quaternary of Scotland (<i>glaciated channels/troughs, landscape of areal glacial scour, megascale glacial lineations</i>)			
Pressure/ activity/ impact pathway ¹⁹⁵	Management scenario		
	Lower	Intermediate	Upper
		<p>several fish species, including whiting, sprat, sandeel, Norway pout, <i>Nephrops</i>, lemon sole and cod but at unknown densities^{205,206}. Scallops are broadcast spawners and as there is a current scallop fishery, it is considered also to be a spawning area for scallops.</p> <p>Taking account of the nature and scale of existing human pressures/activities at NEL pMPA, spillover benefits from the restriction of certain human pressures/activities (e.g. excluding hydraulic gear from sandeel habitat and targeted fishing for sandeels) are likely to be negligible in the immediate term with the potential to be more significant in the long term.</p> <p>Overall, if the intermediate management scenario were to be implemented the spillover benefits are likely to be negligible in the immediate term, with a potential for greater benefits in the future.</p>	
Potential adverse environmental effects resulting from the displacement of activities and the intensification of activities in areas where they already occur	<p>The lower management scenario will not limit or restrict any human pressures/activities and therefore there will be no potential adverse environmental effects resulting from the displacement of activities.</p> <p>Overall, if the lower management scenario were to be implemented there will be no potential adverse environmental effects associated with the displacement of activities.</p>	<p>The existing scale of pressure from the activities that are restricted by this management scenario (i.e. exclusion of hydraulic gear from sandeel habitat, targeted fishing for sandeel, exclusion of drift nets and set nets in the southern half of site) is negligible to very low; VMS analysis indicates that the intensity of demersal mobile fishing that may use hydraulic gear and overlap with the sandeel grounds in the pMPA is negligible to very low, and there is no sandeel fishery or drift nets and set nets within the pMPA boundary.</p> <p>The scale of any displacement of these fishing activities will therefore be negligible to very low.</p> <p>The distance needed to access areas that are already exploited by these fisheries outside of the protected sandeel grounds is small. The environmental effect of the displacement and intensification of fishing activity is therefore considered to be negligible given that the habitat and</p>	<p>The existing scale of pressure from the activities that are restricted by this management scenario (i.e. exclusion of hydraulic gear from sandeel habitat, targeted fishing for sandeels, exclusion of drift nets and set nets between May and October, and noisy activities during Risso's dolphin high season) is negligible to low. VMS analysis indicates that the intensity of demersal mobile fishing that may use hydraulic gear and overlap with the sandeel grounds in the pMPA is negligible to very low, and there is no sandeel fishery or drift nets and set nets within the pMPA boundary.</p> <p>The scale of existing noisy activities from marine survey work is small and this activity is unlikely to be displaced by a temporal restriction. Any displacement is therefore limited to fishing activities, the scale of which will be negligible to very low.</p> <p>The distance needed to access areas that are already exploited by these fisheries outside of the protected sandeel grounds is small. The environmental effect of the displacement and intensification of fishing activity is</p>

²⁰⁵ Coull, K.A., Johnstone, R. and Rogers, S.I., 1998. Fisheries Sensitivity Maps in British Waters. Published and distributed by UKOOA Ltd., v + 58 pp.

²⁰⁶ Ellis, J.R., Milligan, S.P., Readdy, L., Taylor, N. and Brown, M.J. 2012. Spawning and nursery grounds of selected fish species in UK waters. Cefas Science Series Technical Report 147.

Proposed protected features			
Biodiversity: Risso's dolphins; sandeels			
Geodiversity: marine geomorphology of the Scottish shelf bed – longitudinal bedform field; Quaternary of Scotland (<i>glaciated channels/troughs, landscape of areal glacial scour, megascale glacial lineations</i>)			
Pressure/ activity/ impact pathway ¹⁹⁵	Management scenario		
	Lower	Intermediate	Upper
		<p>species in the areas that the fishing will be displaced to have a community composition that is already characterised by this pressure/activity.</p> <p>Overall, if the intermediate management scenario were to be implemented the potential environmental effect of any displacement and intensification of activities in areas where they already occur will be negligible.</p>	<p>therefore considered to be negligible given that the habitat and species in the areas that the fishing will be displaced to have a community composition that is already characterised by this pressure/activity.</p> <p>Overall, if the upper management scenario were to be implemented the potential environmental effect of any displacement and intensification of activities in areas where they already occur will be negligible.</p>
Potential environmental impact of increased fishing effort from other gear types that might not be targeted by the management scenario within the pMPA	<p>The lower management scenario will not limit or restrict any human pressures/activities and therefore there will be no potential adverse environmental effects resulting from increased fishing effort from other gear types that are not targeted.</p> <p>Overall, if the lower management scenario were to be implemented there will be no potential adverse environmental effects associated with changes in gear types.</p>	<p>The ScotMap data and VMS analysis indicates that the main fishing methods that occur within the pMPA are trawling for <i>Nephrops</i>, pelagic fishing and creeling. Assuming that pelagic fisheries already adhere to best practice in terms of reducing the risk of entanglement, this management scenario will not affect the main fishing activities that currently occur in the pMPA. It is considered unlikely that any existing fisheries using the restricted gear (i.e. hydraulic gear) in sandeel grounds would alter their gear type to one of the other methods as there would still be areas within and outwith the MPA where they can fish.</p> <p>Overall, the intermediate management scenario is unlikely to increase the fishing intensity of the non-targeted fishing gears and therefore the environmental impact is considered to be negligible.</p>	<p>Same as intermediate management scenario.</p>
Overall (cumulative) assessment	<p>The lower management scenario for NEL pMPA will have no immediate impact on the environment but a greater potential for future benefits. Assuming that best practice is being followed by existing activities there will be no immediate benefits to habitat and species within the pMPA. The lower management scenario will not limit or restrict any human pressures/activities and therefore there will be no potential spillover benefits, no potential adverse environmental effects resulting from the displacement of activities and no potential adverse environmental effects resulting from increased fishing effort from other gear types that are not targeted.</p>	<p>The intermediate management scenario for NEL pMPA will have an overall negligible to very minor immediate beneficial impact on the environment and a greater potential for future benefits. The existing scale of activities that will be prohibited by the measures (namely hydraulic gear fishing in sandeel grounds and targeted fishing for sandeel) are very small, but their exclusion will potentially provide benefits to some habitats and associated species. The scale of benefit of reducing the number of Acoustic Deterrent Devices (ADDs) at finfish aquaculture sites operating at mid or high frequencies is negligible in the immediate term given that there are currently no active finfish aquaculture sites within NEL pMPA, however, there is the potential for future benefits should any new finfish</p>	<p>The upper management scenario for NEL pMPA will have an overall negligible to minor immediate beneficial impact on the environment and a greater potential for future benefits. The existing scale of activities that will be prohibited or restricted by the measures (namely hydraulic gear fishing in sandeel grounds, targeted fishing for sandeel, exclusion of drift nets and set nets between May and October, and noisy activities during Risso's dolphin high season) are small, but their regulation will provide some benefits to habitats and species. The scale of benefit of replacing all Acoustic Deterrent Devices (ADDs) at finfish aquaculture sites with antipredator nets is negligible in the immediate term given that there are currently no active finfish aquaculture sites within NEL pMPA, however, there is the potential for future benefits</p>

Proposed protected features			
Biodiversity: Risso's dolphins; sandeels			
Geodiversity: marine geomorphology of the Scottish shelf bed – longitudinal bedform field; Quaternary of Scotland (<i>glaciated channels/troughs, landscape of areal glacial scour, megascale glacial lineations</i>)			
Pressure/ activity/ impact pathway ¹⁹⁵	Management scenario		
	Lower	Intermediate	Upper
		aquaculture sites be proposed at this site. The scale of benefits from the measures is unlikely to result in significant spillover benefits outside the boundaries of NEL pMPA. The adverse impacts on the environment will be negligible as a direct impact of displacement as the amount of effort displaced will be very small and the areas into which effort is likely to be displaced are already fished and thus have a community composition that is already characterised by fishing pressures. Furthermore, a change in fishing effort from targeted to non-targeted fishing gears (e.g. from hydraulic gear to creeling) is considered unlikely given that there would still be areas within and outwith NEL pMPA that are available for targeted fisheries to fish. Therefore, the benefit of protection is likely to be greater than the negative impacts associated with displacement.	should any new finfish aquaculture sites be proposed at this site. The scale of benefits from the measures is unlikely to result in significant spillover benefits outside the boundaries of NEL pMPA. The adverse impacts on the environment will be negligible as a direct impact of displacement as the amount of fishing effort displaced will be very small and the areas into which effort is likely to be displaced are already fished and thus have a community composition that is already characterised by fishing pressures. Furthermore, a change in fishing effort from targeted to non-targeted fishing gears (e.g. from hydraulic gear to creeling) is considered unlikely given that there would still be areas outwith NEL pMPA that are available for targeted fisheries to fish. Therefore, the benefit of protection is likely to be greater than the negative impacts associated with displacement.
SEA Objective 1 - To safeguard and enhance marine and coastal ecosystems, including species, habitats, and their interactions	The lower management scenario will not result in an immediate beneficial contribution to SEA Objective 1 but will potentially result in a greater beneficial contribution to this SEA objective in the future through affording enhanced protection to the environment from future activities.	A reduction in existing pressures/activities (namely hydraulic gear fishing on sandeel grounds) will result in a negligible to very minor immediate beneficial contribution to SEA Objective 1. The intermediate management scenario will provide enhanced protection to the environment from future activities and therefore will potentially result in a greater beneficial contribution to this SEA objective in the future.	A reduction in existing pressures/activities (namely hydraulic gear fishing on sandeel grounds and noisy marine survey activities during sensitive periods) will result in a negligible to minor immediate beneficial contribution to SEA Objective 1. The upper management scenario will provide enhanced protection to the environment from future activities and therefore will potentially result in a greater beneficial contribution to this SEA objective in the future.
SEA Objective 2 - To maintain and protect the character and integrity of the seabed	The lower management scenario will not result in an immediate beneficial contribution to SEA Objective 2 but will potentially result in a greater beneficial contribution to this SEA objective in the future through affording enhanced protection to the environment from future activities.	A reduction in existing pressures/activities that interact with the seabed (namely hydraulic gear fishing on sandeel grounds) will provide a negligible to very minor immediate beneficial contribution to SEA Objective 2. The lower management scenario will provide enhanced protection to the environment from future activities and therefore will potentially result in a greater beneficial contribution to this SEA objective in the future.	Same as intermediate management scenario.
SEA Objective 3 - To avoid the pollution of seabed strata and/or bottom sediments	The lower management scenario will not result in an immediate beneficial contribution to SEA Objective 3 but will potentially result in a greater beneficial contribution to this SEA objective in the future through affording enhanced protection to the environment from future activities.	There are unlikely to be any contaminated sediments at the sandeel grounds of the NEL pMPA as they are predominantly gravelly, sandy and dynamic in nature, as well as being located offshore and far from any potential sources of contamination. The potential reduction in the redistribution and settling of any contaminated seabed sediments that are disturbed as an indirect effect of excluding hydraulic gear fishing on sandeel grounds is therefore	Same as intermediate management scenario.

Proposed protected features			
Biodiversity: Risso's dolphins; sandeels			
Geodiversity: marine geomorphology of the Scottish shelf bed – longitudinal bedform field; Quaternary of Scotland (<i>glaciated channels/troughs, landscape of areal glacial scour, megascale glacial lineations</i>)			
Pressure/ activity/ impact pathway ¹⁹⁵	Management scenario		
	Lower	Intermediate	Upper
		considered to provide a negligible contribution to SEA Objective 3.	
SEA Objective 4 - To avoid pollution of the coastal and marine water environment	The lower management scenario will not result in an immediate beneficial contribution to SEA Objective 4 but will potentially result in a greater beneficial contribution to this SEA objective in the future through affording enhanced protection to the environment from future activities.	The reduction in suspended sediments and sedimentation as an indirect effect of excluding hydraulic gear fishing on sandeel grounds will provide a negligible to very minor immediate beneficial contribution to SEA Objective 3. The intermediate management scenario will provide enhanced protection to the environment from future activities and therefore will result in a greater beneficial contribution to this SEA objective in the future.	Same as intermediate management scenario.
SEA Objective 5 - To maintain or work towards achieving 'Good Ecological Status' and 'Good Environmental Status' of water bodies	The lower management scenario will not result in an immediate beneficial contribution to SEA Objective 5 but will potentially result in a greater beneficial contribution to this SEA objective in the future through affording enhanced protection to the environment from future activities.	A reduction in existing pressures/activities (namely hydraulic gear fishing on sandeel grounds) will support the quality elements used to assess 'Good Ecological Status' and the qualitative descriptions used to determine 'Good Environmental Status'. Based on the outcomes of assessing SEA Objectives 1-4 above, it is considered that there is potential for a negligible to very minor immediate beneficial contribution to SEA Objective 5 in terms of the WFD water bodies and MSFD marine region that overlap with the site. The intermediate management scenario will provide enhanced protection to the environment from future activities and therefore will potentially result in a greater beneficial contribution to this SEA objective in the future.	A reduction in existing pressures/activities (namely hydraulic gear fishing on sandeel grounds and noisy marine survey activities during sensitive periods) will support the quality elements used to assess 'Good Ecological Status' and the qualitative descriptions used to determine 'Good Environmental Status'. Based on the outcomes of assessing SEA Objectives 1-4 above, it is considered that there is potential for a negligible to very minor immediate beneficial contribution to SEA Objective 5 in terms of the WFD water bodies and MSFD marine region that overlap with the site. The upper management scenario will provide enhanced protection to the environment from future activities and therefore will potentially result in a greater beneficial contribution to this SEA objective in the future.
SEA Objective 6 - To preserve and enhance existing marine carbon stocks and carbon sequestration potential	Data available on NMPi indicate there are no habitats within NEL pMPA that are blue carbon sinks due to their fixation and sequestration ability. The protection of sandeel habitat will therefore result in no contribution to SEA Objective 6.	Same as lower management scenario.	Same as lower management scenario.

