Scottish Government
Riaghaltas na h-Alba
gov.scot

Marine Scotland

Development of a Deep Sea Marine Reserve West of Scotland

STRATEGIC ENVIRONMENTAL ASSESSMENT

September 2019

marinescotland

Proposed Deep Sea Marine Reserve

Strategic Environmental Assessment
Environmental Report

September 2019

Report prepared by:

ABP mer

For:

Scottish Government
Riaghaltas na h-Alba
gov.scot

marinescotland

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 (MPA).

The deep seas around Scotland are home to some of the most vulnerable habitats and species on earth. A deep sea marine reserve is proposed for designation to prevent the further decline of these globally threatened habitats and species and facilitate their recovery. As part of the process to determine whether this deep sea marine reserve should be designated as an MPA, Marine Scotland is now inviting views on the findings of the Strategic Environmental Assessment.

What is Strategic Environmental Assessment?

Strategic Environmental Assessment identifies the likely significant environmental impacts of plans and policies and proposed reasonable alternatives to them. Strategic Environmental Assessment 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. Strategic Environmental Assessment provides opportunities for the public to consider this information and use it to inform their views on the draft plan or policy.

In accordance with the requirements of the Environmental Assessment (Scotland) Act 2005, a scoping exercise on the designation of the deep sea marine reserve was undertaken by Marine Scotland, whereby the proposed scope, methodology and consultation period of the assessment were identified. In response to the scoping, Consultation Authorities[1] confirmed the need for a Strategic Environmental Assessment due to the potential for significant environmental effects to occur. They also provided comment on the proposed scope and methodology of the assessment and consultation period for the Environmental Report. Their views are taken into account in this Environmental Report, as per the requirements of the 2005 Act.

What are the proposals for a deep sea marine reserve?

The Scottish Government's Program for Scotland 2017-18 included a commitment to 'evaluate options to create a deep sea national marine reserve'. The designation of a deep sea reserve would complement the existing MPA network in Scottish waters and provide a legal framework for the protection of additional deep sea marine habitats and species against emerging threats.

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

The ‘study area’ for the potential deep sea marine reserve is divided into two distinct areas either side of the Wyville-Thomson Ridge, with different seabed features and water temperatures resulting in distinct community types north and south (Figure NTS1).

The boundary options for a proposed deep sea marine reserve that are being considered by Marine Scotland, informed by advice received from JNCC, are as follows:

Faroe Shetland Reserve (Area 1);

West of Scotland Reserve (Area 2); and

West of Scotland and Faroe Shetland Combined (Areas 1 and 2).

Table NTS1 Characteristics of the proposed deep sea marine reserve options under assessment

Boundary option	Proposed protected features
Faroe Shetland Reserve (Area 1)	Burrowed mud (including sea pens)
	Deep sea sponge aggregations
	Atlantic-influenced offshore deep sea muds
	Atlantic-influenced offshore subtidal sands and gravels
	Geodiversity Features
West of Scotland Reserve (Area 2)	Burrowed mud (including sea pens)
	Coral gardens
	Cold-water coral reefs (including *Lophelia pertusa* reefs)
	Deep sea sponge aggregations
	Atlantic-influenced offshore deep sea muds
	Atlantic-influenced offshore subtidal sands and gravels
	Seamount communities
	Seamounts
	Blue Ling (*Molva dypterygia*)
	Leafscale gulper shark (*Centrophorus squamosus*)
	Gulper shark (*Centrophorus granulosus*)
	Orange roughy (*Hoplostethus atlanticus*)
	Portuguese dogfish (*Centroscymnus coelolepis*)
	Roundnose grenadier (*Coryphaenoides rupestris*)
	Geodiversity features
West of Scotland and Faroe Shetland Combined (Areas 1 and 2)	All features listed above under areas 1 and 2.

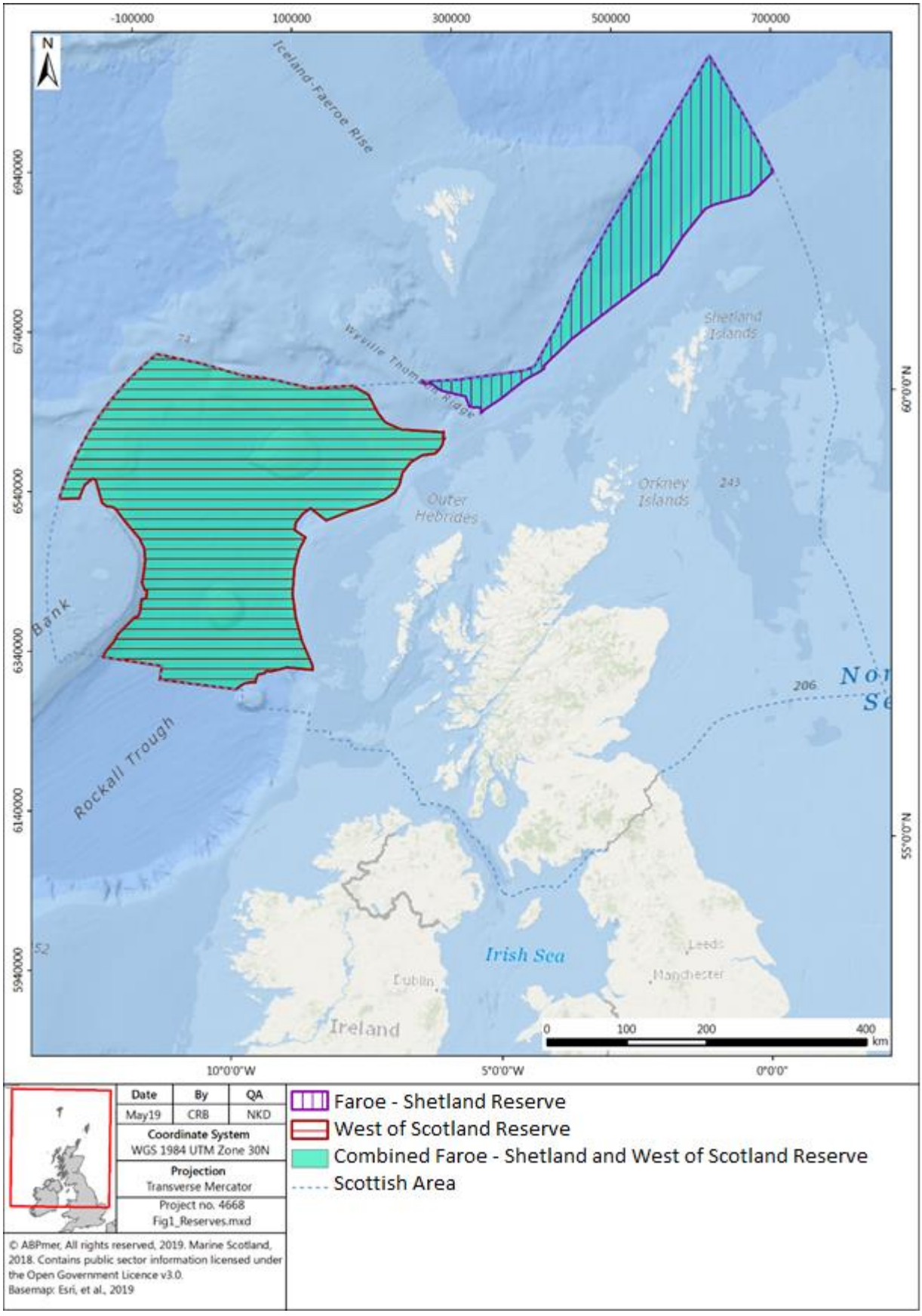


Figure NTS1 Map of proposed deep sea marine reserve options

How was the Strategic Environmental Assessment undertaken?

Strategic Environmental Assessment provides a high-level assessment of the potential environmental effects that are likely to result from the designation of the proposed deep sea marine reserve, including assessment of reasonable alternatives in both boundary options (Faroe Shetland Reserve (Area 1), West of Scotland Reserve (Area 2) and combined Areas 1 and 2) and management scenarios.). In addition, the potential effects that may result from managing the proposed deep sea marine reserve in different ways (reasonable alternatives) are also assessed (see below).

The assessment identifies the individual and overall (cumulative) effects of the designation of the proposed deep sea marine reserve on the Strategic Environmental Assessment topics that are scoped into the assessment, specifically Biodiversity, Flora and Fauna; Soil; Water; and Climatic Factors. These Strategic Environmental Assessment 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 proposed deep sea marine reserve on a series of key statements ('Strategic Environmental Assessment objectives'). These Strategic Environmental Assessment 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 which is reported separately. The Sustainability Appraisal, which is also reported separately, considers the potential environmental, economic and social effects of designating the deep sea marine reserve, drawing on information contained in the Strategic Environmental Assessment and Socio-Economic Impact Assessment.

Which reasonable alternatives have been assessed?

In addition to the assessment of the different boundary areas as reasonable alternatives, Marine Scotland developed lower, intermediate and upper management scenarios for managing pressures/activities at each of the proposed Marine Protected Areas. These scenarios, outlined for assessment purposes, indicate the different ways in which the deep sea marine reserve might be managed in the future to support the achievement of site conservation objectives and are considered reasonable alternatives across the different boundary areas:

Lower Scenario: Existing fisheries management and consenting processes;

Intermediate Scenario: No extractive activities that affect the seabed (e.g. demersal fisheries, oil and gas development, seabed mining etc.); and

Upper Scenario: No extractive activities that affect the seabed or the water column (e.g. demersal and pelagic fisheries, oil and gas exploration and development, seabed mining etc.).

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 proposed Marine Protected Areas will be subject to further consideration under the Environmental Assessment (Scotland) Act 2005.

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. Within the deep sea environment, the habitat type can generally be described as either deep sea muds or deep sea sands and gravels. These two habitats support a wide variety of different species which will vary depending on the depth, sediment type, temperature and the physical characteristics of the seabed. The biological communities and various physical structures that occur within deep sea sedimentary habitats are in general long-lived, slow-growing, late-maturing and fragile.

There are a wide range of mobile species in Scottish waters with several populations considered to be either of international or national importance. There are a number of mobile species associated with the deep sea, principally fish species which will spend a large proportion of their lives in the deep sea, for example orange roughy and leafscale gulper shark. A number of these species are proposed for designation in the West of Scotland Reserve area (Table NTS1).

The current status of the marine environment in the deep sea is uncertain, although historic declines in a number of fish populations in the deep sea have been observed. These declines have, to some degree, been slowed or stopped with some, albeit very slow, recovery in fish populations observed[2] in part due to the implementation of EU legislation preventing some deep sea bottom trawling and fishing activities.

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. A number of the features are proposed for protection within the deep sea marine reserve (Table NTS1). The condition of these features influences the quality of habitats and in turn the viability and health of both flora and fauna populations.

Water quality in the offshore regions is assessed against several different factors (descriptors) under the Marine Strategy Framework Directive. This includes assessment of the impact of a number of pressures from human activities, including oil and gas, chemical pollution and fishing. The proposed deep sea marine reserve falls within the North East Atlantic region (Celtic Seas).

Within the deep sea environment, deep sea sediments provide the largest store of carbon. The rate of storage in these deep sea sediments is lower, as sedimentation rates are reduced in the deep sea. However, due to the low mobility of these sediments the storage is considered to be more permanent.

[2] ICES WGDEEP. (2017). Report of the Working Group on the Biology and Assessment of Deep-sea Fisheries Resources (WGDEEP), 24 April–1 May 2017, Copenhagen, Denmark. ICES CM 2017/ACOM:14. 702 pp.

What are the likely significant environmental effects of the proposed deep sea marine reserve?

Overall, the increased protection from the designation of the deep sea marine reserve will provide environmental benefits for the overarching topic Biodiversity, Flora and Fauna (Biodiversity, Flora and Fauna; Soil; Water; and Climatic Factors), as well as contribute to the achievement of the Strategic Environmental Assessment objectives. This is because the designation of the proposed deep sea marine reserve will provide developers with a better understanding of the species and habitats that need to be protected and will therefore help ensure that more effective environmental assessments are undertaken to support marine licence applications for future activities in the deep sea. Alternatively, developers may look to locate their activities, such as the extraction of minerals through seabed mining, elsewhere to avoid these sites, which in turn would reduce future pressures associated with regulated activities within the proposed deep sea marine reserve and provide potential environmental benefits.

Although no specific management measures are proposed at present within the deep sea marine reserve, 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 Strategic Environmental Assessment objectives where the targeted activities and pressures (extractive activities) currently, or might in the future, occur within the proposed deep sea marine reserve.

A summary of the environmental effects when considering the alternative areas is provided below. The effects of designating both areas are considered within the cumulative effects section.

Faroe Shetland Reserve (Area 1)

The effect of designating the Faroe Shetland Reserve in isolation (lower scenario) will be positive within the reserve, through greater environmental protection and more effective environmental assessments as described above. These beneficial effects within the reserve may be increased through the future implementation of management measures under the intermediate and upper scenarios which reduce or prevent seabed damaging activities within the reserve. The potential displacement of activities, as a result of designating the reserve or from the future implementation of management measures, into other sensitive areas, such as those found in the West of Scotland Reserve, has the potential to introduce an adverse environmental effect outwith the reserve.

It is recognised that the benefits and negative effects of designating the Faroe Shetland Reserve are partially already realised through the designation and potential future management of the North East Faroe Shetland Channel MPA, which overlaps with approximately two thirds of the Faroe Shetland Reserve area.

West of Scotland Reserve (Area 2)

The effect of designating the West of Scotland Reserve in isolation (lower scenario) will be positive within the reserve, through greater environmental protection and more effective environmental assessments as described above. These beneficial effects within the reserve may be increased through the future implementation of management measures under the intermediate and upper scenarios which reduce or prevent seabed damaging activities within the reserve. The potential displacement of activities, as a result of designating the reserve or from the future implementation of management measures, into other sensitive areas, such as those found in the Faroe Shetland Reserve, has the potential to introduce an adverse environmental effect outwith the reserve.

What are the cumulative effects of the proposed deep sea marine reserve?

The cumulative assessment reviews the potential effects of the third boundary alternative, designating the combined area (Area 1 and Area 2) deep sea marine reserve. In addition, the assessment presents the potential cumulative effects arising from the proposal alongside other plans and programs, including the wider MPA network.

The designation of both the West of Scotland Reserve and the Faroe Shetland Reserve within the deep sea marine reserve will have cumulative impacts through the inclusion of a wider range of deep sea habitats and species across a larger area. In addition, the designation of both areas prevents any potential displacement of potentially damaging activities from one area into the other. The potential for cumulative benefits exists under all scenarios. Under the lower scenario, no overarching immediate benefits are observed, whilst under the intermediate and upper scenario there is potential for an overall minor beneficial immediate impact. The potential for greater future benefits exists under all management scenarios.

In addition to the cumulative effects resulting from the designation of both Area 1 and Area 2 within the deep sea marine reserve discussed above, the designation of the proposed Marine Protected Areas will act in-combination with other plans, programmes and/or strategies, namely the wider Marine Protected Area network and existing protection measures, as discussed below, to further benefit the overarching topic of Biodiversity, Flora and Fauna in Scottish waters and contribute to the achievement of Strategic Environmental Assessment objectives.

The assessment recognises that the designation of the deep sea marine reserve will lead to the partial or full de-designation of some current MPAs (Rosemary Bank Seamount MPA (full), North East Faroe-Shetland Channel MPA(partial)), which have associated proposed management measures. Therefore, should the deep sea marine reserve be designated but management measures not be implemented at a level equivalent to those proposed for the current MPAs this could lead to overall negative effects in these areas.

There is the potential for cumulative effects on the environment, both beneficial within the sites and adverse outwith the sites, from the displacement of fishing activities resulting from previous plans in-combination with the current proposals. Specifically, there is

potential for management measures assessed previously for MPA network sites overlapping or adjacent to the proposed deep sea marine reserves to offer benefits in combination with the deep sea marine reserve. These may prevent future damage to sensitive habitats throughout the offshore, and specifically deep sea, environment. The displacement of fishing from multiple areas may, however, concentrate such activities into smaller areas which are already heavily exploited, such as within the shelf seas, leading to an increase of pressures on fish populations and benthic habitats. A more detailed assessment of cumulative effects will need to be undertaken should any specific management measures for the deep sea marine reserve be proposed in future.

How do I respond to the consultation?

The consultation on the designation of the Deep Sea Marine Reserve and the accompanying Environmental Report is now open and will close on 6 September 2019. Views and opinions on this Environmental Report, and the Deep Sea Marine Reserve designation, are now invited.

The management scenarios in this environmental report 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 conservation objectives of the deep sea marine reserve will be subject to further consideration under the 2005 Act and are likely to require their own SEA.

Please provide any comments on this environmental assessment in your responses to the consultation questionnaire, including any comments on general issues or cumulative effects.

Following the consultation period, the responses received will be analysed, and the findings from this analysis will be taken into account in the finalisation of the Deep Sea Marine Reserve.

A Post-Adoption SEA Statement will be prepared, reflecting the findings of the assessment and the views expressed in the consultation, and outlining how the issues raised have been considered.

Please send your response, with the completed Respondent Information Form, to:

- By email to: marine_conservation@gov.scot or
- By post to: MPA Management Consultation
  Scottish Government
  Marine Planning and Policy Division
  Area 1-A South
  Victoria Quay
  Edinburgh EH6 6QQ
- On line: www.consult.gov.scot/

If you have any inquiries please send them to marine_conservation@gov.scot

Table of Contents

Tables

Figures

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 The deep seas around Scotland are home to some of the most vulnerable habitats and species on earth[3,4]. A deep sea marine reserve is proposed for designation to prevent the further decline of these globally threatened habitats and species and facilitate their recovery. This will also protect the range of ecosystem services that deep sea ecosystems provide, including nutrient cycling and carbon storage[5]. When designated, the reserve will complement and form part of Scotland's existing MPA network.

1.1.3 The proposal for a deep sea marine reserve is intended to build on the EU Deep Sea Fisheries Regulation 2016/2336[6] which bans deep sea trawling in EU waters at depths greater than 800 m and closes vulnerable marine ecosystems to bottom gear fishing at depths greater than 400 m. The use of gillnets and entangling nets are also banned at depths greater than 600 m and restricted at depths between 200 and 600 m, according to EU Regulation 227/2013[7]. These EU Regulations complement other international regulations that ensure emerging extractive activities are appropriately managed in the context of the status of vulnerable habitats and species in deep seas around Scotland.

1.1.4 The proposed location for a deep sea marine reserve has not yet been finalised. Three boundary options for the proposed reserve are being considered by Marine

[3] Scottish Government (2011). Scotland's Marine Atlas: Information for The National Marine Plan. Deep Sea Habitats. Available at: https://www2.gov.scot/Publications/2011/03/16182005/49 (accessed 20/11/2018).

[4] JNCC (2012). Nature News Issue 27: Winter 2012. Improving our understanding of deep sea marine habitats. Available at: http://jncc.defra.gov.uk/page-6038 (accessed 20/11/2018).

[5] Hanley, Nick; Hynes, Stephen; Patterson, David; and Jobstvogt, Niels (2015). "Economic Valuation of Marine and Coastal Ecosystems: Is it currently fit for purpose?" Journal of Ocean and Coastal Economics: Vol. 2, Article 1. DOI: http://dx.doi.org/10.15351/2373-8456.1014

[6] Regulation (EU) 2016/2336 of the European Parliament and 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://ec.europa.eu/fisheries/better-future-eu-deep-sea_en (accessed 14/11/2018)

[7] Regulation (EU) No 227/2013 of the European Parliament and of the Council of 13 March 2013 amending Council Regulation (EC) No 850/98 for the conservation of fishery resources through technical measures for the protection of juveniles of marine organisms and Council Regulation (EC) No 1434/98 specifying conditions under which herring may be landed for industrial purposes other than direct human consumption. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32013R0227 (accessed 21/11/2018)

Scotland based on advice from the Joint Nature Conservation Committee (JNCC) and Marine Scotland Science (MSS). These comprise the Faroe Shetland Reserve (FSR) (Area 1), the West of Scotland Reserve (WSR) (Area 2) and a combination of both options (Areas 1 and 2). These areas are shown on Figure 1. Whilst the reserve builds on the deep sea fisheries closures it would include the whole water column and not just the waters below 800m.

1.1.5 It is anticipated that a deep sea marine reserve would be underpinned by designating it as an MPA under the Marine and Coastal Access Act 2009. Sites designated in this manner are protected by provisions in s125 and 126 of the Act which places legal duties on public authorities not to put protected features at significant risk through their decision making. In addition, s140 provides general protection against intentional or reckless damage or destruction. Although a number of fishing activities are already banned or restricted in deep sea areas by existing EU Regulations, the establishment of an MPA will ensure that vulnerable deep sea habitats and species are protected from other activities that do not currently take place but that may occur in the future (e.g. deep sea mining).

1.1.6 The proposal to designate a deep sea marine reserve as an MPA is the subject of this Environmental Report, produced as part of a Strategic Environmental Assessment (SEA).

1.2 Strategic Environmental Assessment

1.2.1 The Environmental Assessment (Scotland) Act 2005 ('the 2005 Act') requires that qualifying public plans, programmes and strategies be assessed for their potential effects on the environment[8]. SEA is the process used to fulfil this requirement and includes consultation with both the public and the Consultation Authorities[9]. The Act also sets out the information that is required to be provided in this Environmental Report.

1.2.2 A scoping exercise of the proposed designation of a deep sea marine reserve as an MPA was undertaken in accordance with the requirements of the 2005 Act[10]. A Scoping Report was published in February 2019, setting out the proposed approach to the SEA, including the proposed scope and level of detail. Comments were invited from the Scottish Consultation Authorities. The proposed scope of the assessment and methodology was broadly accepted by the Scottish Consultation Authorities (see Section 3).

1.2.3 Marine Scotland commissioned ABP Marine Environmental Research Ltd. (ABPmer) to undertake the assessment stage of the SEA and prepare this Environmental Report.

---

[8] 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)

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

[10] A screening exercise was not undertaken as the proposed designation of a deep sea marine reserve falls under Section 5(3) of the 2005 Act.

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 proposed designation of a deep sea marine reserve as an MPA. 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 proposed designation of a deep sea marine reserve as an MPA 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 background information on the development of the proposed deep sea marine reserve and its 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 a deep sea marine reserve;

Section 5 sets out the results of the assessment; and

Section 6 considers the next steps in the designation of the deep sea marine reserve and the SEA process.

