Fisheries Management Options Paper:

WEST OF SCOTLAND MPA

JNCC

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1. Management Options Summary

Table 1. Fisheries management options for fishing gears.

Fishing activity	Management options
Mobile bottom contact gears	**No additional management:** With no additional management in areas shallower than 800m, there is a risk of not achieving the conservation objectives for **Offshore sands and gravels, Burrowed mud (including sea-pens), Offshore deep-sea muds, Leafscale gulper shark** (*Centrophorus squamosus*)**, Gulper shark** (*Centrophorus granulosus*)**, Portuguese dogfish** (*Centroscymnus coelolepis*)**, Blue ling** (*Molva dypterygia*)**, Roundnose grenadier** *(Coryphaenoides rupestris)* and **Orange roughy** (*Hoplostethus atlanticus*). The conservation objectives would not be achieved for **Deep-sea sponge aggregations**, **Coral gardens**, **Cold-water coral reefs (including *Lophelia pertusa* reefs)** or **Seamount communities.** JNCC recommend that this option should not be applied in areas shallower than 800m where these features occur. **Reduce/limit pressures:** If applied in areas shallower than 800m where the following features occur, this option would reduce, but not entirely eliminate, the risk of not achieving the conservation objectives for **Offshore sands and gravels, Burrowed mud (including sea-pens), Offshore deep-sea muds, Blue ling** (*Molva dypterygia*)**, Roundnose grenadier** *(Coryphaenoides rupestris)***, Orange roughy** (*Hoplostethus atlanticus*)**, Leafscale gulper shark** (*Centrophorus squamosus*)**, Gulper shark** (*Centrophorus granulosus*) and **Portuguese dogfish** (*Centroscymnus coelolepis*). Appropriate management could include seasonal or temporal restrictions, to minimise bycatch of mobile species features and their prey, or a zoned approach, restricting mobile bottom contact fisheries over a proportion of the site. Measures could be decided in consultation with stakeholders. Restrictions could be permanent in some cases or temporary/adaptive in others. The conservation objectives would not be achieved for **Deep-sea sponge aggregations, Coral gardens, Cold-water coral reefs (including *Lophelia pertusa* reefs)** or **Seamount communities** in areas shallower than 800m. **Remove/avoid pressures:** If applied in areas shallower than 800m where the following features occur, this option would reduce the risk of not achieving the conservation objectives for **Offshore sands and gravels, Burrowed mud (including sea-pens), Offshore deep-sea muds, Leafscale gulper shark** (*Centrophorus squamosus*)**, Gulper shark** (*Centrophorus granulosus*)**, Portuguese dogfish** (*Centroscymnus coelolepis*)**, Blue ling** (*Molva dypterygia*)**, Roundnose grenadier** *(Coryphaenoides rupestris)* and **Orange roughy** (*Hoplostethus atlanticus*)**,** to the lowest possible levels.

Fishing activity	Management options
	This is the only option that would not risk the achievements of the conservation objectives for **Deep-sea sponge aggregations, Coral gardens, Cold-water coral reefs (including *Lophelia pertusa* reefs)** and **Seamount communities.** JNCC recommend that this option should be applied in areas shallower than 800m, in all areas where these features occur.
Pelagic gear (only applicable to mobile species features)	**No additional management:** This option is considered unlikely to prevent the achievement of the conservation objectives for **Blue ling** (Molva dypterygia)**.** There is a risk of not achieving the conservation objectives for **Roundnose grenadier** (Coryphaenoides rupestris)**, Orange roughy** (Hoplostethus atlanticus)**, Leafscale gulper** shark (Centrophorus squamosus)**, Gulper shark** (Centrophorus granulosus) and **Portuguese dogfish** (Centroscymnus coelolepis)**.** **Reduce/limit pressures:** This option would reduce, but not entirely eliminate, the risk of not achieving the conservation objectives for **Roundnose grenadier** *(Coryphaenoides rupestris)***, Orange roughy** (*Hoplostethus atlanticus*)**, Leafscale gulper shark** (*Centrophorus squamosus*)**, Gulper shark** (*Centrophorus granulosus*) and **Portuguese dogfish** (*Centroscymnus coelolepis*)**.** Appropriate management could include seasonal or temporal restrictions, to minimise bycatch of mobile species features and their prey. Measures could be decided in consultation with stakeholders. Restrictions could be permanent in some cases or temporary/adaptive in others. **Remove/avoid pressure:** This option would reduce the risk of not achieving the conservation objectives for **Roundnose grenadier** *(Coryphaenoides rupestris)***, Orange roughy** (*Hoplostethus atlanticus*)**, Leafscale gulper shark** (*Centrophorus squamosus*)**, Gulper shark** (*Centrophorus granulosus*) and **Portuguese dogfish** (*Centroscymnus coelolepis*), to the lowest possible level.
Static nets (including trammel, gill, tangle, and drift nets)	**No additional management:** With no additional management in areas shallower than 600m, there is a risk of not achieving the conservation objectives for **Burrowed mud (including sea-pens), Offshore deep-sea muds, Offshore sands and gravels, Blue ling** (*Molva dypterygia*)**, Roundnose grenadier** *(Coryphaenoides rupestris)***, Orange roughy** (*Hoplostethus atlanticus)***,** **Leafscale gulper shark** (*Centrophorus squamosus*) **and Gulper shark** (*Centrophorus granulosus*)**, Portuguese dogfish** (*Centroscymnus coelolepis*)**.** This risk is considered to be low for the sedimentary features, however, if static gear fishing activities were to increase or monitoring showed evidence of detrimental effects, this would indicate an increased risk to these features. The conservation objectives would not be achieved for **Deep-sea sponge aggregations, Coral gardens, Cold-water coral reefs (including *Lophelia pertusa* reefs)** or **Seamount communities** in areas shallower than 600m. JNCC recommend that this option should not be applied in areas shallower than 600m where these features occur.

Fishing activity	Management options
	Reduce/limit pressures: If applied in areas shallower than 600m where the following features occur, this option would reduce, but not entirely eliminate, the risk of not achieving the conservation objectives for **Burrowed mud (including sea-pens), Offshore deep-sea muds, Offshore sands and gravels, Blue ling** (*Molva dypterygia*)**, Roundnose grenadier** *(Coryphaenoides rupestris)***, Orange roughy** (*Hoplostethus atlanticus*)**, Leafscale gulper shark** (*Centrophorus squamosus*)**, Gulper shark** (*Centrophorus granulosus*) and **Portuguese dogfish** (*Centroscymnus coelolepis*). Appropriate management could include seasonal or temporal restrictions, or gear deployment rules (e.g., reduced soak times), to minimise bycatch of mobile species features, or a zoned approach, restricting mobile bottom contact fisheries over a proportion of the site. Measures could be decided in consultation with stakeholders. Restrictions could be permanent in some cases or temporary/adaptive in others. The conservation objectives would not be achieved for **Deep-sea sponge aggregations, Coral gardens, Cold-water coral reefs (including *Lophelia pertusa* reefs)** or **Seamount communities** in areas shallower than 600m. **Remove/avoid pressure:** If applied in areas shallower than 600m where the following features occur, this option would reduce the risk of not achieving the conservation objectives for **Burrowed mud (including sea-pens), Offshore deep-sea muds, Offshore sands and gravels, Blue ling** (*Molva dypterygia*)**, Roundnose grenadier** *(Coryphaenoides rupestris)***, Orange roughy** (*Hoplostethus atlanticus*)**, Leafscale gulper shark** (*Centrophorus squamosus*)**, Gulper shark** (*Centrophorus granulosus*) and **Portuguese dogfish** (*Centroscymnus coelolepis*), to the lowest possible levels. This is the only option that would not risk the achievements of the conservation objectives for **Deep-sea sponge aggregations, Coral gardens, Cold-water coral reefs (including *Lophelia pertusa* reefs)** and **Seamount communities**. JNCC recommend that this option should be applied in areas where these features occur in areas shallower than 600m.
Other static gears (including pots, traps, and lines)[1]	**No additional management:** This option is considered unlikely to prevent the achievement of the conservation objectives for **Roundnose grenadier** *(Coryphaenoides rupestris)* and **Orange roughy** (*Hoplostethus atlanticus*). There is a risk of not achieving the conservation objectives for **Burrowed mud (including sea-pens), Offshore deep-sea muds, Offshore sands and gravels, Blue ling** (*Molva dypterygia*)**, Leafscale gulper shark** (*Centrophorus squamosus*)**, Gulper shark** (*Centrophorus granulosus*) **and Portuguese dogfish** (*Centroscymnus coelolepis*). This risk is considered to be low for the sedimentary features, however, if static gear fishing activities were to increase or monitoring showed evidence of detrimental effects, this would indicate an increased risk to these features. The conservation objectives would not be achieved for **Deep-sea sponge aggregations, Coral gardens, Cold-water coral reefs (including**

Fishing activity	Management options
	***Lophelia pertusa* reefs)** or **Seamount communities.** JNCC recommend that this option should not be applied in areas where these features occur. **Reduce/limit pressures:** This option would reduce, but not entirely eliminate, the risk of not achieving the conservation objectives for **Burrowed mud (including sea-pens), Offshore deep-sea muds, Offshore sands and gravels, Blue ling** (*Molva dypterygia*)**, Leafscale gulper shark** (*Centrophorus squamosus*)**, Gulper shark** (*Centrophorus granulosus*) and **Portuguese dogfish** (*Centroscymnus coelolepis*). Appropriate management could include seasonal or temporal restrictions, or gear deployment rules (e.g., reduced soak times), to minimise bycatch of mobile species features, or a zoned approach, restricting mobile bottom contact fisheries over a proportion of the site. Measures could be decided in consultation with stakeholders. Restrictions could be permanent in some cases or temporary/adaptive in others. The conservation objectives would not be achieved for **Deep-sea sponge aggregations, Coral gardens, Cold-water coral reefs (including *Lophelia pertusa* reefs)** or **Seamount communities.** **Remove/avoid pressure:** This option would reduce the risk of not achieving the conservation objectives for **Burrowed mud (including sea-pens), Offshore deep-sea muds, Offshore sands and gravels, Blue ling** (*Molva dypterygia*)**, Leafscale gulper shark** (*Centrophorus squamosus*)**, Gulper shark (*Centrophorus granulosus*)** and **Portuguese dogfish** (*Centroscymnus coelolepis*), to the lowest possible levels. This is the only option that would not risk the achievements of the conservation objectives for **Deep-sea sponge aggregations, Coral gardens, Cold-water coral reefs (including *Lophelia pertusa* reefs)** and **Seamount communities.** JNCC recommend that this option should be applied in areas where these features occur.

[1] Pot and traps are not deemed to pose a risk to the mobile features within West of Scotland MPA. The management options for the mobile species presented under the 'Other static gears' section are only in relation to longlines.

2. Introduction

The purpose of this document is to support discussion of the fisheries management measures for the West of Scotland MPA.

The West of Scotland deep-sea marine reserve (Figure 1) is 107,718km^2 in size. The shallowest area within the MPA is approximately 400m below sea-level and the deepest section is 2,500m below sea-level. It covers a diverse marine landscape to the west of Scotland; from the steep gradient of the continental slope across the sediment plains of the Rockall Trough, to the slopes of George Bligh Bank and Rockall Bank, with two isolated seamounts (Anton Dohrn and Rosemary Bank). It is the geological and geomorphological features that define this marine landscape, with volcanic igneous rock protrusions forming the seamounts and the large banks at the western extent of the deep-sea marine reserve. Slide deposits are a characteristic feature along the Scottish continental slope, while other geomorphological and glacial remnant features (such as sediment wave fields, scour moats, turbidite accumulations, and iceberg plough marks) form the landscape of the seabed (Brooks *et al.* 2011).

All of the protected biodiversity features of the deep-sea marine reserve are Priority Marine Features (PMFs); these are habitats and species considered to be of conservation priority in Scotland's seas. Coral gardens, Cold-water coral reefs (including *Lophelia pertusa* reefs), Deep-sea sponge aggregations, Seamount communities, Leafscale gulper shark (*Centrophorus squamosus*), Gulper shark (*Centrophorus granulosus*), Orange roughy (*Hoplostethus atlanticus*) and Portuguese dogfish (*Centroscymnus coelolepis*) are also listed as OSPAR Threatened and/or Declining habitats or species in the North-East Atlantic region. Burrowed mud (including sea-pens), Coral gardens, Cold-water coral reefs (including *Lophelia pertusa* reefs), Deep-sea sponge aggregations and Seamount communities are all Vulnerable Marine Ecosystems (VMEs) as identified by the joint International Council for the Exploration of the Sea (ICES) / North-west Atlantic Fisheries Organisation (NAFO) Working Group on Deep-Water Ecology (WGDEC) for the North-east Atlantic. These are habitats/ecosystems that are classified as vulnerable due to the characteristics they possess e.g. they may be fragile and susceptible to damage.

Deep-sea sponge aggregations, Cold-water coral reefs and Coral gardens are known as 'habitat formers'. The physical structures they create provide an environment that other species can colonise, and they support a diverse community of associated species (OSPAR 2009, 2010a, 2010b). Sponges may also play a significant role in silicon regulation by providing a long-term sink for silicon (Maldonado *et al.* 2012, Tréguer and Rocha, 2013), while coral skeletons act as a long-term store of carbon (OSPAR, 2009).