Table C2 Sea of the Hebrides (SOH) assessment

Proposed protected features			
Biodiversity: Basking sharks; minke whales; fronts			
Geodiversity: marine geomorphology of the Scottish shelf seabed (<i>Inner Hebrides Carbonate Production Area</i>)			
Pressure/activity/impact pathway ²⁰⁷	Management scenario		
	Lower	Intermediate	Upper
Aquaculture	Follow current best practice guidelines.	Follow current best practice guidelines. 50% of Acoustic Deterrent Devices (ADDs) to be replaced with basking shark/cetacean appropriate devices at end of their life.	Follow current best practice guidelines. Replacement of all Acoustic Deterrent Devices (ADDs) with antipredator nets.
Boat use ²⁰⁸	Follow Scottish Marine Wildlife Watching Code (SMWWC) and produce vessel management plans as required by licensing.		Follow Scottish Marine Wildlife Watching Code (SMWWC) and produce vessel management plans as required by licensing. Vessel speeds ²⁰⁹ restricted to <6 knots within the 'shark awareness zones' between June and October.
Cables/pipelines	Follow existing best practice and licensing process for installation of new cables/pipelines by minimising disturbance to sandeel habitat.		
Noisy activities ²¹⁰	Follow existing best practice mitigation measures/guidance.		Follow existing best practice mitigation measures/guidance. No noisy activities during minke whale and basking shark high season (April-October)
Coastal development (excluding noise)	Follow existing best practice and licensing process.	Follow existing best practice and licensing process. Minimise footprints of development to limit disturbance to sandeel habitats.	
Fishing (bottom-contacting mobile gear)	Follow best practice to minimise risk of bycatch of basking sharks.	Follow best practice to minimise risk of bycatch of basking sharks. Exclusion of hydraulic gear from sandeel habitat. Exclude targeted fishing for sandeel.	
Fishing (static gear)	Reduce risk of entanglement of basking sharks and minke whales by following best practice.	Reduce risk of entanglement of basking shark and minke whale by following best practice. Exclusion of drift nets and set nets between April and October in 'shark awareness zones'.	Reduce risk of entanglement of basking sharks and minke whale by following best practice. Exclusion of drift nets and set nets between April and October across site.
Fishing (pelagic)	Reduce risk of entanglement of minke whales and basking sharks by following best practice.		Reduce risk of entanglement of minke whales and basking sharks by following best practice. Limit herring and sprat fishing effort to current levels.
Marine disposal sites	Current best practice followed.		Current best practice followed. Siting of new marine disposal sites to minimise impacts on sandeel habitat.
Ports and harbours	See 'Coastal development' and 'Noisy activities' for relevant scenarios.		

²⁰⁷ Further to the potential benefits afforded by the designation of the pMPAs described in Section 5.2 of the main report, this table presents a detailed assessment of all the potential additional environmental effects that might arise from the lower, intermediate and upper management scenarios that have been identified as reasonable alternatives.

²⁰⁸ MoD activities are reserved and therefore cannot be controlled or limited. MoD has its own best practice guidelines for meeting obligations.

²⁰⁹ All vessels except lifeline ferry services.

²¹⁰ Noisy activities include all activities which produce underwater noise which may disturb the protected features. This includes, but may not be limited to, construction activities (pile driving and blasting) and marine surveys (seismic, side-scan sonar, multibeam, sub-bottom profiling). MoD activities are reserved and therefore cannot be controlled or limited. MoD has its own best practice guidelines for meeting obligations.

Proposed protected features			
Biodiversity: Basking sharks; minke whales; fronts			
Geodiversity: marine geomorphology of the Scottish shelf seabed (<i>Inner Hebrides Carbonate Production Area</i>)			
Pressure/activity/impact pathway ²⁰⁷	Management scenario		
	Lower	Intermediate	Upper
Renewable energy	Current best practice used to minimise impacts on sandeel habitat.		Current best practice used to minimise impacts on sandeel habitat. Exclude development which could create a barrier to species movement in shark awareness zones.
Scientific survey/research	Survey work adhering to Scottish Marine Wildlife Watching Code (SMWWC) and current species licensing requirements.		
Wildlife tour operators	Follow existing best practice including Scottish Marine Wildlife Watching Code (SMWWC) and Wildlife Safe (WiSe) scheme.		Follow existing best practice including Scottish Marine Wildlife Watching Code (SMWWC) and Wildlife Safe (WiSe) scheme. Vessel speeds restricted to <6 knots within the 'shark awareness zones' between June and October.
Impact pathway	Management scenario		
	Lower	Intermediate	Upper
Potential benefits to habitats and species within the pMPA	In addition to the proposed protected features listed above, there are several other mobile features that occur within and around SOH pMPA, namely harbour porpoise, grey and harbour seals (including a number of breeding and seal haul out sites) and seabirds ^{211,212} . A number of PMFs have also been recorded within the site, namely northern feather star, white cluster anemone and northern sea fan and sponge communities ²¹³ .		
	The implementation of current best practice guidelines across a number of sectors (e.g. the development of Acoustic Deterrent Device (ADD) deployment plans at aquaculture sites) is unlikely to affect the environment as these guidelines are already followed in the management of existing licensed activities and are required to be followed as part of the licensing of new projects.	The implementation of current best practice guidelines across a number of sectors is unlikely to affect the environment as these guidelines are already followed in the management of existing licensed activities and are required to be followed as part of the licensing of new projects.	The implementation of current best practice guidelines across a number of sectors is unlikely to affect the environment as these guidelines are already followed in the management of existing licensed activities and are required to be followed as part of the licensing of new projects.
	The implementation of the Scottish Marine Wildlife Watching Code (SMWWC) for all boat use as part of the licensing process and for scientific survey work and wildlife tour operators will potentially reduce the future risk of collisions with and disturbance of cetaceans and basking shark.	Reducing the number of Acoustic Deterrent Devices (ADDs) at finfish aquaculture sites operating at mid or high frequencies would reduce the level of underwater noise disturbance to cetaceans and basking sharks. The scale of this benefit is minor in the immediate term given that there are currently six active finfish aquaculture sites within SOH pMPA. There is the potential for additional future benefits should any new finfish aquaculture sites be proposed at this site.	The replacement of all Acoustic Deterrent Devices (ADDs) at aquaculture sites with antipredator nets would remove any underwater noise disturbance to marine fauna. Assuming that antipredator nets follow best practice and minimise entanglement risk of marine fauna through appropriate mesh size and tensioning, the scale of this benefit is moderate in the immediate term given that there are currently six active finfish aquaculture sites within SOH pMPA. There is the potential for additional future benefits should any new finfish aquaculture sites be proposed at this site.
	In terms of bottom-contacting mobile gear, ScotMap data indicate that up to 3 under-15m vessels dredge for scallops and up to 21 under-15m vessels trawl for <i>Nephrops</i> within SOH pMPA. VMS analysis indicates there is relatively high intensity dredging for scallops and mobile gear fishing of <i>Nephrops</i> , and some low intensity demersal mobile fishing by over-12m vessels	The implementation of the Scottish Marine Wildlife Watching Code (SMWWC) for all boat use as part of the licensing process and for scientific survey work and wildlife tour operators will potentially reduce the	The implementation of the Scottish Marine Wildlife Watching Code (SMWWC) for all boat use as part of the licensing process and for scientific survey work and wildlife tour operators will potentially reduce the future

²¹¹ Dunn, T., 2012. JNCC seabird distribution and abundance data (all trips) from ESAS database.

²¹² Marine Scotland, 2018. The Marine Scotland MAPS NMPi (National Marine Plan interactive). Available at: <https://www2.gov.scot/Topics/marine/seamanagement/nmpihome> (accessed 01/11/2018)

²¹³ *ibid*

Proposed protected features			
Biodiversity: Basking sharks; minke whales; fronts			
Geodiversity: marine geomorphology of the Scottish shelf seabed (<i>Inner Hebrides Carbonate Production Area</i>)			
Pressure/activity/impact pathway ²⁰⁷	Management scenario		
	Lower	Intermediate	Upper
	<p>within the pMPA. The risk of bycatch of basking sharks is only potentially relevant for <i>Nephrops</i> trawling which utilises nets that skim over the seabed. Assuming that existing <i>Nephrops</i> trawlers are already following best practice in terms of reducing risk of entanglement there will be no immediate environmental benefit. There is potential for future environmental benefits as any fishers that use nets in this pMPA in future will need to adhere to best practice.</p> <p>There is no demersal static fishing (including by drift nets and set nets) within the pMPA boundary that has been reported in the ScotMap or VMS data. This suggests that this management scenario will not result in an immediate benefit in terms of reducing the risk of entanglement. ScotMap data indicate there are up to 3 under-15m vessels that undertake mackerel line fishing within SOH pMPA. VMS analysis indicates that there is some low to moderate intensity herring fishing in the eastern part of the pMPA and some very low intensity mackerel fishing to the west. Assuming that existing pelagic fisheries are already following best practice in terms of reducing risk of entanglement there will be no immediate environmental benefit. There is potential for future environmental benefits as any fishers that use nets in this pMPA in future will need to adhere to best practice.</p> <p>Overall, if the lower management scenario were to be implemented there will be no immediate benefit to habitats and species within the pMPA, but a greater potential for future benefits.</p>	<p>future risk of collisions with and disturbance of cetaceans and basking shark.</p> <p>In terms of coastal development, there are two harbours that are located close to sandeel habitat, namely Port Mòr on the Isle of Muck and at Eigg. Any dredging and/or disposal requirements for these harbours may overlap with and cause disturbance to sandeel habitat. The scale of these benefits is likely to be minor given the small size of these harbours. There is the potential for additional future benefits should any future coastal development overlap with sandeel habitat.</p> <p>The risk of bycatch of basking sharks is only potentially relevant for <i>Nephrops</i> trawling which utilises nets that skim over the seabed. Assuming that existing <i>Nephrops</i> trawlers are already following best practice in terms of reducing risk of entanglement there will be no immediate environmental benefit. There is potential for future environmental benefits as any fishers that use nets in this pMPA in future will need to adhere to best practice.</p> <p>The exclusion of hydraulic gear from sandeel habitat may result in a negligible to minor immediate benefit to the environment as there is only a negligible to low intensity of demersal mobile fishing that may use hydraulic gear and overlaps with the sandeel habitat in SOH pMPA. There is potential for future benefits as fishers will be restricted from using this gear on sandeel habitat.</p> <p>There is no sandeel fishery within the pMPA boundary that has been reported in the ScotMap or VMS data. This suggests that there will not be any initial benefit if target fishing for sandeel were excluded. However, there is potential for future benefits as any fishers will be restricted from setting up a fishery or targeting sandeel within the pMPA.</p>	<p>risk of collisions with and disturbance of cetaceans and basking shark.</p> <p>Restricting vessel speeds to <6 knots within the 'shark awareness zones' between June and October will reduce the risk of collisions and disturbance of cetaceans and marine fauna, in particular basking sharks which occur in large numbers in these zones during this period. The scale of this benefit will be moderate as there are four harbours located within these 'shark awareness zones'.</p> <p>The cessation of all noisy activities within SOH pMPA during the minke whale and basking shark high season (April-October) will avoid any underwater noise disturbance to marine fauna from construction activities and marine surveys during this period. The scale of these benefits will depend on the nature and location of noisy activities. In terms of marine survey sources, side-scan and multibeam generate the lowest estimated sensation levels for all marine mammal species groups and sub-bottom profiling and seismic airguns generate levels that mysticetes (i.e. baleen whales such as minke whales) are most likely to hear²¹⁴. Overall, marine surveys generate shorter periods of relatively low levels of noise and therefore will only provide minor and localised benefits to the environment. In terms of construction activities, an Offshore Wind Plan AoS overlaps with the boundary of SOH pMPA. There is potential for future environmental benefits if offshore wind farm development is restricted from undertaking noisy activities (e.g. percussive piling and blasting) during this sensitive period.</p> <p>In terms of coastal development, there are two harbours that are located close to sandeel habitat, namely Port Mòr on the Isle of Muck and at Eigg. Any dredging and/or disposal requirements for these harbours may overlap with and cause disturbance to sandeel habitat. The scale of these benefits is likely to be minor given the small size of these harbours. There is the potential for additional future benefits should any</p>

²¹⁴ MacGillivray, A.O., Racca, R. and Zizheng, L., 2014. Marine mammal audibility of selected shallow-water survey sources. Available at: <https://asa.scitation.org/doi/10.1121/1.4838296> (accessed 02/11/2018)