1.3.4 The Non-Technical Summary precedes Section 1.

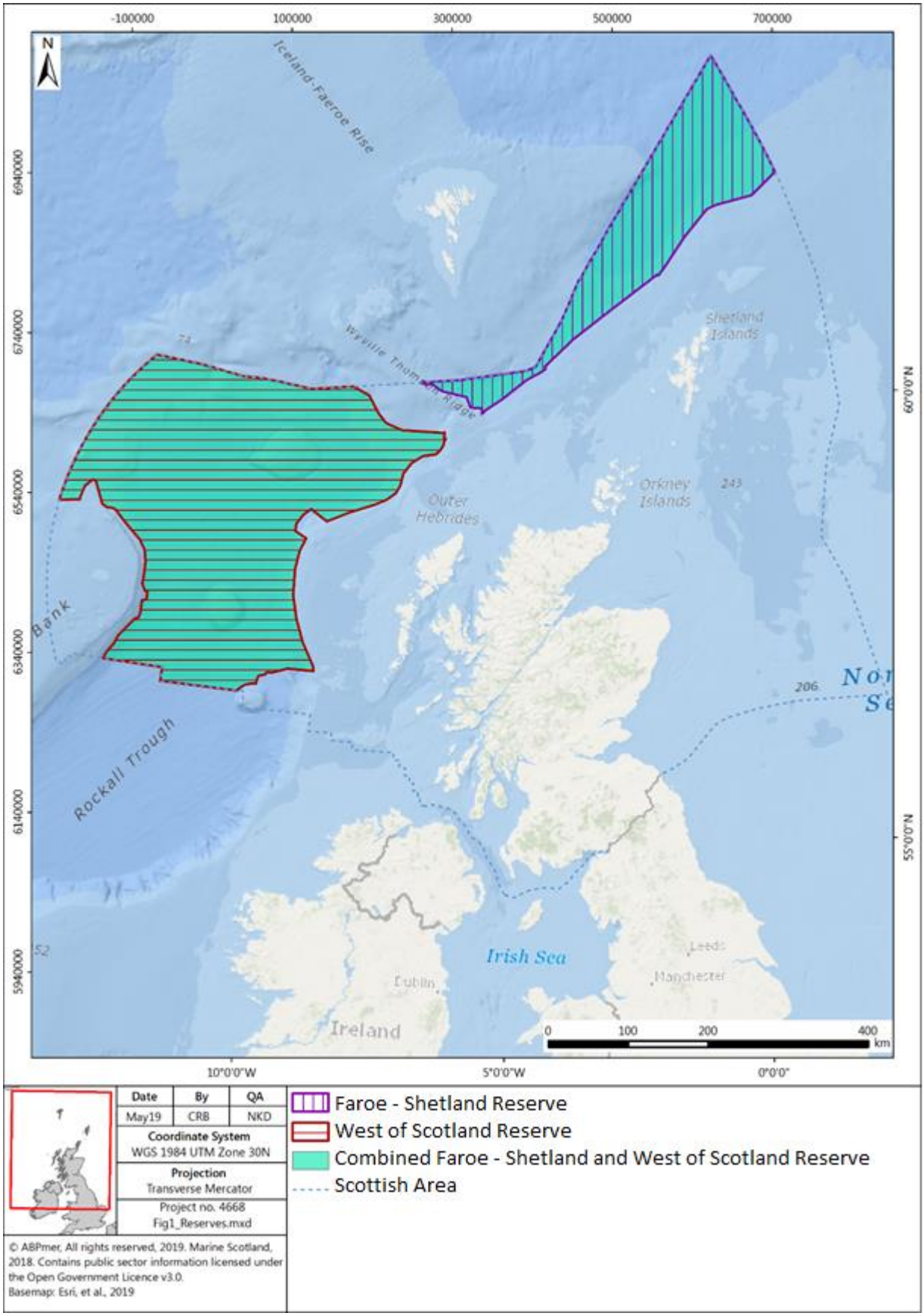


Figure 1 Map of proposed deep sea marine reserve boundary options

2 Proposals for a Deep Sea Marine Reserve

2.1 Background

2.1.1 The deep waters of Scotland support a rich diversity of life[11]. Deep sea habitats occur beyond the continental shelf break at depths typically greater than around 200 m. The inaccessibility of these areas means that research is limited[12]. Although knowledge of these habitats is very patchy and limited, it is growing all the time.

2.1.2 Deep sea habitats are found offshore to the north-east and west of Scotland and comprise cold water coral reefs, coral carbonate mounds, submarine canyons, sea mounts and deep sea sediments. Deep sea habitats and species that are listed as Priority Marine Features (PMFs) include seamount communities, coral gardens, deep sea sponge aggregations, offshore deep sea muds and cold-water coral reefs.

2.1.3 Deep sea habitats can provide spawning, nursery and refuge areas for many fish[13], as well as support a wide range of invertebrates[14]. Cold water coral reefs are slow growing, fragile and easily damaged, and thousands of years of growth can be rapidly destroyed by activities that cause direct physical disturbance of the seabed along with the associated increase in turbidity and subsequent sedimentation. Spawning areas and spawning aggregations of fish present in the deep sea areas of Scotland, for example anglerfish, are vulnerable to targeted fishing[15]. Deep sea fish species for which there is already a zero Total Allowable Catch (TAC), for example Portuguese dogfish, are also vulnerable to bycatch[16].

2.1.4 There is therefore a need to protect these particularly vulnerable habitats and species from activities that currently take place or could take place there in the future, including deep sea mining activities, deep sea oil and gas exploration and development and deep sea fishing.

2.1.5 The MPA network is intended to benefit the marine environment, historic features, coastal communities, marine industries and recreational users[17]. In

[11] Scottish Government (2011). Scotland's Marine Atlas: Information for The National Marine Plan. Deep Sea Habitats. Available at: https://www2.gov.scot/Publications/2011/03/16182005/49 (accessed 03/12/2018).

[12] JNCC website. Nature News 27. Deep sea marine habitats. Available at: http://jncc.defra.gov.uk/page-6038 (accessed 03/12/2018).

[13] Priede, I.G. (2018) Deep sea Fishes Literature Review. JNCC Report No. 619. JNCC, Peterborough. ISSN 0963-8091.

[14] SNH website. Cold water coral. Available at: https://www.nature.scot/landscapes-and-habitats/habitat-types/coast-and-seas/marine-habitats/cold-water-coral (accessed 03/12/2018).

[15] Priede, I.G. (2018) Deep sea Fishes Literature Review. JNCC Report No. 619. JNCC, Peterborough. ISSN 0963-8091.

[16] Ibid.

[17] ibid

total, it consists of 231 sites covering over 22% of Scotland's seas[18]. 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)[19].

2.1.6 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 significance by complementing other systems of protection, both spatially and through the alignment of conservation objectives[20]. For example, Scotland's Nature Conservation MPAs form part of the wider OSPAR network of marine protected areas that are found across the North East Atlantic[21]. In addition, they contribute to achieving Good Environmental Status (GES) as set out by the Marine Strategy Framework Directive 2008/56/EC[22].

2.2 Designation of the MPA network to date

2.2.1 The Marine (Scotland) Act 2010[23] and the Marine and Coastal Access Act 2009[24] 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 environment, including the proposed deep sea marine reserve that is the topic of this assessment[25].

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

[18] SNH (2017) Nature Conservation Marine Protected Areas [online] Available at: http://www.snh.gov.uk/protecting-scotlands-nature/protected-areas/national-designations/mpas/ (accessed 04/11/2018)

[19] Scottish Government (2017) Marine Protected Areas (MPAs) [online] Available at: http://www.gov.scot/Topics/marine/marine-environment/mpanetwork (accessed 04/11/2018)

[20] Scottish Government (2017) Marine Protected Areas (MPAs) [online] Available at: http://www.gov.scot/Topics/marine/marine-environment/mpanetwork (accessed 04/11/2018)

[21] OSPAR Commission (2015) Marine Protected Areas [online] Available at: https://www.ospar.org/work-areas/bdc/marine-protected-areas (accessed 04/11/2018)

[22] 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 04/11/2018)

[23] Scottish Government (2017) Marine (Scotland) Act [online] Available at: http://www.gov.scot/Topics/marine/seamanagement/marineact (accessed 04/11/2018)

[24] Scottish Government (2014) Marine and Coastal Access Act 2009 [online] Available at: http://www.gov.scot/Topics/marine/seamanagement/marineact/ukbill (accessed 04/11/2018)

[25] 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 04/11/2018)

areas of search[26]. 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)[27]. An SEA Environmental Report, which looked at the potential environmental effects of the designations, was among the suite of consultation documents made available at this time[28].

2.2.3 Following on from this consultation and additional advice received from SNH and JNCC[29], 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.

2.2.4 Draft management measures were subsequently developed and an addendum to the original 2013 Environmental Report was published in November 2014[30]. 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 2016[31].

2.2.5 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 management measures are expected to come into force in 2019.

2.2.6 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 from commercial fishing (scallop dredging) in 2017[32]. This designation was temporary and due to expire in 2019[33]. The Loch Carron MPA was permanently designated in May

[26] ibid

[27] Scottish Government (2015) Planning Scotland's Seas [online] Available at: http://www.gov.scot/Topics/marine/seamanagement/national/marine-consultation (accessed 04/11/2018)

[28] 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 04/11/2018)

[29] 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 04/11/2018)

[30] Scottish Government (2014) MPA/SAC Consultation Environmental Assessment [online] Available at: http://www.gov.scot/Topics/marine/marine-environment/mpanetwork/MPAMGT/consultation2014/ManagementSEA (accessed 04/11/2018)

[31] Scottish Government (2017) Inshore MPAs/SACs [online] Available at: http://www.gov.scot/Topics/marine/marine-environment/mpanetwork/inshorempas (accessed 04/11/2018)

[32] 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 04/11/2018

[33] SNH (2017) Loch Carron possible MPA [online] Available at: https://www.nature.scot/loch-carron-possible-mpa (accessed 04/11/2018)

2019, along with associated fisheries management measures[34],following a public consultation which ran to 13 June 2018[35],

2.2.7 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.

2.2.8 In addition to Nature Conservation MPAs, Fair Isle was designated in 2016 as a Demonstration and Research MPA under the Marine (Scotland) Act 2010[36]. There are also eight historic MPAs (HMPAs) that are designated for nationally important historic assets, predominately shipwrecks[37].

2.2.9 Four additional proposed MPAs (pMPAs) that were initially introduced for consideration as areas of search in 2013 have now been recommended for designation[38]. These pMPAs would extend protection to basking shark, minke whale, Risso's dolphin, burrowed mud, shelf banks and mounds, and shelf deeps. Table 2 below provides a description of the four pMPAs, including their general location, proposed protected features, and draft conservation objectives. A Sustainability Appraisal, comprising an SEA and Socio-economic Impact Assessment (SEIA), is currently being consulted on to inform the designation of these four pMPAs.

[34] Scottish Government (2019). The Loch Carron Marine Conservation Order 2019, made 20 March 2019, coming into force 19 May 2019 https://www2.gov.scot/Resource/0054/00546857.pdf

[35] Scottish Government (2019) The Loch Carron Nature Conservation Marine Protected Area Order 2019, made 20 March 2019, coming into force 19 May 2019. https://www2.gov.scot/Resource/0054/00546856.pdf

[36] 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 17/11/2018)

[37] Historic Environment Scotland (2016). Scotland's Historic Marine Protected Areas 2016.

[38] 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 04/11/2018)

Table 1 Existing Nature Conservation MPAs in Scotland

Nature Conservation MPA	Year designated	Protected features	Draft conservation objectives
Inshore			
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	Conserve
		Geodiversity: Quaternary of Scotland	
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	Conserve
		Geodiversity: Quaternary of Scotland – glaciated channels/troughs, glacial lineations, meltwater channels, moraines, streamlined bedforms	
Wyre and Rousay Sounds	2014	Biodiversity: kelp and seaweed communities on sublittoral sediment; maerl beds	Conserve
		Geodiversity: marine geomorphology of the Scottish shelf seabed	
East Caithness Cliffs	2014	Biodiversity: black guillemot	Conserve
Loch Sunart to the Sound of Jura	2014	Biodiversity: common skate	Conserve
		Geodiversity: Quaternary of Scotland – glaciated channels/troughs	
Monach Isles	2014	Biodiversity: black guillemot	Conserve
		Geodiversity: marine geomorphology of Scottish shelf seabed; Quaternary of Scotland – landscape of areal glacial scour	
Noss Head	2014	Biodiversity: horse mussel beds	Conserve
South Arran	2014	Biodiversity: burrowed mud; kelp and seaweed communities on sublittoral	Recover maerl

		sediments; maerl beds; maerl or coarse shell gravel with burrowing sea cucumbers; ocean quahog aggregations; seagrass beds; shallow tide-swept coarse sands with burrowing bivalves	beds, conserve other features
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: sandeel	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	2019	Biodiversity: flame shell beds	Recover

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 (sea pens 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: sandeel	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
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 (sea pen 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: sandeel	Conserve
West Shetland Shelf	2014	Biodiversity: offshore subtidal sands and gravels	Conserve

Table 2 Characteristics of the four additional pMPAs

pMPA	Proposed protected features	Draft conservation objectives
North-east Lewis	Biodiversity: Risso's dolphin; sandeels	Conserve
	Geodiversity: marine geomorphology of the Scottish shelf bed – longitudinal bedform field; Quaternary of Scotland – glaciated channels/troughs, landscape of areal glacial scour, megascale glacial lineations	
Sea of the Hebrides	Biodiversity: basking shark; minke whale; fronts	Conserve
	Geodiversity: marine geomorphology of the Scottish shelf seabed - Inner Hebrides Carbonate Production Area	
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 - drumlinoid forms, glacial lineations, iceberg ploughmarks, streamlined bedrock	
Southern Trench	Biodiversity: burrowed mud; minke whale; fronts; shelf deeps	Conserve
	Geodiversity: Quaternary of Scotland – subglacial tunnel valleys and moraines; Submarine Mass Movement – slide scars	

2.3 Proposed deep sea marine reserve

2.3.1 The Scottish Government's Programme for Scotland 2017-18 included a commitment to 'evaluate options to create a deep sea national marine reserve'. The designation of a deep sea reserve would complement the existing MPA network in Scottish waters and provide a legal framework for the protection of additional deep sea marine habitats and species against emerging threats.

2.3.2 Marine Scotland and JNCC have recently undertaken a scoping exercise to identify the deep sea features of interest and evaluate options for creating a deep sea national marine reserve to the north-west and north-east of Scotland in waters deeper than 800 metres[39]. The 'study area' for the potential deep sea marine reserve is divided into two distinct biogeographic areas either side of the Wyville-Thomson Ridge, with different hydrographic and thermal regimes resulting in distinct community types north and south (Figure 1).

2.3.3 Numerous deep sea habitats and species could be appropriate for spatial protection, many of which are already Priority Marine Features (PMFs) or correlate with existing PMF descriptions. Features of interest include deep sea sedimentary habitats, specifically the PMFs 'offshore deep sea muds' and 'offshore subtidal sands and gravels', and associated biodiversity, specifically sea pens, including the tall sea pen (*Funiculina quadrangularis*). There are also a number of fish species that are regarded as potential features of designation interest for the proposed large-scale deep sea MPAs[40], such as porbeagle (*Lamna nasus*) and monkfish/anglerfish (*Lophius piscatorius*).

2.3.4 The proposal for a deep sea marine reserve has been informed by the EU Deep Sea Fisheries Regulation 2016/2336[41]. This EU Regulation bans deep sea trawling below 800 m depth in EU waters and closes vulnerable marine ecosystems below 400 m to bottom gear fishing. In addition, the use of gillnets and entangling nets are also banned at depths greater than 600 m and restricted at depths between 200 and 600 m, according to EU Regulation 227/2013[42]. Further, designation of the reserve as an MPA under the Marine and Coastal Access Act 2009 will safeguard the site against disturbance by any future activities, such as deep sea mining.

---

[39] Doggett, M., Baldock, B. & Goudge, H. (2018). A review of the distribution and ecological importance of seabed communities in the deep waters surrounding Scotland. JNCC Report No. 625, JNCC, Peterborough, ISSN 0963-8091.

[40] Priede, I.G. (2018) Deep sea Fishes Literature Review. JNCC Report No. 619. JNCC, Peterborough. ISSN 0963-8091.

[41] Regulation (EU) 2016/2336 of the European Parliament and 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://ec.europa.eu/fisheries/better-future-eu-deep sea_en (accessed 14/11/2018]).

[42] Regulation (EU) No 227/2013 of the European Parliament and of the Council of 13 March 2013 amending Council Regulation (EC) No 850/98 for the conservation of fishery resources through technical measures for the protection of juveniles of marine organisms and Council Regulation (EC) No 1434/98 specifying conditions under which herring may be landed for industrial purposes other than direct human consumption. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32013R0227 (accessed 21/11/2018)

2.3.5 The proposed designation of a deep sea marine reserve MPA is the subject of this present assessment. The boundary options for a proposed deep sea marine reserve that are being considered by Marine Scotland, informed by advice received from JNCC, are as follows:

Faroe Shetland Reserve (Area 1);

West of Scotland Reserve (Area 2); and

West of Scotland and Faroe Shetland Combined (Areas 1 and 2).

2.3.6 Table 3 below provides a description of the boundary options for a proposed deep sea marine reserve, including proposed protected features and draft conservation objectives. Figure 1 provides a map of the location of the boundary options.

Table 3 Characteristics of the proposed deep sea marine reserve boundary options under assessment

Boundary option	Proposed protected features
Faroe Shetland Reserve (Area 1)	Burrowed mud (including sea pens)
	Deep sea sponge aggregations
	Atlantic-influenced offshore deep sea muds
	Atlantic-influenced offshore subtidal sands and gravels
	Geodiversity features
West of Scotland Reserve (Area 2)	Burrowed mud (including sea pens)
	Coral gardens
	Cold-water coral reefs (including *Lophelia pertusa* reefs)
	Deep sea sponge aggregations
	Atlantic-influenced offshore deep sea muds
	Atlantic-influenced offshore subtidal sands and gravels
	Seamount communities
	Seamounts
	Blue Ling (*Molva dypterygia*)
	Leafscale gulper shark (*Centrophorus squamosus*)
	Gulper shark (Centrophorus granulosus)
	Orange roughy (*Hoplostethus atlanticus*)
	Portuguese dogfish (*Centroscymnus coelolepis*)
	Roundnose grenadier (*Coryphaenoides rupestris*)
	Geodiversity features
West of Scotland and Faroe Shetland Combined (Areas 1 and 2)	All features listed above under areas 1 and 2.

2.4 Policy context overview of proposals for a deep sea marine reserve

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 for the designation of the proposed deep sea marine reserve as an MPA. This policy context is illustrated in Figure 2. 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 MPAs[43]. 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 users[44].

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/EC[45]. They also form part of the OSPAR Convention network of protected sites found throughout the North East Atlantic Ocean[46]. In addition, they aim to maintain and enhance biodiversity, which is a focus of the Habitats (92/43/EEC)[47] and Birds (2009/147/EC)[48] Directives.

2.4.5 Sites designated as MPAs under the Marine and Coastal Access Act 2009 are protected by provisions in s125 and s126 of the Act which place legal duties on public authorities not to put protected features at significant risk through their decision making. In addition, s140 provides general protection against intentional

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

[44] 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)

[45] 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)

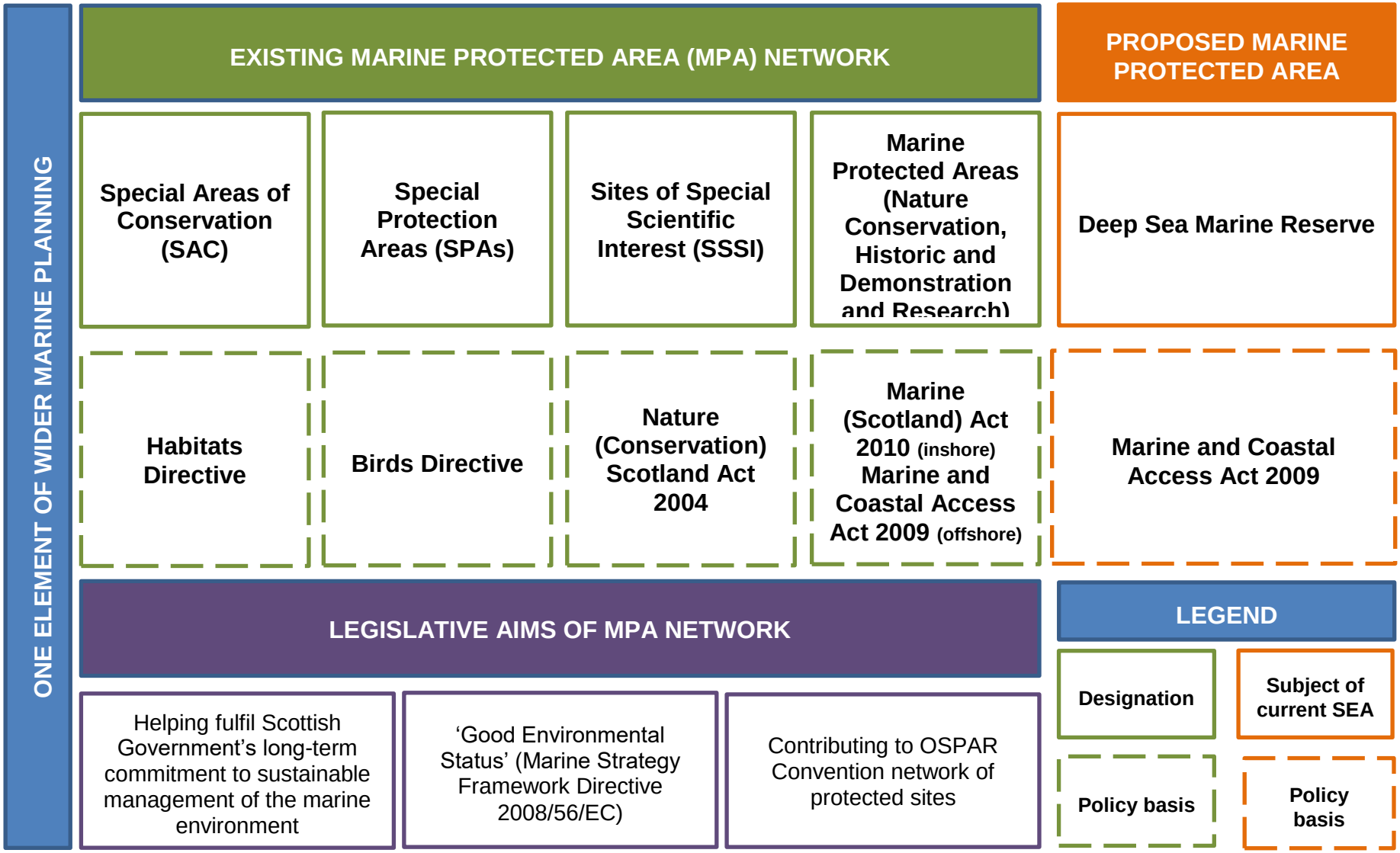
[46] OSPAR Commission (2015) Marine Protected Areas [online] Available at: https://www.ospar.org/work-areas/bdc/marine-protected-areas (accessed 17/10/2018)

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

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

or reckless damage or destruction. Although a number of fishing activities are already banned or restricted in deep sea areas by existing EU Regulations, the establishment of a deep sea marine reserve as an MPA will ensure that vulnerable deep sea habitats and species are protected from other activities that do not currently take place but that may occur in the future (e.g. deep sea mining).

Figure 2 Policy context of proposals for a deep sea marine reserve



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 proposed designation of a deep sea marine reserve. 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 proposed deep sea marine reserve to be assessed

3.2.1 It is not considered within the scope of this SEA to evaluate the evidence base underlying the decision to designate a deep sea marine reserve. JNCC has undertaken desk study literature reviews on deep sea fish species[49] and the distribution and ecological importance of deep sea habitats[50] to support the proposal. Similarly, it is not within the scope of this SEA to evaluate the deep sea marine reserve's effectiveness at conserving or recovering protected features (see Section 2.3). The deep sea marine reserve will have its own reporting and monitoring requirements, in line with the Marine and Coastal Access Act 2009.

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 the boundary options being considered for the proposed deep sea marine reserve based on the outcomes of the SEIA.

3.3 Scope of the assessment

3.3.1 The information presented in this Environmental Report has built on the 2013 SEA undertaken on the first round of Nature Conservation MPA designations[51]. However, it has also been informed by the currently ongoing SEAs of the four

[49] Priede, I.G. (2018) Deep sea Fishes Literature Review. JNCC Report No. 619. JNCC, Peterborough. ISSN 0963-8091

[50] Doggett, M., Baldock, B. & Goudge, H. (2018). A review of the distribution and ecological importance of seabed communities in the deep waters surrounding Scotland. JNCC Report No. 625, JNCC, Peterborough, ISSN 0963-8091.

[51] 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 04/11/2018)

additional pMPAs proposed for designation[52] and of the 15 marine Special Protection Areas (SPAs) that have been proposed for classification[53].

3.3.2 A similar approach to these previous SEAs has been taken for the assessment of the proposed deep sea marine reserve. The rationale for this is that the designation of a deep sea marine reserve as an MPA in offshore waters places duties on public bodies under the Marine and Coastal Access Act 2009 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, irrespective of whether or not any corresponding management measures have been introduced, has the potential to lead to significant environmental effects.

3.3.3 It is acknowledged that specific management measures could exacerbate or introduce additional environmental effects and so preliminary consideration will also be given to the type of impacts that could arise from the development of any future management measures. A number of possible management scenarios for each boundary alternative are considered as reasonable alternatives in this SEA to inform the development of any future management measures (Section 3.4).

3.3.4 The proposed designation of a deep sea marine reserve as an MPA provides some degree of protection to all the species and habitats that fall within or regularly use it, 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 proposed deep sea marine reserve. In addition to potential benefits, the designation of a deep sea MPA may result in potential adverse effects on species and habitats outwith the boundaries of the pMPA reserve as a result of the displacement of any existing and future activities.

3.3.5 A review of related assessment work (see Section 3.6) suggests that potentially significant environmental effects as a result of the designation of a proposed deep sea marine reserve are likely to fall under the SEA topic of Biodiversity, Flora and Fauna. This could also include relevant aspects of Soil (geodiversity), Water (the environmental status of water bodies) and Climatic Factors (carbon cycling and storage). The 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 previous and ongoing SEAs of the MPA network, MPA management measures and the proposals for an additional suite of marine Special Protection Areas (SPAs). The rationale for scoping in and out SEA topics is provided in Table 4.