The deep-sea marine reserve protects six deep-sea fish species (Blue ling (*Molva dypterygia*), Orange roughy, Leafscale gulper shark / Gulper shark, Portuguese dogfish, and Round-nose grenadier (*Coryphaenoides rupestris*). Leafscale gulper shark and Gulper shark are presented as a feature complex due to difficulties in their identification. The MPA contains characteristic habitat for round-nose grenadier, leafscale gulper shark, gulper shark, and Portuguese dogfish. Round-nose grenadier are resident within the MPA, and this is one of only 17 locations globally where Gulper shark has been reported. The MPA protects important aspects of these species' life-cycles, such as spawning areas (Large *et al.* 2010; Moura *et al.* 2014). There is limited understanding on the majority of these species, however, and further scientific research is required to assess the importance of the site for these species.

The two seamounts (Rosemary Bank and Anton Dohrn) are protected as large-scale features of the deep-sea marine reserve and for the rich Seamount communities they support (Figure 2). The seamounts create a very different environment to the sedimentary plains of the Rockall Trough. The dynamic hydrographic environment surrounding the seamounts increases food availability to suspension feeders such as sponges and corals that colonise the seamounts. Many fish species such as Blue ling, black scabbard (*Aphanopus carbo*) and mesopelagic lantern fish (*Lampanyctus* sp.) are attracted to seamounts for feeding or spawning. The concentrations of fish and other prey species around seamounts also attracts larger predators and marine mammals such as Atlantic white-sided dolphin (*Lagenorhynchus acutus*) and sperm whale (*Physeter macrocephalus*), which have been observed in high numbers around these features (Clarke 2007, Macleod *et al.* 2003, Weir *et al.* 2001)

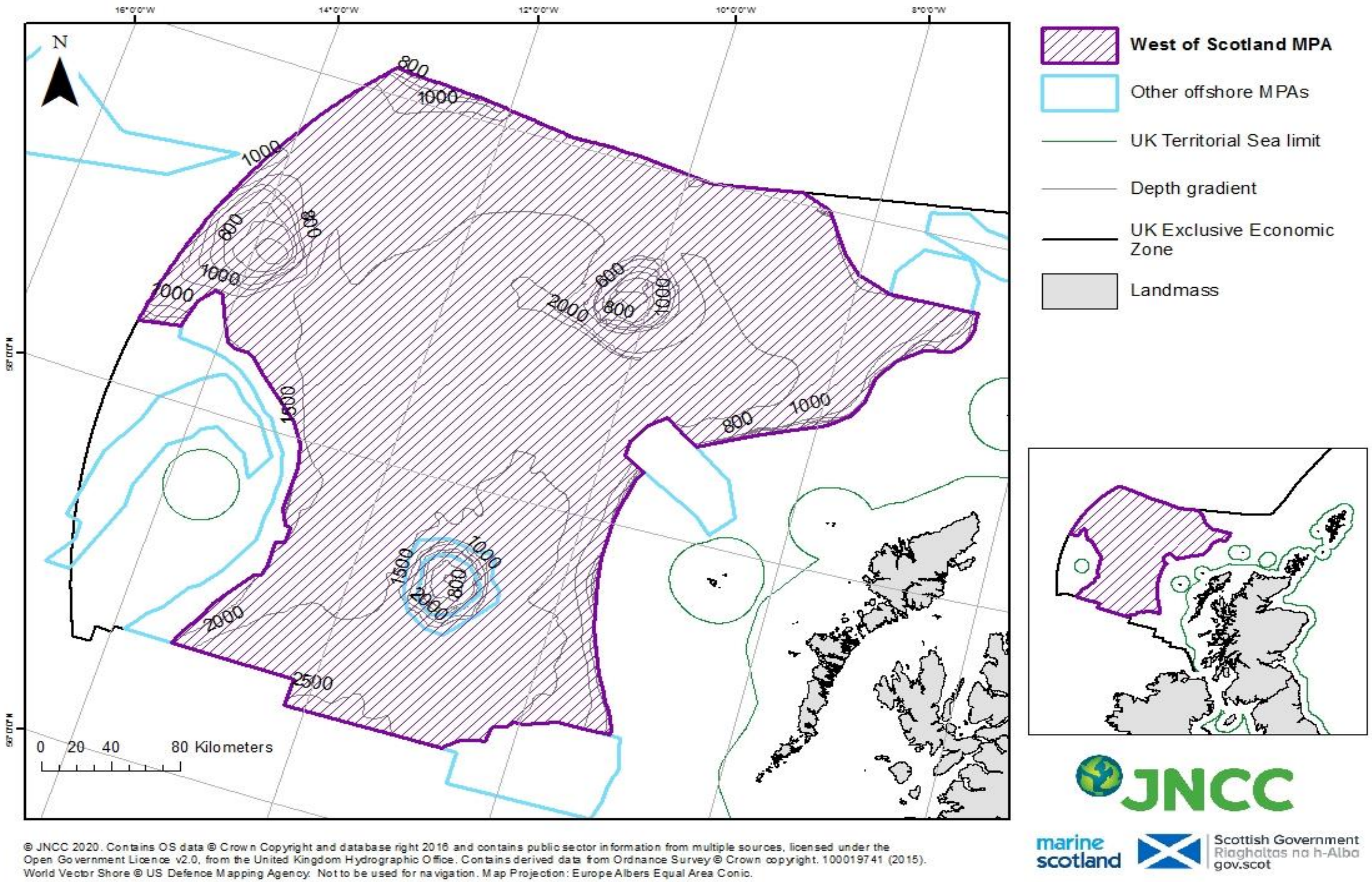

Figure 1. West of Scotland MPA site map and its location in relation to the UK.

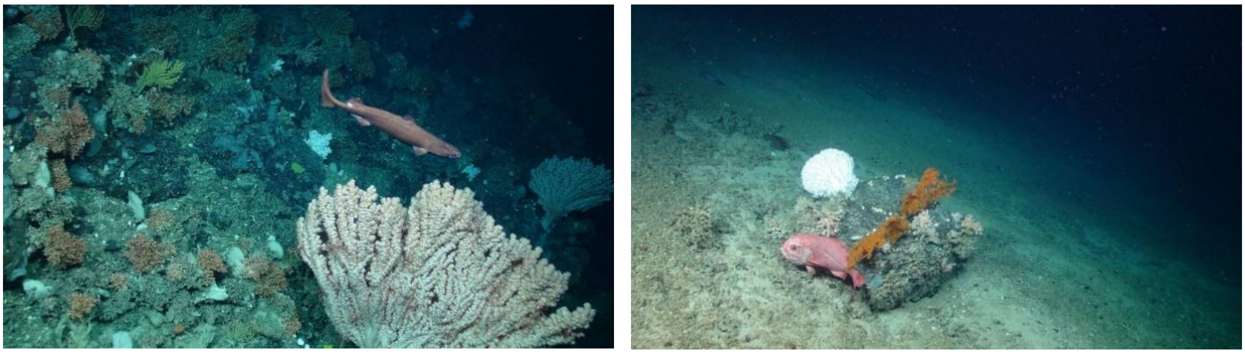

Figure 2. Examples of the features within the West of Scotland MPA.
Left image: Gulper shark and Coral gardens within the West of Scotland MPA © University of Plymouth, University of Oxford, JNCC & BGS, 2016.
Right image: Orange roughy (*Hoplostethus atlanticus*), corals and Offshore sands and gravels within the West of Scotland MPA © University of Plymouth, University of Oxford, JNCC & BGS, 2016.

3. Protected features and conservation objectives

The West of Scotland MPA has been designated for the following protected features:

- Habitat features:
    - Burrowed mud (including Sea-pens)
    - Coral gardens
    - Cold-water coral reefs (including *Lophelia pertusa* reefs)
    - Deep-sea sponge aggregations
    - Offshore deep-sea muds
    - Offshore sands and gravels
    - Seamount communities
- Large scale feature:
    - Seamount
- Species features:
    - Blue ling (*Molva dypterygia*)
    - Leafscale gulper shark (*Centrophorus squamosus*) / Gulper shark (*Centrophorus granulosus*)
    - Orange roughy (*Hoplostethus atlanticus*)
    - Portuguese dogfish (*Centroscymnus coelolepis*)
    - Round-nose grenadier (*Coryphaenoides rupestris*)
- Geological and geomorphological features:
    - A range of features representative of the Key Geodiversity Areas; Anton Dohrn Seamount (and adjacent sea floor), George Bligh Bank (and adjacent sea floor), North-east Rockall Bank (and adjacent sea floor), Rosemary Bank Seamount (and adjacent sea floor), Summer Isles to Sula Sgeir Fan, The Barra Fan and the Peach Slide Complex.
      These seven Key Geodiversity Areas include bioherm reefs, cliff, continental slope turbidite canyons, erosional scour fields, iceberg plough marks, ice-distal and glacimarine facies, ice-proximal and ice-contact facies (e.g., mega-scale glacial lineations), large bank (Palaeogene igneous centre), parasitic cones, prograding wedge, scour moats, seamount (Palaeogene igneous centre), sediment drifts, sediment wave field, slide deposit, slide scars, small scale ridges, sub-glacial tills, turbidite accumulations.

Conservation objectives set out the desired quality of the protected features within each Nature Conservation MPA. The conservation objectives for the features in the West of Scotland MPA are:

Subject to natural change, **conserve the Burrowed mud, Coral gardens, Cold-water coral reefs, Deep-sea sponge aggregations, Offshore deep-sea muds, Offshore sands and gravels and Seamount communities in favourable condition**, such that:

- their extent is stable or increasing;
- their structures and functions, quality, and the composition of their characteristic biological communities are such as to ensure that they are in a condition which is healthy and not deteriorating.

Subject to natural change, **conserve the Blue ling, Leafscale Gulper shark, Gulper shark, Orange roughy, Portuguese dogfish and Round-nose grenadier in favourable condition**, such that:

- the quality and quantity of its habitat;
- the composition of its population is such to ensure that the population is maintained in numbers which enable it to thrive.

Subject to natural change, **conserve the geological and geomorphological features characterising the protected Key Geodiversity Areas** within the deep-sea marine reserve; bioherm reefs, continental slope turbidite canyons, erosional scour fields, iceberg plough marks, ice-distal and glacimarine facies, ice-proximal and ice-contact facies (e.g., mega-scale glacial lineations), large bank (Palaeogene igneous centre), parasitic cones, prograding wedge, scour moat, seamount, sediment drifts, sediment wave field, slide deposit, slide scars, small scale ridges, sub-glacial tills, turbidite accumulations and the large-scale feature seamounts **in favourable condition** such that:

- their extent, component elements and integrity are maintained;
- their structure and functioning are unimpaired;
- their surface remains sufficiently unobscured for the purposes of determining whether the aforementioned points are satisfied.

More information regarding the Designation Orders for the West of Scotland MPA is available in the Designation Order.

4. Roles

The role of JNCC is to advise the Scottish Government on management options for the West of Scotland MPA. In doing this, JNCC's aim is to ensure the conservation objectives for the protected features are met.

Marine Scotland will lead discussions on management with stakeholders. They will consider JNCC's advice and will lead on the development of specific management measures. They will be responsible for making recommendations to Scottish Ministers on these measures.

Stakeholders can provide additional evidence to support the development of management measures, including local knowledge of the environment and activities. Discussions with stakeholders will be one way of highlighting the implications of any management measures to both JNCC and Scottish Government. This will contribute to the development of well-designed and effective management measures.

5. Existing management measures

Of the designated habitats, **Coral gardens**, **Cold-water coral reefs** and **Deep-sea sponge aggregations** are listed as Vulnerable Marine Ecosystems (VMEs) as identified by the joint International Council for the Exploration of the Sea (ICES) / North-west Atlantic Fisheries Organisation (NAFO) Working Group on Deep-Water Ecology (WGDEC) for the North-east Atlantic[1]. These are habitats/ecosystems, classified as vulnerable due to the characteristics they possess (e.g., fragile, long-lived, low fecundity), which were identified for protection from fishing pressure through European Regulation (EU) 2016/2336[2]. Following the UK's exit from the European Union, Regulation (EU) 2016/2336 has been amended through S.I. 2019/739[3], S.I. 2019/753[4] and S.I. 2020/1542[5] to retain these measures in UK waters.

In compliance with Regulation (EU) 2016/2336 (as amended), a ban on the use of bottom trawls is in place below 800m depth across all UK waters. This prohibition applies across the area of the West of Scotland MPA where the depth falls below 800m, covering a vast proportion of the site, and is likely to reduce the impact from bottom trawls on all features of the site, not just the VMEs. Areas shallower than 800m within the site (such as Anton Dohrn Seamount, Rosemary Bank Seamount and George Bligh Bank) are not currently protected, but this regulation does make provision for the introduction of measures for fishing between 400m and 800m where VMEs are present or are likely to occur. Such measures have not yet been adopted at the time of drafting. Demersal dredge and demersal seine gears are not included within the regulation, so are currently permitted across the site. Although demersal dredging is unlikely to occur at the depths within the site, there is a risk that demersal seining could occur.

The same regulation also offers protection to the deep-sea shark species, **Leafscale gulper shark, Gulper shark** and **Portuguese dogfish** which are designated features of the site through measures to prohibit targeted fishing and reduce bycatch. Through Regulation (EU) 2016/2336 (as amended), it is prohibited for vessels to target, retain onboard, tranship, relocate, or land deep-sea sharks in ICES subareas 5 to 9 (this includes the full West of Scotland MPA area). To account for unavoidable bycatch in longline fisheries for black scabbardfish (*Aphanopuss carbo*) in this region and allow for scientific data collection, a limited TAC[6] covering all deep-sea shark species (including Gulper shark, Leafscale Gulper shark and Portuguese dogfish) has previously been allowed. However, the black scabbardfish TAC in this region has been significantly reduced from 2,470 tonnes in 2020, to 583 tonnes in 2021, and 0 tonnes in 2022, and any deep-sea shark bycatch is therefore expected to reduce accordingly. Therefore, in 2021 and 2022, the EU-UK agreed TAC for deep-sea sharks in ICES subregions 5-9 has been reduced to 0 tonnes (per year live weight)[7] and the bycatch of deep-water shark species is no longer permitted.