Proposed protected features			
Biodiversity: Basking sharks; minke whales; fronts			
Geodiversity: marine geomorphology of the Scottish shelf seabed (<i>Inner Hebrides Carbonate Production Area</i>)			
Pressure/activity/impact pathway ²⁰⁷	Management scenario		
	Lower	Intermediate	Upper
		<p>There is no demersal static fishing within the pMPA boundary that has been reported in the ScotMap or VMS data. This suggests that this management scenario will not result in an immediate benefit in terms of reducing the risk of entanglement by following best practice or by excluding drift nets and set nets between April and October in 'shark awareness zones'. There is the potential for future environmental benefits as any fishers that use nets in this pMPA in future will need to avoid fishing in sensitive areas during this sensitive period.</p> <p>Assuming that existing pelagic fisheries are already following best practice in terms of reducing risk of entanglement there will be no immediate environmental benefit. There is potential for future environmental benefits as any fishers that use nets in this pMPA in future will need to adhere to best practice.</p> <p>Overall, if the intermediate management scenario were to be implemented there will be a minor immediate benefit to habitats and species within the pMPA, and a greater potential for future benefits.</p>	<p>future coastal development overlap with sandeel habitat.</p> <p>The risk of bycatch of basking sharks is only potentially relevant for <i>Nephrops</i> trawling which utilises nets that skim over the seabed. Assuming that existing <i>Nephrops</i> trawlers are already following best practice in terms of reducing risk of entanglement there will be no immediate environmental benefit. There is potential for future environmental benefits as any fishers that use nets in this pMPA in future will need to adhere to best practice.</p> <p>The exclusion of hydraulic gear from sandeel habitat may result in a negligible to minor immediate benefit to the environment as there is only a negligible to low intensity of demersal mobile fishing that may use hydraulic gear and overlaps with the sandeel habitat in SOH pMPA. There is potential for future benefits as fishers will be restricted from using this gear on sandeel habitat.</p> <p>There is no sandeel fishery within the pMPA boundary that has been reported in the ScotMap or VMS data. This suggests that there will not be any initial benefit if target fishing for sandeel was excluded. However, there is potential for future benefits as any fishers will be restricted from setting up a fishery or targeting sandeel within the pMPA.</p> <p>There is no demersal static fishing within the pMPA boundary that has been reported in the ScotMap or VMS data. This suggests that this management scenario will not result in an immediate benefit in terms of reducing the risk of entanglement by following best practice or by excluding drift nets and set nets between April and October. There is the potential for future environmental benefits as any fishers that use nets in this pMPA in future will need to avoid fishing during this sensitive period.</p> <p>Assuming that existing pelagic fisheries are already following best practice in terms of reducing risk of entanglement, there will be no immediate environmental benefit. There is potential for future</p>

Proposed protected features			
Biodiversity: Basking sharks; minke whales; fronts			
Geodiversity: marine geomorphology of the Scottish shelf seabed (<i>Inner Hebrides Carbonate Production Area</i>)			
Pressure/activity/impact pathway ²⁰⁷	Management scenario		
	Lower	Intermediate	Upper
			<p>environmental benefits as any fishers that use nets in this pMPA in future will need to adhere to best practice.</p> <p>Limiting herring and sprat fishing effort to current levels will limit any potential further risk of entanglement in future. The scale of this benefit will depend on how the fishery might evolve in the absence of this measure (future baseline) which is not possible to reliably predict.</p> <p>The siting of any new marine disposal sites will need to minimise impacts on sandeel habitat. The harbours that are located adjacent to sandeel habitat in the SOH pMPA are very small and unlikely to require new disposal sites to be licenced. However, this management scenario does provide greater direction and enhanced protection should any new marine disposal sites be licensed in future.</p> <p>Overall, if the upper management scenario were to be implemented there will be a moderate immediate benefit to habitats and species within the pMPA, and a greater potential for future benefits.</p>
Potential spillover benefits beyond pMPA site boundaries	<p>The lower management scenario will not limit or restrict any human pressures/activities and therefore there will be no potential spillover benefits.</p> <p>Overall, if the lower management scenario were to be implemented there will be no spillover benefits.</p>	<p>Restricting certain harmful activities in sensitive areas may result in the potential spillover of species from protected areas into unprotected areas if there is a population surplus and the carrying capacity of the protected area is surpassed^{215,216}. There is, however, variation in the level of effectiveness and scale of benefits that restrictions can have and these are site dependent²¹⁷. The current conditions encountered within a site (e.g. current stock level, species present, and nursery and spawning areas for those species) need to be characterised in order to be able to undertake a detailed assessment of the potential for spillover benefits to occur.</p> <p>There is evidence to suggest that SOH pMPA supports spawning and/or nursery grounds for</p>	<p>Same as intermediate management scenario.</p>

²¹⁵ Buxton, C.D., Hartmann, K., Kearney, R. and Gardner, C., 2014. When is spillover from marine reserves likely to benefit fisheries?. PloS One, 9(9), p.e107032.

²¹⁶ Kerwath, S.E., Winker, H., Götz, A. and Attwood, C.G., 2013. Marine protected area improves yield without disadvantaging fishers. Nature Communications, 4, p.2347.

²¹⁷ Starr, R.M., Wendt, D.E., Barnes, C.L., Marks, C.I., Malone, D., Waltz, G., Schmidt, K.T., Chiu, J., Launer, A.L., Hall, N.C. and Yochum, N., 2015. Variation in responses of fishes across multiple reserves within a network of marine protected areas in temperate waters. PloS one, 10(3), p.e0118502.

Proposed protected features			
Biodiversity: Basking sharks; minke whales; fronts			
Geodiversity: marine geomorphology of the Scottish shelf seabed (<i>Inner Hebrides Carbonate Production Area</i>)			
Pressure/activity/impact pathway ²⁰⁷	Management scenario		
	Lower	Intermediate	Upper
		<p>several fish species, including whiting, sprat, sandeel, saithe, plaice, <i>Nephrops</i>, mackerel, herring and cod but at unknown densities^{218,219}. Scallops are broadcast spawners and as there is a current scallop fishery, it is considered also to be a spawning area for scallops.</p> <p>Taking account of the nature and scale of existing human pressures/activities at SOH pMPA, spillover benefits from the restriction of certain human pressures/activities (e.g. excluding hydraulic gear from sandeel habitat, and excluding targeted fishing for sandeel) are likely to be negligible in the immediate term with the potential to be more significant in the long term.</p> <p>Overall, if the intermediate management scenario were to be implemented the spillover benefits are likely to be negligible in the immediate term, with a potential for greater benefits in the future.</p>	
Potential adverse environmental effects resulting from the displacement of activities and the intensification of activities in areas where they already occur	<p>The lower management scenario will not limit or restrict any human pressures/activities and therefore there will be no potential adverse environmental effects resulting from the displacement of activities.</p> <p>Overall, if the lower management scenario were to be implemented there will be no potential adverse environmental effects associated with the displacement of activities.</p>	<p>The existing scale of pressure from the activities that are restricted by this management scenario (i.e. exclusion of hydraulic gear from sandeel habitat, excluding targeted fishing for sandeel, exclusion of drift nets and set nets between April and October in 'shark awareness zones') is negligible to low; VMS analysis indicates that the intensity of demersal mobile fishing that may use hydraulic gear and overlap with the sandeel grounds in the pMPA is negligible to low, and there is no sandeel fishery or drift nets and set nets within the pMPA boundary. The scale of any displacement of these fishing activities will therefore be negligible to low.</p> <p>The distance needed to access areas that are already exploited by these fisheries outside of the protected sandeel grounds is small. The environmental effect of the displacement and intensification of fishing activity is therefore considered to be negligible given that the habitat and species in the areas that the fishing will be displaced</p>	<p>The existing scale of pressure from the activities that are restricted by this management scenario (i.e. exclusion of hydraulic gear from sandeel habitat, excluding targeted fishing for sandeel, exclusion of drift nets and set nets between April and October across sites, limiting herring and sprat fishing effort to current levels and noisy activities during minke whale and basking shark high season) is negligible to low. VMS analysis indicates that the intensity of demersal mobile fishing that may use hydraulic gear and overlap with the sandeel grounds in the pMPA is negligible to low, and there is no sandeel fishery or drift nets and set nets within the pMPA boundary. The scale of existing noisy activities from marine survey work is small and this activity is unlikely to be displaced by a temporal restriction. Any displacement is therefore limited to fishing activities, the scale of which will be negligible to low.</p> <p>The distance needed to access areas that are already exploited by these fisheries outside of the protected</p>

²¹⁸ Coull, K.A., Johnstone, R. and Rogers, S.I., 1998. Fisheries Sensitivity Maps in British Waters. Published and distributed by UKOOA Ltd., v + 58 pp.

²¹⁹ Ellis, J.R., Milligan, S.P., Readdy, L., Taylor, N. and Brown, M.J. 2012. Spawning and nursery grounds of selected fish species in UK waters. Cefas Science Series Technical Report 147.

Proposed protected features			
Biodiversity: Basking sharks; minke whales; fronts			
Geodiversity: marine geomorphology of the Scottish shelf seabed (<i>Inner Hebrides Carbonate Production Area</i>)			
Pressure/activity/impact pathway ²⁰⁷	Management scenario		
	Lower	Intermediate	Upper
		<p>to have a community composition that is already characterised by this pressure/activity.</p> <p>Overall, if the intermediate management scenario were to be implemented the potential environmental effect of any displacement and intensification of activities in areas where they already occur will be negligible.</p>	<p>sandeel grounds is small. The environmental effect of the displacement and intensification of fishing activity is therefore considered to be negligible given that the habitat and species in the areas that the fishing will be displaced to have a community composition that is already characterised by this pressure/activity.</p> <p>Overall, if the upper management scenario were to be implemented the potential environmental effect of any displacement and intensification of activities in areas where they already occur will be negligible.</p>
Potential environmental impact of increased fishing effort from other gear types that might not be targeted by the management scenario within the pMPA	<p>The lower management scenario will not limit or restrict any human pressures/activities and therefore there will be no potential adverse environmental effects resulting from increased fishing effort from other gear types that are not targeted.</p> <p>Overall, if the lower management scenario were to be implemented there will be no potential adverse environmental effects associated with changes in gear types.</p>	<p>The ScotMap data and VMS analysis indicates that the main fishing methods that occur within the pMPA are dredging for scallops, trawling for <i>Nephrops</i>, pelagic fishing and creeling. Assuming that <i>Nephrops</i> trawlers and pelagic fisheries already adhere to best practice, this management scenario will not affect the main fishing activities that currently occur in the pMPA. It is considered unlikely that any existing fisheries using the restricted gear (i.e. hydraulic gear) in sandeel grounds would alter their gear type to one of the other methods as there would still be areas within and outwith the MPA where they can fish.</p> <p>Overall, the intermediate management scenario is unlikely to increase the fishing intensity of the non-targeted fishing gears and therefore the environmental impact is considered to be negligible.</p>	<p>Same as intermediate management scenario.</p>
Overall (cumulative) assessment	<p>The lower management scenario for SOH pMPA will have no immediate impact on the environment but a greater potential for future benefits. Assuming that best practice is being followed by existing activities there will be no immediate benefits to habitat and species within the pMPA. The lower management scenario will not limit or restrict any human pressures/activities and therefore there will be no potential spillover benefits, no potential adverse environmental effects resulting from the displacement of activities and no potential adverse environmental effects resulting from increased fishing effort from other gear types that are not targeted.</p>	<p>The intermediate management scenario for SOH pMPA will have an overall minor immediate beneficial impact on the environment and a greater potential for future benefits. There are currently six active finfish aquaculture sites within SOH pMPA and therefore reducing the number of Acoustic Deterrent Devices (ADDs) at these sites that operate at mid or high frequencies would result in an immediate minor benefit to the environment. There are two harbours located close to sandeel habitat and therefore the scale of immediate benefits associated with reducing disturbance to sandeel habitat is considered minor. The existing scale of activities that will be prohibited by the measures (namely hydraulic gear fishing in sandeel grounds,</p>	<p>The upper management scenario for SOH pMPA will have an overall moderate immediate beneficial impact on the environment and a greater potential for future benefits. There are currently six active finfish aquaculture sites operating within SOH pMPA and therefore replacing all Acoustic Deterrent Devices (ADDs) with antipredator nets has the potential to result in an immediate moderate benefit to the environment if these follow best practice. There are four harbours located in the 'shark awareness zones' and therefore reducing vessel speeds within these zones during sensitive periods will result in an immediate moderate benefit to basking sharks and the wider environment. There are two harbours located close to sandeel habitat and therefore the scale of</p>