[52] This report can be located on the SEA Database (case number:01398).

[53] This report can be located on the SEA Database (case number:01353).

Table 4 Proposed scoping in/out of SEA topics

SEA topic	In/out	Reasons for inclusion / exclusion
Biodiversity, Flora and Fauna	In	As an area-based conservation measure, the proposed designation of a deep sea marine reserve as an MPA provides some degree of protection to all the species and habitats that fall within or regularly use it, 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 proposed deep sea marine reserve. As such, the proposed deep sea marine reserve will likely benefit not only the species for which they are intended, but marine biodiversity more generally. In addition to potential benefits, the designation of a deep sea MPA may result in potential adverse effects on species and habitats outwith the boundaries of the reserve as a result of the displacement of any existing and future activities. Although certain Soil features are protected features in their own right, it is felt that impacts on Soil 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 be scoped in under Biodiversity, Flora and Fauna. Biodiversity is a key consideration underlying the water quality objectives of 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. In addition, it is proposed that the potential impacts of the designation of a deep sea reserve 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 the potential for deep sea marine flora to serve as long term carbon stores. As noted previously, it is not within the scope of this SEA to assess the effectiveness of the deep sea marine reserve at conserving or recovering protected features.
Population and Human Health	Out	It is proposed that Population and Human Health be scoped out of the assessment as the designation of the proposed deep sea marine reserve as an MPA is unlikely to lead to any significant impacts on this receptor. The SEIA that is being undertaken in parallel to the SEA, as well as the overarching SA of which this SEA is a part, will address any potential socioeconomic impacts.
Soil	In	The protected features on which the proposed deep sea marine reserve is predicated are likely to 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 can be scoped in under the SEA topic of Biodiversity, Flora and Fauna.
Water	In	Scotland has a commitment under the MSFD to bring its marine environment to Good Environmental Status (GES). This involves satisfying several qualitative descriptors relating to biodiversity. Given this link, it is proposed

SEA topic	In/out	Reasons for inclusion / exclusion
		that the role of the proposed deep sea marine reserve in contributing towards GES be covered under the topic of Biodiversity, Flora and Fauna. The proposed deep sea marine reserve will be located well offshore of the waters covered by the Water Framework Directive (WFD) and therefore the consideration of WFD water bodies in achieving Good Ecological Status can be scoped out of the assessment. Effects on water quality and/or quantity are not anticipated and it is proposed that this subtopic can 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 proposed deep sea marine reserve is unlikely to lead to impacts on this receptor.
Climatic Factors	In	Deep sea habitats play a role in climate change regulation by acting as long term carbon stores[54]. It is therefore proposed that the potential impact of the proposed deep sea marine reserve on Climatic Factors as it relates to carbon storage 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 proposed reserve due to the displacement of certain activities that result in the potential re-suspension of stored carbon in the water where it can more easily break down.
Material Assets	Out	The effects of the proposal 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 provides 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 deep sea marine reserve or else are never introduced, thereby indirectly benefiting submerged cultural heritage. However, this benefit is contingent upon the MPA 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	Given that the deep sea reserve will be located offshore and so is likely to be far removed from landscapes and seascapes visible from shore, it is proposed that Landscape/Seascape as a topic be scoped out of the assessment.

[54] Thompson, K., Miler, K., Johnston, P., and Santillo D. (2017). Storage of carbon by marine ecosystems and their contribution to climate change mitigation. Greenpeace Research Laboratories Technical Report (Review) 03-2017. Available at: http://www.greenpeace.to/greenpeace/wp-content/uploads/2017/05/Carbon-in-Marine-Ecosystems-Technical-Report-March-2017-GRL-TRR-03-2017.pdf (accessed 14/11/2018).

3.4 Reasonable alternatives

3.4.1 In accordance with the 2005 Act, there is a requirement to consider reasonable alternatives as part of the SEA. Within this report, the different boundary options (Faroe Shetland Reserve, West of Scotland Reserve and both areas combined) form one set of reasonable alternatives. In addition, the different ways in which the proposed deep sea marine reserve might be managed in the future to support the achievement of site conservation objectives are considered reasonable alternatives. As part of the development of the proposal for a deep sea marine reserve, Marine Scotland has developed lower, intermediate and upper scenarios for managing pressures/activities within the proposed deep sea marine reserve options:

> Lower Scenario: Existing fisheries management and consenting processes;
>
> Intermediate Scenario: No extractive activities that affect the seabed (e.g. demersal fisheries, oil and gas development, deep sea mining, etc.); and
>
> Upper Scenario: No extractive activities that affect the seabed or the water column (e.g. demersal and pelagic fisheries, oil and gas exploration and development, deep sea mining, etc.).

3.4.2 These management scenarios will be considered as reasonable alternatives for each of the potential boundary options for a designated deep sea marine reserve (see Figure 1).

3.4.3 These 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 conservation objectives of the deep sea marine reserve will be subject to further consideration under the 2005 Act.

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 proposed deep sea marine reserve as an MPA. The SEA has also assessed the potential effects that could arise for each of the potential boundaries for the designation subjected to each of the three indicative management scenarios (see Section 3.4).

3.5.2 The FSR and WSR have initially been assessed separately as the first two boundary options, and subsequently assessed together under the cumulative effects section, given the spatial distinction between the two areas and hence the cumulative nature of the effects if both areas were to be designated as a single deep sea marine reserve.

3.5.3 The assessment has been informed by a desk-based review of available information on the existing environment within and around the potential boundary options for a designated deep sea marine reserve. This baseline review is presented in Section 4.

3.5.4 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 potential boundary options for a proposed deep sea marine reserve. This includes available information on the relative fishing intensity of different targeted species and/or gear types[55], telecommunications cables, oil and gas, and military activities. The limitations of the fishing data that has been used to inform the SEA is reviewed in detail in the SEIA. Maps of available spatial data for a range of human activities are included in Appendix B.

3.5.5 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 JNCC studies, available databases on activity-pressures and Scottish Government's Feature Activity Sensitivity Tool (FEAST) and related resources [56].

3.5.6 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, minor, moderate or adverse) of potential immediate effects that may result from the management scenarios at each of the potential boundary options for a designated deep sea marine reserve. The potential for future effects and their type (beneficial or adverse) has also been identified where relevant. However, the magnitude of these potential future effects has not been possible to predict based on available information.

3.5.7 An overall (cumulative) assessment of the potential effects from each of the management scenarios for each of the potential boundary options for a designated deep sea marine reserve has been undertaken. For this, the 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 deep sea marine reserve and negligible spillover benefits beyond the site boundaries versus minor adverse displacement effects, the magnitude of the overall (cumulative) impact is considered to be minor beneficial.

[55] 2009-2013 amalgamated Vessel Monitoring System (VMS) intensity data of relative fishing intensity of over-12 m vessels.

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

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.

3.5.8 The potential implications of the designation of the proposed deep sea marine reserve as well as 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). Apart from maintaining or working towards achieving 'Good Ecological Status' under the WFD, which is replaced here by 'Good Environmental Status' under the MSFD,), the remaining SEA objectives that have been used in recent related SEAs remain applicable to the present assessment.

Table 6 SEA objectives

SEA Topics	Proposed SEA Objective
Biodiversity, Flora and Fauna	• To safeguard and enhance marine 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 marine water environment; • To maintain or work towards achieving 'Good Environmental Status' of the marine environment; 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 As noted earlier, this SEA builds upon the following SEAs of relevant Scottish Government marine conservation work:

The designation of the first round of Nature Conservation MPAs (assessed in 2013)[57];

Proposals for an additional suite of marine SPAs (currently under assessment)[58];

Phase one (assessed in 2014)[59] and proposals for phase two (currently under assessment) of the implementation of MPA management measures; and

Proposals for four additional pMPAs (currently under assessment); and

Proposals for management measures applying to PMFs (currently under assessment).

[57] 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)

[58] 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)

[59] 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)

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 applied. The concurrent assessments that are being undertaken for other 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 Waters[60], the Offshore Wind Sectoral Marine Plan Scoping Report[61] and ongoing SEA of the updated Offshore Wind Sectoral Marine Plan.

3.7 Assumptions

3.7.1 A number of assumptions have underpinned the assessments undertaken on the proposed deep sea marine reserve option areas. These assumptions are based on a combination of expert judgement and reference documentation (referenced individually against each assumption below) and are reported below in Table 7.

[60] 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)

[61] 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)

Table 7 Assumptions used throughout SEA assessment

Assumption	Impact	Justification
Where management measures have been previously proposed for areas within the deep sea marine reserve, it is assumed that these management measures will be adopted even in the event that the deep sea marine reserve is not designated.	Where relevant fishing gears are proposed to be managed within existing MPAs / SACs located within the deep sea marine reserve, the environmental impacts of excluding these activities are not considered within this report.	These measures have been assessed in previous documentation[62] and will be considered as part of cumulative effects in Section 5.4.
As the gear types used by foreign fishing vessels is unknown it is assumed that, based on the banning of demersal trawling in water depths greater than 800 m under EU regulation 2016/2336, the majority of foreign fishing effort within the deep sea marine reserve is non-bottom contacting i.e. pelagic gear.	Although the potential for some demersal foreign gear to be active in the deep sea marine reserve at water depths less than 800 m is recognised, foreign fishing effort will only be considered to be fully excluded under the upper scenario. If more of the foreign fishing effort is bottom contacting than is assumed, the assessment will underestimate the benefits to benthic receptors under the intermediate and upper scenarios.	No reliable evidence is available to determine the gear types being used by foreign vessels. It is therefore considered appropriate to assume the worst-case for the purposes of this assessment i.e. to underestimate rather than overestimate the benefits of the designation and management of the deep sea marine reserve.
It is assumed that the majority of fishing effort excluded from the deep sea marine reserve is likely to be displaced to areas outwith the deep sea marine reserve.	This will protect the features within the boundaries of the deep sea marine reserve but reduce the potential benefit to biodiversity receptors outwith the reserve under the intermediate and upper scenario. Should fishing effort be lost instead of displaced to other areas, there is the potential for further benefits.	It is appropriate to assume a worst-case scenario for the purposes of this assessment. Based on expert judgement, it is considered unlikely that significant fishing effort will be lost altogether from the region and is more likely to be displaced.
It is assumed that there will not be a significant increase in pelagic fisheries within the deep sea marine reserve under the lower or intermediate scenario.	This will not impact the assessment significantly, as future benefits are not directly quantified, however it may cause an under-emphasis to be placed on the future benefits of the deep sea marine reserve.	It is likely that if there were a significant pelagic fishery with the potential to be exploited within the deep sea marine reserve, it would be currently exploited, and is unlikely to develop as a result of the designation of the deep sea marine reserve.

[62] Joint Recommendation regarding the protection of Special Areas of Conservation and Marine Protected Areas in the North Sea, designated under the EU Habitats Directive 92/43/EEC of 21 May 1992 and the EU Marine Strategy Framework Directive 2008/56/EC of 17 June 2008, using the provisions of Article 11 and Article 18 of Regulation (EU) No 1380/2013 of the European Parliament and of the Council of 11 December 2013 on the Common Fisheries Policy

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 proposed designation of the deep sea marine reserve as an MPA. The focus of this baseline information is therefore on Biodiversity, Flora and Fauna; Soils (geodiversity); Water (the environmental status under the MSFD); and Climatic Factors (carbon cycling and storage), reflecting the scope of the assessment as described in Section 3.3.

4.1.2 JNCC has undertaken thorough literature reviews of the seabed communities[63] and deep sea fisheries[64], of the two areas being considered for designation. Rather than reproducing this work in detail, a summary of the relevant baseline information to support the SEA is presented in this section. The reports are both publicly available and can be referred to for further detail if required.

4.2 Biodiversity, flora and fauna

Deep sea habitats

4.2.1 The deep sea sedimentary habitats present within the study areas can be generally characterised as either deep sea muds or deep sea sands and gravels. Both habitats support diverse biological communities which vary with depth, substrate, topography, current regime and temperature. A summary of the characteristics of the sedimentary benthic deep sea habitat is included in Table 8.

4.2.2 The biological communities and various physical structures that occur within deep sea sedimentary habitats are in general long-lived, slow-growing, late-maturing and fragile.

4.2.3 Available Geodatabase of Marine Features in Scotland (GeMS) data[65] relevant to the deep sea areas of Scotland under investigation in this report are presented in Figure 3. Muds are present in the northeast of the area and graduate into offshore subtidal sands and gravels as the channel narrows toward the southwest approaching the Wyville-Thomson Ridge. In the western study area, most of the GeMS point data lie within existing MPAs for which there is already documented evidence of the physical habitats present (see Table 1). There are however,

[63] Doggett, M., Baldock, B. & Goudge, H. (2018). A review of the distribution and ecological importance of seabed communities in the deep waters surrounding Scotland. JNCC Report No. 625, JNCC, Peterborough, ISSN 0963-8091.

[64] Priede, I.G. (2018) Deep sea Fishes Literature Review. JNCC Report No. 619. JNCC, Peterborough. ISSN 0963-8091

[65] Scottish Natural Heritage (2019) Geodatabase of Marine features adjacent to Scotland (GeMS) database, https://gateway.snh.gov.uk/natural-spaces/dataset.jsp?dsid=GEMS-PMF

some data for areas outside existing MPAs, specifically for burrowed mud habitats below 800 m along the Hebridean Slope.

4.2.4 The latest information presented in Figure 4 on predicted seabed habitats is provided by National Marine Plan Interactive (NMPi)[66] 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.

4.2.5 To the far north of Scotland in the northern and deeper Norwegian basin area, the substrates are dominated by muds and an area of mixed sediments. As the Channel narrows toward the Wyville-Thomson Ridge the substrate changes with increasing particle size to sandy muds and muddy sands, through sands to mixed and coarse sediments. Sands and coarse sediments occur along the southern edge of the Faroe-Shetland Channel. Table 8 describes the habitats associated with the sediments described here.

4.2.6 To the far west of Scotland, the substrate type along the Hebridean Slope comprises a mixture of mud, sandy muds and muddy sands with occasional coarser sediments on the upper slope. A larger area of sand and coarse sediment exists toward the Darwin Mounds and Wyville-Thomson Ridge. West of the Hebridean Slope the low energy and deep-water environment of the Rockall Trough results in the vast majority of the area being sandy-mud and muddy-sand habitat, with sands and coarser sediments being located around the larger geological features such as seamounts and banks and within the narrow channel between the George Bligh Bank and East Rockall Bank. North of the George Bligh Bank, bands of mixed and coarse sediments are predicted to be present.

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

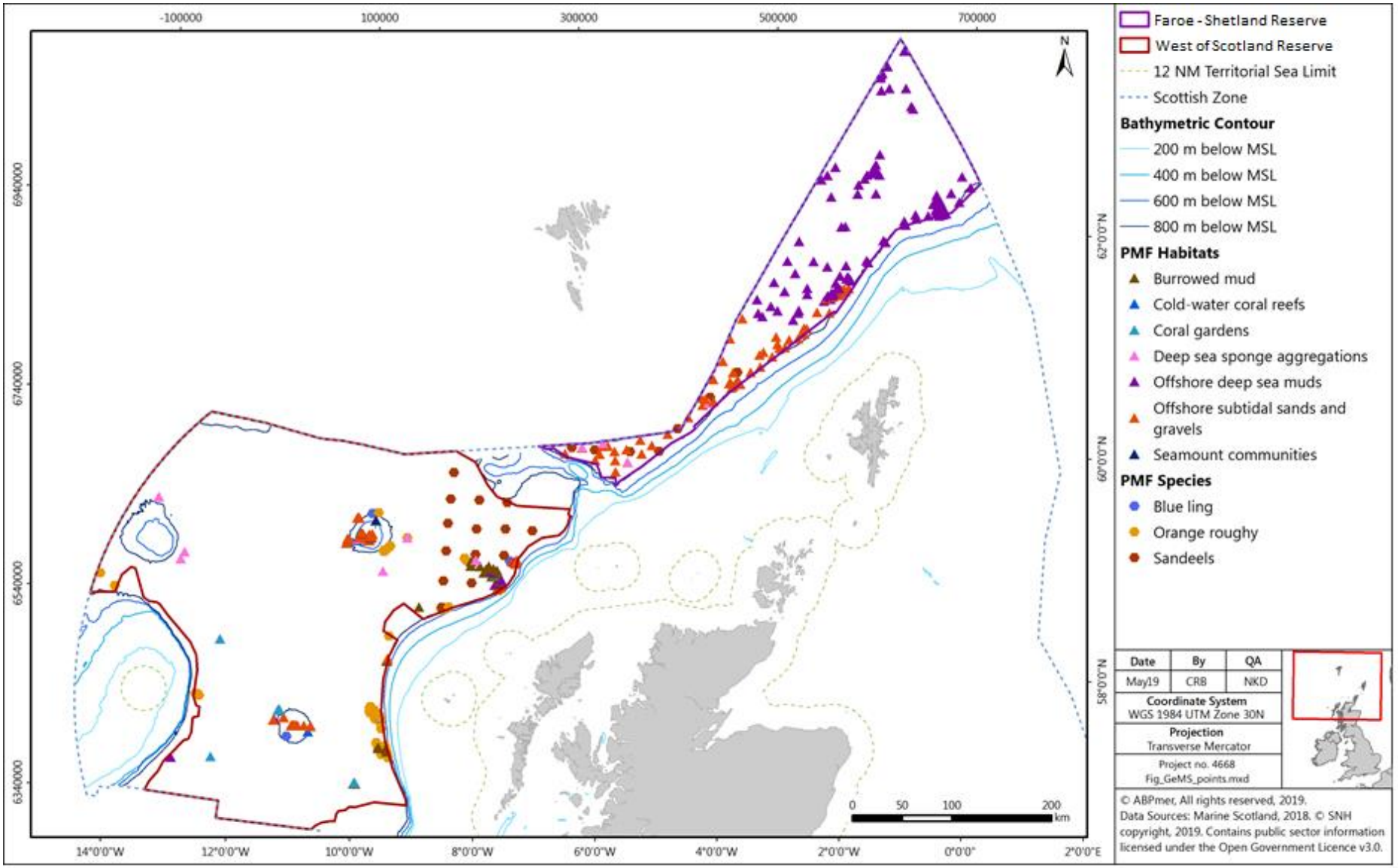


Figure 3 GEMS data applicable to the deep sea marine reserve

Deep sea benthic communities

4.2.7 The ecology of deep sea sedimentary habitats is influenced by sediment type, current regime and temperature. The Faroe-Shetland Channel to the north-east can be classified as 'Arctic deep' and 'Boreal' owing to the ingress of colder (<5°C) northern waters below approximately 600 m depth. Waters to the far west of Scotland can be classed as 'Boreal', 'Boreal-Lusitanian' and 'Atlantic deep'. On the basis that the deep sea fauna to the north and south of the Wyville-Thomson Ridge are considered biogeographically distinct[67], current knowledge on the biodiversity of the sedimentary communities is presented separately below.

Table 8 Summary of benthic habitats within deep sea marine reserve area[68]

	West of Scotland Reserve	Faroe Shetland Reserve
Deep sea muds		
Presence, range and distribution	Present throughout the deeper Rockall Trough and along continental slope habitats	Mainly present in the deeper northeast section of the Faroe-Shetland Channel, becoming coarser as the channel narrows to the southwest
Biological Diversity	Macrofauna is characterised by polychaete communities whilst nematodes dominate the meiofauna. Significant megafauna includes (but not limited to) xenophyophores, sponges, ophiuroids, crustaceans, bivalves, gastropods, acorn worms, octocorals, bamboo coral gardens and anemones. Sea pens are known to occur on the continental slope and deep sea floor.	Characterised by polychaete communities but may also support bivalves, sea pens and holothurians. Burrowed mud habitats are known to occur. Again, nematodes dominate the meiofauna.
Deep sea sands and gravels		
Presence range and distribution	Present in areas with higher energy such as around seamounts, toward and over the Wyville-Thomson Ridge and on the Hatton and George Bligh Banks. Also present along areas of the continental slope.	Present along the continental slope and as the Faroe-Shetland Channel narrows toward the Wyville-Thomson Ridge. Some patches of coarser sediment exist in northern areas.

[67] Hughes, A.J., Narayanaswamy, B.E. & Bett, B.J. (2003). SEA 4: An overview of the benthic ecology of the Faroe-Shetland Channel. 63pp. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/197362/SEA4_TR_Benthos_SOC.pdf

[68] Doggett, M., Baldock, B. & Goudge, H. (2018). A review of the distribution and ecological importance of seabed communities in the deep waters surrounding Scotland. JNCC Report No. 625, JNCC, Peterborough, ISSN 0963-8091.

	West of Scotland Reserve	Faroe Shetland Reserve
Biological diversity	Sands and gravels can support varied communities of sponges, urchins, ophiuroids, crustaceans, anemones, holothurians, gastropods, polychaetes and xenophyrophores. The coral *Lophelia pertusa* is known from coarse sediments on the Darwin Mounds.	Gravels and cobble pavements support diverse epifaunas including octocorals, sponges, crustaceans, sabellid and serpulid worms, echinoderms and crinoids. Sand waves and contourites are known to support sea pen and anemone communities.
Overarching review of deep sea benthic habitats functions		
Functional significance of deep sea benthic habitats	Biogeochemical cycling and retention e.g. carbon and nitrogen storage Climate regulation through carbon acquisition Bioturbation and nutrient exchange Contaminant and waste processing / storage Biodiversity promotes secondary production and where three-dimensional structures are formed, can influence near-bed hydrodynamics Diverse and complex habitats promote more complex food-web dynamics as nursery, feeding and reproductive sites become established, with knock-on benefits for commercial fishing Bacterial diversity can be novel, with potential biotechnology applications Sedimentary habitats support numerous commercial fish species Provide resources for research, education and public engagement Associated with numerous existing PMF habitats and species	

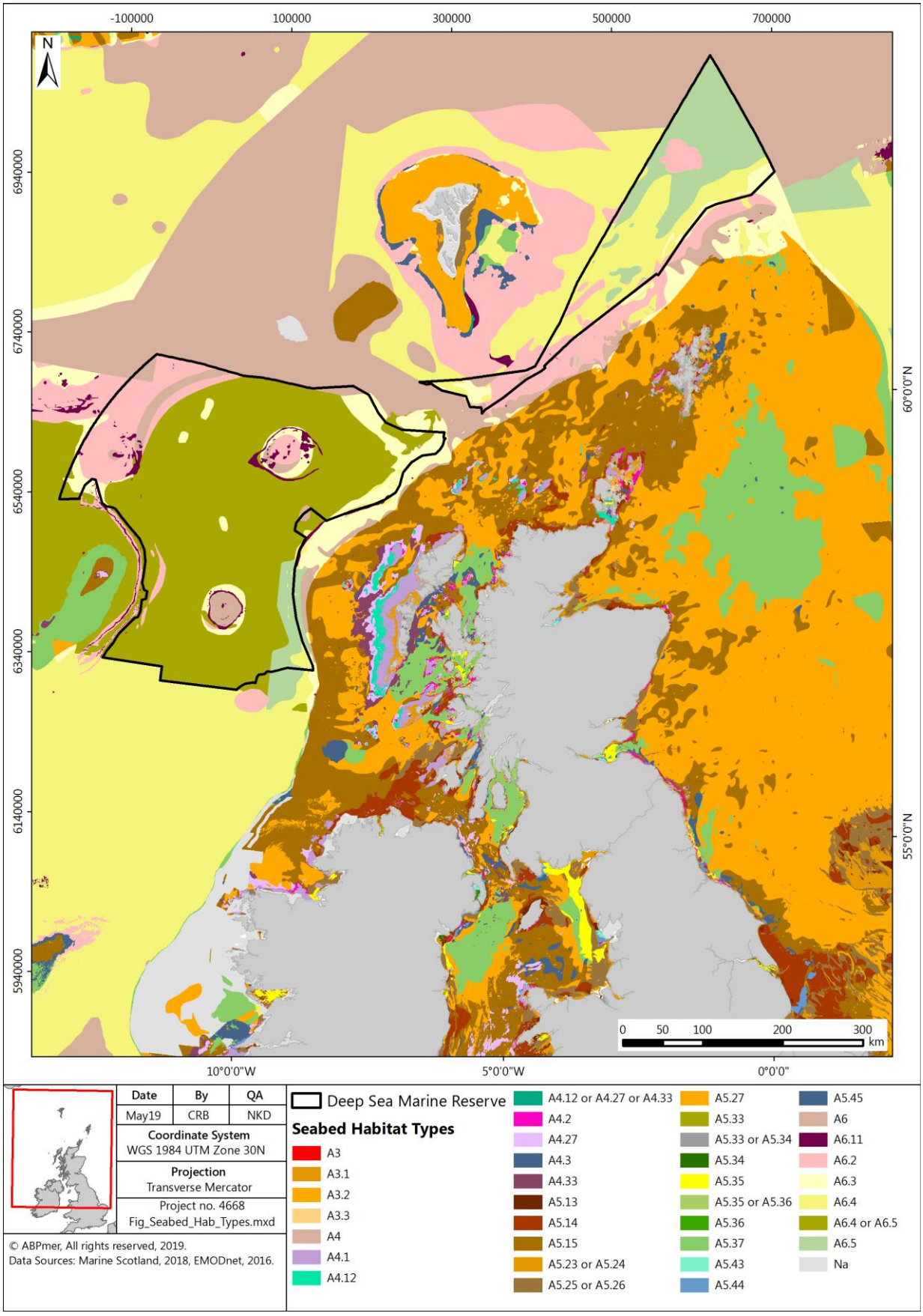


Figure 4 Seabed habitats in Scottish waters (Full key is provided below figure)

Key for Figure 4.