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[1] ICES Vulnerable Marine Ecosystems: https://www.ices.dk/data/data-portals/Pages/vulnerable-marine-ecosystems.aspx

[2] Regulation (EU) 2016/2336 https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32016R2336&rid=1. **NOTE:** Some of the other designated habitats may also contain examples of other types of VMEs listed for protection under this regulation (e.g., seapen fields in **Burrowed mud**)

[3] The Common Fisheries Policy (Amendment etc.) (EU Exit) Regulations 2019 Statutory Instrument (S.I.) 2019 No. 739 which amends Council Regulation (EU) 2016/2336.

[4] The Common Fisheries Policy and Aquaculture (Amendment etc.) (EU Exit) Regulation 2019 Statutory Instrument (S.I.) 2019 No. 753 which amends Council Regulation (EU) 2016/2336.

[5] The Common Fisheries Policy (Amendment etc.) (EU Exit) Regulations 2020 Statutory Instrument (S.I.) No. 1542 which amends Council Regulation (EU) 2016/2336.

[6] A precautionary TAC of 7 tonnes was permitted for the bycatch of deep-sea shark species for the black scabbardfish longline fishery in 2019 and 2020 under Council Regulation (EU) 2018/2025 (Annex, Part 2)

[7] UK-EU Agreement on fishing opportunities (TACs for Deep Sea Species in 2021 and 2022 (in tonnes))

Under Regulation (EU) 2019/1241[8] (as amended by S.I 2019/1312[9] and S.I. 2020/1542), fishing with bottom-set gillnets, entangling nets, and trammel nets below 200m is also prohibited for the protection of deep-water shark species[10]. However, there are derogations for the use of static nets between 200m and 600m[11], which are applicable in the shallower areas of the MPA to allow directed fishing for anglerfish and hake.

Measures to protect and manage the designated deep-sea fish species, **Orange roughy, Blue ling** and **Portuguese dogfish,** are also in force within the MPA.

Under Regulation (EU) 2019/1241 (as amended) a seasonal Blue ling closure is in place from 1st March to 31st May each year to protect spawning aggregations in specified areas along the edge of the Scottish continental shelf and at the edge of Rosemary Bank, imposing a catch restriction of < 6 tonnes per trip. The TAC for Blue ling in 2020[12] for ICES subareas 5b, 6, and 7 (which includes the full West of Scotland MPA are) was set at 11,150 tonnes (live weight). In 2021, the TAC has been reduced by 75% to 2,172 tonnes[13].

A precautionary TAC of 2,558 tonnes (per year live weight) for Roundnose grenadier was provided in 2019 and 2020 for ICES subregions 5b, 6 and 7[14]. The TAC has been significantly reduced to 608 tonnes in 2021 and 0 tonnes in 2022[15].

UK fishing vessels are prohibited from targeting, retaining onboard, transhipping, or landing Orange roughy in Union and waters of ICES subareas 1 to 10, which includes the full West of Scotland MPA area[16].

5.1. Proposed restrictions in existing/previous MPAs in the WoS MPA area

Fisheries management proposals have been previously prepared for the two existing MPAs which fall within the West of Scotland deep-sea marine reserve boundary (i.e. Rosemary Bank Seamount Nature Conservation MPA and Anton Dohrn Seamount SAC). The draft fisheries management proposals for these sites comprise site-wide restrictions on all static and demersal mobile gears. Prior to implementing the proposed fisheries management measures, Rosemary Bank Seamount Nature Conservation MPA was incorporated into the West of Scotland MPA to avoid overlapping designations. It is therefore no longer a stand-alone designated site. Anton Dohrn Seamount SAC remains an MPA in its own right however as it is designated under different legislation.

[8] Regulation (EU) 2019/1241 https://eur-ex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02019R1241-20210101

[9] The Common Fisheries Policy and Animals (Amendment etc.) (EU Exit) Regulations 2019 S.I. 2019, No. 1312 which amends Council Regulation (EU) 2019/1241.

[10] A list of the deep-water shark species is intended to protect is stipulated under The Common Fisheries Policy (Amendment etc.) (EU Exit) Regulations 2019 S.I. 2019, No. 739 which amends Council Regulation (EU) 2016/2336 (Annex I).

[11] Specific derogations on static net use between 200-600m apply in some areas of West of Scotland MPA under The Common Fisheries Policy and Animals (Amendment etc.) (EU Exit) Regulations 2019 S.I. 2019, No. 1312 which amends Council Regulation (EU) 2019/1241 (Section 2, Article 9, as set out in Annex V, Part C, point 9.1).

[12] A TAC of 11,150 tonnes live weight of Blue ling was permitted in 2020 under Council Regulation (EU) 2020/123 (Annex 1A).

[13] The 2021 TAC for Blue ling is set at 2,172 tonnes (2021 EU TACs in the Atlantic and North Sea).

[14] A precautionary TAC of 2,558 tonnes was permitted for Roundnose grenadier in 2019 and 2020 under Council Regulation (EU) 2018/2025 (Annex, Part 2)

[15] UK-EU Agreement on fishing opportunities (TACs ForR Deep Sea Species in 2021 and 2022 (in tonnes))

[16] Fishing for Orange roughy is prohibited under The Common Fisheries Policy (Amendment etc.) (EU Exit) (No. 2) Regulations Statutory Instrument 2019, No. 848 which amends Council Regulation (EU) 2018/2025 (Article 7)

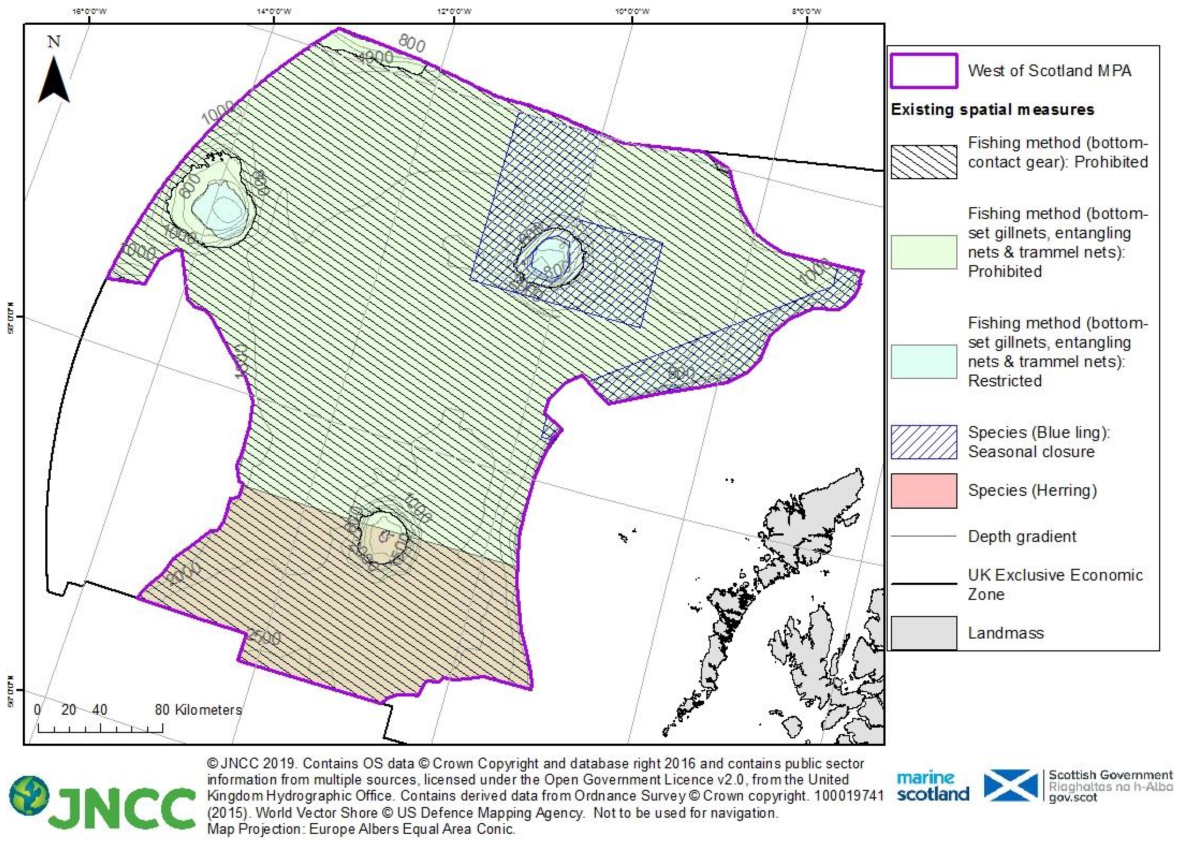

Figure 1. Map showing the existing management measures in place which are relevant for the features designated within the West of Scotland MPA.

6. Effects of fishing on the habitat, geological, and large-scale features

Habitat features

Information on the sensitivity of the protected habitats to various fishing activities is provided within the Feature Activity Sensitivity Tool (FeAST). The habitat assessment has also been informed by feature specific fisheries management guidance prepared by SNH/NS and JNCC.

Large scale features

On the basis of available evidence, the **seamount** large scale features are considered unlikely to be impacted by fishing activities. As such, there is not considered to be any significant risks to the feature not achieving its conservation objective and so the feature has not been considered in the context of management measures.

Geological and geomorphological features

The **iceberg plough mark fields** and **bioherm reefs** are considered sensitive to the pressures associated with fishing activities occurring within the MPA. However, as the iceberg plough mark fields geographically overlap with Offshore sands and gravels, and bioherm reefs geographically overlap with Seamount communities, Cold-water coral reefs, and coral garden features within the MPA, it is considered that there will be a similar perceived risk in terms of achieving the features' conservation objectives, and the management measures presented for biodiversity features will also apply to geological and geomorphological features. As such, iceberg plough mark fields and bioherm reefs have not been reported further in the context of the management options explored below.

The other **geological and geomorphological features** are considered to have a low sensitivity to the pressures associated with fishing activities taking place within the MPA. As such, there is not considered to be a significant risk to these features achieving their conservation objectives.

6.1 Mobile bottom contact gear

The species associated with **Seamount communities** tend to be composed of erect and fragile species that are sensitive to physical disturbance, particularly deep-sea stony corals, gorgonians and black corals, sea anemones, hydroids and sponges (Clark *et al.* 2010; Clark and Tittensor, 2010). Significant reductions in stony coral cover and associated species abundance and diversity have been observed on trawled seamounts in New Zealand and Australia (Goode *et al.* 2020). Clark and Tittensor (2010) found that roughly 100 trawl tows can reduce coral to very low mean levels (<1%) on New Zealand seamounts. Between approximately 100 and 800 tows would remove coral cover entirely. However, mean coral cover on some seamounts can be reduced to less than 1% with far fewer tows. Single passes of trawls can themselves cause more than half of sponges and corals present to be visibly damaged (Freese *et al.* 1999). Mortality of species can occur both by disturbance at the seabed from trawls or through being brought to the surface, resulting in a reduction in abundance (ICES, 2010; Jennings and Kaiser, 1998; Kaiser and Spencer, 1996).

Despite some seamount taxa being more resistance to the direct effects of bottom-trawling, *Goode et al.* (2020) concluded that seamount benthic communities overall appear to have low resistance. Recovery from damage is estimated to be measured in decades, depending on the environmental conditions and biological variables, although the species present on seamounts can exhibit varying recovery rates (ICES, 2010; Clark *et al.* 2010; Goode *et al.* 2020). Species with higher longevity, such as habitat-forming corals and sponges, take much longer to recover. As these can form a key part of Seamount communities, any impacts to those species can significantly alter the structure and function of the Seamount communities feature (Goode *et al.* 2020). These features (Deep-sea sponge aggregations, Cold-water coral reefs and Coral gardens), which are also designated in their own right within the West of Scotland MPA, are discussed below.

There is no evidence of impacted Seamount communities regaining their pre-disturbance condition in terms of community composition, megafaunal abundance or species diversity (Goode *et al.* 2020), indicating the importance of management prior to impacts occurring where possible. Based on the evidence above, there is a high risk that mobile bottom contact gear will affect the extent and distribution of Seamount community features, as well as their structure and function.