Proposed protected features			
Biodiversity: Basking sharks; minke whales; fronts			
Geodiversity: marine geomorphology of the Scottish shelf seabed (<i>Inner Hebrides Carbonate Production Area</i>)			
Pressure/activity/impact pathway ²⁰⁷	Management scenario		
	Lower	Intermediate	Upper
		targeted fishing for sandeel and exclusion of drift nets and set nets between April and October in 'shark awareness zones') is negligible to low, but their exclusion will potentially provide some negligible to minor benefits to habitats and associated species. The scale of these benefits is unlikely to result in significant spillover benefits outside the boundaries of SOH pMPA. The adverse impacts on the environment will be negligible as a direct impact of displacement as the amount of effort displaced will be very small and the areas into which effort is likely to be displaced are already fished and thus have a community composition that is already characterised by fishing pressures. Furthermore, a change in fishing effort from targeted to non-targeted fishing gears (e.g. from hydraulic gear to creeling) is considered unlikely given that there would still be areas within and outwith SOH pMPA that are available for targeted fisheries to fish. Therefore, the benefit of protection is likely to be greater than the negative impacts associated with displacement.	immediate benefits associated with reducing disturbance to sandeel habitat is considered minor. The existing scale of activities that will be prohibited or restricted by the measures (namely noisy activities during basking shark high season, hydraulic gear fishing in sandeel grounds, targeted fishing for sandeel, exclusion of drift nets and set nets between April and October across site, and limiting herring and sprat fishing effort to current levels) are negligible to low, but their regulation will provide some negligible to minor benefits to habitats and species. The scale of these benefits is unlikely to result in significant spillover benefits outside the boundaries of SOH pMPA. The adverse impacts on the environment will be negligible as a direct impact of displacement as the amount of fishing effort displaced will be very small and the areas into which effort is likely to be displaced are already fished and thus have a community composition that is already characterised by fishing pressures. Furthermore, a change in fishing effort from targeted to non-targeted fishing gears (e.g. from hydraulic gear to creeling) is considered unlikely given that there would still be areas outwith SOH pMPA that are available for targeted fisheries to fish. Therefore, the benefit of protection is likely to be greater than the negative impacts associated with displacement.
SEA Objective 1 - To safeguard and enhance marine and coastal ecosystems, including species, habitats, and their interactions	The lower management scenario will not result in an immediate beneficial contribution to SEA Objective 1 but will potentially result in a greater beneficial contribution to this SEA objective in the future through affording enhanced protection to the environment from future activities.	A reduction in existing pressures/activities (i.e. reducing number of Acoustic Deterrent Devices (ADDs) at finfish aquaculture sites operating at mid or high frequencies, minimising footprint of coastal development and excluding hydraulic gear fishing on sandeel grounds) will result in an overall minor immediate beneficial contribution to SEA Objective 1. The intermediate management scenario will provide enhanced protection to the environment from future activities and therefore will potentially result in a greater beneficial contribution to this SEA objective in the future.	A reduction in existing pressures/activities (i.e. replacing all Acoustic Deterrent Devices (ADDs) with antipredator nets, reducing vessel speeds in 'shark awareness zones', minimising footprint of coastal development, cessation of noisy activities during sensitive periods, and excluding hydraulic gear fishing on sandeel grounds) will result in an overall moderate immediate beneficial contribution to SEA Objective 1. The upper management scenario will provide enhanced protection to the environment from future activities and therefore will potentially result in a greater beneficial contribution to this SEA objective in the future.
SEA Objective 2 - To maintain and protect the character and integrity of the seabed	The lower management scenario will not result in an immediate beneficial contribution to SEA Objective 2 but will potentially result in a greater beneficial contribution to this SEA objective in the future through affording enhanced protection to the environment from future activities.	A reduction in existing pressures/activities that interact with the seabed (i.e. minimising footprint of coastal development and excluding hydraulic gear fishing on sandeel grounds) will result in an overall minor immediate beneficial contribution to SEA Objective 2. The intermediate management scenario will provide enhanced protection to the environment	A reduction in existing pressures/activities that interact with the seabed (i.e. minimising footprint of coastal development and excluding hydraulic gear fishing on sandeel grounds) will result in an overall minor immediate beneficial contribution to SEA Objective 2. Replacing all Acoustic Deterrent Devices (ADDs) with antipredator nets may increase interaction with the

Proposed protected features			
Biodiversity: Basking sharks; minke whales; fronts			
Geodiversity: marine geomorphology of the Scottish shelf seabed (<i>Inner Hebrides Carbonate Production Area</i>)			
Pressure/activity/impact pathway ²⁰⁷	Management scenario		
	Lower	Intermediate	Upper
		from future activities and therefore will potentially result in a greater beneficial contribution to this SEA objective in the future.	seabed if these nets are moored to the seabed; however, the scale of this interaction will be negligible and unlikely to affect the character or integrity of the seabed. The upper management scenario will provide enhanced protection to the environment from future activities and therefore will potentially result in a greater beneficial contribution to this SEA objective in the future.
SEA Objective 3 - To avoid the pollution of seabed strata and/or bottom sediments	The lower management scenario will not result in an immediate beneficial contribution to SEA Objective 3 but will potentially result in a greater beneficial contribution to this SEA objective in the future through affording enhanced protection to the environment from future activities.	The intermediate management scenario has the potential to reduce the redistribution and settling of any contaminated seabed sediments that are disturbed as an indirect effect of minimising the footprint of coastal development and excluding hydraulic gear fishing on sandeel grounds. Given that sandeel habitat is predominantly gravelly, sandy and dynamic in nature and therefore unlikely to be contaminated, the potential contribution to SEA Objective 3 is considered to be negligible.	Same as intermediate management scenario.
SEA Objective 4 - To avoid pollution of the coastal and marine water environment	The lower management scenario will not result in an immediate beneficial contribution to SEA Objective 4 but will potentially result in a greater beneficial contribution to this SEA objective in the future through affording enhanced protection to the environment from future activities.	The intermediate management scenario has the potential to reduce pollution of the coastal and marine water environment due to a reduction in suspended sediments as an indirect effect of minimising the footprint of coastal development and excluding hydraulic gear fishing on sandeel grounds. The contribution to SEA Objective 4 of this immediate benefit is minor. The intermediate management scenario will provide enhanced protection to the environment from future activities and therefore will result in a greater beneficial contribution to this SEA objective in the future.	Same as intermediate management scenario.
SEA Objective 5 - To maintain or work towards achieving 'Good Ecological Status' and 'Good Environmental Status' of water bodies	The lower management scenario will not result in an immediate beneficial contribution to SEA Objective 5 but will potentially result in a greater beneficial contribution to this SEA objective in the future through affording enhanced protection to the environment from future activities.	A reduction in existing pressures/activities (i.e. reducing number of Acoustic Deterrent Devices (ADDs) at finfish aquaculture sites operating at mid or high frequencies, minimising footprint of coastal development and excluding hydraulic gear fishing on sandeel grounds) will support the quality elements used to assess 'Good Ecological Status' and the qualitative descriptions used to determine 'Good Environmental Status'. Based on the outcomes of assessing SEA Objectives 1-4 above, it is considered that there is potential for an overall minor immediate beneficial contribution to SEA Objective 5 in terms of the WFD water bodies and MSFD marine region that overlap with the site. The intermediate management scenario will provide enhanced	A reduction in existing pressures/activities (i.e. replacing all Acoustic Deterrent Devices (ADDs) with antipredator nets, reducing vessel speeds in 'shark awareness zones', minimising footprint of coastal development, cessation of noisy activities during sensitive periods, and excluding hydraulic gear fishing on sandeel grounds) will support the quality elements used to assess 'Good Ecological Status' and the qualitative descriptions used to determine 'Good Environmental Status'. Based on the outcomes of assessing SEA Objectives 1-4 above, it is considered that there is potential for an overall minor immediate beneficial contribution to SEA Objective in terms of the WFD water bodies and MSFD marine region that overlap with the site. The upper management scenario

Proposed protected features			
Biodiversity: Basking sharks; minke whales; fronts			
Geodiversity: marine geomorphology of the Scottish shelf seabed (<i>Inner Hebrides Carbonate Production Area</i>)			
Pressure/activity/impact pathway ²⁰⁷	Management scenario		
	Lower	Intermediate	Upper
		protection to the environment from future activities and therefore will potentially result in a greater beneficial contribution to this SEA objective in the future.	will provide enhanced protection to the environment from future activities and therefore will potentially result in a greater beneficial contribution to this SEA objective in the future.
SEA Objective 6 - To preserve and enhance existing marine carbon stocks and carbon sequestration potential	The lower management scenario will not result in an immediate beneficial contribution to SEA Objective 6 but will potentially result in a greater beneficial contribution to this SEA objective in the future, given there are habitats within SOH pMPA that are blue carbon sinks (e.g. kelp beds, maerl beds, seagrass beds), through affording enhanced protection to the environment from future activities.	Same as lower management scenario.	Same as lower management scenario.

Table C3 Shiant East Bank (SEB) assessment

Proposed protected features			
Biodiversity: Circalittoral sands and mixed sediment communities; northern sea fan and sponge communities; shelf banks and mounds			
Geodiversity: Quaternary of Scotland (<i>drumlinoid forms, glacial lineations, iceberg ploughmarks, streamlined bedrock</i>)			
Pressure/activity/impact pathway ²²⁰	Management scenario		
	Lower	Intermediate	Upper
Cables/pipelines	Follow existing best practice and licensing process for installation of new cables/pipelines by minimising disturbance to circalittoral sands and mixed sediment communities and northern sea fan and sponge communities.		Follow existing best practice and licensing process for installation of new cables/pipelines by minimising disturbance to circalittoral sands and mixed sediment communities and northern sea fan and sponge communities. New cable/pipeline routes should avoid northern sea fan and sponge communities.
Fishing (bottom-contacting mobile gear)	No additional management.	Exclusion of mobile/active gear from northern sea fan and sponge communities. Exclude mobile gear from 20% of circalittoral sand.	Exclusion of mobile/active gear from northern sea fan and sponge communities. Exclude mobile gear from 40% of circalittoral sand.
Scientific survey/research	Best practice adopted to minimise effects on sensitive sea fan and sponge communities, and circalittoral sand.		
Impact pathway	Management scenario		
	Lower	Intermediate	Upper
Potential benefits to habitats and species within the pMPA	In addition to the proposed protected features listed above, there are several other ecological features that occur within and around SEB pMPA, including harbour porpoise, seabirds and a very low number of grey and harbour seals ^{221,222} . The ocean quahog which is a PMF has also been recorded within the site ²²³ .		
	<p>The implementation of current best practice guidelines for the installation of new cables/pipelines and scientific survey/research is unlikely to affect the environment as these guidelines are already followed in the management of existing licensed activities and are required to be followed as part of the licensing of new projects.</p> <p>Overall, if the lower management scenario were to be implemented there will be no benefit to habitats and species within the pMPA.</p>	<p>The implementation of current best practice guidelines for the installation of new cables/pipelines and scientific survey/research is unlikely to affect the environment as these guidelines are already followed in the management of existing licensed activities and are required to be followed as part of the licensing of new projects.</p> <p>In terms of bottom-contacting mobile gear, ScotMap data indicate that up to 21 under-15m vessels trawl for <i>Nephrops</i> within SEB pMPA. VMS analysis indicates there is a very low intensity dredging for scallops, high intensity mobile gear fishing of <i>Nephrops</i>, and very low intensity demersal mobile fishing by over-12m vessels within the pMPA. Trawling is likely to remove or severely damage northern sea fan and sponge communities and this habitat is considered to have a low tolerance to this activity²²⁴. Recovery of dislodged sea fans is unlikely,</p>	<p>The implementation of current best practice guidelines for the installation of new cables/pipelines and scientific survey/research is unlikely to affect the environment as these guidelines are already followed in the management of existing licensed activities and are required to be followed as part of the licensing of new projects.</p> <p>There is one existing telecom cable within SEB pMPA that intersects northern sea fan and sponge communities habitat. When this cable requires replacing in future, it is likely to be advised that it should be routed to avoid this sensitive habitat. Most of the characterising species of this protected habitat are sessile and attached to rock/boulders, so cable burial is not feasible and mattressing/grout bags/rock dumping may be used. The addition of artificial hard substrate is likely to cause damage to species immediately under the footprint of the cable protection, although in time</p>

²²⁰ Further to the potential benefits afforded by the designation of the pMPAs described in Section 5.2 of the main report, this table presents a detailed assessment of all the potential additional environmental effects that might arise from the lower, intermediate and upper management scenarios that have been identified as reasonable alternatives.

²²¹ Dunn, T., 2012. JNCC seabird distribution and abundance data (all trips) from ESAS database.

²²² Marine Scotland, 2018. The Marine Scotland MAPS NMPI (National Marine Plan interactive). Available at: <https://www2.gov.scot/Topics/marine/seamanagement/nmpihome> (accessed 01/11/2018)

²²³ ibid

²²⁴ Scottish Government, 2018. Feature Activity Sensitivity Tool (FEAST). Available at: <https://www.marine.scotland.gov.uk/feast/Index.aspx> (accessed 07/11/2018)

Proposed protected features			
Biodiversity: Circalittoral sands and mixed sediment communities; northern sea fan and sponge communities; shelf banks and mounds			
Geodiversity: Quaternary of Scotland (<i>drumlinoid forms, glacial lineations, iceberg ploughmarks, streamlined bedrock</i>)			
Pressure/activity/impact pathway ²²⁰	Management scenario		
	Lower	Intermediate	Upper
		<p>and these colonies will probably die. Settlement of new colonies is dependent on recruitment and larval supply, which is low, therefore recoverability is assessed as very low. Most sponges, however, tend to be slow growing and long lived and therefore their recoverability is likely to be low. The exclusion of mobile/active gear from northern sea fan and sponge communities habitat may result in a moderate immediate benefit to the environment as there is a low intensity of mobile/active gear (namely <i>Nephrops</i> trawling) that overlaps with this highly sensitive habitat in SEB pMPA. There is potential for future benefits as fishers will be restricted from using this gear on this sensitive habitat.</p> <p>The exclusion of existing mobile gear from 20% of circalittoral sand is likely to provide an overall negligible immediate benefit to the environment as there is a high intensity of mobile gear fishing (namely <i>Nephrops</i> trawling) in only a very small proportion (around 20%) of this protected habitat in the SEB pMPA. There is potential for future benefits as any mobile gear fishers will be restricted from setting up a fishery within the pMPA.</p> <p>Overall, if the intermediate management scenario were to be implemented there will be a moderate immediate benefit to habitats and species within the pMPA, and a greater potential for future benefits.</p>	<p>may provide additional substrate on which species could re-colonise depending on circumstances. Although only a short section of northern sea fan and sponge communities habitat covering a length of approximately 1km will be avoided by rerouting the existing telecom cable when it is replaced, the scale of benefit of avoiding this protected feature is considered to be moderate given the high sensitivity of this habitat to physical damage²²⁵. There is also the potential for additional future benefits as any future cables/pipelines that transect SEB pMPA will also need to avoid northern sea fan and sponge communities habitat.</p> <p>The exclusion of mobile/active gear from northern sea fan and sponge communities habitat may result in a moderate immediate benefit to the environment as there is a low intensity of mobile/active gear (namely <i>Nephrops</i> trawling) that overlaps with this highly sensitive habitat in the SEB pMPA. There is potential for future benefits as fishers will be restricted from using this gear on this sensitive habitat.</p> <p>The exclusion of existing mobile gear from 40% of circalittoral sand is likely to provide an overall negligible immediate benefit to the environment as there is a high intensity of mobile gear fishing (namely <i>Nephrops</i> trawling) in only a very small proportion (around 20%) of this protected habitat in the SEB pMPA. There is potential for future benefits as any mobile gear fishers will be restricted from setting up a fishery within the pMPA.</p> <p>Overall, if the upper management scenario were to be implemented there will be a moderate immediate benefit to habitats and species within the pMPA, and a greater potential for future benefits.</p>
Potential spillover benefits beyond pMPA site boundaries	The lower management scenario will not limit or restrict any human pressures/activities and therefore there will be no potential spillover benefits.	Restricting certain harmful activities in sensitive areas may result in the potential spillover of species from protected areas into unprotected areas if there is a population surplus and the carrying capacity of the protected area is surpassed ^{226,227} . There is,	Same as intermediate management scenario.