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

4.2.8 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 waters 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 waters 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.

4.2.9 The key mobile species that are found within the deep sea environment are fish, therefore the following section provides a baseline description of this species group. Seals, birds and otters will have no interaction with the deep sea environment and are therefore not described further.

4.2.10 Information regarding cetaceans in the deep sea is limited, although some species present in Scottish waters are known to dive to significant depths and could therefore have some interaction with the deep sea environment. However, as the understanding of this interaction is limited, no further baseline information is included for cetacean species.

Fish

4.2.11 There are a number of fish species present in the deep seas. JNCC has reviewed literature available on eleven species of fish regarded as potential features of designation interest to the west of Scotland[69]. The distribution and status of each species are reviewed together with accounts of the life cycle and fisheries exploitation, summarised in Table 9.

4.2.12 Three species, the gulper shark, Atlantic halibut and orange roughy are very rarely encountered in surveys. The gulper shark is of uncertain status. This is the southern limit of the Greenland halibut which probably only occurs in the Faroe-Shetland channel and further north. Fisheries for porbeagle shark, spurdog, leafscale gulper shark and Portuguese dogfish are all prohibited. The roundnose grenadier, blue ling, anglerfish and Greenland halibut are fished commercially within total allowable catch limits. For the roundnose grenadier, blue ling, anglerfish and orange roughy the study area provides important areas for spawning and may be of critical importance as a source of juveniles within the area and for surrounding seas. The study area contains distinctive habitat for endangered species of deep sea sharks, the gulper sharks and Portuguese dogfish. Of the species included here, the gulper shark, leafscale gulper shark, Portuguese dogfish and orange roughy are included in the OSPAR list of threatened and declining species and habitats[70].

Table 9 Summary of information on 11 species of deep sea fish found in Scottish waters[71]

Information on 11 species of deep sea fish		
Porbeagle shark, *Lamna nasus*		
Depth range	Minimum	Surface
	Maximum	700 m
Distribution	In the study area	Oceanic shark that migrates widely throughout the temperate North Atlantic and Mediterranean including the study area.
	Seasonality	Transit through the area in the second half of the year.
	Migration	Homing to breeding grounds in the Irish Sea and Bay of Biscay.
Life History Characteristics	Sexual maturity[72]	Males 8 years, 1.74 m total length. Females 13 years, 2.37 m total length.
	Mating/pupping areas	Females give birth to usually 4 live young along the continental shelf edge (200 m depth). There is

[69] Priede, I.G. (2018) Deep sea Fishes Literature Review. JNCC Report No. 619. JNCC, Peterborough. ISSN 0963-8091

[70] OSPAR commission, 2019. List of Threatened and / or Declining Species and Habitats, https://www.ospar.org/work-areas/bdc/species-habitats/list-of-threatened-declining-species-habitats

[71] ibid

[72] where a single figure is given this is the age or length at which 50% of the population is sexually mature.

Information on 11 species of deep sea fish		
		circumstantial evidence for pupping west of Shetland to the east of the study area.
	Nursery areas	There are nursery areas in the southern Irish Sea but no information for the study area.
Habitat use in the study area		Adults feed mostly in the water column, migratory individuals pass through the area.
Threats		Porbeagle shark has been severely depleted by fisheries throughout the NE Atlantic. Since 2010, targeted fishing has been prohibited in EU waters. They remain vulnerable to capture in high seas fisheries for tunas and swordfish.
NE Atlantic spurdog, *Squalus acanthias*		
Depth range	Minimum	Surface
	Maximum	200 m usually but 950 m recorded in the study area.
Distribution	In the study area	In shallow and epipelagic waters of the study area on the continental slopes and around Rockall.
	Seasonality	Present throughout the year.
	Migration	Spurdog from the study area migrate to Faroe and southern Norway forming a distinctive Scottish-Norwegian stock.
Life History Characteristics	Sexual maturity	Females 9-13 years, 75 – 95 cm total length, males smaller.
	Mating/pupping areas	Spurdog forms large aggregations for pupping in inshore waters at around 50 m depth; known sites are Galway Bay and the Irish Sea. Each female produces 2-21 pups. Most of the study area is too deep for pupping.
	Nursery areas	Mainly shallow areas near the pupping grounds, spurdog move deeper as they grow.
Habitat use in the study area		Spurdog feed in midwater, younger individuals targeting plankton and switching to fishes and benthic prey as they grow.
Threats		The study area was historically a rich fishery for spurdog but stocks are severely depleted with a zero TAC since 2010. The main threat is continued bycatch in long line and trawl fisheries, but there is evidence of very slow stock recovery.
Gulper shark, *Centrophorus granulosus*		
Depth range	Minimum	200 m
	Maximum	2000 m
Distribution	In the study area	The study area is the northernmost of 17 known locations around the world in which the species has been recorded.
	Seasonality	Present all the year round.

Information on 11 species of deep sea fish		
	Migration	No information, the nearest substantial population is off Galicia, NE Spain and migrations are plausible.
Life History Characteristics	Sexual maturity	Females 147 cm, Males 110 cm. Age uncertain.
	Mating/pupping areas	Each female produces 3-8 live young. Reproduction is aseasonal with young produced all the year round. Location is unknown but possibly includes the study area.
	Nursery areas	No information
Habitat use in the study area		Demersal throughout the Rockall Trough within its depth range.
Threats		This species is a rare cryptic species that is not often identified but is captured in fisheries for "mixed deep-water sharks" which are depleted and zero catch recommended since 2010 by ICES.
Leafscale gulper shark, *Centrophorus squamosus*		
Depth range	Minimum	145 m
	Maximum	2400 m
Distribution	In the study area	Found throughout its depth range with peak abundance at 800 m depth.
	Seasonality	Present throughout the year.
	Migration	Extensive migrations in the NE Atlantic so the individuals in the study area form part of a wider population.
Life History Characteristics	Sexual maturity	Females 35 years, 120 cm total length, Males 30 years, 102 cm total length.
	Mating/pupping areas	Each female produces 4 -10 pups. There is evidence of pupping off Iceland, the Iberian Peninsula, Madeira and west Africa, with no information for the study area.
	Nursery areas	No information.
Habitat use in the study area		Demersal fish that feeds on the bottom and on deep-water fishes including blue whiting.
Threats		Exploited together with the Portuguese dogfish as part of a mixed fishery. The stock is depleted and no targeted fishing is permitted but bycatch continues. No significant change in abundance has been detected since 2004.
Portuguese dogfish, *Centroscymnus coelolepis*		
Depth range	Minimum	700 m
	Maximum	2400 m in the study area but recorded as world's deepest shark at 3700 m in the Bay of Biscay.
Distribution	In the study area	Peak abundance is at 1350 m in the study area. Occurs on the Mid Atlantic Ridge and continental margins of the North Atlantic and other parts of the world.

Information on 11 species of deep sea fish		
	Seasonality	Present all the year round. No evidence of seasonality in reproduction.
	Migration	Capable of long distance migrations in the NE Atlantic.
Life History Characteristics	Sexual maturity	Females 102 cm total length, males 86 cm ages unknown.
	Mating/pupping areas	Gravid females with 8-21 pups caught west of the British Isles. Pupping location(s) unknown but some authors suggest off NW Africa, but also evidence for localised pupping throughout the species range.
	Nursery areas	Few juveniles have been caught, most at less than 1000 m depth. Nursery areas are unknown.
Habitat use in the study area		Bentho-pelagic feeder predominantly fish and squid in the stomachs.
Threats		Portuguese dogfish have a long history of exploitation but together with the leafscale gulper shark, stocks have become severely depleted and zero targeted catch since 2010. Bycatch continues in deep-water trawl fisheries in the study area and the Scottish Deepwater Trawl Survey shows continuing decline in abundance since 2000.
Roundnose grenadier, *Coryphaenoides rupestris*		
Depth range	Minimum	180 m
	Maximum	2600 m
Distribution	In the study area	On slopes around the Rockall Trough with a peak of abundance at around 1500 m depth.
	Seasonality	Present all the year round.
	Migration	The species is endemic to the N Atlantic. Separate populations N and S of the Wyville Thompson Ridge.
Life History Characteristics	Sexual maturity	Females 9-11 years, 55 cm total length, Males 8-10 years 46 cm total length.
	Mating/pupping areas	Spawning peaks during May to October and appears to occur all along the preferred depth range of the species. Egg and larvae disperse in mid water.
	Nursery areas	Larvae settle on the sea floor at 8-10 cm total length. Nursery areas are not well defined.
Habitat use in the study area		Bentho-pelagic species that lives on the slopes and feeds on crustacea and fishes of the deep-scattering layers.
Threats		There is an active fishery for roundnose grenadier in the study area. The stock is depleted below maximum sustainable yield but with evidence of recovery. Evidence from other areas shows recruitment is sporadic and stocks are vulnerable. Recommended TAC is 3399 tonnes compared with peak catches of over 14000 tonnes in 2001.

Information on 11 species of deep sea fish		
Blue Ling, *Molva dypterygia*		
Depth range	Minimum	300 m
	Maximum	1500 m
Distribution	In the study area	Widely dispersed in the study area with peak abundance at 750-1000 m. Species is endemic to the NE Atlantic and the study area is one of the most important areas of aggregation.
	Seasonality	Present all the year round but forming spawning aggregations mainly during March to May.
	Migration	Regional pattern of migration to the spawning areas.
Life History Characteristics	Sexual maturity	Females 8.1 years, 79 cm total length, Males 6.4 years 79 cm total length.
	Mating/pupping areas	Spawning aggregations at depths of 730 -1100 m. Each female produces 1 - 3.5 million eggs.
	Nursery areas	The nursery areas are unknown.
Habitat use in the study area		Demersal species that ventures into mid-water to prey on fish and squid. Seasonally forms spawning aggregations on slopes in preferred locations.
Threats		Very vulnerable to targeted fishing on spawning aggregations in and around the study area to the west of Scotland. Since 2009 these have been closed to fishing from March to May each year and a total allowable catch is imposed. Fishing pressure is considered to be at a long-term low and the stock is stable.
Monkfish/Anglerfish, *Lophius piscatorius*		
Depth range	Minimum	20 m
	Maximum	1000 m
Distribution	In the study area	Endemic to the shelves and slopes around NE Atlantic Ocean with highest abundances in the study area at 200 – 500 m depth including around Rockall.
	Seasonality	Present all the year round.
	Migration	Adults make seasonal migrations to winter deep-water spawning grounds in the study area. Individuals can move between Shetland and Iceland and the study area.
Life History Characteristics	Sexual maturity	Females 73.5 cm total length, Males 48.9 cm total length. 6-8 years old.
	Mating/pupping areas	Spawning occurs in the study area at depths of 150 – 900 m during November to April, producing large egg masses that float towards the surface and hatch during February to April.
	Nursery areas	From the study area juveniles mainly develop in the North Sea but those spawned around Rockall probably also grow there.

Information on 11 species of deep sea fish		
Habitat use in the study area		A demersal fish that preys mainly on other fish including Norway pout, sandeel, cod and whiting.
Threats		Anglerfish form an important component of the demersal whitefish fisheries. There was concern about decline in stock size, but ICES consider that since 2014 the stock is recovering. It is assumed there is a single stock covering Subareas 6 (West of Scotland), 4 (North Sea) and 3a (Skagerrak).
Orange roughy, *Hoplostethus atlanticus*		
Depth range	Minimum	180 m
	Maximum	1800 m
Distribution	In the study area	Circumglobal species found in the NE Atlantic along the Mid-Atlantic Ridge, continental slopes and around offshore banks. Occurs on slopes and summits of the study area.
	Seasonality	Present all the year round but forming spawning aggregations during January to April.
	Migration	The species is confined to narrow strips along the continental and mid ocean ridge slopes. No evidence of large scale migrations.
Life History Characteristics	Sexual maturity	Females 27.5 years, 37.8 cm total length (females continue spawning up to 160 years old).
	Mating/pupping areas	Dense spawning aggregations around seamounts and submarine hills but also spawn on flat ground. Each female produces 20,000 to 250,000 eggs. Little is known about the larvae. Post-larvae probably forage offshore in mid water at 700-800 m depth.
	Nursery areas	Nursery areas are not known but studies from Ireland indicate that juveniles settle to a bottom life style at 1200 -1400 m when about 10 cm long and are presumed to gradually move shallower as they grow.
Habitat use in the study area		Bentho-pelagic fish that feeds off the bottom on crustacea, including mysids, amphipods, decapods plus some cephalopods and fish including lantern fishes and deep sea smelts.
Threats		Growth rate is very slow and a significant part of the unexploited spawning population was over 100 years old. Spawning aggregations were discovered in the study area in the 1990s and were fished out within a few years. The stock is likely to take decades to recover. A zero TAC has been in force since 2010 but there is a continuing bycatch from fisheries for other species.
Atlantic halibut, *Hippoglossus hippoglossus*		
Depth range	Minimum	50 m
	Maximum	2000 m

Information on 11 species of deep sea fish		
Distribution	In the study area	The Atlantic halibut is endemic to shelf areas and continental slopes around the North Atlantic basin at depths of 50 to 2000 m, ranging from the Barents Sea to the Bay of Biscay in the Eastern Atlantic with records from the study area on the continental slope west of Scotland, around Rockall and within the Faroe Shetland channel.
	Seasonality	Present all the year round with seasonal spawning aggregations.
	Migration	Wide dispersal during apparently random emigrations from nursery areas and capable of extensive migrations on the NE Atlantic slopes.
Life History Characteristics	Sexual maturity	Female 7 years, Male 4.5 years. Longevity over 50 years
	Mating/pupping areas	Forms spawning aggregations at depths of 700 - 1000 m during January to April. Spawning occurs S of Faroe very near to the boundary of the area. Each female produces 0.5 to 7 million eggs.
	Nursery areas	Juveniles live at depths of 20-60 m during the first 4- 6 years and then gradually emigrate to deeper waters. Nursery areas in the study area are unknown.
Habitat use in the study area		Benthopelagic feeder consuming and increasing proportion of fish as they grow.
Threats		Atlantic halibut were historically the basis for a very valuable fishery including in the study area but from the 1950s stocks became so depleted that they are now rarely encountered. Discovery of spawning aggregations made the species particularly vulnerable. Stocks are so low that ICES collects no data and issues no advice. A small fishery continues off Faroe but in the study area the species is commercially extinct. Small remaining numbers are vulnerable as bycatch in demersal fisheries.
Greenland Halibut, *Reinhardtius hippoglossoides*		
Depth range	Minimum	300 m
	Maximum	1500 m
Distribution	In the study area	Circumpolar species endemic to cold waters of the northern hemisphere in both the Atlantic and Pacific Oceans. The study area is at the extreme southern boundary of the species native distribution. It is rarely caught south of the Wyville Thompson Ridge.
	Seasonality	Present all the year round in the Faroe-Shetland Channel.
	Migration	There is interchange of fish across the area occupied by the Nordic stock between Faroe and Iceland.
	Sexual maturity	Female 57- 64 cm long, ca. 10 years.

Information on 11 species of deep sea fish		
Life History Characteristics	Mating/pupping areas	Spawning occurs on continental slopes at 450 -1100 m depth during November to January but with evidence of all year round spawning in some areas. Each female produces 20,000 to 230,000 eggs. There is no evidence of spawning in the study area.
	Nursery areas	Juveniles are found at 200- 500 m depth but there is no evidence of their occurrence in the study area.
Habitat use in the study area		Pelagic top predator on fishes, but only present North of the Wyville-Thomson Ridge.
Threats		The study area is on the southern fringe of the Nordic stock of Greenland halibut. The species is caught in the Faroe-Shetland Channel but is essentially absent from the main part of the study area. The Nordic stock is considered by ICES to be below acceptable limits.

Protected habitats and species

4.2.13 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 22% of Scottish seas. The current designations are:

Special Areas of Conservation (SAC): These include both inshore and offshore SAC and cover eleven different marine habitat types which occur in Scotland (sandbanks which are slightly covered by seawater all the time; estuaries; mudflats and sandflats not covered by seawater at low tide; coastal lagoons; large shallow inlets and bays; reefs; submarine structures made by leaking gases; and submerged or partially submerged sea caves). Seven marine species that occur in Scotland are also protected (bottlenose dolphin, harbour porpoise, grey seal, harbour seal, sea lamprey, Atlantic salmon and otter).

Nature Conservation MPAs (NCMPAs): These protect habitats and species such as maerl beds, coral gardens and common skate.

4.2.14 Existing and proposed NCMPAs, SACs and SPAs sites are shown in Figure 5.

4.2.15 Currently there are 18 MPAs designated for nature conservation purposes under the Marine (Scotland) Act 2010 and 37[73] SACs designated under the EU Habitats Directive located within territorial waters (i.e. within 12NM of the territorial baseline) (Figure 5). A further 13 MPAs and 11 SACs are designated in the

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

offshore environment[74] (i.e. from 12 NM from the territorial baseline, or within non-territorial waters) (Figure 5).

4.2.16 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 65 SSSI for the further protection of species such as seabirds and seals and habitats ranging from sea caves and rocky shores[75]. There are also 51 Ramsar sites in Scotland designated as internationally important wetlands, covering a total area of about 313,000 hectares[76], of which 16 form part of the MPA network[77].

4.2.17 The Habitats Directive also affords protection to certain species of plants and animals (European Protected Species). In the marine environment these include cetaceans and otters.

Priority marine features

4.2.18 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 Scotland[78]. 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*'[79].

4.2.19 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).

4.2.20 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 for 11 of the most vulnerable PMFs and these are currently being assessed as part of a separate SEA (see Section 3.6).

[74] 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)

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

[76] 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)

[77] Scottish Government (2018) Marine Protected Areas (MPAs) [online] (Available at: http://www.gov.scot/Topics/marine/marine-environment/mpanetwork accessed 27/03/2019)

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

[79] 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)

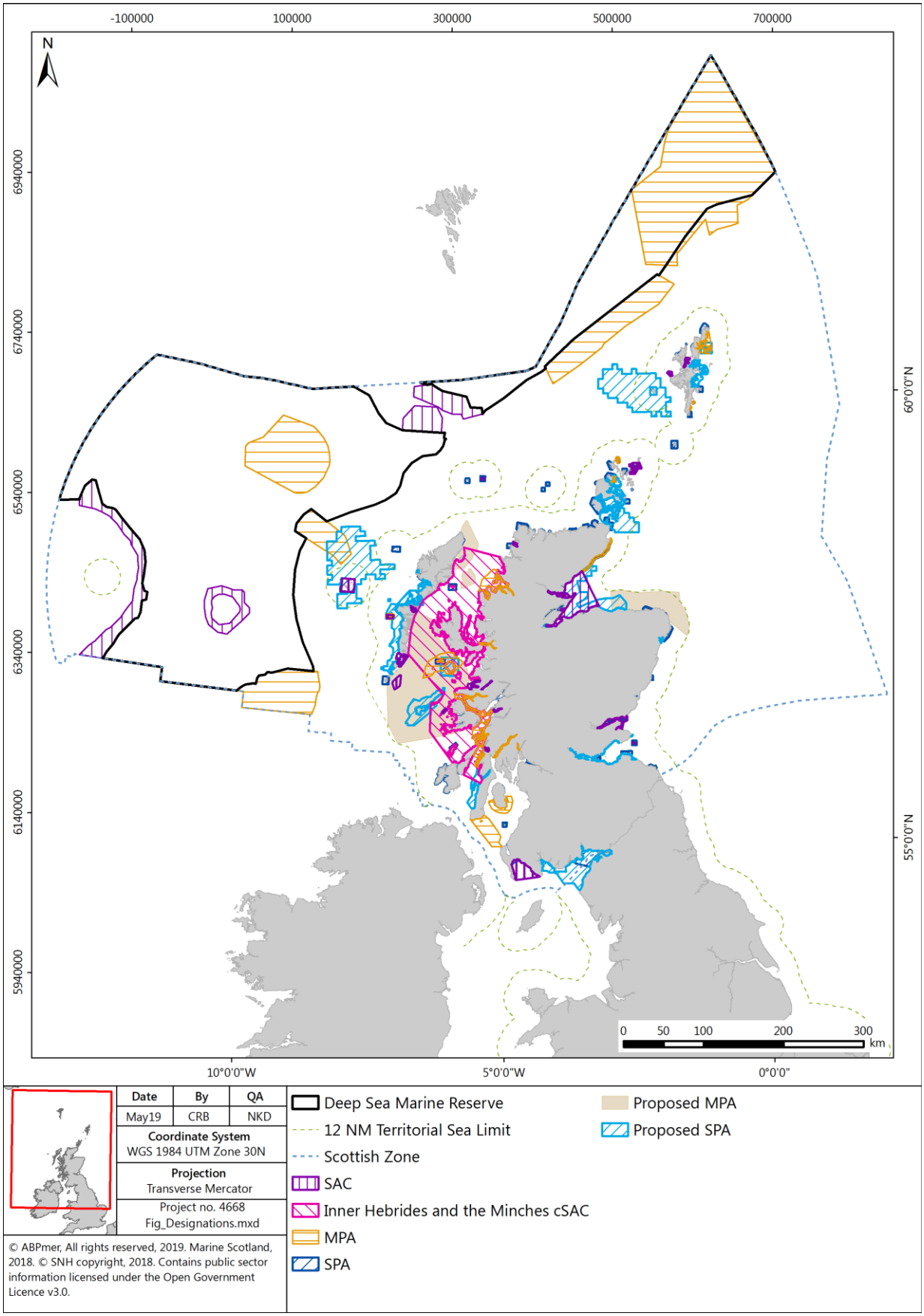


Figure 5 Nature conservation sites

Trends and pressures

4.2.21 Numerous assessments of bottom-trawling impacts suggest that almost all deep sea communities are susceptible to long-lasting damage from such activities. Similarly, deep sea mining has the potential to cause long-lasting damage across wide areas. Other industries such as oil and gas exploitation can cause less widespread damaging effects but potentially of equal duration.

4.2.22 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 activity[80]. It was based on scientific evidence from available data and analysis, supported by expert judgement and taking account of key data gaps[81].

4.2.23 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. There were some concerns about the effects of trawling on deep sea habitat, although such activity has now been banned at depths greater than 800 m under EU Deep Sea Fisheries Regulation 2016/2336[82]. Vulnerable marine ecosystems are also closed to bottom gear fishing at depths greater than 400 m under this EU regulation.

4.2.24 Box 1 sets out some of the key current and future pressures on marine biodiversity, flora and fauna in the deep sea. 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 pressures[83].

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 with potential impacts on populations;
- The seabed and its benthic habitat may be damaged by mobile fishing gear, with the consequent loss of marine plants and animals[84]; and

[80] Marine Scotland (2011) Scotland's Marine Atlas: Information for The National Marine Plan.

[81] 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)

[82] 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)

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

[84] The use of bottom contacting fishing gear in water depths greater than 800 m is prohibited under EU 2016/2006, and under 400 m where encounters with vulnerable marine ecosystems (VME) are experienced.

- Removal of target species may also decrease the availability of prey species, leading to potential declines in populations of other species (e.g. birds).

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 give rise to population decline of marine species;
- May result in new competitors arriving in Scottish waters, including non-native invasive species;
- Ocean acidification may reduce efficiency or resilience of carbonate reef building species and lead to dissolution of carbonate based structures; and
- May increase stratification of the upper ocean and hence reduce organic carbon export to the deep sea.