Deep-sea sponge aggregations are highly sensitive to bycatch, abrasion, and penetration pressures (Dinwoodie, 2021a, 2021b, Last *et al.* 2019a, 2019b). Studies on Deep-sea sponge aggregations have found that trawling damages, displaces and removes sponges through direct physical impact, as well as from disturbed sediment resettling and causing smothering beyond the path of the trawl itself (Buhl-Mortensen *et al.* 2016; ICES, 2007, 2010; Kędra *et al.* 2017; OSPAR, 2010a). Deep-sea sponges have some capacity for recovery from mild damage, but significant disturbance, damage or smothering may result in sponges being unlikely to survive (Fang *et al.* 2018; Freese, 2001; ICES, 2007, 2010; Jones *et al.* 2012; Malecha and Heifetz, 2017). Pham *et al.* (2019) modelled the impact of bottom trawling on sponge grounds dominated by *Geodia* sp. in Canadian waters, finding that a simulation of

30 trawls would remove 884 tonnes of sponges. Similarly, a scientific experiment on the effects of an Agassi bottom trawl on deep-sea sponge grounds in the Arctic Ocean significantly reduced megafaunal densities, including large sponge species (Morrison *et al.* 2020). Although smaller morphotype sponges showed lower trawling impacts, it is the large sponges that have the greatest contribution to the structural complexity of Deep-sea sponge aggregations (Morrison *et al.* 2020). In addition to reductions in numbers, *Geodia* spp. sponges in areas impacted by trawling may also have reduced mean individual sponge biomasses (Kędra *et al.* 2017). Viera *et al.* (2020) Viera *et al.* (2020) inferred a relationship between increased bottom trawl fishing activity and decreased aggregation-forming sponge *Pheronema carpenteri*, condition (individual mass, sponge equatorial diameter, and geometric mean densities). Morrison *et al.* (2020) found no signs of recovery of impacted deep-sea sponge grounds four years after the trawling occurred, whilst Malecha and Heifetz (2017) found significantly delayed mortality and stress effects still evident in the deep-sea sponge communities after 13-years following trawling impact. Sedimentation events, which can also be caused by trawling activity, similarly resulted in negligible recovery over a 10-year period (Jones *et al.* 2012). Recovery of structure and function following damage is therefore likely to take at least 25 years (Dinwoodie, 2021a, 2021b, Last *et al.* 2019a, 2019b). Deep-sea sponge aggregations dominated by *Geodia* spp. play a key functional role in the wider deep-sea environment, filtering approximately 56,000 million litres of seawater on a daily basis, consuming roughly 63 tonnes of organic carbon through respiration and contributing to the turnover of several nitrogen nutrients (Pham *et al.* 2019). Based on the evidence above, there is a high risk that mobile bottom contact gear will affect the extent and distribution of Deep-sea sponge aggregation features, as well as their structure and function.

Cold-water coral reefs are highly sensitive to bycatch, abrasion and penetration pressures (Garrard *et al.* 2020). Bottom trawling has been found to severely damage reefs, breaking up the structure, fragmenting the reef, and potentially resulting in the complete disintegration of the coral matrix, and loss of the associated species (Fosså *et al.* 2002; Grehan *et al.* 2005; Hall-Spencer *et al.* 2002; Roberts *et al.* 2009; Rogers, 1999). Cold-water coral specimens can also be bycaught in trawls (Durán Muñoz *et al.* 2012). Cold-water coral reefs can occur on seamounts, and as stated above, significant reductions in stony coral cover and associated species abundance and diversity have been observed on trawled seamounts in New Zealand and Australia (Goode *et al.* 2020). Clark and Tittensor (2010) found that roughly 100 trawl tows can reduce coral to very low mean levels (<1%) on New Zealand seamounts. Between approximately 100 and 800 tows would remove coral cover entirely. However, mean coral cover on some seamounts can be reduced to less than 1% with far fewer tows. Cold-water coral reef habitats completely damaged by physical pressures such as those associated with benthic trawling do not show signs of recovery even a decade after such pressure has been removed (Althaus *et al.* 2009; Buhl-Mortensen *et al.* 2013; Buhl-Mortensen, 2017; Hall-Spencer *et al.* 2002; Howell *et al.* 2014; Huvenne *et al.* 2016; Williams *et al.* 2010). However, recovery (or regrowth) has been observed in areas where some living coral remains after impact (Buhl-Mortensen *et al.* 2013; Buhl-Mortensen, 2017; Huvenne *et al.* 2016). If coral colonies are killed, any recovery of extent and distribution will be influenced by the method of reproduction, dispersal potential, the relative location of a potential source population of reproductive adults and the presence of suitable supporting habitat (Dahl *et al.* 2012; Fox *et al. 2016)*. Evidence indicates that for some species of cold-water corals, successful recruitment events may only occur once a decade (Stone *et al.* 2015), which could limit the opportunities for recovery. Based on the evidence above, there is a high risk that mobile bottom contact gear will affect the extent and distribution of Cold-water coral reef features, as well as their structure and function.

Coral gardens are highly sensitive to physical disturbance and bycatch (Yoklavich *et al.* 2018). Mobile benthic gears can result in significant damage and mortality (Durán Muñoz *et al.* 2012; OSPAR, 2010b) and over time, the structural and biological diversity of the habitat will be reduced. Coral gardens on soft bottoms within fishing depths are particularly vulnerable (Edinger and Sherwood, 2009), however, where they occur on low relief hard substrate Coral gardens may also be accessible to rockhopper gears (OSPAR, 2010b). Re-establishment of individual specimens of corals may occur within 50 to 100 years but the time taken for complex coral garden habitat to develop is likely to be longer (ICES, 2010). Based on this evidence, there is a high risk that mobile bottom contact gear will affect the extent and distribution of Coral garden features, as well as their structure and function.

In lower energy deep water locations, such as in the West of Scotland MPA, sedimentary habitats tend to be more stable and their associated fauna less tolerant of disturbance (Hiddink *et al.* 2006; Kaiser *et al.* 2006). Studies have shown that areas of mud habitats (which includes **Offshore deep-sea mud** and **Burrowed mud including sea-pens)** subject to mobile fishing activity, support a modified biological community with lower diversity, reduction or loss of long-lived filter-feeding species and increased abundance of opportunistic scavengers (Ball *et al.* 2000; Tuck *et al.* 1998). This effect is often greatest in the more heavily fished offshore areas suggesting that impact is related to the intensity of fishing (Ball *et al.* 2000). Furthermore, modelling studies suggest that the greatest impact is produced by the first pass of a trawl (Hiddink *et al.* 2006). Trawling on these deep-sea sedimentary habitats can cause significant decreases in organic matter content, slower organic carbon turnover, reduced meiofauna abundance, biodiversity and nematode species richness (Pusceddu *et al.* 2014). The use of penetrative gear over soft substrates, can further cause removal or re-stratification of sediment layers and homogenisation of sedimentary habitats (Goode *et al.* 2020; Martín *et al.* 2014). Sediment resuspension can also occur, resulting in increases in turbidity and risks of smothering to benthic fauna (Martín *et al.* 2014). The physical integrity of the seabed can also be altered, becoming flattened in trawled areas with less bioturbation (fewer and smaller burrows, mounds and faunal tracks) compared to non-trawled areas (Ramalho *et al.* 2017). Other physical impacts include scars created by the trawl doors (Goode *et al.* 2020). These alterations to the seafloor structure can be long lasting, with scars remaining visible for more than 10 years after trawling ceases (Goode *et al.* 2020). Based on the evidence above, it is likely that mobile bottom contact gear will affect the extent and distribution, and structure and function of Burrowed mud (including sea-pens) and Offshore deep-sea mud features, including the sediment composition and finer scale topology.

Deep-sea **sea-pens**, associated with **Burrowed mud** and **Offshore deep-sea mud** habitats, are likely to have medium sensitivity to bycatch, abrasion and penetration pressures and are highly sensitivity to heavy levels of smothering (up to 30cm) (Last *et al.* 2020a, 2020b). Although some sea-pen species have behavioural adaptations and can recover from minor damage (Kenchington *et al.* 2011; Malecha and Stone, 2009; Troffe *et al.* 2005), high levels of bycatch in trawl nets can occur and incidental mortality is a concern for those remaining on the seafloor (Last *et al.* 2020a, 2020b). Otter trawls have been found to catch the greatest frequency of sea-pens compared to other gear types, e.g., twin trawl, triple trawl, shrimp trawl, and static gears (Wareham and Edinger, 2007). Dredges can also catch high numbers of sea-pens (Pires *et al.* 2009). A number of studies indicate that the abundance of sea-pen species are negatively correlated with bottom trawling (Adey, 2007; Buhl-Mortensen *et al.* 2016; Hixon and Tissot, 2007). In addition to sea-pens, *Nephrops* may be an important component of the benthic community associated with Offshore deep-sea mud and Burrowed mud. Any fisheries, such as mobile bottom-contact gears, that greatly alter the abundance or size composition of this species may therefore have a negative impact on the biological structure of the features. This evidence further suggests that mobile bottom contact gear will likely affect the biological assemblages and biological structure of the features, resulting in impacts to the extent and distribution, and the structure and function of the Burrowed mud (including sea-pens) and Offshore deep-sea mud habitat features.

Similar to the above, trawling on **Offshore sands and gravels** also can cause significant decreases in organic matter content, slower organic carbon turnover, reduced meiofauna abundance, biodiversity and nematode species richness (Pusceddu *et al.* 2014). Stable Offshore sands and gravels often support a 'turf' of fragile species which are easily damaged by trawling and recover slowly (Collie *et al.* 2005; Foden *et al.* 2010). Trawling and dredging tends to cause increased mortality of fragile and long lived species and favour opportunistic, disturbance-tolerant species (Bergmann and Van Santbrink, 2000; Eleftheriou and Robertson, 1992). Some particularly sensitive species may disappear entirely (Bergmann and Van Santbrink, 2000). The net result is benthic communities modified to varying degrees relative to the un-impacted state (Bergmann and Van Santbrink, 2000; Kaiser *et al.* 2006). The use of penetrative gear over soft substrates, can further cause removal or re-stratification of sediment layers and homogenisation of sedimentary habitats (Goode *et al.* 2020; Martín *et al.* 2014). Sediment resuspension can also occur, resulting in increases in turbidity and risks of smothering to benthic fauna (Martín *et al.* 2014). Other physical impacts include scars created by the trawl doors and dislodgment or removal of boulders, rocks and biogenic substrates (Goode *et al.* 2020). These alterations to the seafloor structure can be long lasting, with scars remaining visible for more than 10 years after trawling ceases (Goode *et al.* 2020). Based on this evidence, it is likely that mobile bottom contact gear will affect the extent and distribution, and structure and function of Offshore sands and gravels, including the sediment composition, finer scale topology, biological assemblages, and biological structure.

6.2 Static bottom contact gear

No studies providing evidence of the effects of static gears on Scottish **Seamount communities** were found, however impacts occurring on analogous vulnerable habitats and species, such as sponges and corals in Scottish waters are applicable (Durán Muñoz *et al.* 2011). Impacts can arise from hooks, lines, nets and ropes becoming entangled with corals and other fragile species, including 'plucking' them from the seabed during hauling (Durán Muñoz *et al.* 2011; Mortensen *et al.* 2005; OSPAR, 2010b). While the degree of damage from individual fishing operations is likely to be lower than for trawling, cumulative damage may be significant. Based on the evidence above, there is a high risk that static bottom contact gear will affect the extent and distribution of Seamount community features, as well as their structure and function.

The **Deep-sea sponge aggregation** feature is considered to be sensitive to static gear activity, notably because sponges may become caught or entangled in static gears and damaged on the seabed or brought to the surface (OSPAR, 2010a). Such by-catch by demersal longliners of hexactinellid and demospongid sponges has been documented within the North-east Atlantic (Durán Muñoz *et al.* 2011), the Azores (Cyr, 2018) and in the Antarctic (Parker and Bowden, 2010). One study on Hatton Bank collected 3.5kg of sponges from a total of 38 longline sets (Durán Muñoz *et al.* 2011), however this only contributed < 0.1% of the total catch. 65.8% of the total sponge catch was obtained with monofilament gear, compared to 34.2% with multifilament gear. In the Azores, low bycatch rates were recorded overall (0.07 sponge per 1000 hooks), however on average per 1000m^2, 1 out of 4 individuals remaining on the seafloor were left damaged by the longline activities (e.g., fragmented, dislodged, entangled or dead; Cyr, 2018). These in-situ impacts, causing incidental mortality and abrasive damages, were greater for sponges with higher structural complexities, such as those with massive, flabellate and pedunculate morphologies (Cyr, 2018). Where sponges are dislodged, this is likely to impact a sponge's ability to filter water (Parker and Bowden, 2010). While these evidence source show that the extent of damage caused by individual static gear fishing events is likely to be lower than that for trawling, the effect of cumulative damage may be significant. Recovery from damage is likely to take at least 25 years (Dinwoodie, 2021a, 2021b, Last *et al.* 2019a, 2019b). Based on the evidence above, particularly considering cumulative effects, there is a high risk that static bottom contact gear will affect the extent and distribution of Deep-sea sponge aggregation features, as well as their structure and function.

Damage to **Cold-water coral reefs** and **Coral gardens** can occur from static fishing gear such as gill nets and long-line fisheries, where corals can become entangled in ropes/lines or nets and can be plucked off the seabed during hauling (Fosså *et al.* 2002; ICES, 2010; Mortensen *et al.* 2005; OSPAR, 2010b; Parker and Bowden, 2010; Wareham and Edinger, 2007). Bottom longlining poses a high risk to large erect species such as gorgonians, cup corals, soft corals, black corals and lace corals (Durán Muñoz *et al.* 2011; OSPAR, 2010b). Although coral damage by these types of gears are probably of limited extent compared to bottom trawling (Fosså *et al.* 2002), in a study off Portugal, 85% of bottom-set gillnet deployments caught cold-water corals, 45% of which were entire colonies (Dias *et al.* 2020). 22 different coral species were recorded as bycatch. Coral bycatch was higher when the nets were deployed on or nearby areas where rocky substrate is known to occur. The average coral CPUE was 0.92 per day with a 100 m net length (31.1 corals per set), however this increased to 13.02 over rocky substrates. A study in the Ionian Sea similarly found that 72% of longline sets captured corals (Mytilineou *et al.* 2014). In comparison, in the Azores, Sampaio et al. (2012) reported that 15.2% of 297 commercial longline fishing trips landed corals and deep-sea longline fishing removed 0.32 corals per 1000 hooks (1.14 corals per set) (Pham *et al.* 2014). Where static gears do cause mortality or damage to coral garden habitats, the recovery and re-establishment characteristics are the same as those for mobile gears above. Traps are unlikely to catch any bycatch in comparison (Shester and Micheli, 2011). It is worth noting that these coral removal rates are much lower than those reported for bottom trawling (Clark *et al.* 2016). Site specific difference in coral density will also affect the bycatch rates. Based on the evidence above, there is a high risk that static bottom contact gear will affect the extent and distribution of Cold-water coral reef and Coral garden features, as well as their structure and function.