²²⁵ Scottish Government, 2018. Feature Activity Sensitivity Tool (FEAST). Available at: <https://www.marine.scotland.gov.uk/feast/Index.aspx> (accessed 07/11/2018)

²²⁶ Buxton, C.D., Hartmann, K., Kearney, R. and Gardner, C., 2014. When is spillover from marine reserves likely to benefit fisheries?. PloS One, 9(9), p.e107032.

²²⁷ Kerwath, S.E., Winker, H., Götz, A. and Attwood, C.G., 2013. Marine protected area improves yield without disadvantaging fishers. Nature Communications, 4, p.2347.

Proposed protected features			
Biodiversity: Circalittoral sands and mixed sediment communities; northern sea fan and sponge communities; shelf banks and mounds			
Geodiversity: Quaternary of Scotland (<i>drumlinoid forms, glacial lineations, iceberg ploughmarks, streamlined bedrock</i>)			
Pressure/activity/impact pathway ²²⁰	Management scenario		
	Lower	Intermediate	Upper
	<p>Overall, if the lower management scenario were to be implemented there will be no spillover benefits.</p>	<p>however, variation in the level of effectiveness and scale of benefits that restrictions can have and these are site dependent²²⁸. The current conditions encountered within a site (e.g. current stock level, species present, and nursery and spawning areas for those species) need to be characterised in order to be able to undertake a detailed assessment of the potential for spillover benefits to occur.</p> <p>There is evidence to suggest that SEB pMPA supports spawning and/or nursery grounds for several fish species, including whiting, sprat, sandeel, Norway pout, <i>Nephrops</i>, lemon sole and cod but at unknown densities^{229,230}. Scallops are broadcast spawners and as there is a current scallop fishery, it is considered also to be a spawning area for scallops.</p> <p>Taking account of the nature and scale of existing human pressures/activities at SEB pMPA, spillover benefits from the restriction of certain human pressures/activities (i.e. excluding mobile/active gear from northern sea fan and sponge communities and from 20% of circalittoral sand) are likely to be minor in the immediate term with the potential to be more significant in the long term.</p> <p>Overall, if the intermediate management scenario were to be implemented the spillover benefits are likely to be minor in the immediate term, with a potential for greater benefits in the future.</p>	
Potential adverse environmental effects resulting from the displacement of activities and the intensification of activities in areas where they already occur	<p>The lower management scenario will not limit or restrict any human pressures/activities and therefore there will be no potential adverse environmental effects resulting from the displacement of activities.</p> <p>Overall, if the lower management scenario were to be implemented there will be no potential adverse environmental effects associated with the displacement of activities.</p>	<p>The existing scale of pressure from the activities that are restricted by this management scenario (i.e. excluding mobile/active gear from northern sea fan and sponge communities and from 20% circalittoral sand) is low; VMS analysis indicates that the intensity of mobile gear fishing that overlaps with the northern sea fan and sponge communities in the pMPA is low, and there is a high intensity of mobile gear fishing in a small proportion of circalittoral sand within the pMPA boundary. The scale of any</p>	<p>The existing scale of pressure from the activities that are restricted by this management scenario (i.e. new cable/pipeline routes that avoid northern sea fan and sponge communities, excluding mobile/active gear from northern sea fan and sponge communities and from 40% of circalittoral sand) is moderate.</p> <p>The section of existing telecom cable that occurs within the site and will need to be replaced at the end of its lifetime is relatively short (less than 1km) and will need</p>

²²⁸ Starr, R.M., Wendt, D.E., Barnes, C.L., Marks, C.I., Malone, D., Waltz, G., Schmidt, K.T., Chiu, J., Launer, A.L., Hall, N.C. and Yochum, N., 2015. Variation in responses of fishes across multiple reserves within a network of marine protected areas in temperate waters. PloS one, 10(3), p.e0118502.

²²⁹ Coull, K.A., Johnstone, R. and Rogers, S.I., 1998. Fisheries Sensitivity Maps in British Waters. Published and distributed by UKOOA Ltd., v + 58 pp.

²³⁰ Ellis, J.R., Milligan, S.P., Readdy, L., Taylor, N. and Brown, M.J. 2012. Spawning and nursery grounds of selected fish species in UK waters. Cefas Science Series Technical Report 147.

Proposed protected features			
Biodiversity: Circalittoral sands and mixed sediment communities; northern sea fan and sponge communities; shelf banks and mounds			
Geodiversity: Quaternary of Scotland (<i>drumlinoid forms, glacial lineations, iceberg ploughmarks, streamlined bedrock</i>)			
Pressure/activity/impact pathway ²²⁰	Management scenario		
	Lower	Intermediate	Upper
		<p>displacement of these fishing activities will therefore be low.</p> <p>The distance needed to access areas that are already exploited by these fisheries outside of the protected northern sea fan and sponge communities and circalittoral sand is small. The environmental effect of a low level of displacement and intensification of fishing activity is therefore considered to be negligible given that the habitat and species in the areas that the fishing will be displaced to have a community composition that is already characterised by this pressure/activity.</p> <p>Overall, if the intermediate management scenario were to be implemented the potential environmental effect of any displacement and intensification of activities in areas where they already occur will be negligible.</p>	<p>to intersect circalittoral sands and mixed sediment communities which are considered to have a low to medium sensitivity to low siltation changes and abrasion²³¹ and recover relatively rapidly from physical disturbance²³². Future cables/pipelines that transect SEB pMPA may also be routed through circalittoral sands and mixed sediment communities. The potential impacts of cable/pipeline installation and use are likely to be short-term and the impacts on the seabed will remain local. The environmental effect of the displacement of cables/pipelines is therefore considered to be minor.</p> <p>VMS analysis indicates that the intensity of mobile gear fishing that overlaps with the northern sea fan and sponge communities in the pMPA is low, and there is a high intensity of mobile gear fishing in a small proportion of circalittoral sand within the pMPA boundary. The scale of any displacement of these fishing activities will therefore be low.</p> <p>The distance needed to access areas that are already exploited by these fisheries outside of the protected northern sea fan and sponge communities and circalittoral sand is small. The environmental effect of the low level of displacement and intensification of fishing activity is therefore considered to be negligible given that the habitat and species in the areas that the fishing will be displaced to have a community composition that is already characterised by this pressure/activity.</p> <p>Overall, if the upper management scenario were to be implemented the potential environmental effect of any displacement and intensification of activities in areas where they already occur will be minor.</p>
Potential environmental impact of increased fishing effort from other gear types that might not be targeted by the management scenario within the pMPA	The lower management scenario will not limit or restrict any human pressures/activities and therefore there will be no potential adverse environmental effects resulting from increased fishing effort from other gear types that are not targeted.	The ScotMap data and VMS analysis indicates that the main fishing method that occurs within the pMPA is trawling for <i>Nephrops</i> , with some low intensity dredging for scallops, pelagic fishing and creeling. It is considered unlikely that any existing fisheries using the restricted gear (i.e. mobile/active gear) in northern sea fan and sponge communities and	Same as intermediate management scenario.

²³¹ Scottish Government, 2018. Feature Activity Sensitivity Tool (FEAST). Available at: <https://www.marine.scotland.gov.uk/feast/Index.aspx> (accessed 07/11/2018)

²³² JNCC and Natural England, 2011. General advice on assessing potential impacts of and mitigation for human activities on Marine Conservation Zone (MCZ) features, using existing regulation and legislation. Advice from the Joint Nature Conservation Committee and Natural England to the Regional MCZ Projects. June 2011. 107pp.

Proposed protected features			
Biodiversity: Circalittoral sands and mixed sediment communities; northern sea fan and sponge communities; shelf banks and mounds			
Geodiversity: Quaternary of Scotland (<i>drumlinoid forms, glacial lineations, iceberg ploughmarks, streamlined bedrock</i>)			
Pressure/activity/impact pathway ²²⁰	Management scenario		
	Lower	Intermediate	Upper
	Overall, if the lower management scenario were to be implemented there will be no potential adverse environmental effects associated with changes in gear types.	circalittoral sands and mixed sediment communities would alter their gear type to one of the other methods as there is a low level of fishing by other gear types and there would still be areas outwith the MPA where they can fish using the targeted gear. Overall, the intermediate management scenario is unlikely to increase the fishing intensity of the non-targeted fishing gears and therefore the environmental impact is considered to be negligible.	
Overall (cumulative) assessment	The lower management scenario for SEB pMPA will have no impact on the environment . Assuming that best practice is being followed by existing activities there will be no benefits to habitat and species within the pMPA. The lower management scenario will not limit or restrict any human pressures/activities and therefore there will be no potential spillover benefits, no potential adverse environmental effects resulting from the displacement of activities and no potential adverse environmental effects resulting from increased fishing effort from other gear types that are not targeted.	The intermediate management scenario for SEB pMPA will have an overall moderate immediate beneficial impact on the environment and a greater potential for future benefits . The existing scale of activities that will be prohibited by the measures (namely excluding mobile/active gear from northern sea fan and sponge communities and from 20% of circalittoral sand) is low, but their exclusion will potentially provide some moderate environmental benefits given the sensitivity of habitats and associated species that will be protected. These moderate environmental benefits have the potential to result in minor spillover benefits outside the boundaries of SEB pMPA given the nature and scale of existing human pressures/activities in the area and also the fact that the site supports spawning and nursery grounds for several fish species. The adverse impacts on the environment will be negligible as a direct impact of displacement as the amount of effort displaced will be small and the areas into which effort is likely to be displaced are already fished and thus have a community composition that is already characterised by fishing pressures. Furthermore, a change in fishing effort from targeted to non-targeted fishing gears (e.g. from hydraulic gear to creeling) is considered unlikely given that there is a low level of fishing by non-targeted gear types and there would still be areas outwith SEB pMPA that are available for targeted fisheries to fish. Therefore, the benefit of protection is likely to be greater than the negative impacts associated with displacement.	The upper management scenario for SEB pMPA will have an overall minor immediate beneficial impact on the environment and a greater potential for future benefits . The existing scale of activities that will be prohibited or restricted by the measures (namely new cable/pipeline routes that avoid northern sea fan and sponge communities, excluding mobile/active gear from northern sea fan and sponge communities and from 40% of circalittoral sand) is moderate. Their regulation will therefore provide some moderate benefits to habitats and species. These moderate environmental benefits have the potential to result in minor spillover benefits outside the boundaries of SEB pMPA given the nature and scale of existing human pressures/activities in the area and also the fact that the site supports spawning and nursery grounds for several fish species. The environmental effect of the displacement of cables/pipelines is considered to be minor given the nature and scale of impacts on the seabed and sensitivity of habitats. The effect of displacement of fishing activities is considered negligible as the amount of existing fishing effort displaced will be small and the areas into which effort is likely to be displaced are already fished and thus have a community composition that is already characterised by fishing pressures. Furthermore, a change in fishing effort from targeted to non-targeted fishing gears (e.g. from hydraulic gear to creeling) is considered unlikely given that there is a low level of fishing of non-targeted gear types and there would still be areas outwith SEB pMPA that are available for targeted fisheries to fish. Therefore, the benefit of protection is likely to be greater than the negative impacts associated with displacement.

