Assessing progress towards an ecologically coherent MPA network in Secretary of State Waters in 2016:

Methodology

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Executive summary

Defra asked JNCC to assess the progress with the designation of Marine Protected Areas (MPA) in Secretary of State (SoS) waters up to Spring 2016 towards a meeting their policy commitments for network of MPAs. The results would help inform Defra's planning for any further MPA designations that may be necessary to complete the network. JNCC were asked to look at what is protected within the existing MPA network and then consider the potential contribution of other site options for a third tranche of Marine Conservation Zone (MCZ) designations if required. The second scenario would help visualise any remaining shortfalls that may require identifying further areas for designation beyond those remaining areas recommended by the Regional MCZ Projects.

JNCC used the data provided up to April 2016 by the Statutory Nature Conservation Bodies (SNCBs) through the ongoing UK MPA stocktake work[1]. These data were deemed appropriate as the source data for this 2016 network assessment. JNCC initially considered the progress made by the existing MPAs in SoS waters, followed by an assessment of the potential contribution of site options that could be taken forward in a third tranche of designations. These potential site options were determined by Defra, JNCC and Natural England on the basis of whether they filled a gap and had sufficient data to likely be taken forward for possible designation. These options were only selected to inform this network assessment and to better understand their potential contribution to the network. Defra emphasised that the inclusion of any option does not confer any indication that it might progress to designation in the future. JNCC were asked to identify any shortfalls that might need to be addressed in future by further designation work.

JNCC on considered those features on the MCZ features list deemed suitable for MPAs in the Ecological Network Guidance (ENG). Shortfalls were identified against the recommended criteria for establishing an ecological coherent network at a biogeographic region scale; the Charting Progress 2 (CP2) regions were used as a proxy for biogeographic regions. The network criteria were based on the principles for achieving an ecologically coherent MPA network recommended by the OSPAR Commission and adopted by the UK, with specific targets tailored for SoS waters based on previous MPA network assessments and the ENG. This analysis included data for existing MPAs within the five CP2 regions that overlap with SoS waters; Northern North Sea, Southern North Sea, Eastern Channel, Western Channel and Celtic Sea, and Irish Sea. For the purposes of this study, the extent of SoS waters did not include UK offshore waters around Wales as responsibility for nature conservation in this area is likely to transfer to Welsh Government in the future.

Mapped data for the inshore area within 12nm were provided by Natural England's evidence base and were used in conjunction with the JNCC Combined map (containing both data from habitat models and survey data). Data for MPAs and their protected features were provided by each of the responsible SNCBs through the ongoing work of the UK MPA stocktake and was deemed correct at the time of data submission.

[1] The UK MPA Stocktake is an ongoing exercise by the Statutory Nature Conservation Bodies to catalogue all MPAs and their protected features in a standardised manner across the UK.

JNCC note that the principles set out in OSPAR MPA network guidance includes Features, Representativity, Resilience, Connectivity **and** Management. OSPAR Contracting Parties agreed to establish a 'well-managed network' of MPAs. JNCC's assessment in 2016 has not considered whether the existing MPAs in SoS waters have sufficient management in place to deliver their conservation objectives.

JNCC processed the available data to draw conclusions; Natural England reviewed the results for inshore waters to validate these conclusions. This present paper describes the approach and methodology used for the assessment, noting its limitations. The results from the assessment are published in a separate 'Results Report'.

Contents

1 Background

The UK Government and Devolved Administrations are committed to creating an ecologically coherent network of Marine Protected Areas (MPAs) in UK waters and, in 2012, published a statement on the expected UK contribution to an ecologically coherent MPA network in the north-east Atlantic[2]. UK MPAs will create this UK network and contribute to wider European and global initiatives. The key international obligations come from the Oslo/Paris Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR) and the Aichi Targets under the Convention on Biological Diversity.

Following on from the previous two assessments of the MPA network in Secretary of State (SoS) waters[3,4], Defra asked JNCC for a further third analysis of progress up to Spring 2016. Defra requested that the assessment considers both the existing MPA network and a future scenario with the network containing potential options that could be designated in the third tranche of MCZs. This second element would help Defra visualise any shortfalls that might need to be addressed by further designation work. JNCC adopted a two stage approach:

1. Identify what features are currently protected within the existing MPA network in SoS waters and how they compare with the MPA network criteria to identify any shortfalls; and,
2. Analyse the existing MPA network plus potential site options for a third tranche of MCZs against the same network criteria to identify any remaining shortfalls.

Defra, JNCC and Natural England determined the potential site options to be included in the second stage. These options were only selected to inform this network assessment and to better understand their potential contribution to the network. Defra emphasised that the inclusion of any option does not confer any indication that it might progress to designation in the future.

2 Criteria for identifying gaps in the MPA network

The UK MPA network is underpinned by the guidance developed by the OSPAR Commission[5] for developing an ecologically coherent network of MPAs. The UK Government and the Devolved Administrations published a Joint Administration Statement in 2012 on the UK Contribution to Ecologically Coherent MPA Network in the North East Atlantic that stated[2]:

> *"We are aiming for a UK contribution to an ecologically coherent MPA network in the North East Atlantic, in accordance with the OSPAR Convention which is an evolving scientific concept. The OSPAR Commission guidance outlines five main elements to assist in interpreting the concept of an ecologically coherent MPA network. The principles which underpin an ecologically coherent network are widely accepted and supported by the scientific community and by the administrations.*

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[2] Joint Administrations Statement. 2012. UK Contribution to Ecologically Coherent MPA Network in the North East Atlantic. Available at: http://www.scotland.gov.uk/Resource/0041/00411304.pdf