Offshore sands and gravels within subtidal areas are not considered to be sensitive to the level of abrasion caused by static demersal gears, with minimal impact on the faunal communities and seabed structure (Tillin *et al.* 2010; Tyler-Walters *et al.* 2009). However, in lower energy deep water locations, such as in the West of Scotland MPA, sediments tend to be more stable and their associated fauna less tolerant of disturbance (Hiddink *et al.* 2006; Kaiser *et al.* 2006). Bycatch of associated communities, such as invertebrates also poses a risk. For example, in British Columbia Favaro *et al.* (2010) found that one species of squat lobster (*Munida quadrispina)* was the most abundant bycatch in spot prawn traps. In New Zealand, experimental pots targeting the deep-sea New Zealand scampi caught proportionally more invertebrates than the established trawl fishery (Major *et al.* 2017). Pot design however significantly affected the total bycatch, with up to 10.1 times more total bycatch in two-chambered parlour pots compared to other pot designs (Major *et al.* 2017). Overall, the risk from low levels of static bottom contact gear on the abundance and distribution, and the structure and function of Offshore sands and gravels is likely to be limited, however higher levels of fishing activity will pose a greater risk to the features and their attributes.

Studies on the impacts of pots on **sea-pens** associated with mud habitats in subtidal areas have shown limited adverse effect on the sea-pens from a ‘single’ fishing operation (Eno *et al.* 2001; Kinnear *et al.* 1996). Research has shown that certain species of sea pen are caught during the recovery of creels/shrimp traps or damaged from heavier gear, although the extent of damage and the impacts of repeated exposure to these types of fishing gear at high levels of fishing activity are less well understood (Adey, 2007; Eno *et al.* 2001; Troffe *et al.* 2005). However, in lower energy deep water locations, such as in the West of Scotland MPA, sediments tend to be more stable and their associated fauna less tolerant of disturbance (Hiddink *et al.* 2006; Kaiser *et al.* 2006). Bycatch of deep-sea **sea-pen** species (associated with **Offshore deep-sea mud** and **Burrowed mud**) has been recorded in gillnets and longlines, although at a lower frequency than otter trawls (Wareham and Edinger, 2007). Longline hooks of varied sizes can catch specimens of all size ranges; however, these tend to catch larger specimens compared to shrimp traps and whelk pots, which mainly catch small size colonies (de Moura Neves *et al.* 2018). If static fishing activity is low, direct impact on the habitat is likely to be minimal and seabed structure is likely to be maintained in a slightly modified state (Adey, 2007). In addition to sea-pens, *Nephrops* may be an important component of the benthic community associated with Offshore deep-sea mud and Burrowed mud. Any fisheries, such as static gears, that greatly alter the abundance or size composition of this species may therefore have a negative impact on the biological structure of the features. Based on the evidence above, the risk from low levels of static bottom contact gear on the abundance and distribution, and the structure and function of Burrowed mud (including sea-pens) and Offshore deep-sea mud is likely to be limited, however higher levels of fishing activity will pose a greater risk to the features and their attributes.

7. Effects of fishing on the mobile species features

JNCC have prepared feature specific fisheries management guidance providing advice on the impact various fishing activities may have on features in Scotland's seas. Further information regarding the sensitivity of the protected features to fishing activity is provided within the Feature Activity Sensitivity Tool (FeAST).

Deepwater shark species are often combined in landings records (recorded as 'siki' shark), which has recently been dominated by Leafscale gulper shark (*Centrophorus squamosus)* and Portuguese dogfish (*Centroscymnus coelolepis)* records (OSPAR, 2010). They can also be assigned to generic categories, such as 'various sharks nei', resulting in a lack of species-specific statistics. Furthermore, there are difficulties in distinguishing different species of deep-water squaliformes, particularly between the Gulper shark *(Centrophorus granulosus*) and the Leafscale gulper shark (*Centrophorus squamosus) (*Priede, 2018*).* It is recommended that these three designated deep-water shark species features are managed in a multi-species context, however evidence is presented for the separate species where available below.

7.1 Mobile bottom contact gear

Orange roughy (*Hoplostethus atlanticus*) occurs in a narrow depth band between 180-1800m (Priede, 2019), corresponding with an area about 20 nautical miles wide in the West of Scotland MPA. The species has historically been targeted in a directed demersal otter trawl fishery in deep water west of Scotland, which resulted in a strong decline in the stock (ICES, 2019a, 2020a). This fishery targeted the spawning aggregations that occur around steep slope and seamount environments, allowing very large catches to be taken over a short period of time, leading to local depletions (FeAST, 2013). However, since 2003 no direct fishery has been permitted for Orange roughy, with limited bycatch allowed in mixed fisheries until 2010 when a zero Total Allowable Catch (TAC) was implemented across all ICES subareas. In addition to the spawning aggregations around seamounts and steep slopes, Scottish deep-water trawl surveys found several juvenile cohorts were present on the gentle slopes of the continental slope (Dransfeld *et al.* 2013; ICES, 2019a). The species' long life-span, slow growth rate, late maturity (27.5 years; Minto and Nolan, 2006), low fecundity and episodic recruitment characteristics contribute to its vulnerability, making the species particularly susceptible to population declines if mature adults are removed (Dransfeld *et al.* 2013). Fishing pressure can also disrupt the schooling behaviour of Orange roughy (Clark and Tracey 1991, cited in Branch, 2001). In areas where fishing is prohibited, smaller and denser aggregations are been observed (Clark *et al.* 2000). Based on the evidence above, mobile bottom contact gear may affect the presence and distribution of the Orange roughy feature, due to the risk associated with accidental bycatch.

The **Roundnose grenadier** *(Coryphaenoides rupestris)* is typically a bottom-living, demersal fish, occurring at depths from 180-2,600m (Priede, 2019). The species is known to move seasonally up and down the continental slope (Cohen *et al.* 1990). They are also poor swimmers, so are vulnerable to target and non-target fisheries (Simpson *et al.* 2011). The long tapering tail of the Roundnose grenadier is also easily damaged after trawling (Priede, 2019; Simpson *et al.* 2011), suggesting that bycatch incidents can be fatal. The species was first targeted in the North Atlantic by deep-sea fishing fleets in the 1960s and landings peaked in the early 1970s, before declining sharply (Devine and Haedrich, 2008; Priede, 2019). Over a 26-year period from 1978-2003, there was a 99.6% decline in the relative abundance of Roundnose grenadier in the Canadian waters of the northwest Atlantic, as sampled through scientific surveys (Devine *et al.* 2006). Over 17-years (1978-1994), the individual mean size of Roundnose grenadier declined by 54.9% (Devine *et al.* 2006). These declines were found to be best explained by fisheries selection, although large-scale atmospheric conditions also played a role (Devine *et al.* 2006). Catches of Roundnose grenadier in the Rockall Trough have previously represented 28% of entire fish hauls (Mauchline and Gordon, 1984) and on the Hatton Bank the species represented 64% of the catch composition, indicating that the species is at high risk of exploitation. High discards have also been recorded due to catches being comprised of small sized individuals, representing up to 50% of the catch by number and 30% by weight (Durán Muñoz *et al.* 2012; Pawlowski and Lorance, 2014). Bycatch of Roundnose grenadier most notably occurs in demersal trawl fisheries targeting Greenland halibut, *Reinhardtius hippoglossoide*s and redfish, *Sebastes* spp. (Devine and Haedrich, 2008; Devine *et al.* 2006; Jørgensen *et al.* 2014). Assuming a fisheries catch equal to 5% of the total population, recovery rates of the Roundnose grenadier (based on life history characteristics) are estimated to be between 16 and 136 years (Baker *et al.* 2009). All size classes are found within the West of Scotland MPA (Priede, 2019), so there is a risk of a decline in the mean size of individuals, in addition to there being high discard rates of the smaller individuals. Although there is currently a zero TAC in place for Roundnose grenadier within ICES area 6, based on the evidence above, mobile bottom contact gear may affect the presence and distribution of the Roundnose grenadier feature, due to the risk associated with accidental bycatch.

Blue ling *(Molva dypterygia)* occur at 500 to 1,250m depths in the Rockall Trough (Priede, 2019) and all Blue ling in the ICES subareas 5b, 6 and 7 (including the whole West of Scotland area) are deemed to be mature (Lorance, 2020).The species has mainly been targeted during their spawning season, due to higher catchability, using standard deep-water trawling techniques, gillnets and longlines (FeAST, 2013). From 1970 to 1990, the bulk of the fishery for Blue ling was seasonal fisheries targeting these aggregations (Lorance, 2020). This has previously led to local depletions of aggregations and in 2009 a seasonal closure (1st March to 31st May each year) was introduced to protect spawning aggregations. Outside the spawning season Blue ling is taken in mixed trawl fisheries (targeting shelf species such as saithe, hake, monkfish and megrim; Lorance, 2020). ICES (2018) found that the spawning-stock biomass has increased since 2004 and the fishing mortality has decreased since 2004. Blue ling recruitment is thought to be stable. In 2017, 95% of landings in ICES subareas 6-7 were in trawl fisheries, with 5% longline fisheries. Discards are thought to be negligible as no undersized Blue ling are caught, and due to low fishing activity, catches have been lower than TACs. Based on the evidence available, a precautionary approach is recommended as there is a risk that the presence and distribution of Blue ling would be impacted if mobile bottom contact gear activity increases.

Evidence for the three deep-sea shark species features, **Gulper shark** *(Centrophorus granulosus)*, **Leafscale gulper shark** *(Centrophorus squamosus)* and **Portuguese dogfish** (*Centroscymnus coelolepis*) are presented together below. Literature reviews by Wilson *et al.* (2009) and Kyne and Simpfendorfer (2007) suggest many long-lived deep-water shark species are unable self-sustain populations at catch rates exceeding 5% of total biomass. The populations are therefore likely to continue to decline for as long as the species are targeted or taken as bycatch (OSPAR, 2010c). Due to their life history characteristics of very slow growth rates, late maturity, low reproductive potential, long intervals between litters and extreme longevity (Priede, 2019), deep-sea shark species are likely to be very slow to recover (exceeding 25 years), even if deep-water fisheries and all bycatch ceases. There are not known to be any measures that could mitigate the bycatch of sharks in commercial deep-water fisheries, therefore preventing mortality will be very difficult or impossible to achieve whilst fisheries continue in deep-water shark habitats (OSPAR, 2010c). OSPAR (2010d) recommended that a zero by-catch TAC is introduced, but also that bycatch is minimised through depth and effort restrictions, gear controls and area closures, as appropriate. Furthermore, they recommended restricting overall fishing effort in deep-water shark habitat to the lowest possible level.

Gulper shark, **Leafscale gulper shark** and **Portuguese dogfish** have historically been landed as bycatch in the mixed deep-water bottom trawl fisheries targeting Roundnose grenadier, Blue ling, black scabbardfish and Orange roughy off the west of Scotland (Priede, 2019), which resulted in significant population declines. In the 1998-2004, a scientific deep-water trawl survey dataset collected by Fishery Research Services (FRS) Marine Laboratory within the 1,200m depth band (i.e., middle of the species' depth range), found that population declines were evident for Portuguese dogfish and Leafscale gulper shark (Jones *et al.* 2005a). Peak catch rates for these species were found to be 62-99% lower compared to pre-fishery values. In 1975, 72% of hauls by Scottish Association for Marine Science surveys in the North-East Atlantic contained at least one Portuguese dogfish specimen, but this declined to 12% in 1999 (OSPAR, 2010d). A bycatch only TAC for deep-sea sharks (including Gulper shark, Leafscale gulper shark and Portuguese dogfish**,** amongst other species) was introduced in 2007, which was then reduced annually until it became zero in 2010[17] (ICES WGEF, 2020). No directed fisheries were permitted under these quotas and the landings subsequently declined sharply (Priede, 2019). Between 2009 and 2017, Scottish deep-water survey data has shown no trend in the abundance for Portuguese dogfish (ICES WGEF, 2019). Data from the Scottish deep-water bottom trawl surveys in ICES subarea 6 at depths from 300-2040m showed a decreasing trend from 2005 to 2011 for Leafscale gulper shark, however abundance has increased and stabilized between 2011 and 2017 (ICES WGEF, 2019).