Proposed protected features			
Biodiversity: Circalittoral sands and mixed sediment communities; northern sea fan and sponge communities; shelf banks and mounds			
Geodiversity: Quaternary of Scotland (<i>drumlinoid forms, glacial lineations, iceberg ploughmarks, streamlined bedrock</i>)			
Pressure/activity/impact pathway ²²⁰	Management scenario		
	Lower	Intermediate	Upper
SEA Objective 1 - To safeguard and enhance marine and coastal ecosystems, including species, habitats, and their interactions	The lower management scenario will not result in a beneficial contribution to SEA Objective 1.	A reduction in existing pressures/activities (i.e. excluding mobile/active gear from northern sea fan and sponge communities and from 20% of circalittoral sand) will result in an overall moderate immediate beneficial contribution to SEA Objective 1. The intermediate management scenario will provide enhanced protection to the environment from future activities and therefore will potentially result in a greater beneficial contribution to this SEA objective in the future.	A reduction in existing pressures/activities (i.e. new cable/pipeline routes that avoid northern sea fan and sponge communities, excluding mobile/active gear from northern sea fan and sponge communities and from 40% of circalittoral sand) will result in an overall moderate immediate beneficial contribution to SEA Objective 1. The upper management scenario will provide enhanced protection to the environment from future activities and therefore will potentially result in a greater beneficial contribution to this SEA objective in the future.
SEA Objective 2 - To maintain and protect the character and integrity of the seabed	The lower management scenario will not result in a beneficial contribution to SEA Objective 2.	A reduction in existing pressures/activities that interact with the seabed (i.e. excluding mobile/active gear from northern sea fan and sponge communities and from 20% of circalittoral sand) will result in an overall moderate immediate beneficial contribution to SEA Objective 2. The intermediate management scenario will provide enhanced protection to the environment from future activities and therefore will potentially result in a greater beneficial contribution to this SEA objective in the future.	A reduction in existing pressures/activities that interact with the seabed (i.e. new cable/pipeline routes that avoid northern sea fan and sponge communities, excluding mobile/active gear from northern sea fan and sponge communities and from 40% of circalittoral sand) will result in an overall moderate immediate beneficial contribution to SEA Objective 2. The upper management scenario will provide enhanced protection to the environment from future activities and therefore will potentially result in a greater beneficial contribution to this SEA objective in the future.
SEA Objective 3 - To avoid the pollution of seabed strata and/or bottom sediments	The lower management scenario will not result in a beneficial contribution to SEA Objective 3.	The intermediate management scenario has the potential to reduce the redistribution and settling of any contaminated seabed sediments that are disturbed as an indirect effect of excluding mobile gear from 20% of circalittoral sand. Circalittoral sand and mixed sediments is unlikely to be contaminated, and therefore the potential contribution to SEA Objective 3 is considered to be negligible.	The upper management scenario has the potential to reduce the redistribution and settling of any contaminated seabed sediments that are disturbed as an indirect effect of excluding mobile gear from 40% of circalittoral sand. New cable/pipeline routes within SEB pMPA will avoid northern sea fan and sponge communities and therefore are likely to intersect circalittoral sand and mixed sediment communities. Circalittoral sand and mixed sediments are unlikely to be contaminated, and therefore the potential contribution to SEA Objective 3 is considered to be negligible.
SEA Objective 4 - To avoid pollution of the coastal and marine water environment	The lower management scenario will not result in a beneficial contribution to SEA Objective 4.	The intermediate management scenario has the potential to reduce pollution of the coastal and marine water environment due to a reduction in suspended sediments as an indirect effect of excluding mobile gear from 20% of circalittoral sand within SEB pMPA. This will result in a minor contribution to SEA Objective 4. The intermediate management scenario will provide enhanced protection to the environment from future activities	The intermediate management scenario has the potential to reduce pollution of the coastal and marine water environment due to a reduction in suspended sediments as an indirect effect of excluding mobile gear from 40% of circalittoral sand within SEB pMPA. This will result in a minor contribution to SEA Objective 4. The intermediate management scenario will provide enhanced protection to the environment from future activities and therefore will result in a greater beneficial contribution to this SEA objective in the future.

Proposed protected features			
Biodiversity: Circalittoral sands and mixed sediment communities; northern sea fan and sponge communities; shelf banks and mounds			
Geodiversity: Quaternary of Scotland (<i>drumlinoid forms, glacial lineations, iceberg ploughmarks, streamlined bedrock</i>)			
Pressure/activity/impact pathway ²²⁰	Management scenario		
	Lower	Intermediate	Upper
		and therefore will result in a greater beneficial contribution to this SEA objective in the future.	
SEA Objective 5 - To maintain or work towards achieving 'Good Ecological Status' and 'Good Environmental Status' of water bodies	The lower management scenario will not result in a beneficial contribution to SEA Objective 5.	A reduction in existing pressures/activities (i.e. excluding mobile/active gear from northern sea fan and sponge communities and from 20% of circalittoral sand) will support the quality elements used to assess 'Good Ecological Status'. Based on the outcomes of assessing SEA Objectives 1-4 above, it is considered that there is potential for an overall minor immediate beneficial contribution to SEA Objective 5 in terms of the WFD water bodies that occur at the site. The intermediate management scenario will provide enhanced protection to the environment from future activities and therefore will potentially result in a greater beneficial contribution to this SEA objective in the future.	A reduction in existing pressures/activities (i.e. new cable/pipeline routes that avoid northern sea fan and sponge communities, excluding mobile/active gear from northern sea fan and sponge communities and from 40% of circalittoral sand) will support the quality elements used to assess 'Good Ecological Status'. Based on the outcomes of assessing SEA Objectives 1-4 above, it is considered that there is potential for an overall minor immediate beneficial contribution to SEA Objective 5 in terms of the WFD water bodies that occur at the site. The intermediate management scenario will provide enhanced protection to the environment from future activities and therefore will potentially result in a greater beneficial contribution to this SEA objective in the future.
SEA Objective 6 - To preserve and enhance existing marine carbon stocks and carbon sequestration potential	The lower management scenario will not result in a beneficial contribution to SEA Objective 6.	Data available on NMPi indicate there are no habitats within SEB pMPA that are blue carbon sinks due to their fixation and sequestration ability. The protection of northern sea fan and sponge communities and circalittoral sands and mixed sediment communities will therefore not contribute to SEA Objective 6.	Same as intermediate management scenario.

Table C4 Southern Trench (STR) assessment

Proposed protected features			
Biodiversity: Burrowed mud; minke whale; fronts; shelf deeps			
Geodiversity: Quaternary of Scotland (<i>subglacial tunnel valleys and moraines</i>); Submarine Mass Movement (<i>slide scars</i>)			
Pressure/activity/impact pathway ²³³	Management scenario		
	Lower	Intermediate	Upper
Boat use ²³⁴	Follow Scottish Marine Wildlife Watching Code (SMWWC) and produce vessel management plans as required by licensing.		
Cables/pipelines	Follow existing best practice and licensing process for installation of new cables/pipelines by minimising disturbance to burrowed mud.		
Noisy activities ²³⁵	Follow existing best practice mitigation measures/guidance.		Follow existing best practice mitigation measures/guidance. No noisy activities during minke whale high season (June-October)
Coastal development (excluding noise)	Follow existing best practice and licensing process.	Follow existing best practice and licensing process. Minimise footprints of development to limit disturbance to burrowed mud and sandeel habitat.	
Fishing (bottom-contacting mobile gear)	No additional management.	Exclusion of hydraulic gear from sandeel habitat. Exclude targeted fishing for sandeel. Exclude mobile gear from 20% of burrowed mud.	Exclusion of hydraulic gear from sandeel habitat. Exclude targeted fishing for sandeel. Exclude mobile gear from 40% of burrowed mud.
Fishing (static gear)	Reduce risk of entanglement of minke whales by following best practice.		Reduce risk of entanglement of minke whale by following best practice. Exclusion of drift nets and set nets between June and October.
Fishing (pelagic)	Reduce risk of entanglement of minke whales by following best practice.		Reduce risk of entanglement of minke whale by following best practice. Limit herring and sprat fishing effort to current levels.
Marine disposal sites	Current best practice followed.		Current best practice followed. Siting of new marine disposal sites to minimise impacts on burrowed mud and sandeel habitat.
Ports and harbours	See 'Coastal development' and 'Noisy activities' for relevant scenarios.		
Renewable energy	Current best practice used to minimise impacts on burrowed mud and sandeel habitat.		
Scientific survey/research	Survey work adhering to Scottish Marine Wildlife Watching Code (SMWWC) and current species licensing requirements. Best practice adopted to minimise effects on burrowed mud.		
Wildlife tour operators	Follow existing best practice including Scottish Marine Wildlife Watching Code (SMWWC) and Wildlife Safe (WiSe) scheme.		

²³³ Further to the potential benefits afforded by the designation of the pMPAs described in Section 5.2 of the main report, this table presents a detailed assessment of all the potential additional environmental effects that might arise from the lower, intermediate and upper management scenarios that have been identified as reasonable alternatives.

²³⁴ MoD activities are reserved and therefore cannot be controlled or limited. MoD has its own best practice guidelines for meeting obligations.

²³⁵ Noisy activities include all activities which produce underwater noise which may disturb the protected features. This includes, but may not be limited to, construction activities (pile driving and blasting) and marine surveys (seismic, side-scan sonar, multibeam, sub-bottom profiling). MoD activities are reserved and therefore cannot be controlled or limited. MoD has its own best practice guidelines for meeting obligations.

Proposed protected features			
Biodiversity: Burrowed mud; minke whale; fronts; shelf deeps			
Geodiversity: Quaternary of Scotland (<i>subglacial tunnel valleys and moraines</i>); Submarine Mass Movement (<i>slide scars</i>)			
Pressure/activity/impact pathway ²³³	Management scenario		
	Lower	Intermediate	Upper
Impact pathway	Management scenario		
	Lower	Intermediate	Upper
Potential benefits to habitats and species within the pMPA	In addition to the proposed protected features listed above, there are several other mobile features that occur within and around STR pMPA, namely seabirds and a low number of grey seals ^{236,237} . A number of PMFs have also been recorded within the site, namely European spiny lobster, ocean quahog and white cluster anemone ²³⁸ .		
	The implementation of current best practice guidelines for a number of sectors, including cables/pipelines, coastal development and renewable energy, is unlikely to affect the environment as these guidelines are already followed in the management of existing licensed activities and are required to be followed as part of the licensing of new projects.	The implementation of current best practice guidelines across a number of sectors is unlikely to affect the environment as these guidelines are already followed in the management of existing licensed activities and are required to be followed as part of the licensing of new projects.	The implementation of current best practice guidelines across a number of sectors is unlikely to affect the environment as these guidelines are already followed in the management of existing licensed activities and are required to be followed as part of the licensing of new projects.
	Boat operators adhering to the Scottish Marine Wildlife Watching Code (SMWWC) for all boat use including scientific survey work and wildlife tour operators will potentially reduce the future risk of collisions with and disturbance of cetaceans.	Boat operators adhering to the Scottish Marine Wildlife Watching Code (SMWWC) for all boat use including scientific survey work and wildlife tour operators will potentially reduce the future risk of collisions with and disturbance of cetaceans.	Boat operators adhering to the Scottish Marine Wildlife Watching Code (SMWWC) for all boat use including scientific survey work and wildlife tour operators will potentially reduce the future risk of collisions with and disturbance of cetaceans.
	There is no demersal static fishing (including by drift nets and set nets) within the pMPA boundary that has been reported in the ScotMap or VMS data. This suggests that this management scenario will not result in an immediate benefit in terms of reducing the risk of entanglement. ScotMap data indicate there are up to 45 under-15m vessels that undertake mackerel line fishing within STR pMPA. VMS analysis indicates that there is some low to moderate intensity herring fishing and some low intensity mackerel fishing in the eastern part of STR pMPA. There is also some low intensity squid fishing in the central and western part of the site. Assuming that existing pelagic fisheries are already following best practice in terms of reducing risk of entanglement there will be no immediate environmental benefit. There is potential for future environmental benefits as any fishers that use nets in this pMPA in future will need to adhere to best practice.	In terms of coastal development, there are three minor ports, several harbours and four licensed disposal grounds located within and/or close to sandeel habitat, including Port Gordon, Port Buckie and North Buchan Ness disposal site. Any dredging and/or disposal requirements for the ports and harbours may overlap with and cause disturbance to sandeel habitat. The scale of benefits from minimising footprints of development is considered to be minor given the relatively small size of the existing ports, harbours and disposal sites. There is the potential for additional future benefits should any future coastal development overlap with sandeel habitat. In terms of bottom-contacting mobile gear, ScotMap data indicate that up to 3 under-15m vessels dredge for scallops, up to 14 under-15m vessels trawl for species other than <i>Nephrops</i> and up to 16 under-15m vessels trawl for <i>Nephrops</i> within STR pMPA, predominantly in the western part of the site. VMS	The cessation of all noisy activities within STR pMPA during the minke whale high season (June-October) will avoid any underwater noise disturbance to marine fauna from construction activities and marine surveys during this period. The scale of these benefits will depend on the nature and location of noisy activities. In terms of marine survey sources, side-scan and multibeam generate the lowest estimated sensation levels for all marine mammal species groups and sub-bottom profiling and seismic airguns generate levels that mysticetes (i.e. baleen whales such as minke whales) are most likely to hear ²³⁹ . The survey and maintenance of two existing telecom cables located within the STR pMPA and Hywind Scotland Pilot Park project (30MW capacity) located adjacent to the site may result in noise disturbance of marine fauna. Survey activities generate short periods of relatively low levels of noise and therefore a temporal restriction will only provide minor and localised benefits to the environment. In terms of construction activities that generate greater levels of noise (e.g. percussive piling and blasting), under construction and/or consented

²³⁶ Dunn, T., 2012. JNCC seabird distribution and abundance data (all trips) from ESAS database.