Deep sea mining

- Will cause long term damage to seafloor substrate, with significant consequences for biodiversity within areas chosen for mining activities.

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.

Oil and Gas exploration and extraction

- May disturb marine animals, through increased noise levels in the marine environment associated with the use of acoustic survey equipment; and
- In an emergency event, the release of hydrocarbons may cause smothering of seabed features, and contamination of mobile features, in the deep sea environment.

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.

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.).

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 protected 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 6.

4.3.4 There are elements of protected geodiversity features identified within the deep sea marine reserve (see Table 3).

4.3.5 Water depths in the deep sea areas to the west and north of Scotland range between 800 m and approximately 2,500 m at the deepest point, between the Rockall Bank and the Hebrides Terrace Seamount (Figure 6). These areas support large expanses of mud and fine clay with a variety of coarse sediments present in places[85]. The distribution of sediment types within the study area is influenced by the presence of various geological features e.g. seamounts, the continental slope, ridges, troughs and banks and their associated oceanic currents[86].

4.3.6 Throughout the west of Scotland and north-east of the Wyville-Thomson Ridge, topographic features influence the prevailing currents and consequently, the

[85] Baxter, J.M., Boyd, I.L., Cox, M., Donald, A.E., Malcolm, S.J., Miles, H., Miller, B. & Moffat, C.F. (Editors) (2011). Scotland's Marine Atlas: Information for the national marine plan. Marine Scotland, Edinburgh. pp. 191. http://www.gov.scot/resource/doc/345830/0115122.pdf

[86] Inall, M.E. & Sherwin, T.J. (2006). SEA7 Technical Report - Hydrography. SAMS Report No. 251, 76pp.

sediment types present[87,88,89,90,91]. In general, deep sea, subsurface currents are weaker when compared with surface flows but are intensified around topographic features such as seamounts, the continental slope and the Rockall Bank[92],[93]. In deeper areas, away from large topographic features and with low or negligible currents, finer, muddy sediments are present[94]. The highly varied topography in the region of the Faroe-Shetland Channel results in complex current patterns, which in turn influence sediment distribution patterns. Within the Faroe-Shetland Channel, stronger currents are present as the channel narrows toward the Wyville-Thomson Ridge; this results in coarser sediments being located at greater depths compared with the deep sea to the west of Scotland[95]. Low sediment deposition rates in the Faroe-Shetland Channel also play a role in determining which sediments are present[96]. Overall, there is a trend of increasing mud content from the southwest to the northeast within the Faroe-Shetland Channel. There are higher percentages of sands and gravels around such features as the Rockall Bank, the continental slope and around the Wyville Thomson Ridge.

4.3.7 Several geological sedimentary features exist in Scottish offshore waters with some already designated as interest features in existing MPAs (see Table 1). These features may take the form of slide deposits, iceberg plough marks, sediment drifts, sediment wave fields, sand contourites and barchan sand wave

[87] Inall, M.E. & Sherwin, T.J. (2006). SEA7 Technical Report - Hydrography. SAMS Report No. 251, 76pp.

[88] Holmes, R., Fraser, J., Gunn, V., Henni, P., Jacobs, C., Shannon, P. & Unnithan, V. (2002). DTI Strategic Environmental Assessment Area 7 (SEA7) Geological Metadata. British Geological Survey, Commissioned Report CR/02/275, 123pp.

[89] Holmes, R., Cooper, R. & Jones, S. (2003). DTI Strategic Environmental Assessment Area 4 (SEA4): Continental shelf seabed geology and processes. British Geological Survey Commercial Report CR/03/081.

[90] Masson, D.G. (2003). Seafloor sediments and sedimentary processes on the outer continental shelf, continental slope and basin floor. DTI SEA4 Report, 49pp. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/197371/SEA4_TR_Sediments_SOC.pdf

[91] Bett, B.J. (2012). Seafloor biotope analysis of the deep waters of the SEA4 region of Scotland's seas. JNCC Report No. 472, JNCC, Peterborough, ISSN 0963-8091. http://jncc.defra.gov.uk/pdf/472_web.pdf

[92] Baxter, J.M., Boyd, I.L., Cox, M., Donald, A.E., Malcolm, S.J., Miles, H., Miller, B. & Moffat, C.F. (Editors) (2011). Scotland's Marine Atlas: Information for the national marine plan. Marine Scotland, Edinburgh. pp. 191. http://www.gov.scot/resource/doc/345830/0115122.pdf

[93] Holmes, R., Fraser, J., Gunn, V., Henni, P., Jacobs, C., Shannon, P. & Unnithan, V. (2002). DTI Strategic Environmental Assessment Area 7 (SEA7) Geological Metadata. British Geological Survey, Commissioned Report CR/02/275, 123pp.

[94] Holmes, R., Cooper, R. & Jones, S. (2003). DTI Strategic Environmental Assessment Area 4 (SEA4): Continental shelf seabed geology and processes. British Geological Survey Commercial Report CR/03/081.

[95] Masson, D.G. (2003). Seafloor sediments and sedimentary processes on the outer continental shelf, continental slope and basin floor. DTI SEA4 Report, 49pp. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/197371/SEA4_TR_Sediments_SOC.pdf

[96] Hughes, A.J., Narayanaswamy, B.E. & Bett, B.J. (2003). SEA 4: An overview of the benthic ecology of the Faroe-Shetland Channel. 63pp. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/197362/SEA4_TR_Benthos_SOC.pdf

fields[97], mud diapirs[98] / mounds and sediment plains. Within the Faroe-Shetland Channel, including the approach to the Wyville-Thomson Ridge, Bett (2012)[99] illustrates the distribution of the known sedimentary physical features. Below 800 m these include contourite deposits, barchan sand dunes, gravel / cobble deposits, landslide debris (mud blocks) and mud diapirs and mud mounds.

4.3.8 Sediments along the Hebridean slope to the west of Scotland show a general decrease in grain size with increasing depth and are described as being thickest within the eastern Rockall Trough and along the Hebridean slope and thinnest in the western Rockall Trough and on the Rockall Plateau[100]. A survey to locate rocky reef features on the Rockall Bank also recorded this gradation in sediment type, identifying mud habitats at the base of the bank in ~1,100 – 1,600 m depth[101]. Along the continental slope, sediments change from sands at 700 m to silty mud and mud between 700 – 1,000 m depth with gravel patches being rare and cobbles and boulders even rarer[102]. Sediments extending into the Rockall Trough are described as being mainly mud with some areas of coarse sand and gravel[103].

4.3.9 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.

4.3.10 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 (200 m 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 high[104] (Figure 7).

---

[97] Barchan sand dunes are crescent-shaped and can be found in high-energy areas. The 'horns' of the crescent face down current. The dunes may be up to 120 m across and the slopes can support abundant fauna such as sea pens and anemones.

[98] Mud diapirs are vertical intrusions of mud through fractures or zones of weakness of over-lying brittle rock layers. The resulting structures can be mushroom-shaped, mound-like or elongated 'dykes' depending on the geological materials involved.

[99] Bett, B.J. (2012). Seafloor biotope analysis of the deep waters of the SEA4 region of Scotland's seas. JNCC Report No. 472, JNCC, Peterborough, ISSN 0963-8091. http://jncc.defra.gov.uk/pdf/472_web.pdf

[100] Davies, A.J., Narayanaswamy, B.E., Hughes, D.J. & Roberts, J.M. (2006). An introduction to the benthic ecology of the Rockall – Hatton Area (SEA 7). A Report for the Department of Trade and Industry. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/197028/SEA7_Benthos_SRSL.pdf

[101] Howell, K.L., Davies J.S., Jacobs, C. & Narayanaswamy, B.E. (2009). Broadscale Survey of the Habitats of Rockall Bank, and mapping of Annex I Reef Habitat. JNCC Report No. 422, JNCC, Peterborough, ISSN 0963-8091. http://jncc.defra.gov.uk/PDF/jncc422_web.pdf

[102] Davies, A.J., Narayanaswamy, B.E., Hughes, D.J. & Roberts, J.M. (2006). An introduction to the benthic ecology of the Rockall – Hatton Area (SEA 7). A Report for the Department of Trade and Industry. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/197028/SEA7_Benthos_SRSL.pdf

[103] ibid

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

Figure 6 Extent of Scotland's seas, showing bathymetry and locations of major physiographical features

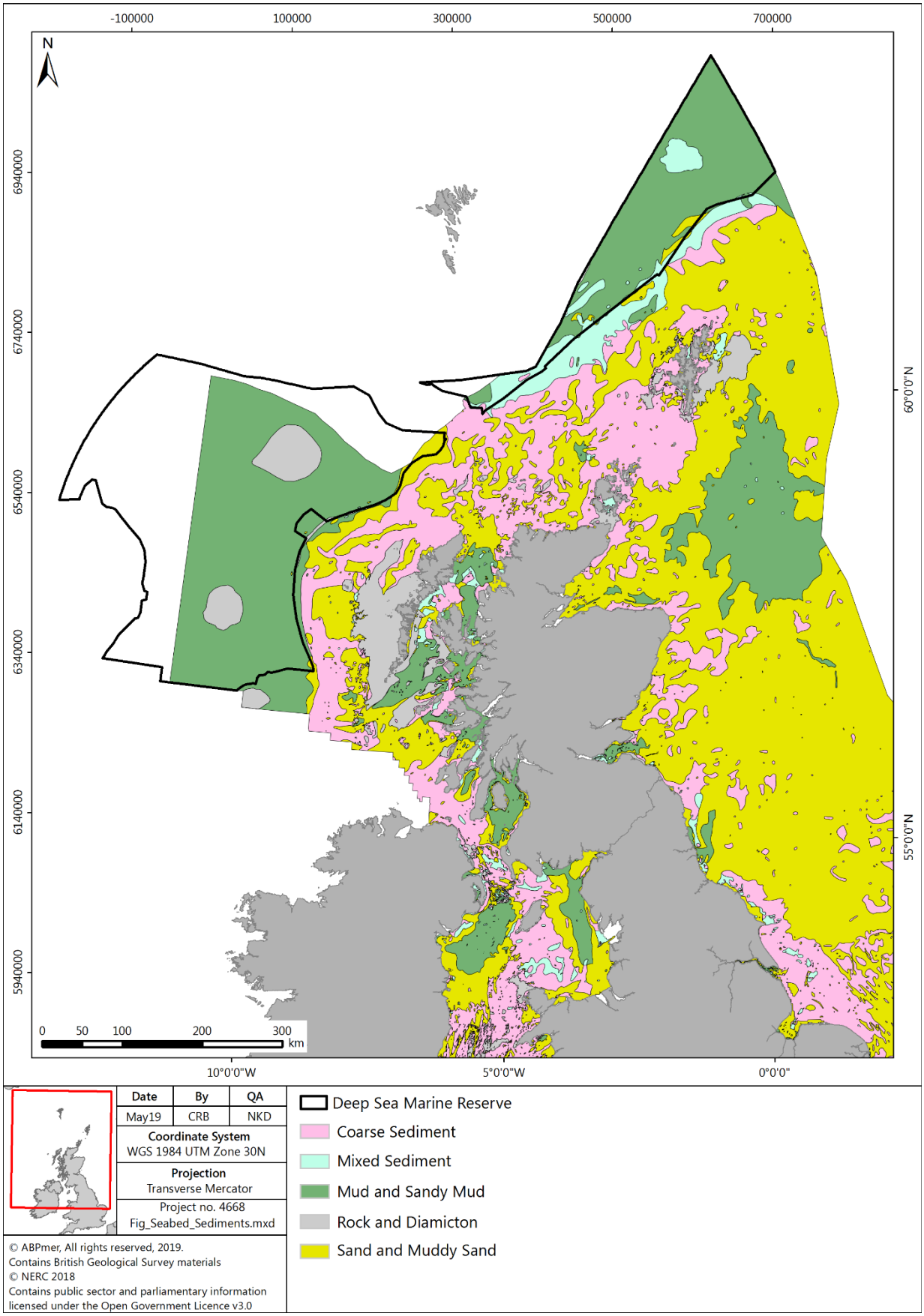


Figure 7 Seabed sediments

Trends and pressures

4.3.11 Pressures on geodiversity features in Scottish seas arise from multiple activities, including renewable energy scheme development, seafloor exploration activities, including oil and gas exploration, seafloor mining and fishing[105].

4.4 Environmental status of water bodies

4.4.1 In offshore waters in Europe the protection of water bodies is driven by the objectives of the Marine Strategy Framework Directive (MSFD), which aims to protect more effectively the marine environment across Europe. The MSFD was adopted in 2008 and requires all member states to develop a strategy for its marine waters in order to progress towards achieving Good Environmental Status of the marine environment by 2020.

4.4.2 The proposed deep sea marine reserve overlaps with the MSFD North-East Atlantic Ocean marine region (Celtic Seas) (Figure 8). 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

4.4.3 Under the MSFD progress is monitored against the qualitative descriptors at a regional level. The OSPAR intermediate assessment[106] identified in 2017 that progress has been made against a number of descriptors, particularly regarding recovery of the population abundance of sensitive fish species in the Celtic Seas. As discussed against Biodiversity in Section 4.2 above, there is limited data on the condition of deep sea habitats in Scottish seas, and as such it is not possible to assess trends against benthic habitat indicators.

4.4.4 The intermediate assessment does, however, review the progress of the oil and gas sector against indicators of contaminant release, recognising that chemical releases by the sector have decreased significantly during all phases of development, specifically against the following indicators:

- The amount of dispersed oil discharged in produced water decreased by 18% between 2009 and 2014;
- The use of chemicals on OSPAR's List of Chemicals for Priority Action (LCPA) has reduced by over 90% since 2009, and in 2014 no LCPA chemicals were discharged; and

[105] 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)

[106] OSPAR (2017) Intermediate Assessment 2017, available at https://oap.ospar.org/en/ospar-assessments/intermediate-assessment-2017/

There has been a 30% decrease in the use of chemicals carrying substitution warnings, and a 40% decrease in their discharge between 2009 and 2014.

4.4.5 However, no trends were identified in the quantities of chemicals spilled; number of oil spills or quantity of oil spilled.

4.4.6 Potential pressures against the MSFD applicable to the deep sea marine reserve include increases in fishing activity, increases in oil and gas activity (and associated chemical discharges), increases in seabed extractive activities (i.e. seabed mining).

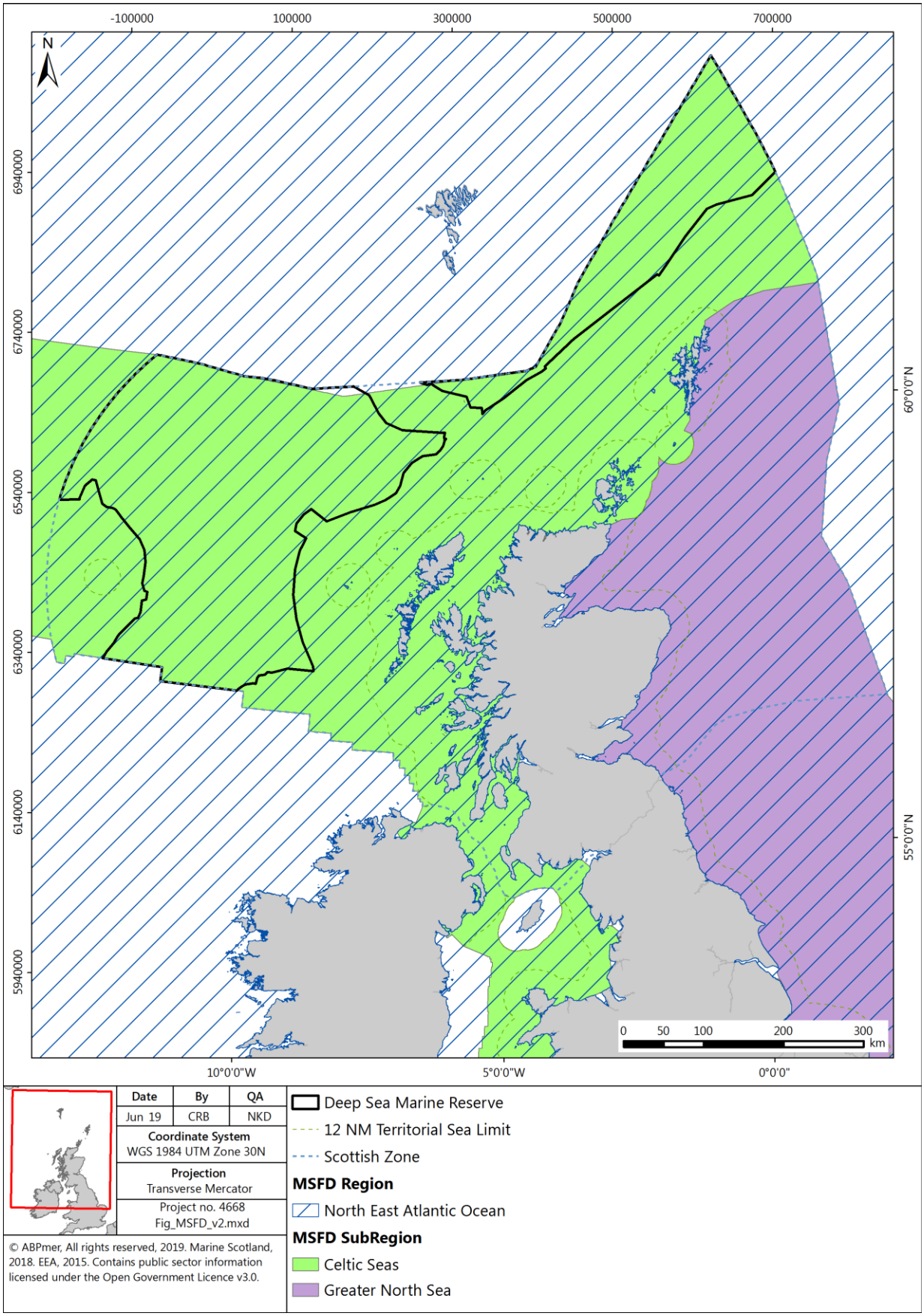


Figure 8 MSFD regions

Climatic factors (including carbon cycling, storage and sequestration)

4.4.7 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.

4.4.8 Over half of global carbon sequestration occurs through fixation during oceanic photosynthesis and the subsequent long-term storage of the produced organic material. 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.

4.4.9 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 are[107]:

- 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;
- Blue mussel beds (*Mytilus edulis*);
- Brittlestar beds;
- Sediment; and

[107] 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.

- Phytoplankton.

4.4.10 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 chain[108].

4.4.11 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 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 matter[109], which is primarily influenced by disturbance of seabed sediments and the oxygen content of the seawater above the seabed.

4.4.12 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.

4.4.13 Several of the other habitats listed, including maerl beds, are more efficient at carbon fixation and sequester a larger proportion of carbon relative 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

4.4.14 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.

4.4.15 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

[108] 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)

[109] ibid

carbon sequestration capacity of marine habitats. However, in offshore areas such as the deep sea MPA option areas, storm events will have no influence on turbidity due to the water depths.

4.4.16 Several methods of fishing, deep sea mining and oil and gas activities 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 across deep sea carbon rich sediments may have greater impacts. In general, direct pressure from fishing activity has the potential to affect how Scotland's marine environments regulate atmospheric carbon levels.

4.4.17 Shelf seas around the UK are predicted to be 1.5°C to 4°C warmer by the end of the 21st century[110]. Warmer sea temperatures could result in a shift in distribution of certain habitats and species and both biodiversity and benthic biomass in the deep oceans are predicted to decrease as a result of climate change[111]. This additional warmth will, eventually, also be circulated and lead to warmer conditions in the deep oceans, having potentially similar impacts on biodiversity features to those seen in shallower waters.

4.4.18 An increase in atmospheric carbon dioxide will lead to a subsequent increase in dissolved CO_2 concentrations within the ocean, increasing ocean acidity. This has the potential to hinder calcium carbonate producing organisms, and therefore their ability to sequester carbon in the long term. In addition, following mortality of such organisms, there is increased potential for carbonate shells or skeletons to dissolve faster, in both shallow shelf seas and deeper ecosystems, and therefore recycle greater amounts of carbon before they can be sequestered in seabed sediments. This pathway is particularly significant where the carbonate pump forms a considerable portion of the carbon export to deep sea sediments.

4.5 Future trends in marine industry

4.5.1 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.

4.5.2 Where marine industry activities require licensing, the designation of the deep sea marine reserve increases the protection afforded to the features through increased assessment requirements in the form of Environmental Impact Assessments (EIAs) under the Marine (Scotland) Act 2010. Within the scope of this SEA, this applies principally to oil and gas and deep sea mining activities,

[110] 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)

[111] Sweetman, A. K. et al 2017 Major impacts of climate change on deep-sea benthic ecosystems. Elem Sci Anth, 5: 4, DOI: https://doi.org/10.1525/elementa.203

and potentially also offshore renewables, albeit the development of offshore renewables is considered unlikely in depths that occur within the deep sea marine reserve.

Fisheries

4.5.3 There is a degree of uncertainty around future trends in the commercial fisheries sector. Future policies and the response to those policies remain difficult to predict therefore this assessment has assumed that the location and intensity of commercial fisheries activities do not change significantly in the future, this is consistent with the associated SEIA for the deep sea marine reserve which assumes no changes to commercial fisheries activities over the assessment period of 20 years.

4.5.4 Exceptions to this assumption are associated with the proposed management measures highlighted for the Anton Dohrn SAC, North East Faroe MPA and Rosemary Bank MPA which are assumed to exclude demersal fishing gear from these areas and are considered under the cumulative assessment.

4.5.5 Whilst fishing effort impacted by this assessment has been concentrated on the George Bligh Bank area (Figure B3 in Appendix B), new regulations may prohibit fishing in this area in the future. Council Regulation 2016/2336 Article 9 prohibits bottom fishing gears operating in waters with depths 400-800 m where VMEs have been established. ICES have identified several VMEs in late 2018, e.g. around George Bligh Bank[112] but these are not yet established in regulations. Therefore, it is assumed that these areas can still be fished by bottom gears unless specified in the regulations.

Oil and Gas

4.5.6 Future oil and gas development depends on the presence of exploitable resources and the economic viability of development.

4.5.7 Information on proposed front-end development activity (resource surveys and exploration/appraisal wells) is available from awards made under the Oil and Gas Authority's (OGA's) oil and gas licensing rounds. However, it is difficult to anticipate the extent to which this front-end activity might subsequently lead to development projects. Furthermore, information from recent and current licensing rounds provides a relatively short-term view of future activity. OGA initiated a 31st licensing round in the first quarter of 2019 and awards are expected to be announced in the second quarter. On 23rd May 2018, OGA announced the first awards under the 30th licensing round. There is some overlap between the deep sea marine reserve areas and the 29th licensing round (five sites intersecting the western deep sea marine reserve and five sites intersecting

[112] ICES. 2018. Report of the ICES/NAFO Joint Working Group on Deep-water Ecology (WGDEC). Available at: http://www.ices.dk/sites/pub/Publication%20Reports/Expert%20Group%20Report/acom/2018/WGDEC/WGDEC_2018.pdf

the north-eastern deep sea marine reserve), 30th licensing round (28 sites intersecting the north-eastern deep sea marine reserve) and the 31st offshore blocks on offer and the proposed deep sea marine reserve areas[113].

4.5.8 There are several gas discovery sites that intersect the deep sea marine reserve areas[114]. Due to these developments and the significant development of the nearby Clair field[115], there is potential for both exploration and extraction activities, and their associated pipelines to cross the proposed deep sea marine reserve areas.

4.5.9 The location of the deep sea marine reserve areas relative to oil and gas activity is presented in Figure B2 in Appendix B.

Deep Sea Mining

4.5.10 The UK government recently considered deep sea mining as an emerging sector. Seabed mining is estimated to be worth £40 billion to the UK over the next 30 years, however, the majority of economic opportunities are expected to occur in Areas Beyond National Jurisdiction (ABNJ)[116]. Any exploration or related activities in the high seas (or in ABNJ) are regulated at an international level by an organisation that was established under UNCLOS, the International Seabed Authority (ISA). ISA is developing exploitation regulations.

4.5.11 Production inside the UK's domestic EEZ is not expected to be able to support significant commercial interest as it is currently unknown if the UK harbours sufficient mineral deposits[117]. Two areas (which lie in the proposed deep sea marine reserve area) are either not expected to be subject to mining, as they do not harbour the geological structures associated with seabed mining (north-east of the Wyville-Thomson Ridge, called SEA4), or there is no current plan known for seabed mining (the area west of Scotland called SEA7)[118].