In general, sharks tend to be fast swimmers so catch rates will be strongly influenced by fishing gear characteristics. Small trawls on a single warp at low speed will be less efficient at catching sharks, compared to larger paired warp trawls used by commercial vessels (Gordon and Swan, 1997; Jones *et al.* 2005b). However, evidence shows that the deep-sea shark species features are nonetheless at risk from bycatch in the West of Scotland MPA. On average, **Portuguese dogfish** and **Leafscale gulper sharks** were respectively caught as bycatch in 11% and 15% of deep-water trawl hauls taken by French vessels in the Northeast Atlantic (subareas 4-14) during 2005-2014 (ICES WGEF 2017, Table 3.6). Discards of **Portuguese dogfish** and **Leafscale gulper shark** from the fleet in 2018 were estimated to be 172 tonnes, with the majority, if not all of this being from the west of Scotland (ICES WGEF, 2020). In contrast, **Portuguese dogfish** discards data from Irish trawl fleets operating in the area since 2009 was recorded as being negligible (<1 tonne most years; ICES WGEF, 2020). The 2020 report by the ICES Working Group on Bycatch of Protected Species (ICES, 2020b), which presented data on bycatch of elasmobranchs from 2018, found that **Gulper shark, Leafscale gulper shark** and **Portuguese dogfish** were all bycaught in bottom trawl fisheries. For Leafscale gulper shark, the bottom trawl bycatch rate (number of specimens observed per day at sea) in the oceanic Northeast Atlantic was 0.094. For Gulper shark, highest bycatch rates from bottom trawls were in the western Mediterranean Sea and the Aegean-Levantine Sea, both at 0.071. For Portuguese dogfish, highest bycatch rates from bottom trawl were 0.113 in the Greenland

[17] Note that a 10% and 3% bycatch of 2009 quotas was permitted in 2010 and 2011, respectively (ICES WGEF, 2020).

Sea. Based on the evidence presented, including the species slow recovery rates, it is likely that mobile bottom contact gear will affect the presence and distribution of the Gulper shark, Leafscale gulper shark and Portuguese dogfish features due to the associated bycatch risk.

7.2 Pelagic gear

Orange roughy have previously solely been targeted in the west of Scotland are using specialised bottom trawling techniques (FeAST, 2013), however, the species is known to feed on bentho-pelagic prey (Gordon and Duncan, 1987). Furthermore, the species can be caught by pelagic gear, for example the Faroese fleet's fishery for Orange roughy uses semi-pelagic trawls (ICES, 2020c) and in other parts of the world mid-water trawls are also used (Bensch *et al.* 2009). Post-larval growth in Orange roughy is thought to occur in the mesopelagic, with active foraging at 700-800m depth (Shephard *et al.* 2007). Spawning aggregations can also form into dynamic plumes, extending 200m off the seabed (Branch, 2001). Although there is a zero TAC in place for Orange roughy, based on the evidence above, pelagic fishing gear may affect the presence and distribution of the species due to the associated bycatch risk at all life-stages.

Although the **Roundnose grenadier** is typically a bottom-dwelling, demersal fish, there are records of the species being caught in pelagic nets fished at depths between 1,000-2,000m and 270-1,440m above the seafloor in the Denmark Strait (Haedrich, 1974). In the Rockall Trough, one study caught only small numbers of Roundnose grenadier between 3 and 60m above the seabed in pelagic trawls (Merrit *et al.* 1986). The species is known to feed on pelagic prey, which descends through the water column during their daytime diel vertical migration and concentrates at the sea floor (Mauchline and Gordon, 1991). Juveniles are also thought to feed bentho-pelagically (Priede, 2019). Roundnose grenadiers may therefore play an important role in the transfer of food energy from the pelagic to the deep sea floor (Haedrich, 1974). Roundnose grenadier are thought to only exhibit vertical migrations to a few hundred metres above the seabed to intercept their prey during the day, remaining on the sea floor at night (Atkinson, 1995 cited in Priede, 2019). This pelagic behaviour appears to be rare, or only for short time periods (Mauchline and Gordon, 1991), however it does put the species at risk of being bycaught by pelagic fisheries. Furthermore, pelagic fisheries may pose an indirect threat to Roundnose grenadier, by the removal of pelagic prey species upon which Roundnose grenadier rely. Although there is a zero TAC in place for Roundnose grenadier, based on the evidence above, pelagic fishing gear may affect the presence and distribution of the species due to the associated bycatch risk at all life-stages.

Blue ling are a demersal fish and there is no evidence of the species being caught in pelagic nets, either as bycatch or as a target species. The species is therefore not considered further in this section.

Leafscale gulper shark are found at or near the seabed on continental slopes at depths of 230-2400 m, however the species has also been reported from the upper 1,250m of oceanic water, well above the seabed in ocean depths of around 4,000m (OSPAR, 2010e). Tagging studies have shown that the species can travel over long distances (maximum estimated at 990 nm), with some individuals making large slow vertical displacements throughout the water column, lasting several hours (Rodríguez-Cabello *et al.* 2016; Rodríguez-Cabello and Sánchez, 2014). In some instances, individuals travelled in midwater thousands of metres above abyssal plains. This species is therefore at risk of being bycaught by pelagic fisheries. Furthermore, the species also appears to be highly migratory and exhibits size, maturity and sex related distribution patterns (Clarke *et al.* 2001a, 2005; Moura *et al.* 2014). Within the NE Atlantic, there is a lack of juveniles and pregnant females recorded, but late stage pregnant females appear to segregate from the general population in other areas with pupping occurring in various locations, including potentially off Ireland (Priede, 2019). This puts the species at risk from fisheries impacts over a wide area, with an increased risk of bycatch occurring when the species is migrating. In an experimental midwater drifting longline fishing survey for black scabbardfish off the Canary Islands, Leafscale gulper shark were the most captured species, with 170 individuals caught over twenty hauls (one with a line containing around 500 hooks and the second with a line containing 5000 hooks; Freitas *et al.* 2018) The 2020 report by the ICES Working Group on Bycatch of Protected Species (ICES, 2020b), which collated data on bycatch of elasmobranchs, found that Leafscale gulper shark were bycaught in pelagic trawl fisheries. Bycatch rates (number of specimens observed per day at sea) were highest in the Celtic Seas and were recorded as 0.111. Although there is a zero TAC in place for Leafscale gulper shark, based on the evidence above, pelagic fishing gear may affect the presence and distribution of the species due to the associated bycatch risk at all life-stages.

Gulper shark have been recorded at depths from 98 to 1700m, suggesting that they may use the water column (Priede, 2019). Although there is no reliable information on migrations or the pupping grounds of Gulper shark, pregnant females appear to segregate from the rest of the population along the outer edge of continental shelves and in canyons (Priede, 2019). This poses a greater risk for the species, as there is a risk of bycatch occurring when over a wider area. In an experimental midwater drifting longline fishing survey for black scabbardfish off the Canary Islands, ten Gulper sharks were caught from twenty hauls, one with a line containing around 500 hooks and the second with a line containing 5000 hooks (Freitas *et al.* 2018). The 2020 report by the ICES Working Group on Bycatch of Protected Species (ICES, 2020b), which collated data on bycatch of elasmobranchs, found that **Gulper shark** were bycaught in pelagic trawl fisheries. Bycatch rates (number of specimens observed per day at sea) were highest in the Celtic Seas and were recorded as 0.333. Although there is a zero TAC in place for Gulper shark, based on the evidence above, pelagic fishing gear may pose a risk to the presence and distribution of the species, due to the associated bycatch risk at all life-stages.

Portuguese dogfish are one of the deepest living sharks and are known to occur on or near the seabed, from 700 –1900m, in the area to the west of Scotland (Priede, 2019). There is evidence of the species exhibiting vertical migration and females are known to move to shallower waters to give birth (500-1000m), increasing risks of interactions with fisheries (Clarke *et al.* 2001a; Girard and Du Buit, 1999; Moura *et al.* 2014; OSPAR, 2010f; STECF, 2006). Mature females have been found dominating some catches, for example. The species is known to feed on fish and squid, including Roundnose grenadier, indicating bentho-pelagic foraging (Mauchline and Gordon, 1983, cited in Priede, 2019), putting the species at risk of being bycaught by pelagic fisheries. Furthermore, pelagic fisheries may pose an indirect threat to Portuguese dogfish, by the removal of pelagic prey species upon which Portuguese dogfish rely. The species is not thought to be highly migratory as different maturity stages and sizes are found in the same geographical areas, so it is likely that the species can complete its life cycle within the same area (Moura *et al.* 2014). Recolonization from neighbouring areas will therefore be extremely slow, with recovery likely to take longer than 25 years (OSPAR, 2010d), similar to that of the other deep-water shark species discussed here. Although there is a zero TAC in place for Portuguese dogfish, based on the evidence above, pelagic fishing gear may pose a risk to the presence and distribution of the species, due to the associated bycatch risk at all life-stages.

7.3 Static nets (including trammel, gill, tangle, and drift nets)

Orange roughy were only targeted using specialised bottom trawling techniques and are not commercially targeted with other gear types (FeAST, 2013), however, the species has also been recorded as bycatch in other fisheries. In the northwest Atlantic, there are records of Orange roughy caught in gillnets, with the vast majority of these at depths greater than 500m and 800m (96% and 92%, respectively; Kulka *et al.* 2001). In gillnet sets below 500m, 0.26% of these caught Orange roughy (Kulka *et al.* 2001). In comparison, Orange roughy was caught in 0.49% of otter trawls below 500m (Kulka *et al.* 2001). Although there is a zero TAC in place for Orange roughy, based on the evidence above, static nets may pose a risk to the presence and distribution of the species, due to the associated bycatch risk.

Although **Roundnose grenadier** were previously only targeted using mobile bottom contact gears in the west of Scotland area, the species can be taken using gillnets (e.g., in Canada; Simpson *et al.* 2011). Although there is a zero TAC in place for Roundnose grenadier, static nets may therefore pose a risk to the presence and distribution of the species, due to the associated bycatch risk.

Blue ling is landed as bycatch in Norwegian longline and gillnet fisheries targeting ling, tusk, and saithe (ICES, 2019b). However, landings from these gear types have been small since 2000 (Lorance, 2020) (ICES, 2020d). One gillnetter in the area of Hatton and Rockall Banks in 2006 caught 19 tonnes of Blue ling (Bensch *et al.* 2009). Trammel nets deployed between 1-25 m depth off Norway have also caught the species (Vea Salvanes, 1986) and blue ling are bycaught in the monkfish tangle net fishery that operates to the west of Scotland (STECF, 2006). In the area to the northwest and west of Rockall, Blue ling comprised 5% of catches in 2006 (compared with 16% for the target monkfish species; STECF, 2006). At George Bligh Bank and Lousy Bank, Blue ling accounted for around 8% and 12% of the total catches, respectively. However, a high proportion of these catches were discarded due to spoilage, as Blue ling deteriorate very quickly, even with short-soak times, due to their soft-flesh. Discards were around 60% at Rockall and George Bligh Banks, although only 12% at Lousy Bank. Blue ling were previously bycaught in deep-water gillnet fisheries targeting Leafscale gulper sharks and Portuguese dogfish (Hareide *et al.* 2017; STECF, 2006), however this fishery has now ceased. Only minimal bycatch of Blue ling, comprising 1% of total catch, occurred in deep-water crab gillnet fisheries operating to the west of Scotland, again with high levels of discards (40%; Hareide *et al.* 2017; STECF, 2006). Based on the evidence available, there is a risk that the presence and distribution of Blue ling would be impacted by static nets, either as a target species or as bycatch.

Leafscale gulper shark were previously targeted in Scotland using gillnets or tangle net hybrids (Hareide *et al.* 2017; STECF, 2006). These fisheries have now ceased, however, bycatch still occurs and the long soak times and discards of nets from gillnet fisheries are known to increase bycatch mortality (Hareide *et al.* 2005). There are records of Leafscale gulper shark being bycaught in monkfish tangle net fisheries in the area to the west of Scotland from observer data (STECF, 2006). At Rosemary Bank and to the northwest and west of Rockall, deep-water sharks comprised 1% of total catches, mainly comprising Leafscale gulper shark, of which 6% to 11% were discarded. Similarly, Leafscale gulper sharks are bycaught in deep-water crab gillnet fisheries on Rosemary Bank. However, deep-sea sharks comprised less than 1% of total catches, with 11% of the Leafscale gulper sharks being discarded (STECF, 2006). In a survey to retrieve lost gillnet gear in the Rockall and Porcupine Bank areas, 6,209 kg of **Leafscale gulper shark** were recorded from 150 gillnets/tangle nets at depths of 1,000-1,100m in the South Porcupine area, with only 7kg from 350 nets between 650-800m in the SE Rockall area (Rihan *et al.* 2005). Over 70% of the Leafscale gulper sharks from the South Porcupine area were decayed. In terms of the selectivity of nets, only Leafscale gulper sharks with lengths in excess of 85cm were found to be retained in retrieved nets with

160mm mesh size (Rihan *et al.* 2005). Based on the evidence available, there is a risk that the presence and distribution of Leafscale gulper shark would be impacted by static nets, due to the associated bycatch risk.

Gulper shark were previously targeted in Scotland using gillnets or tangle net hybrids (Hareide *et al.* 2017; STECF, 2006). These fisheries have now ceased, however, bycatch still occurs targeting other species and the long soak times and discards of nets from gillnet fisheries are known to increase bycatch mortality (Hareide *et al.* 2005). In a study by (Moura *et al.* 2018) off Portugal, one **Gulper shark** specimen was found bycaught in the trammel net fishery targeting anglerfish in the 300-400m depth range, however no survival information was available. Based on the evidence available, there is a risk that the presence and distribution of Gulper shark would be impacted by static nets, due to the associated bycatch risk.