²³⁷ Marine Scotland, 2018. The Marine Scotland MAPS NMPI (National Marine Plan interactive). Available at: <https://www2.gov.scot/Topics/marine/seamanagement/nmpihome> (accessed 01/11/2018)

²³⁸ *ibid*

²³⁹ MacGillivray, A.O., Racca, R. and Zizheng, L., 2014. Marine mammal audibility of selected shallow-water survey sources. Available at: <https://asa.scitation.org/doi/10.1121/1.4838296> (accessed 02/11/2018)

Proposed protected features			
Biodiversity: Burrowed mud; minke whale; fronts; shelf deeps			
Geodiversity: Quaternary of Scotland (<i>subglacial tunnel valleys and moraines</i>); Submarine Mass Movement (<i>slide scars</i>)			
Pressure/activity/impact pathway ²³³	Management scenario		
	Lower	Intermediate	Upper
	<p>Overall, if the lower management scenario were to be implemented there will be no immediate benefit to habitats and species within the pMPA, but a greater potential for future benefits.</p>	<p>analysis indicates there is relatively high intensity dredging for scallops, relatively moderate intensity mobile gear fishing for <i>Nephrops</i>, and some low to moderate intensity demersal mobile fishing by over-12m vessels within the pMPA. The exclusion of hydraulic gear from sandeel habitat may result in a minor to moderate immediate benefit to the environment as there is a low to moderate intensity of demersal mobile fishing that may use hydraulic gear and overlaps with the sandeel habitat in STR pMPA. There is potential for future benefits as fishers will be restricted from using this gear on sandeel habitat.</p> <p>There is no sandeel fishery within the pMPA boundary that has been reported in the ScotMap or VMS data. This suggests that there will not be any initial benefit if target fishing for sandeels were excluded. However, there is potential for future benefits as any fishers will be restricted from setting up a fishery or targeting sandeels within the pMPA.</p> <p>The exclusion of existing mobile gear from 20% of burrowed mud is likely to provide an overall moderate immediate benefit to the environment as there is a moderate to high intensity of mobile gear fishing (namely trawling for <i>Nephrops</i> and other species and scallop dredging) that currently overlaps with the burrowed mud habitat in STR pMPA. There is potential for future benefits as any mobile gear fishers will be restricted from setting up a fishery within the pMPA within this exclusion zone.</p> <p>There is no demersal static fishing within the pMPA boundary that has been reported in the ScotMap or VMS data. This suggests that this management scenario will not result in an immediate benefit in terms of reducing the risk of entanglement by following best practice. There is the potential for future environmental benefits as any fishers that use nets in this pMPA in future will need to avoid fishing in sensitive areas during this sensitive period.</p> <p>Assuming that existing pelagic fisheries are already following best practice in terms of reducing risk of</p>	<p>offshore wind farms (Moray Offshore Wind Farm East and West, and Beatrice Offshore Wind Farm) are located approximately 20-30km from STR pMPA. The proposed export cable route for Moray Offshore Wind Farm East overlaps with STR pMPA. There are also two offshore wind farm Areas of Search (AoS) located within 10km of the site. There is potential for future environmental benefits if offshore wind farm development is restricted from undertaking noisy activities during this sensitive period, particularly those that generate high levels of noise (e.g. percussive piling and blasting).</p> <p>In terms of coastal development, there are three minor ports, several harbours and four licensed disposal grounds located within and/or close to sandeel habitat, including Port Gordon, Port Buckie and North Buchan Ness disposal site. Any dredging and/or disposal requirements for the ports and harbours may overlap with and cause disturbance to sandeel habitat. The scale of benefits from minimising footprints of development is considered to be minor given the relatively small size of the existing ports, harbours and disposal sites. There is the potential for additional future benefits should any future coastal development overlap with sandeel habitat.</p> <p>The exclusion of hydraulic gear from sandeel habitat may result in a minor to moderate immediate benefit to the environment as there is a low to moderate intensity of demersal mobile fishing that may use hydraulic gear and overlaps with the sandeel habitat in STR pMPA. There is potential for future benefits as fishers will be restricted from using this gear on sandeel habitat.</p> <p>There is no sandeel fishery within the pMPA boundary that has been reported in the ScotMap or VMS data. This suggests that there will not be any initial benefit if target fishing for sandeel were excluded. However, there is potential for future benefits as any fishers will be restricted from setting up a fishery or targeting sandeels within the pMPA.</p> <p>The exclusion of existing mobile gear from 40% of burrowed mud is likely to provide an overall major</p>

Proposed protected features			
Biodiversity: Burrowed mud; minke whale; fronts; shelf deeps			
Geodiversity: Quaternary of Scotland (<i>subglacial tunnel valleys and moraines</i>); Submarine Mass Movement (<i>slide scars</i>)			
Pressure/activity/impact pathway ²³³	Management scenario		
	Lower	Intermediate	Upper
		<p>entanglement there will be no immediate environmental benefit. There is potential for future environmental benefits as any fishers that use nets in this pMPA in future will need to adhere to best practice.</p> <p>Overall, if the intermediate management scenario were to be implemented there will be a moderate immediate benefit to habitats and species within the pMPA, and a greater potential for future benefits.</p>	<p>immediate benefit to the environment as there is a moderate to high intensity of mobile gear fishing (namely trawling for <i>Nephrops</i> and other species and scallop dredging) that currently overlaps with the burrowed mud habitat in STR pMPA. There is potential for future benefits as any mobile gear fishers will be restricted from setting up a fishery within the pMPA.</p> <p>There is no demersal static fishing within the pMPA boundary that has been reported in the ScotMap or VMS data. This suggests that this management scenario will not result in an immediate benefit in terms of reducing the risk of entanglement by following best practice or by excluding drift nets and set nets between June and October. There is the potential for future environmental benefits as any fishers that use nets in this pMPA in future will need to avoid fishing during this sensitive period.</p> <p>Assuming that existing pelagic fisheries are already following best practice in terms of reducing risk of entanglement, there will be no immediate environmental benefit. There is potential for future environmental benefits as any fishers that use nets in this pMPA in future will need to adhere to best practice.</p> <p>Limiting herring and sprat fishing effort to current levels will limit any potential further risk of entanglement in future. The scale of this benefit will depend on how the fishery might evolve in the absence of this measure (future baseline) which is not possible to reliably predict.</p> <p>The siting of any new marine disposal sites will need to minimise impacts on burrowed mud and sandeel habitat. There are already four existing licensed disposal sites within or close to STR pMPA and the requirement for a new disposal site to be licensed is considered unlikely. However, this management scenario does provide greater direction and enhanced protection should any new marine disposal sites be licensed in future.</p> <p>Overall, if the upper management scenario were to be implemented there will be a major immediate</p>

Proposed protected features			
Biodiversity: Burrowed mud; minke whale; fronts; shelf deeps			
Geodiversity: Quaternary of Scotland (<i>subglacial tunnel valleys and moraines</i>); Submarine Mass Movement (<i>slide scars</i>)			
Pressure/activity/impact pathway ²³³	Management scenario		
	Lower	Intermediate	Upper
			benefit to habitats and species within the pMPA, and a greater potential for future benefits.
Potential spillover benefits beyond pMPA site boundaries	<p>The lower management scenario will not limit or restrict any human pressures/activities and therefore there will be no potential spillover benefits.</p> <p>Overall, if the lower management scenario were to be implemented there will be no spillover benefits.</p>	<p>Restricting certain harmful activities in sensitive areas may result in the potential spillover of species from protected areas into unprotected areas if there is a population surplus and the carrying capacity of the protected area is surpassed^{240,241}. There is, however, variation in the level of effectiveness and scale of benefits that restrictions can have and these are site dependent²⁴². The current conditions encountered within a site (e.g. current stock level, species present, and nursery and spawning areas for those species) need to be characterised in order to be able to undertake a detailed assessment of the potential for spillover benefits to occur.</p> <p>There is evidence to suggest that STR pMPA supports spawning and/or nursery grounds for several fish species, including whiting, sprat, sandeel, saithe, plaice, <i>Nephrops</i>, lemon sole, herring and haddock but at unknown densities^{243,244}. Scallops are broadcast spawners and as there is a current scallop fishery, it is considered also to be a spawning area for scallops.</p> <p>Taking account of the nature and scale of existing human pressures/activities at STR pMPA, spillover benefits from the restriction of certain human pressures/activities (e.g. excluding hydraulic gear from sandeel habitat, targeted fishing for sandeel and excluding mobile gear from 20% of circalittoral sands) are likely to be minor in the immediate term with the potential to be more significant in the long term.</p>	Same as intermediate management scenario.

²⁴⁰ Buxton, C.D., Hartmann, K., Kearney, R. and Gardner, C., 2014. When is spillover from marine reserves likely to benefit fisheries?. PloS One, 9(9), p.e107032.

²⁴¹ Kerwath, S.E., Winker, H., Götz, A. and Attwood, C.G., 2013. Marine protected area improves yield without disadvantaging fishers. Nature Communications, 4, p.2347.

²⁴² Starr, R.M., Wendt, D.E., Barnes, C.L., Marks, C.I., Malone, D., Waltz, G., Schmidt, K.T., Chiu, J., Launer, A.L., Hall, N.C. and Yochum, N., 2015. Variation in responses of fishes across multiple reserves within a network of marine protected areas in temperate waters. PloS one, 10(3), p.e0118502.

²⁴³ Coull, K.A., Johnstone, R. and Rogers, S.I., 1998. Fisheries Sensitivity Maps in British Waters. Published and distributed by UKOOA Ltd., v + 58 pp.

²⁴⁴ Ellis, J.R., Milligan, S.P., Readdy, L., Taylor, N. and Brown, M.J. 2012. Spawning and nursery grounds of selected fish species in UK waters. Cefas Science Series Technical Report 147.

Proposed protected features			
Biodiversity: Burrowed mud; minke whale; fronts; shelf deeps			
Geodiversity: Quaternary of Scotland (<i>subglacial tunnel valleys and moraines</i>); Submarine Mass Movement (<i>slide scars</i>)			
Pressure/activity/impact pathway ²³³	Management scenario		
	Lower	Intermediate	Upper
		Overall, if the intermediate management scenario were to be implemented the spillover benefits are likely to be minor in the immediate term, with a potential for greater benefits in the future.	
Potential adverse environmental effects resulting from the displacement of activities and the intensification of activities in areas where they already occur	<p>The lower management scenario will not limit or restrict any human pressures/activities and therefore there will be no potential adverse environmental effects resulting from the displacement of activities.</p> <p>Overall, if the lower management scenario were to be implemented there will be no potential adverse environmental effects associated with the displacement of activities.</p>	<p>The overall existing scale of pressure from the activities that are restricted by this management scenario (i.e. exclusion of hydraulic gear from sandeel habitat, excluding targeted fishing for sandeels and exclusion of mobile gear from 20% of burrowed mud) is moderate; VMS analysis indicates that the intensity of demersal mobile fishing that may use hydraulic gear and overlap with the sandeel grounds in the pMPA is low to moderate, there is no sandeel fishery and a moderate to high intensity of mobile fishing gear within burrowed mud habitat within the pMPA boundary. The scale of any displacement of these fishing activities will therefore be low to moderate.</p> <p>The distance needed to access areas that are already exploited by these fisheries outside of the protected sandeel and burrowed mud habitat is small. Furthermore, the habitat and species in the areas that the fishing will be displaced to have a community composition that is already characterised by this pressure/activity. The immediate environmental effect of the low to moderate level of displacement and intensification of fishing activity is therefore considered to be minor at most.</p> <p>Overall, if the intermediate management scenario were to be implemented the potential environmental effect of any displacement and intensification of activities in areas where they already occur will be minor.</p>	<p>The overall existing scale of pressure from the activities that are restricted by this management scenario (i.e. exclusion of hydraulic gear from sandeel habitat, excluding targeted fishing for sandeels, excluding mobile gear from 40% of burrowed mud, exclusion of drift nets and set nets between June and October, limiting herring and sprat fishing effort to current levels and excluding noisy activities during minke whale high season) is major. VMS analysis indicates that the intensity of demersal mobile fishing that may use hydraulic gear and overlap with the sandeel grounds in the pMPA is low to moderate, there is no sandeel fishery, a moderate to high intensity of mobile gear fishing that overlaps with burrowed mud, and no drift nets and set nets within the pMPA boundary. The scale of existing noisy activities from marine survey work is small and this activity is unlikely to be displaced by a temporal restriction. Any displacement is therefore limited to fishing activities, the scale of which could be moderate to major.</p> <p>The distance needed to access areas that are already exploited by these fisheries outside of the protected sandeel and burrowed mud habitat is small. Furthermore, the habitat and species in the areas that the fishing will be displaced to have a community composition that is already characterised by this pressure/activity. The immediate environmental effect of the moderate to major level of displacement and intensification of fishing activity is therefore considered to be moderate at most.</p> <p>Overall, if the upper management scenario were to be implemented the potential environmental effect of any displacement and intensification of activities in areas where they already occur will be moderate.</p>
Potential environmental impact of increased fishing effort from other gear	The lower management scenario will not limit or restrict any human pressures/activities and therefore there will be no potential adverse environmental	The ScotMap data and VMS analysis indicates that the main fishing method that occurs within the pMPA is dredging for scallops, trawling for <i>Nephrops</i> and	Same as intermediate management scenario.