4.5.12 Similarly, the BGS concluded that seabed mining potential for offshore coal is uncertain. Offshore coal mining is considered unlikely in the near future, due to the significant development costs (because of its depth and distance from the shore). The BGS considers that the UK Continental Shelf contains a wide range of minerals, although there is a lack of data regarding the existence, location and

---

[113] OAG. 2018. Offshore Licensing Rounds. Available at: https://www.ogauthority.co.uk/licensing-consents/licensing-rounds/offshore-licensing-rounds/#tabs. [Accessed on 29th January 2019]

[114] Marine Scotland. NMPI. Available at: https://marinescotland.atkinsgeospatial.com/nmpi/. [Accessed 11/02/2019]

[115] Offshore Energy Today. 2018. BP boosts Clair stake after closing ConocoPhillips deal. 21st December 2018. Available at: https://www.offshoreenergytoday.com/bp-boosts-clair-stake-after-closing-conocophillips-deal/.

[116] Government Office for Science. Foresight Future of the Sea: A Report from the Government Chief Scientific Adviser. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/706956/foresight-future-of-the-sea-report.pdf

[117] ibid

[118] Doggett, M., Baldock, L. & Goudge, H. 2018. A review of the distribution and ecological importance of seabed communities in the deep waters surrounding Scotland. JNCC Report No. 625, JNCC, Peterborough, ISSN 0963-8091.

properties of offshore metallic minerals[119]. However, several types of minerals have been identified in Scottish waters, with potential commercial opportunities. Some of these have been found close to the deep sea marine reserve to impact exploration or mining activities. These metallic minerals include sediments containing titanium minerals such as rutile and ilmenite, which may be found off north-east Scotland and the Sea of the Hebrides. Placer-type deposits of heavy minerals have been found off Shetland and high concentrations of heavy metals may also exist off the west of the Outer Hebrides.

4.5.13 In areas close to the deep sea marine reserve, zircon, garnet and staurolite-rich heavy mineral suites have been identified in the Clair Field. These deposits may be present north of the Clair group, but have not been explored yet[120].

4.5.14 There is additionally some potential for ferromanganese deposits to occur on seamounts[121]. However, only thin ferromanganese oxide layers have been identified within the deep sea marine reserve[122], which are unlikely to be commercially viable for exploitation.

Renewable energy

4.5.15 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.

4.5.16 As a result, a number of projects have already been consented for development within coastal waters, and the draft plans for wind[123], wave[124] and tidal[125] energy development identify future opportunities for expansion (Figure B1 in Appendix B). Marine Scotland is currently in the early planning stages for a new sectoral marine plan for offshore wind energy[126]. The current, planned and potential future areas for hosting offshore energy generation around Scottish coasts are shown in Figure B1 in Appendix B. The Offshore Wind Plan Areas of Search (AoS) will be superseded by Draft Plan Options (DPOs) in early 2019.

[119] Green, S., Campbell, E., Bide, T.P., Balson, P.S., Mankelow, J.M., Shaw, R.A. and Walters, A.S. 2013. The Mineral Resources of Scottish Waters and the Central North Sea. British Geological Survey Minerals and Waste Programme Open Report, OR/13/013. 19 pages. Available online at http://nora.nerc.ac.uk/id/eprint/502151/1/OR13013.pdf. Accessed 4th April 2019.

[120] Morton, A., and McGill, P. 2018. Correlation of Hydrocarbon Reservoir Sandstones Using Heavy Mineral Provenance Signatures: Examples from the North Sea and Adjacent Areas. Minerals, 8(12), pp: 564. DOI:10.3390/min8120564. Available online at https://www.mdpi.com/2075-163X/8/12/564. Accessed 06.03.2019.

[121] Royal Society, 2017. Future ocean resources: Metal-rich minerals and genetics – evidence pack. Available at https://royalsociety.org/~/media/policy/projects/future-oceans-resources/future-of-oceans-evidence-pack.pdf

[122] Jones et al, 1993. Anton Dohrn Seamount and the evolution of the Rockall Trough, Ocanologica Acta, Vol. 17 – 3. Available at http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.871.5346&rep=rep1&type=pdf

[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)

4.5.17 Due to the depths of the deep sea marine reserve, no applications for the development of renewable energy within the reserve are expected. However, the areas inshore of the deep sea marine reserve could be developed, which may lead to potential cumulative effects as a result of the displacement of fisheries from both shallower and deeper water into shelf seas.

5 Results of the 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 deep sea marine reserve on the environment, namely the Biodiversity, Flora and Fauna headline topic and component topics (see Section 3.2) and SEA objectives, is provided in this section.

5.1.4 Any specific management measures that are subsequently required to meet the conservation objectives of the deep sea marine reserve 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 within each of the potential boundary areas 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.

5.2 Environmental effects

5.2.1 The designation of a deep sea marine reserve in Scottish waters is likely to have significant environmental effects on the environment. The initial designation only of either Faroe Shetland Reserve (FSR), the West of Scotland Reserve (WSR), or both, without further management, will not directly exclude activities from the reserve, however it will support the development of more effective Environmental Impact Assessments (EIAs).

5.2.2 EIAs are required to be undertaken on regulated activities such as oil and gas or marine renewables. These assess the significant environmental effects of a project, including on current and proposed nature conservation sites such as pMPAs. The designation of the deep sea marine reserve as an MPA 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 the deep sea marine reserve. This is particularly the case for features that are not currently protected

(e.g. Atlantic-influenced offshore deep sea muds and Atlantic-influenced offshore subtidal sands and gravels).

5.2.3 Alternatively, developers may look to avoid progressing consented developments that have not been built and re-locating regulated activities away from the deep sea marine reserve as they will require further assessment and the consideration of appropriate mitigation measures. The avoidance of the proposed reserve by potentially harmful activities would therefore result in future environmental benefits within the deep sea marine reserve.

5.2.4 In addition to the potential benefits afforded by the designation of the reserve described above, the manner in which the site is managed to ensure that the conservation objectives for the protected features are achieved has the potential to result in significant environmental changes. The effects of the various management scenarios that have been developed by Marine Scotland for each of the potential boundary options for a designated deep sea marine reserve (see Section 3.4) are considered within the reasonable alternatives in Section 0 below.

5.2.5 In generic terms, any management measures that might be implemented in the future have the potential to result in overall 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 deep sea marine reserve. In turn, these may also result in the potential for marginal spillover benefits beyond boundaries of the reserve. 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]. The implementation of management measures may, however, result in the potential displacement of an activity and its associated pressures outwith the boundaries of the deep sea marine reserve resulting in potential adverse environmental effects in other areas, where such activities are not managed. It is also possible that management measures targeting specific fishing activities could result in increased levels of non-targeted fishing activities within the reserve although this is considered unlikely and as such, the effect is considered negligible.

5.2.6 The following sections assess the effects of designating either the FSR or the WSR. The potential impact of the de-designation of current MPAs where these overlap with the deep sea marine reserve options are also considered. Where current MPAs are already considering management measures, there is potential for a negative effect from the non-implementation of these measures as a result of the de-designation of the site. Whilst this is a potential effect from the designation of the deep sea marine reserve, it is recognised that it is likely in the

[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.

medium term, that similar management measures will be identified and implemented for the deep sea marine reserve, and hence these effects will only be realised in the short term.

Faroe Shetland Reserve

5.2.7 Within the FSR the increased protection that will result from the designation of the deep sea marine reserve will provide potential long term environmental benefits for the overarching topic Biodiversity, Flora and Fauna and contribute to the achievement of the SEA objectives (Table 10), by supporting more effective EIA as described above.

5.2.8 As part of the designation of the deep sea marine reserve, the overlapping nature conservation MPAs are expected to be de-designated, specifically the majority of the North East Faroe Shetland Channel MPA. Proposals are currently under consideration for the implementation of management measures to exclude some demersal fisheries in the North East Faroe Shetland Channel MPA[129]. The de-designation of this MPA could prevent the implementation of these management measures. Therefore, it is recognised that the designation of the deep sea marine reserve without further management measures has the potential to lead to less management at this MPA, and as such is likely to have a negative effect on the environment within the current North East Faroe Shetland Channel MPA boundary, which covers approximately two thirds of the FSR area. The magnitude of this negative effect cannot be determined within this assessment but will be proportional to any positive impacts that result from the North East Faroe Shetland Channel MPA management measures.

5.2.9 The effects of potential management scenarios that have been developed by Marine Scotland and identified as reasonable alternatives within the FSR are discussed in Section 0 below.

Table 10 Impact on SEA objectives: Faroe Shetland Reserve

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 within the deep sea marine reserve 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 marine species and habitats within the deep sea marine reserve could contribute to the achievement of this objective by reducing or preventing destruction of the seafloor.

[129] JNCC, 2014. Scottish MPA Project, Management Options Paper, North East Faroe Shetland Channel Nature Conservation Marine Protect Area. Available at http://jncc.defra.gov.uk/pdf/North-east_Faroe_Shetland_Channel_Management_Options_Paper_v4_0.pdf

SEA objective	Met/ not met	Rationale
3. To avoid the pollution of the sea-bed strata and/or bottom sediments	Yes	Protection of marine species and habitats within the deep sea marine reserve could contribute to the achievement of this objective by reducing or preventing the potential disturbance and re-settling of sediment-bound contaminants and reducing contamination from regulated activities e.g. oil and gas activities.
4. To avoid the pollution of the coastal and marine water environment	Yes	Protection of marine species and habitats within the deep sea marine reserve 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 and reducing contamination from regulated activities e.g. oil and gas activities.
5. To maintain or work towards achieving 'good environmental status' of water bodies	Yes	Protection of marine species and habitats within the deep sea marine reserve 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 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.

West of Scotland Reserve

5.2.10 Within the WSR the increased protection that will result from the designation of the deep sea marine reserve will provide potential long term environmental benefits for the overarching topic Biodiversity, Flora and Fauna and contribute to the achievement of the SEA objectives (Table 11), by supporting more effective EIA as described above.

5.2.11 As part of the designation of the deep sea marine reserve, the overlapping nature conservation MPAs are expected to be de-designated, specifically Rosemary Bank MPA. Proposals are currently under consideration for the implementation of management measures to exclude demersal fisheries in the Rosemary Bank MPA[130]. The de-designation of this MPA could prevent the implementation of these management measures. Therefore, it is recognised that the designation of the deep sea marine reserve without further management measures has the potential to lead to less management at this MPA, and as such is likely to have a

[130] JNCC, 2014. Scottish MPA Project, Management Options Paper, North East Faroe Shetland Channel Nature Conservation Marine Protect Area. Available at http://jncc.defra.gov.uk/pdf/North-east_Faroe_Shetland_Channel_Management_Options_Paper_v4_0.pdf

negative effect on the environment within the current Rosemary Bank MPA boundary. The magnitude of this negative effect cannot be determined within this assessment but will be proportional to any positive impacts that result from the Rosemary Bank MPA management measures.

5.2.12 The effects of potential management scenarios that have been developed by Marine Scotland and identified as reasonable alternatives within the WSR are discussed in Section 0 below.

Table 11 Impact on SEA objectives: West of Scotland Reserve

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 within the deep sea marine reserve 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 marine species and habitats within the deep sea marine reserve 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 marine species and habitats within the deep sea marine reserve could contribute to the achievement of this objective by reducing or preventing the potential disturbance and re-settling of sediment-bound contaminants and reducing contamination from regulated activities e.g. oil and gas activities.
4. To avoid the pollution of the coastal and marine water environment	Yes	Protection of marine species and habitats within the deep sea marine reserve 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 and reducing contamination from regulated activities e.g. oil and gas activities.
5. To maintain or work towards achieving 'good environmental status' of water bodies	Yes	Protection of marine species and habitats within the deep sea marine reserve 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 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.

5.3 Reasonable alternatives

5.3.1 Further to the potential benefits afforded by the designation of the deep sea marine reserve 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 for each boundary alternative 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 environmental effects on the overarching topic of Biodiversity, Flora and Fauna is included in Section 5.2. A full justification for the outcomes of this assessment is provided in Appendix C.

5.3.2 The lower management scenario involves the process of designating the deep sea marine reserve, with no further management measures. This scenario is therefore described and assessed within Section 5.2 above.

Faroe Shetland Reserve

Intermediate Scenario

5.3.3 Under the intermediate scenario, the exclusion of all demersal fishing gears will have a direct impact on currently occurring demersal fishing activities, albeit these currently occur at a low density. There is a very low level of demersal fishing effort within FSR which is close to the boundaries of the site and therefore there is a high likelihood of displacement of effort outwith the deep sea marine reserve. This displacement is into areas of already high density fishing and would form a negligible proportion of fishing on the continental shelf and is therefore not considered to be a significant effect. As described in Table 7, where fishing effort is related to foreign fleets there is uncertainty as to the exact gear type deployed but the majority is assumed to be pelagic, therefore it is mostly expected that this fishing would continue under the intermediate scenario.

5.3.4 In addition to the limited benefit described above, there is potential for significant future benefits under the intermediate scenario from the prevention of the establishment of future bottom damaging extractive industry in the deep sea marine reserve.

Upper Scenario

5.3.5 Under the upper scenario, the exclusion of all demersal fishing gears will have the same impacts on the benthic environment and fish populations as those under the intermediate scenario. In addition, the exclusion of pelagic gears, including surrounding nets, midwater trawls and foreign fishing effort, may have some additional benefits on pelagic species within the deep sea marine reserve. It is unlikely, however, to provide additional benefits to the habitats proposed for designation within FSR. Furthermore, it is likely that the majority of pelagic fishing effort excluded will be displaced to other regions outwith the deep sea marine

reserve boundary. The overall effect of excluding pelagic fisheries in the wider region is therefore considered to be negligible.

5.3.6 In addition, there is potential for significant future benefits under the upper scenario from the prevention of the establishment of extractive industry in the deep sea marine reserve.

West of Scotland Reserve

Intermediate Scenario

5.3.7 Under the intermediate scenario, the exclusion of all demersal fishing gears will have a direct impact on currently occurring demersal fishing activities, albeit these currently occur at a low density. Within the WSR this scenario will exclude set netting on George Bligh Bank, which has the potential to have a beneficial impact both on benthic habitat and the fish populations currently targeted by commercial fisheries in the region. The majority of other demersal fishing effort within WSR is close to the boundaries of the site and therefore there is a high likelihood of displacement of effort into shallower water on the continental shelf. This displacement is into an area of already high density fishing and would form a negligible proportion of fishing on the continental shelf and is therefore not considered to be a significant effect. As described in Table 7, where fishing effort is related to foreign fleets there is uncertainty as to the exact gear type deployed but the majority is assumed to be pelagic, therefore it is mostly expected that this fishing would continue under the intermediate scenario.

5.3.8 In addition to the benefits described above, there is potential for significant future (long term) benefits under the intermediate scenario from the prevention of the establishment of future bottom damaging extractive industry in the deep sea marine reserve.

Upper Scenario

5.3.9 Under the upper scenario the exclusion of all demersal fishing gears will have the same impacts on the benthic environment and fish populations as those under the intermediate scenario. In addition, the exclusion of pelagic gears, principally UK midwater trawls and foreign fishing effort, may have some additional benefits on pelagic species within the deep sea marine reserve. It is unlikely, however to provide additional benefits to the habitats and species proposed for designation within WSR. Furthermore, it is likely that the majority of pelagic fishing effort excluded will be displaced to other regions outwith the deep sea marine reserve boundary. The overall effect of excluding pelagic fisheries in the wider region is therefore considered to be negligible,

5.3.10 In addition, there is potential for significant future benefits under the upper scenario from the prevention of the establishment of extractive industry in the deep sea marine reserve.

5.4 Cumulative effects

5.4.1 There is potential for cumulative effects, both as a result of the combined two boundary areas assessed separately within this report (WSR and FSR), considered to be the third boundary alternative, and with other protected sites or plans and programmes likely to be undertaken in Scottish seas.

Cumulative effects of WSR and FSR boundary areas (Boundary Alternative)

5.4.2 The third boundary alternative is to designate both the WSR and FSR together. This is considered here, as part of the cumulative assessment as the two areas are spatially distinct and have the potential to have interactions and cumulative effects on the wider Scottish marine area.

5.4.3 The two deep sea marine reserve areas have, further to the potential benefits afforded by their designation described in Section 5.2, the potential for additional future benefits under all three management scenarios. There is also the potential for direct immediate benefits under the intermediate and upper management scenarios. The benefits, should both areas be designated, would be additive, as a larger spatial area of habitat would be protected. Whilst deep sea fish are only identified for designation under the WSR, the designation of FSR is also likely to provide some additional benefits to deep sea species in this region.

5.4.4 The designated features vary between the two sites, with offshore deep sponge aggregations identified only in FSR, and a number of deep sea fish only identified in WSR. The designation of both therefore provides for inclusion of a wider range of species and habitats within the wider MPA network.

5.4.5 The designation of either only one, or other area has the potential to displace some fishing activity into the other, and therefore the potentially negative impact of displaced activity is lower under the cumulative scenario where it would be displaced from both areas (and therefore assumed to be away from higher sensitivity habitats), despite the total displaced activity being higher under this scenario. The potential impact of displaced fishing activity is small for UK fleets across both the intermediate or upper scenarios as there is relatively little UK fishing activity in either area. There is, however, greater potential for the displacement of foreign fishing effort, some of which could have the potential to be displaced outwith the deep sea marine reserve, particularly under the upper scenario where pelagic fisheries are excluded from a region. The designation of both areas would therefore protect sensitive deep sea habitat from the displacement of fishing activity.

Cumulative effects of the deep sea marine reserve overlap with potential management measures identified within the current MPA network

5.4.6 Within the boundaries of the deep sea marine reserve there are a number of overlaps with current MPAs, some of which have proposed fisheries management measures. These measures have been assessed separately and have the potential for cumulative effects with the proposed deep sea marine reserve management measures.

5.4.7 The following areas have been designated and identified for future management:

North East Faroe MPA (proposed that use of demersal gears be prohibited in the part of the site where known records of deep sea sponge aggregations are found, falls within the FSR);

Rosemary Bank MPA (proposed to prohibit all demersal towed and static gears from the MPA, falls within the WSR);

Anton Dohrn SAC (proposed to prohibit all demersal towed and static gears from the SAC, falls within the WSR and will remain as it is under all scenarios).

5.4.8 It is recognised that the Rosemary Bank MPA would be de-designated in its entirety and North East Faroe MPA would be de-designated where it overlaps with the deep sea marine reserve in the event of the deep sea marine reserve being designated. However, as management measures for these MPAs have been assessed elsewhere, it is therefore more appropriate to consider them cumulatively with the deep sea marine reserve.

5.4.9 It is, however, noted that under the lower scenario, the de-designation of the MPAs would lead to less management of these areas than would be taken forwards without the designation of the deep sea marine reserve.

5.4.10 Under the intermediate scenario the proposed management measures for the deep sea marine reserve would be similar to, and overlap with, the management measures for the other designations with demersal gears being excluded from all areas. This includes some UK demersal trawls and hook and line activity around Rosemary Bank MPA. The overall benefits would therefore be greater than those contained in the assessment of the individual MPAs, with larger areas of habitat protected within Scottish Seas as a result of the deep sea marine reserve.

5.4.11 Under the upper scenario, the deep sea marine reserve extends the exclusion of fishing effort to pelagic gear. None of the other designations have proposed the exclusion of pelagic fishing effort, and therefore there is no potential for additional cumulative effects.

Cumulative effects of the deep sea marine reserve within the wider MPA network

5.4.12 The deep sea marine reserve will, together with the wider MPA network and existing protection measures, further benefit the overarching topic of Biodiversity, Flora and Fauna in Scottish waters and contribute to the achievement of SEA objectives.

5.4.13 There may be cumulative adverse effects on the environment from the displacement of fishing activities resulting from previous plans in-combination with the designation and management of the deep sea marine reserve. The previous plans which could lead to cumulative effects and have been assessed are the 30 Nature Conservation MPAs designated in 2014; the implemented phase 1 measures in inshore MPAs and SACs; the draft (now proposed) SPAs; the proposed phase 2 fisheries management measures in inshore MPAs and SACs; the four proposed MPAs for mobile and benthic features (North-East Lewis, Sea of Hebrides, Shiant East Bank and Southern Trench); the Phase 1 fisheries management measures in MPAs[131] and proposals for Phase 2 fisheries management measures in MPAs.

5.4.14 The Nature Conservation MPAs and SACs that lie within the proposed deep sea marine reserve area have been taken account of above. Management measures for the Nature Conservation MPAs that lie adjacent to or in proximity to the proposed deep sea marine reserve area have the potential to result in in-combination impacts on commercial fisheries, and resulting effects on environmental receptors. These are principally beneficial as a result of protection of sensitive species and habitat, with some potential negative effects from cumulative displacement of fishing activity. However, due to the existing restrictions on trawling and netting in deep water, additional impacts on the environment (both beneficial and negative) are expected to be minor or negligible under the intermediate scenario. Under the upper scenario, the impact is mainly on the pelagic sector, and no management measures are anticipated for the pelagic sector in the other designations, therefore there is no cumulative impact.

5.4.15 The Seas off St Kilda and Seas off Foula pSPAs are located on the shelf in proximity to the proposed FSR deep sea marine reserve area. No management measures have yet been defined for the pSPAs therefore it is not possible to assess the potential for cumulative impacts.

[131] 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)

5.5 Mitigation and monitoring

5.5.1 There are no significant adverse effects on the environment from the designation of the proposed deep sea marine reserve, with adverse effects related to displacement of fishing activity likely to be negligible. It is, however, expected that a monitoring strategy will be required to help address the following research priorities:

Understand recovery from historic disturbance;

Understand its value for and effect on fish stock recovery;

Enable an enhancement of our understanding of the ecology and genetics of deep sea species;

Understand the role such an area plays at the ocean processes scale and the interaction between the physical, chemical and biological processes; and

Act as a resource against which EIAs can be evaluated.

5.5.2 This monitoring strategy will build on the monitoring that is currently undertaken at existing MPAs (i.e. seabed habitat surveys and deep water fish community surveys). It will be developed through cooperation with the research community (including public sector bodies, non-governmental organisations and research institutions), in order to develop projects which address the research priorities above. Based on monitoring that is already undertaken at existing MPAs, it is expected that fish surveys will continue to be undertaken biannually and benthic surveys every 12 years.

5.6 Conclusion

5.6.1 Overall, this assessment considers that the increased protection that will result from the designation of the deep sea marine reserve 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 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 the deep sea marine reserve. Alternatively, developers may look to site their projects some distance from the deep sea marine reserve 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 in both the WSR and FSR areas as part of the consideration of reasonable alternatives.

5.6.3 The lower management scenario will result in no overall immediate environmental impact, but the intermediate and upper scenarios will result in an overall minor immediate beneficial environmental impact. The potential for greater future benefits exists under all management scenarios.

5.6.4 The deep sea marine reserve 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 has been identified as a result of the management of fisheries in adjacent MPAs, however due to legislative restrictions on deep sea fisheries, this potential is limited. A more detailed assessment of cumulative effects will need to be undertaken should further management measures for the deep sea marine reserve be proposed in future.

5.6.5 The management scenarios that have been considered as reasonable alternatives do not constrain future decisions or 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 designation of the Deep Sea Marine Reserve and the accompanying Environmental Report is now open and will close on 6 September 2019. Views and opinions on this Environmental Report, and the designation of the Deep Sea Marine Reserve , are now invited.

6.1.2 The management scenarios in this environmental report 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 conservation objectives of the deep sea marine reserve will be subject to further consideration under the 2005 Act and are likely to require their own SEA.

6.1.3 Please provide any comments on this environmental assessment in your responses to the consultation questionnaire, including any comments on general issues or cumulative effects.

6.1.4 Following the consultation period, the responses received will be analysed, and the findings from this analysis will be taken into account in the finalisation of the Deep Sea Marine Reserve.

6.1.5 A Post-Adoption SEA Statement will be prepared, reflecting the findings of the assessment and the views expressed in the consultation, and outlining how the issues raised have been considered.

6.1.6 Copies of the consultation documents and the Environmental Report are available for viewing during office hours at the Scottish Government library at Saughton House, Edinburgh (K Spur, Saughton House, Broomhouse Drive, Edinburgh, EH11 3XD).