Similar to the other shark species, **Portuguese dogfish** were previously targeted in Scotland using gillnets or tangle net hybrids (Hareide *et al.* 2017; STECF, 2006). These fisheries have now ceased, however, bycatch still occurs and the long soak times and discards of nets from gillnet fisheries are also known to increase bycatch mortality (Hareide *et al.* 2005). In a survey to retrieve lost gillnet gear in the Rockall and Porcupine Bank areas, 240kg of **Portuguese dogfish** were recorded as being caught in 150 gillnets/tangle nets retrieved from depths of 1,000-1,100m in the South Porcupine area (Rihan *et al.* 2005). This is much lower than the records of Leafscale gulper shark mentioned above, which is likely to be due to depleted stocks of Portuguese dogfish. Moura *et al.* (2018) found that off Portugal, the trammel net fishery targeting anglerfish had a very low impact on deep-water shark populations, presumably due to the species preferring deeper depths. Bycatch was recorded as <5% by weight of the total catch in 98% of the hauls at depths <600m. The largest proportion of deep-water sharks caught (by weight and number) consisted of **Portuguese dogfish**, with 29 females and 1 male caught during 4 hauls in 400-500m depth at the top of an underwater knoll. Where information on survival was available, 81% were in “poor” condition, i.e. dead, or nearly dead, or had no body movement. In the case of Portuguese dogfish, all three available specimens were classed as being in this “poor” condition category. Based on the evidence available, there is a risk that the presence and distribution of Portuguese dogfish would be impacted by static nets, due to the associated bycatch risk.

7.4 Other static gears (including pots, traps, and lines)

Orange roughy were only targeted using specialised bottom trawling techniques and the species is not commercially catchable by other gear types such as longlines (FeAST, 2013). For example, there were no catches of Orange roughy in 4,998 longlines sets monitored by fisheries observers between 1991 and 2000 in the Northwest Atlantic (Kulka *et al.* 2001). Therefore, this species is not considered further in this section.

As **Roundnose grenadier** are not attracted to the odour of baits, they can only be caught by trawl, rather than longlines or traps (Priede, 2018). Jørgensen (1995) for example, didn’t record any catches of Roundnose grenadier in longlines, despite being present in large numbers in bottom trawls off west Greenland. Pots have been used to target Blue ling and Roundnose grenadier on the south slope of the Lousy Bank and inside the Faroe Island EEZ (Bensch *et al.* 2009), however this is unlikely to be a significant risk to Roundnose grenadier. Therefore, this species is not considered further in this section.

Blue ling are caught both as a target species and as bycatch in longline fisheries, including around Rockall and the Hatton Bank (Clark, 2006; Gordon, 2003; ICES, 2019c, 2019b, 2020c; Lorance, 2020). In the Porcupine Bank and Seabight, 597 kg (2.12% of total catch) of Blue ling were caught across 20 deep-water commercial longline deployments, with the peak catch rate occurring at 700-1,100m (Clarke *et al.* 2001b). Another study found that longlines deployed in the Rockall Trough caught larger specimens of Blue ling compared to trawls (Kelly *et al.* 1998). From three longline sets on the Hatton Bank, catches of Blue ling ranged from 6% to 10.2% of total catch by weight (Stene and Buner, 1991 cited in Gordon, 2003). In another longline survey on the Hatton Bank at depths of 600 to 1800 m, the proportion of Blue ling caught from 67 deployments was 7.05% (by weight), compared to 1.4% from trawl (Gordon, 2003). Based on the evidence available, there is a risk that the presence and distribution of Blue ling would be impacted by static gears, either as a target species or as bycatch.

Leafscale gulper shark has previously been targeted by Irish longline, Norwegian longline and Portuguese longline fisheries, which resulted in a rapid decline in stocks (OSPAR, 2010e, 2010d). Although there is now a zero TAC in place, there remains a risk of accidental bycatch in longline fisheries and evidence shows that catch rates can be relatively high for the species. AZTI survey data in the Bay of Biscay using a former commercial deep-water shark longline (for which the number of hooks was reduced), found that Leafscale gulper sharks were caught at a rate of almost 20kg per hook per minute between 2016 and 2018 (ICES WGEF, 2020). Individuals were more frequently caught in the bottom sections of the longline compared to the floating sections. Although the black scabbardfish longline fishery off Portugal is known to be concentrated on fishing locations where the proportion of Leafscale gulper shark catch is low (Veiga *et al.* 2013), data collected between 2009 to 2018 showed that the relative occurrence of Leafscale gulper sharks varied between 17% and 100%, depending on year, haul, vessel and location (ICES WGEF, 2020). From a study of three longline sets on Hatton Bank, catches of Leafscale gulper shark ranged from 15.8 to 46.2% of total catch by weight (Stene and Buner, 1991 cited in Gordon, 2003). In another longline survey on the Hatton Bank, the proportion of Leafscale gulper shark caught by longlines was 25.97% (by weight) from 67 deployments, compared to 0% by trawls (Gordon, 2003). In the Rockall Trough, evidence shows that longlines and trawls catch the same size ranges of the species (Kelly *et al.* 1998).

In a scientific tagging survey off Spain, Rodríguez-Cabello and Sánchez (2017) found that **Leafscale gulper sharks** could survive being bycaught on deep-water bottom longlines when the soaking time was restricted to 2-3 hours and lines were hauled back at very slow speeds (0.4-0.5 m/s). 1.2% of Leafscale gulper shark were dead when brought on board, with a further number being in 'poor' condition, increasing the at vessel mortality to 18.9% for the species. This species had the highest vitality rate, with 37.3% in good condition and 43.8% in moderate condition. Three out of nine Leafscale gulper sharks died within 3-10 weeks after release, however, whilst the others survived until the tags were released (45-120 days). Although this paper found that at-vessel mortality was lower than expected for deep-water sharks (i.e. <10%), post-release mortality over short and relatively long periods was sometimes high. Leafscale gulper shark was found to have the highest survival rate of all the deep-water sharks sampled (> 66%). It is worth noting however that these fishing practices are different to those normally used by commercial vessels. Research into the survival rates of ***Centrophorus* spp.** (this family includes **Leafscale gulper shark** and **Gulper shark**) taken on demersal longline gear (Wilson *et al.* 2009) have shown that, if handled appropriately before being released (without using automatic de-hooking gear), individuals have a high rate of survival. Another study on survival rates of *Centrophorus* sp. bycaught in demersal longlines in the Gulf of Mexico however found that the at-vessel mortality rate was 30.8% and the 24 hr post-release mortality rate was 83.0% (±16.0) (Talwar *et al.* 2017). None of the sharks exhibited correct orientation or regular, sustained swimming behaviours during the caged monitoring period underwater. Soak times were 3.5hrs and longline were hauled at a rate of 0.3 m/s. An earlier demersal longline study found similar at vessel mortality rates for *Centrophorus* sp. (29.41%) and data indicated that post-release predation <200m from the surface had also occurred (Brooks *et al.* 2015). This predation, likely to be from pelagic sharks, therefore presents an additional risk to any individuals released. Based on the evidence presented above for Leafscale gulper sharks and *Centrophorus* spp., post-release mortality poses a key risk to the species. Therefore, the presence and distribution of Leafscale gulper sharks may be impacted by static gears, based on this associated bycatch risk.

Gulper shark have previously been targeted by longline fisheries and their abundance was estimated to have declined 80-95% from baseline, based on data from a target longline fishery for deep-water sharks in the north of Portugal from 1990-2004 (OSPAR, 2010c, 2010d). Although there is now a zero TAC in place, there remains a risk of accidental bycatch in longline fisheries. The 2020 report by the ICES Working Group on Bycatch of Protected Species (WGBYC; ICES, 2020c), which collated data on bycatch of elasmobranchs, found that Gulper shark was bycaught in longline fisheries. Highest bycatch rates (specimens per day at sea observed) were in the Azores at 0.019. Based on the evidence presented above and the information on survival rates for *Centrophorus* spp., post-release mortality poses a key risk to the species. Therefore, the presence and distribution of Gulper sharks may be impacted by static gears, based on this associated bycatch risk.

Portuguese dogfish have been targeted by Irish longline, Norwegian longline and Portuguese longline fisheries, which resulted in a rapid decline in stocks (OSPAR, 2010e, 2010d). Although there is now a zero TAC in place, there remains a risk of accidental bycatch in longline fisheries. AZTI survey data in the Bay of Biscay using a former commercial deep-water shark longline (for which the number of hooks was reduced), found that Portuguese dogfish were more frequently caught in the bottom sections of longlines compared to the floating sections (ICES WGEF, 2020). From a study of three longline sets on Hatton Bank, catches of Portuguese dogfish ranged from 1.6% to 17.7% of total catch by weight (Stene and Buner, 1991 cited in Gordon, 2003). In another longline survey on the Hatton Bank at depths of 600 to 1800 m, the proportion of Portuguese dogfish caught from 67 deployments was 17.16% (by weight), compared to 10.9% from trawl (Gordon, 2003). Although the deep-water black scabbardfish longline fishery off Portugal is known to operate at locations where Portuguese dogfish have lower abundances (Veiga *et al.* 2015, WD, cited in ICES WGEF, 2020), data collected between 2009 to 2018 showed that the relative occurrence of Portuguese dogfish was between 33 and 100% (ICES WGEF, 2020). Although these rates varied by haul, year, vessel and location, high numbers of specimens were consistently recorded in some places. In the Rockall Trough, evidence shows that longlines and trawls catch the same size ranges of the species (Kelly *et al.* 1998). In a scientific tagging survey off Spain, Rodríguez-Cabello and Sánchez (2017) found that 4.5% of Portuguese dogfish were dead when brought on board after being bycatch in deep-water bottom longlines. However, a further number of specimens were in 'poor' condition, increasing the at vessel mortality to 38.6%. Only 6.8% of Portuguese dogfish were in good condition, and 54.5% were in moderate condition. Two out of four Portuguese dogfish died immediately after release. Although this paper found that at-vessel mortality was lower than expected for deep-water sharks (i.e. <10%), post-release mortality over short and relatively long periods was sometimes high. It is worth noting however that these fishing practices are different to those normally used by commercial vessels. Based on the evidence above, there is a risk that the presence and distribution of Portuguese dogfish may be impacted by static gears, due to the associated bycatch risk.

8. Development of management options

A range of options are available to managers, which differ in the degree of restriction they would place on fishing operations and the risk they would pose to the achievement of the conservation objectives. Three broad categories of possible management are considered below and further described in Tables 2 and 3.

For each of these broad management categories, JNCC have evaluated the level of risk posed to the achievement of the conservation objectives (Tables 2 and 3). It is not generally possible to quantify the degree of risk posed by each management option; however, we have indicated where we consider that a risk exists, where it would be ‘significant’, and where it would be reduced by application of management. In most cases we have not recommended a single preferred option but would advise that fisheries managers and stakeholders consider the identified levels of risk when further developing management measures.

Risks were evaluated using existing data and information on protected features and relevant activities, and also our understanding of the relationships between the feature and relevant activities. Our identification of the risk has been refined using available information on the interaction between the features and activities where this is available (see section 5). The text focuses on interactions in terms of geographical overlap but the assessment of risk in future should also take account of the intensity and frequency of activities within the NCMPA.

A gradient of management options has been considered. These have been described under three potential management option categories:

a) **No additional management** - where fisheries managers choose to apply no additional site specific fisheries management within the site.

b) **Additional management to reduce pressures** – where fisheries managers may wish to consider a range of measures that could be used to reduce the risk to features by managing fishing activity. These could include**:**

- Area restrictions (permanently closing some or all of the features’ area).
- Temporal restrictions (e.g., closing some or all of the MPA at specified periods to protect key life history stages).
- Gear restrictions (e.g., restricting use of the more damaging gears).

Ideally, any measures would generally apply only to the parts of the sites where the vulnerable feature is present. However, there may be some circumstances in which it could be desirable to extend management measures beyond the known area of feature distribution, for example, where conditions are suitable for a feature to exist but there are insufficient data to confirm its presence.

In situations where there is high uncertainty regarding the impacts of fishing on the features, these management measures could be “adaptive” i.e., following introduction of management measures, changes in the features’ condition could be monitored and future management may be adapted accordingly.

c) **Additional management to remove pressures** – where fishing activities known to adversely affect the feature would be excluded. Such exclusion would generally apply only to the parts of the sites where the feature is present, although it may occasionally be necessary to apply them to a wider area.

We recognise that stakeholders can provide local environmental knowledge and more detailed information on activities, including distribution and intensity of effort, frequency of activity, and fishing methods employed. This additional information will help us to develop more specific management measures, focused on interactions between features and activities.

9. Overview of activities

Existing fishing activities believed to take place within or close to the West of Scotland MPA considered capable of affecting the protected features:

- Demersal trawls;
- Demersal seines;
- Purse seines;
- Pelagic trawls;
- Unknown trawls;
- Gillnets;
- Hooks and lines;
- Pots and traps.

10. Management options

Mobile bottom contact gears are currently prohibited below 800m within the MPA, covering a vast proportion of the site. However, these regulations do not currently apply to areas of the site above 800m, including the shallower seamounts and shelf margin. JNCC therefore recommends that management is considered for mobile bottom contact gears in areas shallower than 800m (Table 2).

Table 2. Management options for mobile bottom contact gear.