Proposed protected features			
Biodiversity: Burrowed mud; minke whale; fronts; shelf deeps			
Geodiversity: Quaternary of Scotland (<i>subglacial tunnel valleys and moraines</i>); Submarine Mass Movement (<i>slide scars</i>)			
Pressure/activity/impact pathway ²³³	Management scenario		
	Lower	Intermediate	Upper
types that might not be targeted by the management scenario within the pMPA	<p>effects resulting from increased fishing effort from other gear types that are not targeted.</p> <p>Overall, if the lower management scenario were to be implemented there will be no potential adverse environmental effects associated with changes in gear types.</p>	<p>other species, demersal mobile fishing, pelagic fishing and creeling. Assuming that pelagic fisheries already adhere to best practice, this management scenario will not affect the main fishing activities that currently occur in the pMPA. It is considered unlikely that any existing fisheries using the restricted gear (i.e. hydraulic and mobile gear) in sandeel and burrowed mud habitat would alter their gear type to one of the other methods as there would still be areas within and outwith the MPA where they can fish.</p> <p>Overall, the intermediate management scenario is unlikely to increase the fishing intensity of the non-targeted fishing gears and therefore the environmental impact is considered to be negligible.</p>	
Overall (cumulative) assessment	<p>The lower management scenario for STR pMPA will have no immediate impact on the environment but a greater potential for future benefits. Assuming that best practice is being followed by existing activities there will be no immediate benefits to habitat and species within the pMPA. The lower management scenario will not limit or restrict any human pressures/activities and therefore there will be no potential spillover benefits, no potential adverse environmental effects resulting from the displacement of activities and no potential adverse environmental effects resulting from increased fishing effort from other gear types that are not targeted.</p>	<p>The intermediate management scenario for STR pMPA will have an overall minor immediate beneficial impact on the environment and a greater potential for future benefits. There are currently three minor ports, several harbours and four licensed disposal grounds located within and/or close to sandeel habitat and therefore the scale of immediate benefits associated with reducing disturbance to sandeel habitat is considered minor. The existing scale of activities that will be prohibited by the measures (namely hydraulic gear fishing in sandeel grounds, targeted fishing for sandeel and exclusion of mobile gear from 20% of burrowed mud) is low to high, and their exclusion will potentially provide some moderate benefits to habitats and associated species. The scale of these benefits is likely to result in minor spillover benefits outside the boundaries of STR pMPA. The adverse impacts on the environment will be minor as a direct impact of displacement as the amount of effort displaced will be low to moderate and the areas into which effort is likely to be displaced are already fished and thus have a community composition that is already characterised by fishing pressures. A change in fishing effort from targeted to non-targeted fishing gears (e.g. from hydraulic gear to creeling) is considered unlikely given that there would still be areas within and outwith STR pMPA that are available for targeted fisheries to fish. Therefore, the</p>	<p>The upper management scenario for STR pMPA will have an overall minor immediate beneficial impact on the environment and a greater potential for future benefits. There are currently three minor ports, several harbours and four licensed disposal grounds located within and/or close to sandeel habitat and therefore the scale of immediate benefits associated with reducing disturbance to sandeel habitat is considered minor. The existing scale of activities that will be prohibited or restricted by the measures (namely noisy activities during minke whale high season, hydraulic gear fishing in sandeel grounds, targeted fishing for sandeel, mobile gear from 40% of burrowed mud, drift nets and set nets between June and October across site, and limiting herring and sprat fishing effort to current levels) are low to high, and their regulation will provide some major benefits to habitats and species. The scale of these benefits is likely to result in minor spillover benefits outside the boundaries of STR pMPA. The adverse impacts on the environment will be moderate at most as a direct impact of displacement as the amount of fishing effort displaced will be moderate to major and the areas into which effort is likely to be displaced are already fished and thus have a community composition that is already characterised by fishing pressures. A change in fishing effort from targeted to non-targeted fishing gears (e.g. from hydraulic gear to creeling) is considered unlikely given that there would still be areas within and outwith STR</p>

Proposed protected features			
Biodiversity: Burrowed mud; minke whale; fronts; shelf deeps			
Geodiversity: Quaternary of Scotland (<i>subglacial tunnel valleys and moraines</i>); Submarine Mass Movement (<i>slide scars</i>)			
Pressure/activity/impact pathway ²³³	Management scenario		
	Lower	Intermediate	Upper
		benefit of protection is likely to be greater than the negative impacts associated with displacement.	pMPA that are available for targeted fisheries to fish. Therefore, the benefit of protection is likely to be greater than the negative impacts associated with displacement.
SEA Objective 1 - To safeguard and enhance marine and coastal ecosystems, including species, habitats, and their interactions	The lower management scenario will not result in an immediate beneficial contribution to SEA Objective 1 but will potentially result in a greater beneficial contribution to this SEA objective in the future through affording enhanced protection to the environment from future activities.	A reduction in existing pressures/activities that interact with the marine and coastal environment (i.e. minimising footprint of coastal development, excluding hydraulic gear fishing on sandeel grounds, and exclusion of mobile gear from 20% of burrowed mud) will result in an overall moderate immediate beneficial contribution to SEA Objective 1. The intermediate management scenario will provide enhanced protection to the environment from future activities and therefore will potentially result in a greater beneficial contribution to this SEA objective in the future.	A reduction in existing pressures/activities that interact with the marine and coastal environment (i.e. minimising footprint of coastal development, cessation of noisy activities during sensitive periods, excluding hydraulic gear fishing on sandeel grounds, excluding mobile gear from 40% of burrowed mud, excluding drift nets and set nets between June and October across site, and limiting herring and sprat fishing effort to current levels) will result in an overall moderate immediate beneficial contribution to SEA Objective 1. The intermediate management scenario will provide enhanced protection to the environment from future activities and therefore will potentially result in a greater beneficial contribution to this SEA objective in the future.
SEA Objective 2 - To maintain and protect the character and integrity of the seabed	The lower management scenario will not result in an immediate beneficial contribution to SEA Objective 2 but will potentially result in a greater beneficial contribution to this SEA objective in the future through affording enhanced protection to the environment from future activities.	A reduction in existing pressures/activities that interact with the seabed (i.e. minimising footprint of coastal development in sandeel habitat, excluding hydraulic gear fishing on sandeel grounds, excluding mobile gear from 20% of burrowed mud) will result in an overall moderate immediate beneficial contribution to SEA Objective 2. The intermediate management scenario will provide enhanced protection to the environment from future activities and therefore will potentially result in a greater beneficial contribution to this SEA objective in the future.	A reduction in existing pressures/activities that interact with the seabed (i.e. minimising footprint of coastal development in sandeel habitat, excluding hydraulic gear fishing on sandeel grounds and excluding mobile gear from 40% of burrowed mud) will result in an overall moderate immediate beneficial contribution to SEA Objective 2. The intermediate management scenario will provide enhanced protection to the environment from future activities and therefore will potentially result in a greater beneficial contribution to this SEA objective in the future.
SEA Objective 3 - To avoid the pollution of seabed strata and/or bottom sediments	The lower management scenario will not result in an immediate beneficial contribution to SEA Objective 3 but will potentially result in a greater beneficial contribution to this SEA objective in the future through affording enhanced protection to the environment from future activities.	The intermediate management scenario has the potential to reduce the redistribution and settling of any contaminated seabed sediments that are disturbed as an indirect effect of minimising the footprint of coastal development on sandeel habitat, excluding hydraulic gear fishing on sandeel grounds and excluding mobile gear from 20% of burrowed mud. Sandeel habitat is predominantly gravelly, sandy and dynamic in nature and therefore unlikely to be contaminated. Burrowed mud habitat is located further offshore in the STR pMPA and therefore also unlikely to be contaminated. Overall, therefore, the potential contribution to SEA Objective 3 is considered to be negligible.	The upper management scenario has the potential to reduce the redistribution and settling of any contaminated seabed sediments that are disturbed as an indirect effect of minimising the footprint of coastal development on sandeel habitat, excluding hydraulic gear fishing on sandeel grounds and excluding mobile gear from 40% of burrowed mud. Sandeel habitat is predominantly gravelly, sandy and dynamic in nature and therefore unlikely to be contaminated. Burrowed mud habitat is located further offshore in the STR pMPA and therefore also unlikely to be contaminated. Overall, therefore, the potential contribution to SEA Objective 3 is considered to be negligible.

Proposed protected features			
Biodiversity: Burrowed mud; minke whale; fronts; shelf deeps			
Geodiversity: Quaternary of Scotland (<i>subglacial tunnel valleys and moraines</i>); Submarine Mass Movement (<i>slide scars</i>)			
Pressure/activity/impact pathway ²³³	Management scenario		
	Lower	Intermediate	Upper
SEA Objective 4 - To avoid pollution of the coastal and marine water environment	The lower management scenario will not result in an immediate beneficial contribution to SEA Objective 4 but will potentially result in a greater beneficial contribution to this SEA objective in the future through affording enhanced protection to the environment from future activities.	The intermediate management scenario has the potential to reduce pollution of the coastal and marine water environment due to a reduction in suspended sediments as an indirect effect of minimising the footprint of coastal development on sandeel habitat, excluding hydraulic gear fishing on sandeel grounds and excluding mobile gear from 20% of burrowed mud. This will result in a minor contribution to SEA Objective 4. The intermediate management scenario will provide enhanced protection to the environment from future activities and therefore will result in a greater beneficial contribution to this SEA objective in the future.	The upper management scenario has the potential to reduce pollution of the coastal and marine water environment due to a reduction in suspended sediments as an indirect effect of minimising the footprint of coastal development on sandeel habitat, excluding hydraulic gear fishing on sandeel grounds and excluding mobile gear from 40% of burrowed mud. This will result in a minor contribution to SEA Objective 4. The intermediate management scenario will provide enhanced protection to the environment from future activities and therefore will result in a greater beneficial contribution to this SEA objective in the future.
SEA Objective 5 - To maintain or work towards achieving 'Good Ecological Status' and 'Good Environmental Status' of water bodies	The lower management scenario will not result in an immediate beneficial contribution to SEA Objective 5 but will potentially result in a greater beneficial contribution to this SEA objective in the future through affording enhanced protection to the environment from future activities.	A reduction in existing pressures/activities (i.e. minimising footprint of coastal development, excluding hydraulic gear fishing on sandeel grounds, and exclusion of mobile gear from 20% of burrowed mud) will support the quality elements used to assess 'Good Ecological Status' and the qualitative descriptions used to determine 'Good Environmental Status'. Based on the outcomes of assessing SEA Objectives 1-4 above, it is considered that there is potential for an overall moderate immediate beneficial contribution to SEA Objective 5 in terms of the WFD water bodies and MSFD marine region that overlap with the site. The intermediate management scenario will provide enhanced protection to the environment from future activities and therefore will potentially result in a greater beneficial contribution to this SEA objective in the future.	A reduction in existing pressures/activities (i.e. minimising footprint of coastal development, cessation of noisy activities during sensitive periods, excluding hydraulic gear fishing on sandeel grounds, excluding mobile gear from 40% of burrowed mud, excluding drift nets and set nets between June and October across site, and limiting herring and sprat fishing effort to current levels) will support the quality elements used to assess 'Good Ecological Status' and the qualitative descriptions used to determine 'Good Environmental Status'. Based on the outcomes of assessing SEA Objectives 1-4 above, it is considered that there is potential for an overall moderate immediate beneficial contribution to SEA Objective 5 in terms of the WFD water bodies and MSFD marine region that overlap with the site. The intermediate management scenario will provide enhanced protection to the environment from future activities and therefore will potentially result in a greater beneficial contribution to this SEA objective in the future.
SEA Objective 6 - To preserve and enhance existing marine carbon stocks and carbon sequestration potential	Data available on NMPi indicate there are habitats within STR pMPA that are blue carbon sinks due to their fixation and sequestration ability (e.g. kelp beds). These habitats are not supported by the habitats that would be protected by the lower management scenario, namely sandeel or burrowed mud habitat. There will, therefore, be no beneficial contribution to SEA Objective 6.	Same as lower management scenario.	Same as lower management scenario.

Appendix D Abbreviations

ABPmer	ABP Marine Environmental Research Ltd
ADD	Acoustic Deterrent Device
BGS	British Geological Survey
BRIA	Business and Regulatory Impact Assessment
EC	European Commission
EEC	European Economic Community
EMODnet	European Marine Observation and Data Network
ESAS	European Seabirds At Sea
EU	European Union
EUNIS	European Union Nature Information System
EuroSION	European Initiative for Sustainable Coastal Erosion Management
EUSeaMap	European Broad-Scale Seabed Habitat Map
FEAST	Feature Activity Sensitivity Tool
GeMS	Geodatabase for Marine Habitats and Species in Scotland
GEN	General
GES	Good Environmental Status
GHG	Greenhouse Gas
HES	Historic Environment Scotland
JNCC	Joint Nature Conservation Committee
MCZ	Marine Conservation Zone
MPA	Marine Protected Area
MSFD	Marine Strategy Framework Directive
MW	Megawatt
NEL	North East Lewis
NM	Nautical Mile
NMPi	National Marine Plan Interactive
NTS	Non-Technical Summary
OSPAR	Convention for the Protection of the Marine Environment of the North-East Atlantic (Oslo/Paris)
PMF	Priority Marine Features
pMPA	proposed Marine Protected Area
pSPA	proposed Special Protection Area

Ramsar	Wetlands of International Importance, designated under The Convention on Wetlands (Ramsar, Iran, 1971)
RBMP	River Basin Management Plan
SA	Sustainability Appraisal
SAC	Special Areas of Conservation
SEA	Strategic Environmental Assessment
SEB	Shiant East Bank
SEIA	Socio-Economic Impact Assessment
SEPA	Scottish Environment Protection Agency
SMWWC	Scottish Marine Wildlife Watching Code
SNH	Scottish Natural Heritage
SOH	Sea of the Hebrides
SPA	Special Protection Area
SSSI	Site of Specific Scientific Interest
STR	Southern Trench
UK	United Kingdom
UKOOA	UK Offshore Operators Association
UKCIP	UK Climate Impacts Programme
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
WFD	Water Framework Directive
WiSe	Wildlife Safe



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Published by the Scottish Government, 2019

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