6.1.7 Please send your response, with the completed Respondent Information Form, to:

- By email to: marine_conservation@gov.scot or
- By post to: MPA Management Consultation
  Scottish Government
  Marine Planning and Policy Division
  Area 1-A South
  Victoria Quay
  Edinburgh EH6 6QQ
- On line: www.consult.gov.scot

6.1.8 If you have any inquiries, please send them to marine_conservation@gov.scot

Appendix A Policy Context of the Proposed Deep Sea Marine Reserve

This appendix sets out the wider policy context in which the proposed deep sea marine reserve sits, 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)[132].

Overarching marine policy

Species and habitat conservation is one of several key areas of interest underlying marine policy in Scotland. Additional policy areas relate to topics such the management of commercial and recreational fisheries[133]. 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 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 pollution[134]. Specifically, it added an annex covering the protection and conservation of marine ecosystems and biodiversity[135]. In 2003, Recommendation 2003/3 was adopted, relating to the establishment of an ecologically coherent network of MPAs in the North East Atlantic[136] and Recommendation 2010/5[137] on the assessment of environmental impacts on threatened and/or declining species[138].

[132] 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.

[133] Scottish Government (2017) Marine & Fisheries [online] Available at: http://www.gov.scot/Topics/marine (accessed 04/11/2018)

[134] OSPAR Commission (2017) OSPAR Convention [online] Available at: https://www.ospar.org/convention (accessed 04/11/2018)

[135] ibid

[136] OSPAR Commission (2018) Marine Protected Areas [online] Available at: https://www.ospar.org/work-areas/bdc/marine-protected-areas (accessed 24/11/2018)

[137] OSPAR Recommendation 2010/5 on the assessment of environmental impacts on threatened and/or declining species. Available at: https://www.ospar.org/convention/agreements?q=OSPAR+Recommendation+2010%2F5+on+the+assessment+of+environmental+impacts+on+threatened+and%2For+declining+species&t=&a=&s= (accessed 03/12/2018)

[138] OSPAR List of Threatened and/or Declining Species and Habitats. Available at: https://www.ospar.org/convention/agreements?q=OSPAR+List+of+Threatened+and%2For+Declining+Species+and+Habitats+&t=&a=&s= (accessed 03/12/2018)

The **EU Marine Strategy Framework Directive** (MSFD) obliges 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 activities[139]. It distributes responsibility for the marine environment via a regional approach that makes use of the existing cooperative framework of the OSPAR Convention[140]. The Directive is implemented within the UK via a three-part **Marine Strategy**[141].

The **EU Deep Sea Fisheries Regulation**[142] requires that fishing activities are environmentally sustainable in the long term and are managed in a way that is consistent with the objectives of achieving economic, social and employment benefits, as well as contributing to the availability of food supplies.

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 strategies[143].

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 Government[144].

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 cohesive approach to the management of both inshore and offshore waters[145] in accordance with **EU Directive 2014/89/EU[146] on maritime spatial planning**. It strives to promote development in a way that is compatible with the protection and enhancement of the marine environment[147].

---

[139] 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 04/11/2018)

[140] 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 04/06/2018)

[141] JNCC (2016) EU Marine Strategy Framework Directive [online] Available at: http://jncc.defra.gov.uk/page-5193 (accessed 04/11/2018)

[142] Regulation (EU) 2016/2336 of the European Parliament and 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://ec.europa.eu/fisheries/better-future-eu-deep sea_en (accessed 14/11/2018)

[143] Scottish Government (2015) UK Marine Policy Statement [online] Available at: http://www.gov.scot/Topics/marine/seamanagement/international/MPS (accessed 04/11/2018)

[144] Scottish Government (2014) Marine and Coastal Access Act 2009 [online] Available at: http://www.gov.scot/Topics/marine/seamanagement/marineact/ukbill (accessed 04/11/2018)

[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 04/11/2018)

[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 04/11/2018)

[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 04/11/2018)

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 environment, this includes planning for sustainable fisheries, the protection of migratory species, including birds and fish stocks, the protection of marine 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 biodiversity[148], including the establishment of an ecologically coherent network of MPAs in the North East Atlantic[149]. The OSPAR List of Threatened and/or Declining Species and Habitats[150] identifies species and habitats that are considered to be priorities for protection.

At the European level, the Natura 2000[151] network is the primary vehicle for meeting the aims of the **Habitats (92/43/EEC)**[152] and **Birds (2009/147/EC)[153] 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.

The 2020 Challenge for Scotland's Biodiversity[154] is Scotland's response to the international UN Aichi Targets for 2020[155] and the EU Biodiversity Strategy to 2020[156]. The

[148] ibid

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

[150] 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)

[151] Scottish Government (2016) Natura 2000 [online] Available at: http://www.gov.scot/Topics/Environment/Wildlife-Habitats/protectedareas/NATURA (accessed 04/11/2018)

[152] European Commission (1992) The Habitats Directive [online] Available at: http://ec.europa.eu/environment/nature/legislation/habitatsdirective/index_en.htm (accessed 04/11/2018)

[153] European Commission (2009) The Birds Directive [online] Available at: http://ec.europa.eu/environment/nature/legislation/birdsdirective/index_en.htm (accessed 04/11/2018)

[154] 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 04/11/2018)

[155] Convention on Biological Diversity (2010) Aichi Biodiversity Targets [online] Available at: https://www.cbd.int/sp/targets/default.shtml (accessed 04/11/2018)

[156] 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 04/11/2018)

2020 Challenge supplements the 2004 Scottish Biodiversity Strategy[157] 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 environment[158]. 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 Directives[159]. It also proposed the PMF system to guide the identification of MPAs and provide focus for marine planning and other activities.

Soil policy

At present, there is no legislative or policy tool developed specifically for the protection of soil[160]. 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 a site[161]. For example, marine geology forms part of the basis for the designation of **MPAs** within Scottish waters[162]. 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.

At the European level, the **Marine Strategy Framework Directive** includes Annex I, comprising a list of 11 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 practice[163]. 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) characteristics[164]. Meeting this indicator is regarded as crucial

[157] 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 04/11/2018)

[158] 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 04/11/2018)

[159] ibid

[160] Scottish Government (2009) The Scottish Soil Framework [online] Available at: http://www.gov.scot/Publications/2009/05/20145602/0 (accessed 04/11/2018)

[161] ibid

[162] Scottish Government (2016) Nature Conservation MPAs [online] Available at: http://www.gov.scot/Topics/marine/marine-environment/mpanetwork/ncmpas (accessed 04/11/2018)

[163] 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 04/11/2018)

[164] ibid

to achieving the Strategy's overarching aims of protecting biodiversity and ensuring the sustainable use of the marine environment[165].

Water policy

The **Marine Strategy Framework Directive** aims to achieve Good Environmental Status (GES) of the EU's marine waters by 2020 and to protect the resource base upon which marine-related economic and social activities depend. It is the first EU legislative instrument related to the protection of marine biodiversity, as it contains the explicit regulatory objective that "biodiversity is maintained by 2020", as the corner-stone for achieving GES. In order to achieve its goal, the Directive establishes European marine regions and sub-regions on the basis of geographical and environmental criteria.

Climatic factors policy

In November 2016, the United Nations Framework Convention on Climate Change (UNFCCC) **Paris Agreement** came into force[166]. 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˚C [167]. 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 damage[168].

The **Climate Change (Scotland) Act 2009** provides the statutory framework for Greenhouse (GHG) emissions reductions in Scotland. It sets a target for a reduction in emissions of the basket of Kyoto Protocol GHGs[169] 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 consultation[170]. 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.

---

[165] 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 04/11/2018)

[166] UNFCCC (2016) The Paris Agreement [online] Available at: http://unfccc.int/paris_agreement/items/9485.php (accessed 04/11/2018)

[167] European Commission (2016) Paris Agreement [online] Available at: http://ec.europa.eu/clima/policies/international/negotiations/paris/index_en.htm (accessed 04/11/2018)

[168] European Commission (2016) Paris Agreement [online] Available at: http://ec.europa.eu/clima/policies/international/negotiations/paris/index_en.htm (accessed 04/11/2018)

[169] The basket of Kyoto Protocol greenhouse gases comprises carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O), for which the baseline is 1990; and hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6), for which the baseline is 1995. Nitrogen trifluoride (NF_3) has subsequently been added and applies to the second commitment period of 2013-20.

[170] Scottish Government (2017) Climate Change Bill – Consultation Paper [online] Available at: http://www.gov.scot/Publications/2017/06/8208/0 (accessed 04/11/2018)

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'[171]. Scotland's **National Marine Plan**[172] 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.

Scotland's Climate Change Adaptation Programme[173] is a direct requirement of the Climate Change (Scotland) Act 2009, replacing the Climate Change Adaptation Framework[174] and accompanying Sector Action Plans[175]. Among its proposals and policies for meeting adaptation objectives are actions around conducting additional research into the role of blue carbon ecosystems in carbon sequestration and protecting these ecosystems[176]. The role of marine planning and MPAs in protecting these ecosystems is also noted[177].

[171] Marine (Scotland) Act 2010, asp 5 [online] Available at: http://www.legislation.gov.uk/asp/2010/5/pdfs/asp_20100005_en.pdf (accessed 04/09/2017)

[172] Scottish Government (2015) Scotland's National Marine Plan [online] Available at: http://www.gov.scot/Publications/2015/03/6517 (accessed 22/06/2017)

[173] 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 01/09/2017)

[174] Scottish Government (2009) Scotland's Climate Change Adaptation Framework [online] Available at: http://www.gov.scot/Resource/Doc/295110/0091310.pdf (accessed 04/11/2018)

[175] Scottish Government (2011) Sector Action Plans [online] Available at: http://www.gov.scot/Topics/Environment/climatechange/scotlands-action/adaptation/AdaptationFramework/SAP (accessed 04/11/2018)

[176] Scottish Government (2014) Climate Ready Scotland Scottish Climate Change Adaptation Programme [online] Available at: http://www.gov.scot/Resource/0045/00451392.pdf (accessed 04/11/2018)

[177] ibid

Appendix B Maps of Proposed Deep Sea Marine Reserve and Other Activities

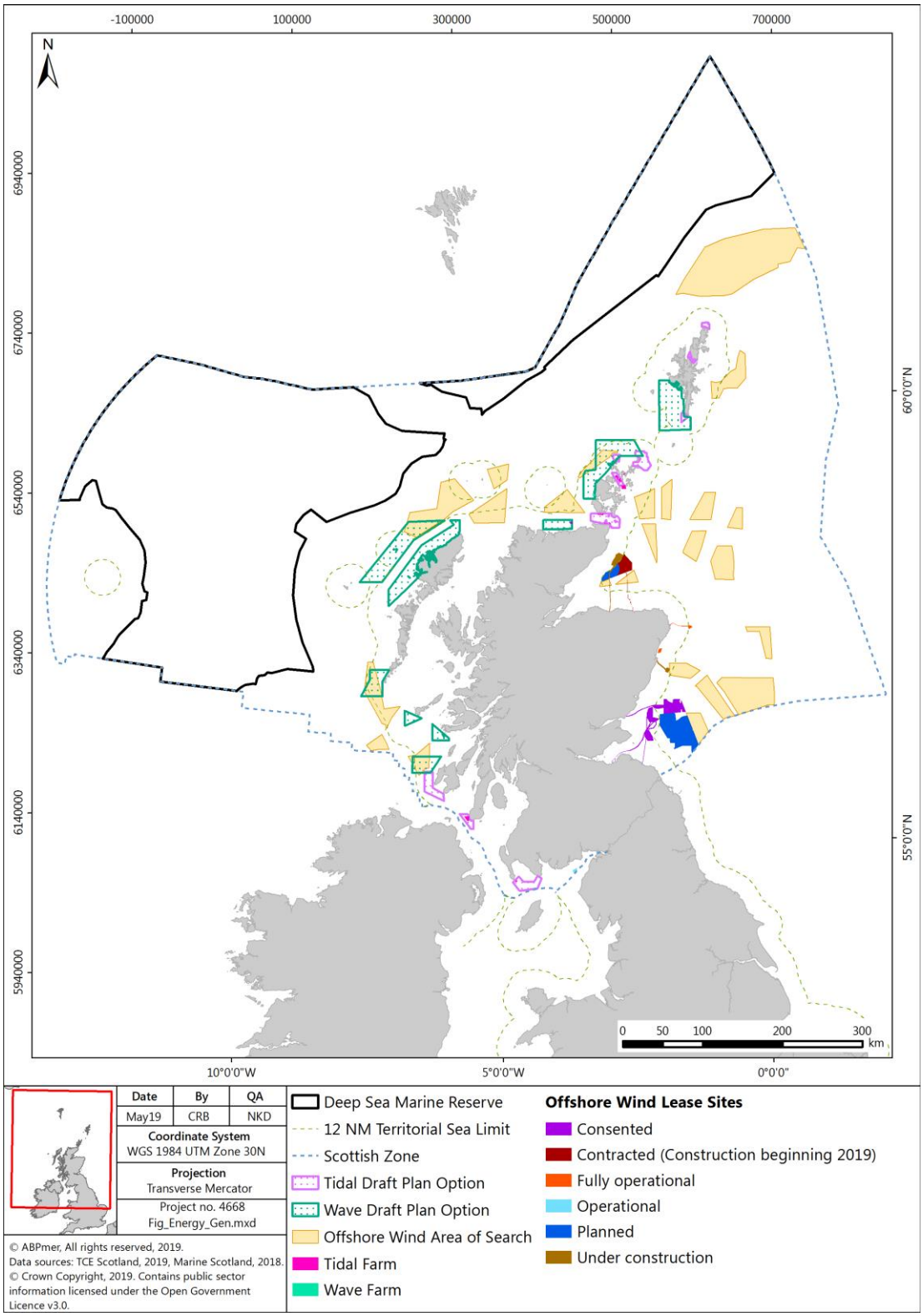


Figure B1 Location of the deep sea marine reserve with energy generation activities

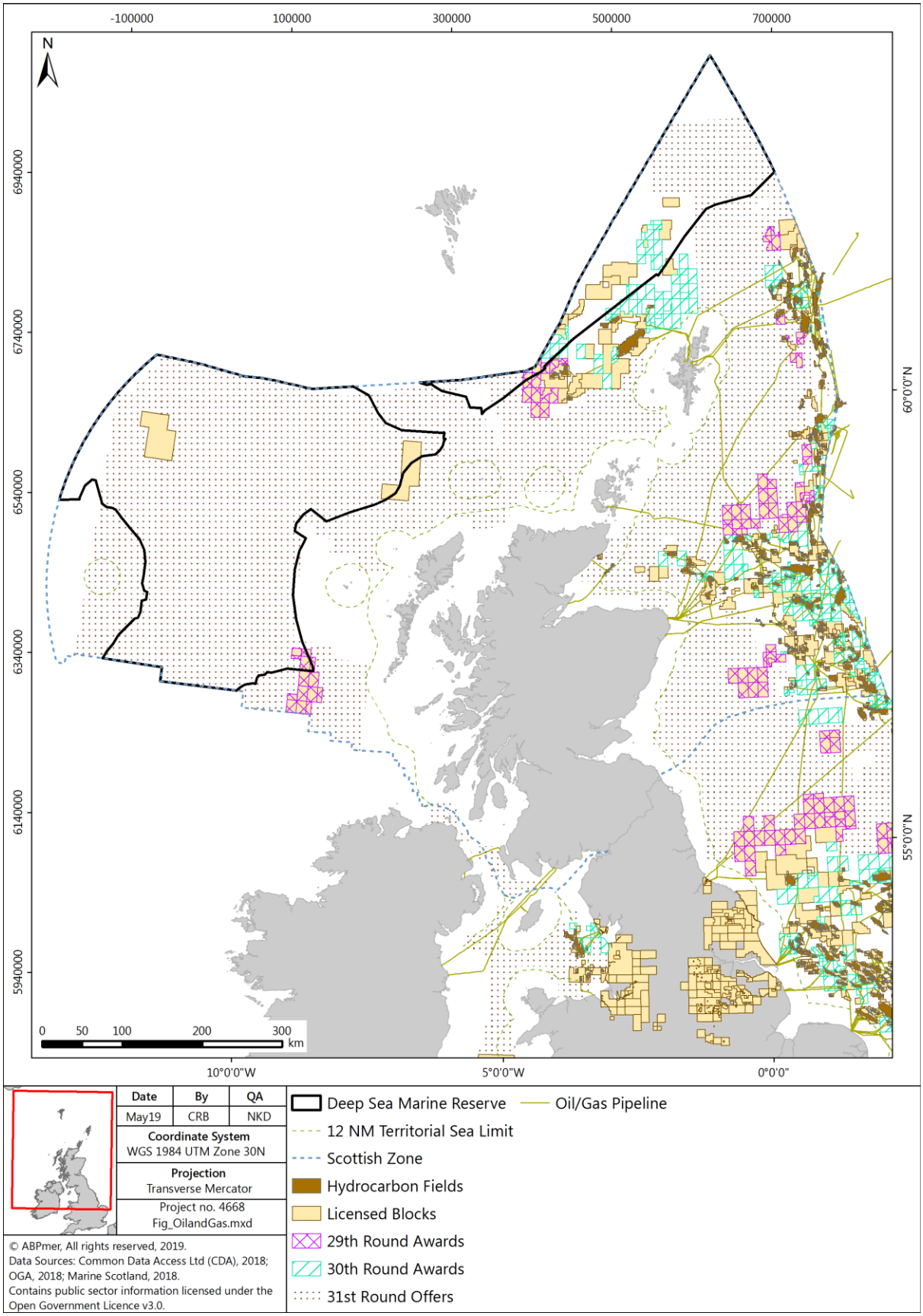


Figure B2 Location of deep sea marine reserve with offshore oil and gas activities

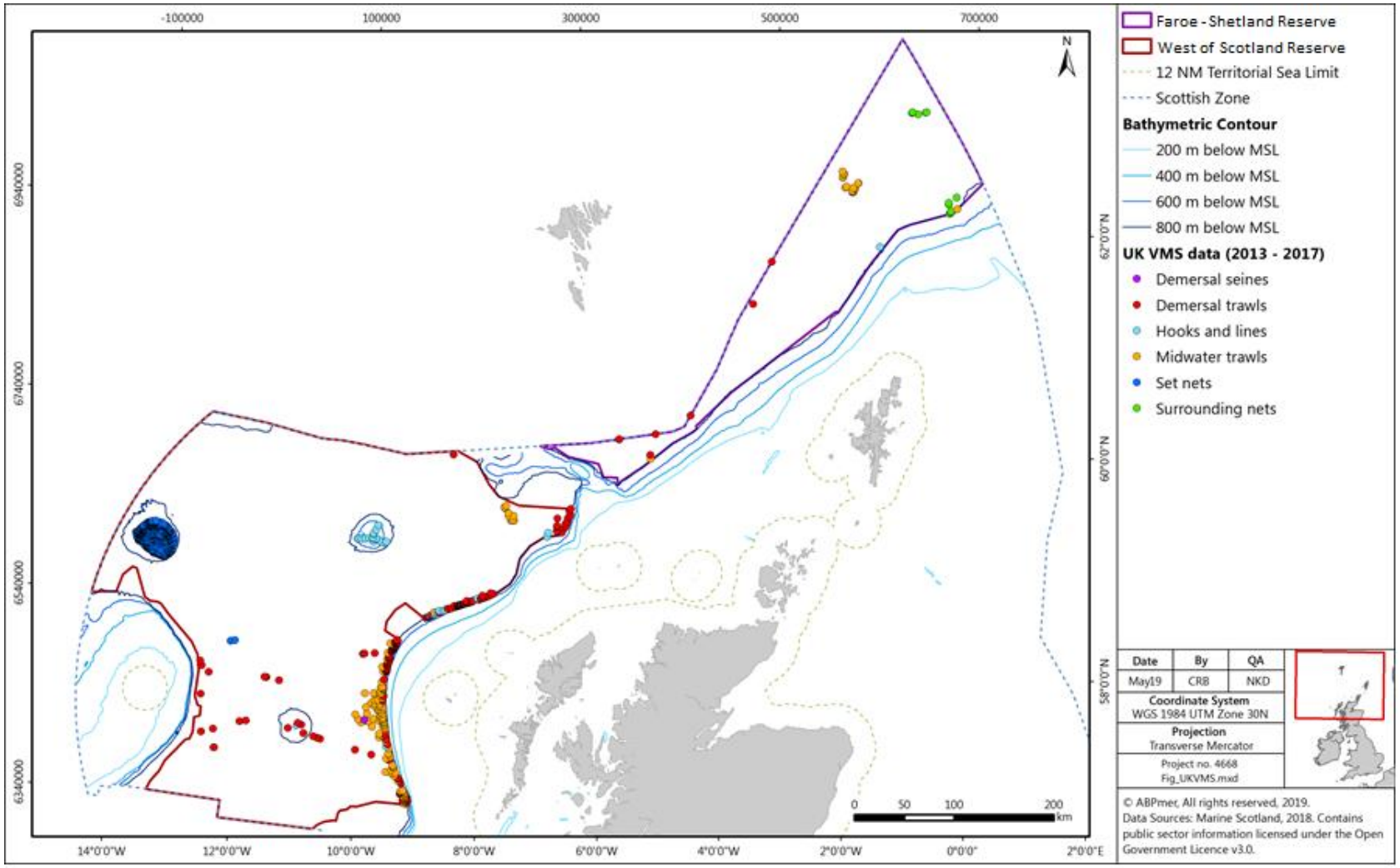


Figure B3 Location of the deep sea marine reserve with UK fishing activity

Appendix C Assessment Tables

A.1 Faroe-Shetland Reserve

Proposed protected features			
Burrowed mud (including sea pens), Deep sea sponge aggregations, Atlantic-influenced offshore deep sea muds, Atlantic-influenced offshore subtidal sands and gravels			
Pressure/ activity/ impact pathway[178]	**Management scenario**		
	Lower	**Intermediate**	**Upper**
Alternative Scenario Description	Designation as an MPA with existing fisheries management and consenting as normal.	Designation as an MPA with no extractive activities that affect the seabed (e.g. no demersal fisheries / no consenting oil and gas, etc.).	Designation as an MPA with no extractive activities that affect the seabed or in the water column.
Potential benefits to habitats and species within the pMPA	There is currently almost no activity affecting the seabed being undertaken within this region, therefore in the short term this is likely to remain the case. Under this low scenario the designation itself will increase the burden of proof required to demonstrate appropriate consideration of environmental parameters by any developer seeking permission to develop activities within the deep sea marine reserve. In the short term there are therefore few benefits to the designation of the deep sea marine reserve with no further management measures under the lower scenario. However, there is potential that the designation will increase the required scrutiny before further damaging activities are undertaken.	There is currently almost no extractive activity affecting the seabed being undertaken within this region[179]. The designation of the deep sea marine reserve and the implementation of the proposed management measures will therefore have no direct impact on current activities and therefore no direct impact on biodiversity in the deep sea marine reserve. There is some potential for foreign long-line activity within the proposed deep sea marine reserve region, however the extent of this is unknown and therefore the benefits cannot be quantified. Under this medium scenario the designation itself and proposed management measures will also prevent the future establishment of extractive industries within the region, effectively preventing the future damage of the marine environment by extractive activities (principally oil and gas, demersal fisheries, deep sea mining activities). In the short term there are therefore some direct benefits to the designation and management of the deep sea marine reserve, albeit spatially limited to areas currently exploited by bottom contacting fishing gears. The designation will also increase required scrutiny on any development of industry in the region and the application of the proposed management measures will provide future protection to marine receptors within the deep sea marine reserve.	There is currently almost no extractive activity affecting the seabed being undertaken within this region. However, there is activity within the region which affects the water column, including more significant pelagic fisheries, specifically pelagic trawls and surrounding nets (UK fisheries) and foreign fleet fisheries, where the exact gear is unknown. Under this upper scenario, therefore, in addition to the benefits described under the intermediate scenario, the designation itself and proposed management measures will directly reduce the activities currently being undertaken. This has the potential to have a positive direct impact on the biodiversity within the region, particularly mobile species, allowing fish stocks to increase, and therefore supporting the overall ecosystem in the region[180], although this beneficial impact may be reduced by displacement impacts, discussed below. This subsequently includes potential benefits to marine mammals and birds in the region, where pressures from fishing on prey species is reduced. Furthermore, the prevention of the development of future extractive industry will effectively prevent the future damage of the marine environment by extractive activities (principally oil and gas, demersal fisheries and deep sea mining activities). In the short and medium term there are therefore potential direct benefits to the designation of the deep sea marine reserve under the upper scenario. Furthermore, the application of the proposed management measures will provide future protection to marine receptors within the deep sea marine reserve.

[178] 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.