Management option	Risk to achieving the conservation objectives
Option 1: No additional management	With no additional management in areas shallower than 800m, there is a risk of not achieving the conservation objectives for **Offshore sands and gravels, Burrowed mud, Offshore deep-sea muds, Leafscale gulper shark** (*Centrophorus squamosus*)**, Gulper shark** (*Centrophorus granulosus*)**, Portuguese dogfish** (*Centroscymnus coelolepis*)**, Blue ling** (*Molva dypterygia*)**, Roundnose grenadier** *(Coryphaenoides rupestris)* and **Orange roughy** (*Hoplostethus atlanticus*)**.** The conservation objectives would not be achieved for **Deep-sea sponge aggregations, Coral gardens, Cold-water coral reefs** (including *Lophelia pertusa* reefs) or **Seamount communities.** JNCC recommend that this option should not be applied in areas shallower than 800m where these features occur.
Option 2: Reduce/limit pressures	If applied in areas shallower than 800m where the following features occur, this option would reduce, but not entirely eliminate, the risk of not achieving the conservation objectives for **Offshore sands and gravels, Burrowed mud, Offshore deep-sea muds, Blue ling** (*Molva dypterygia*)**, Roundnose grenadier** *(Coryphaenoides rupestris)***, Orange roughy** (*Hoplostethus atlanticus*)**, Leafscale gulper** shark (*Centrophorus squamosus*)**, Gulper shark** (*Centrophorus granulosus*) and **Portuguese dogfish** (*Centroscymnus coelolepis*). Appropriate management could include seasonal or temporal restrictions, to minimise bycatch of mobile species features and their prey, or a zoned approach, restricting mobile bottom contact fisheries over a proportion of the site. Measures could be decided in consultation with stakeholders. Restrictions could be permanent in some cases or temporary/adaptive in others.

Management option	Risk to achieving the conservation objectives
	The conservation objectives would not be achieved for **Deep-sea sponge aggregations, Coral gardens, Cold-water coral reefs** (including *Lophelia pertusa* reefs) or **Seamount communities** in areas shallower than 800m.
Option 3: Remove/avoid pressures	If applied in areas shallower than 800m where the following features occur, this option would reduce the risk of not achieving the conservation objectives for **Offshore sands and gravels, Burrowed mud, offshore deep-sea muds, Leafscale gulper shark** (*Centrophorus squamosus*)**, Gulper shark** (*Centrophorus granulosus*)**, Portuguese dogfish** (*Centroscymnus coelolepis*)**, Blue ling** (*Molva dypterygia*)**, Roundnose grenadier** *(Coryphaenoides rupestris)* and **Orange roughy** (*Hoplostethus atlanticus*)**,** to the lowest possible levels. This is the only option that would not risk the achievements of the conservation objectives for **Deep-sea sponge aggregations, Coral gardens, Cold-water coral reefs** (including Lophelia pertusa reefs) and **Seamount communities.** JNCC recommend that this option should be applied in areas shallower than 800m, in all areas where these features occur.

Table 3. Management options for pelagic gear (note that this is only applicable to mobile species features).

Management option	Risk to achieving the conservation objectives
Option 1: No additional management	Option 1 is unlikely to prevent the achievement of the conservation objectives for **Blue ling** (*Molva dypterygia*). There is a risk of not achieving the conservation objectives for **Roundnose grenadier** *(Coryphaenoides rupestris)***, Orange roughy** (*Hoplostethus atlanticus*)**, Leafscale gulper shark** (*Centrophorus squamosus*)**, Gulper shark** (*Centrophorus granulosus*) and **Portuguese dogfish** (*Centroscymnus coelolepis*).
Option 2: Reduce/limit pressures	This option would reduce, but not entirely eliminate, the risk of not achieving the conservation objectives for **Roundnose grenadier** *(Coryphaenoides rupestris)***, Orange roughy** (*Hoplostethus atlanticus*)**, Leafscale gulper shark** (*Centrophorus squamosus*)**, Gulper shark** (*Centrophorus granulosus*) and **Portuguese dogfish** (*Centroscymnus coelolepis*)**.** Appropriate management could include seasonal or temporal restrictions, to minimise bycatch of mobile species features and their prey. Measures could be decided in consultation with stakeholders. Restrictions could be permanent in some cases or temporary/adaptive in others.
Option 3: Remove/avoid pressures	This option would reduce the risk of not achieving the conservation objectives for **Roundnose grenadier** *(Coryphaenoides rupestris)***, Orange roughy** (*Hoplostethus atlanticus*)**, Leafscale gulper shark** (*Centrophorus squamosus*)**, Gulper shark** (*Centrophorus granulosus*) and **Portuguese dogfish** (*Centroscymnus coelolepis*), to the lowest possible level.

There is a prohibition in ICES divisions 6a and 6b (including West of Scotland MPA) for static nets (bottom-set gillnets, entangling nets and trammel nets) in depths greater than 200m, with the exception of specific derogations for the 200-600m zone. This derogation permits bottom set gillnets only for directed fishing for hake and entangling nets only for directed fishing for anglerfish. Based on this, no additional management for static nets is required for areas at depths greater than 600m. The shallowest area within the MPA is approximately 400 m below sea-level, and JNCC therefore recommends that management is considered for static nets in areas shallower than 600m (i.e., the 200-600m derogation zone; Table 4). Table 4 presents the management options for these gear types at these depths.

Table 4. Management options for static nets (including trammel, gill, tangle, and drift nets).

Management option	Risk to achieving the conservation objectives
Option 1: No additional management	With no additional management in areas shallower than 600m, there is a risk of not achieving the conservation objectives for **Burrowed mud (including sea-pens), Offshore deep-sea muds, Offshore sands and gravels, Blue ling** (*Molva dypterygia*)**, Roundnose grenadier** *(Coryphaenoides rupestris)***, Orange** roughy (*Hoplostethus atlanticus),* **Leafscale gulper shark** (*Centrophorus squamosus*)**, Gulper shark** (*Centrophorus granulosus*) **and Portuguese dogfish** (*Centroscymnus coelolepis*)***.*** This risk is considered to be low for the sedimentary features, however, if static gear fishing activities were to increase or monitoring showed evidence of detrimental effects, this would indicate an increased risk to these features. The conservation objectives would not be achieved for **Deep-sea sponge aggregations, Coral gardens, Cold-water coral reefs** (including *Lophelia pertusa* reefs) or **Seamount communities** in areas shallower than 600m. JNCC recommend that this option should not be applied in areas shallower than 600m where these features occur.
Option 2: Reduce/limit pressures	If applied in areas shallower than 600m where the following features occur, this option would reduce, but not entirely eliminate, the risk of not achieving the conservation objectives for **Burrowed mud (including sea-pens), Offshore deep-sea muds, Offshore sands and gravels, Blue ling** (*Molva dypterygia*)**, Roundnose grenadier** *(Coryphaenoides rupestris)***, Orange roughy** (*Hoplostethus atlanticus*)**, Leafscale gulper shark** (*Centrophorus squamosus*)**, Gulper shark** (*Centrophorus granulosus*) and **Portuguese dogfish** (*Centroscymnus coelolepis*). Appropriate management could include seasonal or temporal restrictions, or gear deployment rules (e.g., reduced soak times), to minimise bycatch of mobile species features, or a zoned approach, restricting mobile bottom contact fisheries over a proportion of the site. Measures could be decided in consultation with stakeholders. Restrictions could be permanent in some cases or temporary/adaptive in others. The conservation objectives would not be achieved for **Deep-sea sponge aggregations, Coral gardens, Cold-water coral reefs** (including *Lophelia pertusa* reefs) or **Seamount communities** in areas shallower than 600m.
Option 3: Remove/avoid pressures	If applied in areas shallower than 600m where the following features occur, this option would reduce the risk of not achieving the conservation objectives for **Burrowed mud (including sea-pens), Offshore deep-sea**

Management option	Risk to achieving the conservation objectives
	muds, Offshore sands and gravels, Blue ling (*Molva dypterygia*)**, Roundnose grenadier** *(Coryphaenoides rupestris)***, Orange roughy** (*Hoplostethus atlanticus*)**, Leafscale gulper shark** (*Centrophorus squamosus*)**, Gulper shark** (*Centrophorus granulosus*) and **Portuguese dogfish** (*Centroscymnus coelolepis*), to the lowest possible levels. This is the only option that would not risk the achievements of the conservation objectives for **Deep-sea sponge aggregations, Coral gardens, Cold-water coral reefs** (including *Lophelia pertusa* reefs) and **Seamount communities**. JNCC recommend that this option should be applied in areas where these features occur in areas shallower than 600m.

Pot and traps are not deemed to pose a risk to the mobile features within West of Scotland MPA. The management options for the mobile species presented in Table 5 below are therefore only in relation to longlines.

Table 5. Management options for longlines.

Management option	Risk to achieving the conservation objectives
Option 1: No additional management	This option is unlikely to prevent the achievement of the conservation objectives for **Roundnose grenadier** *(Coryphaenoides rupestris)* and **Orange roughy** (*Hoplostethus atlanticus*). However, if static gear fishing activities were to increase or monitoring showed evidence of detrimental effects, it may be necessary to apply limits in the future. There is a risk of not achieving the conservation objectives for **Burrowed mud (including sea-pens), Offshore deep-sea muds, Offshore sands and gravels, Blue ling** (*Molva dypterygia*), **Leafscale gulper shark** (*Centrophorus squamosus*)**, Gulper shark** (*Centrophorus granulosus*) **and Portuguese dogfish** (*Centroscymnus coelolepis*). This risk is considered to be low for the sedimentary features, however, if static gear fishing activities were to increase or monitoring showed evidence of detrimental effects, this would indicate an increased risk to these features. The conservation objectives would not be achieved for **Deep-sea sponge aggregations, Coral gardens, Cold-water coral reefs** (including *Lophelia pertusa* reefs) or **Seamount communities.** JNCC recommend that this option should not be applied in areas where these features occur.
Option 2: Reduce/limit pressures	This option would reduce, but not entirely eliminate, the risk of not achieving the conservation objectives for **Burrowed mud (including sea-pens), Offshore deep-sea muds, Offshore sands and gravels, Blue ling** (*Molva dypterygia)***, Leafscale gulper** shark (*Centrophorus squamosus*)**, Gulper shark** (*Centrophorus granulosus*) and **Portuguese dogfish** (*Centroscymnus coelolepis*). Appropriate management could include seasonal or temporal restrictions, or gear deployment rules (e.g., reduced soak times), to minimise bycatch of mobile species features, or a zoned approach, restricting mobile bottom contact fisheries over a proportion of the site. Measures could be decided in consultation with stakeholders. Restrictions could be permanent in some cases or temporary/adaptive in others.

Management option	Risk to achieving the conservation objectives
	The conservation objectives would not be achieved for **Deep-sea sponge aggregations, Coral gardens, Cold-water coral reefs** (including *Lophelia pertusa* reefs) or **Seamount communities.**
Option 3: Remove/avoid pressures	This option would reduce the risk of not achieving the conservation objectives for **Burrowed mud (including sea-pens), Offshore deep-sea muds, Offshore sands and gravels, Blue ling** (*Molva dypterygia*), **Leafscale gulper shark** (*Centrophorus squamosus*), **Gulper shark** (*Centrophorus granulosus*) and **Portuguese dogfish** (*Centroscymnus coelolepis*), to the lowest possible levels. This is the only option that would not risk the achievements of the conservation objectives for **Deep-sea sponge aggregations, Coral gardens, Cold-water coral reefs** (including *Lophelia pertusa* reefs) and **Seamount communities.** JNCC recommend that this option should be applied in areas where these features occur.

11. Conclusions

Fisheries management measures for the West of Scotland MPA will be developed through discussion with stakeholders. Discussions will focus on our understanding of the features and the likely risks to the designated features where there are interactions with fishing activities. In most cases we have not recommended a single preferred option but would advise that fisheries managers and stakeholders consider the identified levels of risk when further developing management measures.

12. Further information

The following documents relevant to the West of Scotland MPA are available:

- The Ecological Overview Document, Data Confidence Assessment and Conservation and Management Advice are all available on the West of Scotland MPA page on the JNCC website: https://jncc.gov.uk/our-work/west-of-scotland-mpa/
- Deep-sea sponge aggregation Fisheries Management Guidance document – https://hub.jncc.gov.uk/assets/2d7638f7-cdd5-4153-8abb-9d33c5e02bf8#SMPA-fish-man-guidance-deep-sea-sponge-aggs-July2013.pdf
- Coral gardens Fisheries Management Guidance document – https://hub.jncc-.gov.uk/assets/2d7638f7-cdd5-4153-8abb-9d33c5e02bf8#SMPA-fish-man-guidance-coral-gardens-July2013.pdf
- Seamount communities Fisheries Management Guidance document - https://hub.jncc.gov.uk/assets/2d7638f7-cdd5-4153-8abb-9d33c5e02bf8#SMPA-fish-man-guidance-seamount-comms-July2013.pdf
- Offshore sands and gravels Fisheries Management Guidance document – https://hub.jncc.gov.uk/assets/2d7638f7-cdd5-4153-8abb-9d33c5e02bf8#SMPA-fish-man-guidance-offshore-subtidal-sand-gravel-July2013.pdf
- Burrowed mud, inshore deep mud with burrowing heart urchins and Offshore deep-sea muds (draft) Fisheries Management Guidance document - https://hub.jncc.gov.uk/assets/2d7638f7-cdd5-4153-8abb-9d33c5e02bf8#SMPA-fish-man-guidance-burrowed-muds-V1.3.pdf

- Orange roughy (draft) Fisheries Management Guidance document – https://hub.jncc.gov.uk/assets/2d7638f7-cdd5-4153-8abb-9d33c5e02bf8#SMPA-fish-man-guidance-orange-roughy-v1.pdf

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