[179] It is recognised that there is further activity on the continental shelf slope in the North East Faroe Shetland Channel, however these are already proposed for fisheries management measures, and it is therefore assumed that the benefits from management in these areas will occur irrespective of the deep sea marine reserve designation, and are therefore not included in this assessment.

[180] Whilst this is a potential benefit to biodiversity receptors from the management of the deep sea marine reserve under the upper scenario, the benefits are not to the deep sea habitats and species proposed for designation.

95

Proposed protected features			
Burrowed mud (including sea pens), Deep sea sponge aggregations, Atlantic-influenced offshore deep sea muds, Atlantic-influenced offshore subtidal sands and gravels			
Pressure/ activity/ impact pathway[178]	**Management scenario**		
	Lower	**Intermediate**	**Upper**
Potential spillover benefits beyond pMPA site boundaries	As there is little change to the current baseline under this lower scenario it is not expected that there will be spillover benefits beyond the deep sea marine reserve boundaries.	There is very little exploitive activity impacting the seabed, therefore little or no currently occurring activity will be excluded, and therefore there is no potential for spillover benefits to areas outwith the deep sea marine reserve.	The reduction in pelagic fisheries across the deep sea marine reserve has the potential to allow for population increases which could spillover outwith the deep sea marine reserve boundaries. The magnitude of these beneficial spillover impacts cannot be quantified, due to the mobile nature of the features targeted in the pelagic fisheries and uncertainty as to the nature of the fisheries in the region, particularly with reference to foreign fishing fleets.
Potential adverse environmental effects resulting from the displacement of activities and the intensification of activities in areas where they already occur	The designation of the deep sea marine reserve with no further management measures will not necessarily exclude activities, therefore it is not considered that there will be displacement to other areas.	Designation and management has the potential exclude a very small amount of activity from the deep sea marine reserve, including some foreign fishing fleet activity. This activity has the potential to be displaced to areas outwith the deep sea marine reserve. There are not significant volumes of demersal fisheries within the deep sea marine reserve, therefore displacement is highly unlikely to have any impact on the benthic environment or fish stocks in the region.	In addition to the displacement considered under the intermediate scenario, pelagic gears will be displaced under the upper scenario. The UK fishing fleet activity is concentrated in small pockets towards the northeast of the deep sea marine reserve and are likely to be displaced to areas outwith the deep sea marine reserve. There is also significant foreign fishing activity, the exact gear type of which is unknown. This includes a high density of Faroese fishing activity in the south-west of the region, and lower levels of German, Dutch and Norwegian fishing throughout the deep sea marine reserve which all may be displaced. The displacement is likely to be over a small distance, and therefore current impacts on pelagic fish populations are likely to be replicated in the areas outwith the deep sea marine reserve, particularly given the mobile nature of the target species.
Potential environmental impact of increased fishing effort from other gear types that might not be targeted by the management scenario within the pMPA	The designation of the deep sea marine reserve with no further management measures will not necessarily exclude activities, therefore it is not considered that there will be increased fishing effort from other gears as a direct result of the designation.	The designation and management will exclude some activity from the deep sea marine reserve, specifically some demersal trawls / hooks and lines from the continental shelf slope and potentially a small amount of foreign activity. There is limited potential for this effort to be replaced by other gears, as all demersal gears are included in the management measures under the intermediate scenario.	Under the upper scenario all fishing gears are excluded from the deep sea marine reserve.

96

Proposed protected features			
Burrowed mud (including sea pens), Deep sea sponge aggregations, Atlantic-influenced offshore deep sea muds, Atlantic-influenced offshore subtidal sands and gravels			
Pressure/ activity/ impact pathway[178]	**Management scenario**		
	Lower	**Intermediate**	**Upper**
Overall (cumulative) assessment	The designation of the deep sea marine reserve with no further management measures will have no direct impact on activities currently being undertaken. The designation of the deep sea marine reserve may, however, increase the level of scrutiny applied to developers looking to expand activities which would impact the seabed in the future. The designation will therefore have a **no immediate benefit** with potential for more significant future benefits.	The designation of the deep sea marine reserve in the FSR and management under the intermediate scenario will exclude a very small amount of UK gears and potentially some foreign fishing gears. However, any benefits from exclusion of activity are likely to be offset by impacts on benthic habitats and fisheries where activity is likely to be displaced. The designation and management in the FSR under the intermediate scenario will also prevent the further development of extractive industry (particularly oil and gas, deep sea mining and demersal fisheries) in the future, providing significant protection to deep sea features. The designation will therefore have a **negligible immediate benefit** with potential for more significant future benefits.	The designation of the deep sea marine reserve in the FSR and management under the upper scenario will exclude a very small amount of UK demersal gears, some UK pelagic gear and a more significant volume of foreign fishing gears, potentially both demersal and pelagic. However, any benefits from exclusion of activity are likely to be offset by impacts on benthic habitats and fisheries where activity is likely to be displaced. The designation and management in the FSR under the upper scenario will also prevent the further development of extractive industry (particularly oil and gas, deep sea mining and demersal and pelagic fisheries) in the future, providing significant protection to both deep sea features and pelagic features within the deep sea marine reserve. The designation will therefore have a **minor immediate benefit** with potential for more significant future benefits.
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.	The intermediate scenario will result in a negligible immediate beneficial contribution to SEA Objective 1 and 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 upper scenario will result in a negligible to minor immediate beneficial contribution to SEA Objective 1, through the exclusion of a very small volume of demersal fishing activity and a larger volume of pelagic fishing activity. The benefits of the upper scenario, are principally not associated with the features proposed for designation within the deep sea marine reserve. The upper scenario 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.
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.	The intermediate scenario will result in a negligible immediate beneficial contribution to SEA Objective 2 and 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, particularly through the exclusion of oil and gas or potential seabed mining activities which may cause significant disturbance to the seabed.	The upper scenario will result in a negligible immediate beneficial contribution to SEA Objective 2 and 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, particularly through the exclusion of oil and gas or potential seabed mining activities which may cause significant disturbance to the seabed.

97

Proposed protected features			
Burrowed mud (including sea pens), Deep sea sponge aggregations, Atlantic-influenced offshore deep sea muds, Atlantic-influenced offshore subtidal sands and gravels			
Pressure/ activity/ impact pathway[178]	**Management scenario**		
	Lower	**Intermediate**	**Upper**
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 scenario will result in a negligible immediate beneficial contribution to SEA Objective 3 and 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, particularly with the exclusion of oil and gas activities which have the potential to pollute seabed sediments.	The upper scenario will result in a negligible immediate beneficial contribution to SEA Objective 3 and 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, particularly with the exclusion of oil and gas activities which have the potential to pollute seabed sediments.
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 scenario will result in a negligible immediate beneficial contribution to SEA Objective 4 and 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, particularly with the exclusion of oil and gas activities which have the potential to pollute the water column.	The upper scenario will result in a negligible immediate beneficial contribution to SEA Objective 4 and 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, particularly with the exclusion of oil and gas activities which have the potential to pollute the water column.
SEA Objective 5 - To maintain or work towards achieving '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.	The intermediate scenario will result in a negligible immediate beneficial contribution to SEA Objective 5 and 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, particularly with the exclusion of oil and gas, demersal fishing and seabed mining activities which have the potential to cause deterioration against MSFD indicators.	The intermediate scenario will result in a minor immediate beneficial contribution to SEA Objective 5, specifically supporting the potential recovery of pelagic fish species, and 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, particularly with the exclusion of oil and gas, demersal fishing, pelagic fishing and seabed mining activities which have the potential to cause deterioration against MSFD indicators.
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 through affording enhanced protection to the environment from future activities.	The intermediate scenario will result in a negligible immediate beneficial contribution to SEA Objective 2 and 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, particularly with the exclusion of oil and gas and seabed mining activities which could disturb deep sea sediments, potentially causing reduced storage of carbon within these sediments.	The intermediate scenario will result in a negligible immediate beneficial contribution to SEA Objective 2 and 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, particularly with the exclusion of oil and gas and seabed mining activities which could disturb deep sea sediments, potentially causing reduced storage of carbon within these sediments.

A.2 West of Scotland Reserve (WSR)

Proposed protected features			
Biodiversity Burrowed mud (including sea pens), Coral gardens, Cold-water coral reefs (including *Lophelia pertusa* reefs), Deep sea sponge aggregations, Atlantic-influenced offshore deep sea muds, Atlantic-influenced offshore subtidal sands and gravels, Seamount communities, Seamounts, Blue Ling (*Molva dypterygia*), Leafscale gulper shark (*Centrophorus squamosus*) / Gulper shark (*Centrophorus granulosus*), Orange roughy (*Hoplostethus atlanticus*), Portuguese dogfish (*Centroscymnus coelolepis*), Roundnose grenadier (*Coryphaenoides rupestris*), Geodiversity features			
Pressure/ activity/ impact pathway[181]	**Management scenario**		
	Lower	**Intermediate**	**Upper**
Alternative Scenario Description	Designation as an MPA with existing fisheries management and consenting as normal.	Designation as an MPA with no extractive activities that affect the seabed (e.g. no demersal fisheries / no consenting oil and gas, etc.).	Designation as an MPA with no extractive activities that affect the seabed or in the water column.
Potential benefits to habitats and species within the pMPA	There is currently little activity affecting the seabed being undertaken within this region, therefore in the short term this is likely to remain the case. Under this low scenario the designation itself will increase the burden of proof required to demonstrate appropriate consideration of environmental parameters by any developer seeking permission to develop activities within the deep sea marine reserve. In the short term there are therefore few benefits to the designation of the deep sea marine reserve with no further management measures under the lower scenario. However, there is potential that the designation will increase the required scrutiny before further damaging activities are undertaken.	There is currently little extractive activity affecting the seabed being undertaken within this region, with the exception of demersal trawls / hooks and lines on the continental slope, and set netting around George Bligh Rise[182]. The designation of the deep sea marine reserve and the implementation of the proposed management measures will therefore stop this activity, and therefore allow a reduction in pressures on both targeted and bycatch fisheries in the short term. This has the potential to allow for the recovery of fish populations in the area. There is some potential for foreign long-line activity within the proposed deep sea marine reserve region, however the extent of this is unknown and therefore the benefits cannot be quantified. In addition, the reduction in pressures from fisheries around George Bligh Bank has the potential to reduce pressures on coral garden features, either protecting them from damage, or allowing recovery where damage has already occurred. Due to the slow growing nature, it is expected that recovery of coral garden features will be a medium term benefit from the exclusion of seabed contacting activity. Under this medium scenario the designation itself and proposed management measures will also prevent the future establishment of extractive industries within the region, effectively preventing the future damage of the marine environment by extractive activities (principally oil and gas, demersal fisheries, deep sea mining activities). In the short term there are therefore some direct benefits to the designation and management of the	There is currently little extractive activity affecting the seabed being undertaken within this region, with the exception of demersal trawls on the continental slope, and set netting around George Bligh Rise. However, there is activity within the region which affects the water column, including more significant pelagic fisheries both UK pelagic trawls and foreign fleet fisheries, where the exact gear is unknown. Under this upper scenario, therefore, in addition to the benefits described under the intermediate scenario, the designation itself and proposed management measures will directly reduce the activities currently being undertaken. This has the potential to have a positive direct impact on the biodiversity within the region, particularly mobile species, allowing fish stocks to increase, and therefore supporting the overall ecosystem in the region, although this beneficial impact may be reduced by displacement impacts, discussed below. This subsequently includes potential benefits to marine mammals and birds in the region, where pressures from fishing on prey species is reduced[183]. Furthermore, the prevention of the development of future extractive industry will effectively prevent future damage of the marine environment by extractive activities (principally oil and gas, demersal fisheries and deep sea mining activities). In the short and medium term there are therefore potential direct benefits to the designation of the deep sea marine reserve under the upper scenario. Furthermore, the application of the proposed management measures will provide future protection

[181] 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.

[182] It is recognised that there is further activity around Rosemary Bank, however these are already proposed for fisheries management measures, and it is therefore assumed that the benefits from management in these areas will occur irrespective of the deep sea marine reserve designation, and are therefore not included in this assessment.

[183] Whilst this is a potential benefit to biodiversity receptors from the management of the deep sea marine reserve under the upper scenario, the benefits are not to the deep sea habitats and species proposed for designation.

Proposed protected features			
Biodiversity Burrowed mud (including sea pens), Coral gardens, Cold-water coral reefs (including *Lophelia pertusa* reefs), Deep sea sponge aggregations, Atlantic-influenced offshore deep sea muds, Atlantic-influenced offshore subtidal sands and gravels, Seamount communities, Seamounts, Blue Ling (*Molva dypterygia*), Leafscale gulper shark (*Centrophorus squamosus*) / Gulper shark (*Centrophorus granulosus*), Orange roughy (*Hoplostethus atlanticus*), Portuguese dogfish (*Centroscymnus coelolepis*), Roundnose grenadier (*Coryphaenoides rupestris*), Geodiversity features			
Pressure/ activity/ impact pathway[181]	**Management scenario**		
	Lower	**Intermediate**	**Upper**
		deep sea marine reserve, albeit spatially limited to areas currently exploited by bottom contacting fishing gears. The designation will also increase required scrutiny on any development of industry in the region and the application of the proposed management measures will provide future protection to marine receptors within the deep sea marine reserve.	to marine receptors within the deep sea marine reserve.
Potential spillover benefits beyond pMPA site boundaries	As there is little change to the current baseline under this lower scenario it is not expected that there will be spillover benefits beyond the pMPA boundaries.	The reduction in fishing effort around George Bligh Bank and on the continental shelf slope has the potential to allow for recovery of fish stocks, in the region. Increasing fish populations within the pMPA has the potential to spillover to areas outwith the deep sea marine reserve, however these impacts are considered likely to be negligible.	In addition to the potential spillover benefits under the intermediate scenario, the reduction in pelagic fisheries across the pMPA has the potential to allow for population increases which could spillover outwith the deep sea marine reserve boundaries. The magnitude of these beneficial spillover impacts cannot be quantified, due to the mobile nature of the features targeted in the pelagic fisheries.
Potential adverse environmental effects resulting from the displacement of activities and the intensification of activities in areas where they already occur	The designation of the deep sea marine reserve with no further management measures will not necessarily exclude activities, therefore it is not considered that there will be displacement to other areas.	The designation and management will exclude some activity from the deep sea marine reserve, specifically set nets from George Bligh Bank and some demersal trawls / hooks and lines from the continental shelf slope. This activity has the potential to be displaced to areas outwith the deep sea marine reserve, particularly the demersal trawls and hooks and lines which are likely to be displaced into shallower waters on the continental shelf. The displacement of the hooks and lines / demersal trawls from the continental shelf slope is a small proportion of the total demersal trawl / hooks and lines landings in the region, and is displaced over a small distance to an area of already high intensity fishing. It is therefore unlikely to significantly impact the benthic environment or fish stocks in the region.	In addition to the displacement considered under the intermediate scenario, pelagic trawls will be displaced under the upper scenario. These trawls are concentrated around the continental shelf slope, and therefore are likely to be displaced in a similar manner to the demersal trawls, up the slope into slightly shallower water. This displacement is over a small distance, and therefore there are likely to be limited impacts to either target or bycatch species in the region.
Potential environmental impact of increased fishing effort from other gear types that might not be targeted by the management scenario within the pMPA	The designation of the deep sea marine reserve with no further management measures will not necessarily exclude activities, therefore it is not considered that there will be increased fishing effort from other gears as a direct result of the designation.	The designation and management will exclude some activity from the deep sea marine reserve, specifically set nets from George Bligh Bank and some demersal trawls / hooks and lines from the continental shelf slope. There is limited potential for this effort to be replaced by other gears, as all demersal gears are included in the management measures under the intermediate scenario.	Under the upper scenario all fishing gears are excluded from the deep sea marine reserve.
Overall (cumulative) assessment	The designation of the deep sea marine reserve with no further management measures will have no direct impact on activities currently being undertaken. The designation of the deep sea marine reserve may,	The designation of the deep sea marine reserve in the WSR and management under the intermediate scenario will exclude set netting around George Bligh	The designation of the deep sea marine reserve in the WSR and management under the upper scenario will exclude set netting around George Bligh Bank and

100

Proposed protected features			
Biodiversity Burrowed mud (including sea pens), Coral gardens, Cold-water coral reefs (including *Lophelia pertusa* reefs), Deep sea sponge aggregations, Atlantic-influenced offshore deep sea muds, Atlantic-influenced offshore subtidal sands and gravels, Seamount communities, Seamounts, Blue Ling (*Molva dypterygia*), Leafscale gulper shark (*Centrophorus squamosus*) / Gulper shark (*Centrophorus granulosus*), Orange roughy (*Hoplostethus atlanticus*), Portuguese dogfish (*Centroscymnus coelolepis*), Roundnose grenadier (*Coryphaenoides rupestris*), Geodiversity features			
Pressure/ activity/ impact pathway[181]	**Management scenario**		
	Lower	**Intermediate**	**Upper**
	however, increase the level of scrutiny applied to developers looking to expand activities which would impact the seabed in the future. The designation will therefore have a **no immediate benefit** with potential for more significant future benefits.	Bank and hence reduce pressures on deep sea features, specifically coral gardens. The exclusion of demersal trawls and hooks and lines on the edge of the continental shelf slope will have lower impacts, as benefits to benthic habitat and fisheries in this area will be offset by impacts on benthic habitats and fisheries where activity is likely to be displaced into slightly shallower water on the continental shelf. The designation and management in the WSR under the intermediate scenario will also prevent the further development of extractive industry (particularly oil and gas, deep sea mining and demersal fisheries) in the future, providing significant protection to deep sea features. The designation will therefore have a **minor immediate benefit** with potential for more significant future benefits.	hence reduce pressures on deep sea features, specifically coral gardens. The exclusion of demersal trawls and hooks and lines, and pelagic fishing gear on the edge of the continental shelf slope will have lower impacts, as benefits to benthic habitat and fisheries in this area will be offset by impacts on benthic habitats and fisheries where activity is likely to be displaced into slightly shallower water on the continental shelf. The designation and management in the WSR under the intermediate scenario will also prevent the further development of extractive industry (particularly oil and gas, deep sea mining and demersal and pelagic fisheries) in the future, providing significant protection to both deep sea features and pelagic features within the deep sea marine reserve. The designation will therefore have a **minor immediate benefit** with potential for more significant future benefits.
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.	The intermediate scenario will result in a minor immediate beneficial contribution to SEA Objective 1 through exclusion of set nets around George Bligh Bank and 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 upper scenario will result in a minor immediate beneficial contribution to SEA Objective 1, through the exclusion of a limited volume of demersal fishing activity and a larger volume of pelagic fishing activity. The benefits of the upper scenario from the restriction of pelagic fishing activity, are principally not associated with the features proposed for designation within the deep sea marine reserve. The upper scenario will also potentially result in a greater beneficial contribution to this SEA objective in the future through affording enhanced protection to the environment from future activities.
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.	The intermediate scenario will result in a minor immediate beneficial contribution to SEA Objective 2 through exclusion of set nets around George Bligh Bank. It will also potentially result in a greater beneficial contribution to this SEA objective in the future through affording enhanced protection to the environment from future activities, particularly through the exclusion of oil and gas or potential seabed mining activities which may cause significant disturbance to the seabed.	The upper scenario will result in a minor immediate beneficial contribution to SEA Objective 2 through exclusion of set nets around George Bligh Bank. It will also potentially result in a greater beneficial contribution to this SEA objective in the future through affording enhanced protection to the environment from future activities, particularly through the exclusion of oil and gas or potential seabed mining activities which may cause significant disturbance to the seabed.

101

Proposed protected features			
Biodiversity Burrowed mud (including sea pens), Coral gardens, Cold-water coral reefs (including *Lophelia pertusa* reefs), Deep sea sponge aggregations, Atlantic-influenced offshore deep sea muds, Atlantic-influenced offshore subtidal sands and gravels, Seamount communities, Seamounts, Blue Ling (*Molva dypterygia*), Leafscale gulper shark (*Centrophorus squamosus*) / Gulper shark (*Centrophorus granulosus*), Orange roughy (*Hoplostethus atlanticus*), Portuguese dogfish (*Centroscymnus coelolepis*), Roundnose grenadier (*Coryphaenoides rupestris*), Geodiversity features			
Pressure/ activity/ impact pathway[181]	**Management scenario**		
	Lower	**Intermediate**	**Upper**
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 scenario will result in a minor immediate beneficial contribution to SEA Objective 2 through exclusion of set nets around George Bligh Bank. It will also potentially result in a greater beneficial contribution to this SEA objective in the future through affording enhanced protection to the environment from future activities, particularly with the exclusion of oil and gas activities which have the potential to pollute seabed sediments.	The upper scenario will result in a minor immediate beneficial contribution to SEA Objective 2 through exclusion of set nets around George Bligh Bank. It will also potentially result in a greater beneficial contribution to this SEA objective in the future through affording enhanced protection to the environment from future activities, particularly with the exclusion of oil and gas activities which have the potential to pollute seabed sediments.
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 scenario will result in a minor immediate beneficial contribution to SEA Objective 2 through exclusion of set nets around George Bligh Bank. It will also potentially result in a greater beneficial contribution to this SEA objective in the future through affording enhanced protection to the environment from future activities, particularly with the exclusion of oil and gas activities which have the potential to pollute the water column.	The upper scenario will result in a minor immediate beneficial contribution to SEA Objective 2 through exclusion of set nets around George Bligh Bank. It will also potentially result in a greater beneficial contribution to this SEA objective in the future through affording enhanced protection to the environment from future activities, particularly with the exclusion of oil and gas activities which have the potential to pollute the water column.
SEA Objective 5 - To maintain or work towards achieving '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.	The intermediate scenario will result in a minor immediate beneficial contribution to SEA Objective 5, through protection of benthic habitat around George Bligh Bank, and 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, particularly with the exclusion of oil and gas, demersal fishing and seabed mining activities which have the potential to cause deterioration against MSFD indicators.	The intermediate scenario will result in a minor immediate beneficial contribution to SEA Objective 5, through protection of benthic habitat around George Bligh Bank and support for the recovery of pelagic fish populations. It will also potentially result in a greater beneficial contribution to this SEA objective in the future through affording enhanced protection to the environment from future activities, particularly with the exclusion of oil and gas, demersal fishing, pelagic fishing and seabed mining activities which have the potential to cause deterioration against MSFD indicators.
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 through affording enhanced protection to the environment from future activities.	The intermediate scenario will result in a minor immediate beneficial contribution to SEA Objective 2 through exclusion of set nets around George Bligh Bank. It will also potentially result in a greater beneficial contribution to this SEA objective in the future through affording enhanced protection to the environment from future activities, particularly with the exclusion of oil and gas and seabed mining activities which could disturb deep sea sediments, potentially causing reduced storage of carbon within these sediments.	The upper scenario will result in a minor immediate beneficial contribution to SEA Objective 2 through exclusion of set nets around George Bligh Bank. It will also potentially result in a greater beneficial contribution to this SEA objective in the future through affording enhanced protection to the environment from future activities, particularly with the exclusion of oil and gas and seabed mining activities which could disturb deep sea sediments, potentially causing reduced storage of carbon within these sediments.

102

Appendix D Abbreviations

Acronym	Definition
ABNJ	Area Beyond National Jurisdiction
BGS	British Geological Survey
EC	European Commission
EEZ	Exclusive Economic Zone
EU	European Union
EUNIS	European Nature Information System
FEAST	Feature Activity Sensitivity Tool
FSR	Faroe Shetland Reserve
GEMS	Global and regional Earth-system (atmosphere) Monitoring using Satellite and *in situ* data
GEN	General Planning Policy
GES	Good Environmental Status
GHG	Greenhouse Gas
ICES	International Council for the Exploration of the Sea
ISA	International Seabed Authority
JNCC	Joint Nature Conservation Council
LCPA	List of Chemicals for Priority Action
MPA	Marine Protected Area
MSFD	Marine Strategy Framework Directive
NM	Nautical Mile
OGA	Oil and Gas Authority
OSPAR	Oslo-Paris Conventions
PMF	Priority Marine Features
WSR	West of Scotland Reserve
SA	Sustainability Appraisal
SAC	Special Area of Conservation
SEA	Strategic Environmental Assessment
SEIA	Socio-economic Impact Assessment
SNH	Scottish Natural Heritage
SSSI	Site of Special Scientific Interest
TAC	Total Allowable Catch
UK	United Kingdom
UN	United Nations

Acronym	Definition
UNCLOS	United Nations Law of the Sea
UNFCCC	United Nations Framework Convention on Climate Change
WFD	Water Framework Directive