[3] Identifying the remaining MCZ site options that would fill big gaps in the existing MPA network around England and offshore waters of Wales & Northern Ireland. Available at: http://jncc.defra.gov.uk/page-6658

[4] Assessing progress towards an ecologically coherent MPA network in Secretary of State Waters in 2014, JNCC, November 2014. Available at: http://jncc.defra.gov.uk/pdf/JNCC_NetworkProgressInSoSWaters_2014.pdf

[5] OSPAR Commission (2006). Guidance on developing an ecologically coherent network of OSPAR marine protected areas. No. 2006-03. Available at: http://jncc.defra.gov.uk/pdf/06-03e_Guidance%20ecol%20coherence%20MPA%20network.pdf

The five main OSPAR principles guiding the process are:

Features: *Sites should represent the range of species, habitats and ecological processes in the area. The proportion of features included in the MPA network should be determined on a feature-by-feature basis, considering whether features that are in decline, at risk or particularly sensitive are of a higher priority and would benefit from a higher proportion being protected by MPAs.*

Representativity: *To support the sustainable use, protection and conservation of marine biological diversity and ecosystems, areas which best represent the range of species, habitats and ecological processes.*

Connectivity: *This may be approximated by ensuring the MPA network is well distributed in space and takes into account the linkages between marine ecosystems.*

Resilience: *Adequate replication of habitats, species and ecological processes in separate MPAs in each biogeographic area is desirable where possible. The size of the site should be sufficient to maintain the integrity of the feature for which it is being selected.*

Management: *MPAs should be managed to ensure the protection of the features for which they were selected and to support the functioning of an ecologically coherent network."*

JNCC previously provided advice to Defra on the criteria to be used for assessing progress towards a network of MPAs in SoS Waters through both the MCZ Ecological Network Guidance (ENG)[6] and previous MPA network assessments[3,4]. These criteria took into account the OSPAR MPA network principles (for those where appropriate information was available) and wider guidance published by the OSPAR Commission. In 2016, Defra asked JNCC to provide updated advice on these MPA network criteria. JNCC completed a review, in particular to determine if there was any recent scientific advice that could update the ENG and build on those criteria used for previous assessments. From this review JNCC provided Defra with a set of recommendations on proposed criteria for this 2016 assessment (Annex 1). These criteria were agreed with Defra in May 2016.

JNCC note the criteria for this current assessment only use the four of the OSPAR principles: Features, Representativity, Resilience and Connectivity. JNCC's assessment in 2016 did not consider the criterion 'Management' to assess whether the existing MPAs in SoS waters have the necessary management (of human activity) in place to deliver their conservation objectives.

2.1 Assessment criteria by feature type

The assessment criteria encompassed the OSPAR network principles (outlined above) on a feature-type basis, tailored to the different network requirements for broadscale habitats compared to habitat and species Features of Conservation Importance (FOCI). Representativity and replication were assessed for all features on the MCZ features list. Only broad-scale habitats were also assessed in terms of adequacy (the amount of feature protection in a region).

[6] Natural England and the Joint Nature Conservation Committee (2010). *The Marine Conservation Zone Ecological Network Guidance*. Sheffield and Peterborough, UK. Available at: http://jncc.defra.gov.uk/pdf/100705_ENG_v10.pdf

For the purposes of this present assessment, JNCC identified a *gap* in the MPA network if any of the following criteria were ***not*** met:

I. Where present, each MCZ feature (broad-scale habitats and FOCI) should be represented within the MPA network in each Charting Progress 2 (CP2) biogeographic region [in SoS waters];

- This criterion is relevant to the OSPAR principle of **representativity**.

II. Where present (and practicable) each broad-scale habitat (at EUNIS Level 3) should be represented in the intertidal, the shallow inshore and deeper shelf areas of each CP2 biogeographic region;

- This criterion is relevant to the OSPAR principle of **representativity**.

III. At least two viable examples of each broad-scale habitat (at EUNIS Level 3) are protected within the MPA network in each CP2 biogeographic region;

- Ensures that all broadscale habitats (equivalent to the current EUNIS level 3 habitats) are represented within the network in each biogeographic region. This criterion is relevant to the OSPAR principle of **representativity**; and,
- Ensures a degree of replication of broadscale habitats within the network. This criterion is relevant to the OSPAR principle of **resilience**.

IV. At least three viable examples of each Feature of Conservation Importance (FOCI) are protected within the MPA network in each CP2 biogeographic region;

- Ensures that rare and/or threatened species and habitats are afforded specific protection within the network,
  This criterion is relevant to the OSPAR **features** principle; and,
- Helps ensure replication of rare and/or threatened species and habitats within the network;
  This criterion is relevant to the OSPAR **resilience** principle.

V. The proportion by area of each broad-scale habitat within MPAs should exceed the minimum OSPAR network guideline (10% of known area), and ideally attain the targets set out in the ENG[6] for the level of 70% of species known from that habitat[7] within each CP2 region [in SoS waters].

- The proportion of each broadscale habitat afforded protection within the network (known as 'adequacy') is relevant to the OSPAR **features** principle; and,
- Ensures that an appropriate amount of each habitat is represented within the network for it to be effective and ecologically viable.

VI. At least 80% of MCZs for broad-scale habitats should have a minimum diameter of 5 km with the average size being between 10 and 20 km in diameter (or equivalent

[7] An full explanation is presented in Section 4.4.4 and Annex 4 of the Ecological Network Guidance. An approach was used to estimate the proportion of the total area of a habitat that would likely cover 70% of all the species known to occur within that habitat. The calculations use species-area curves derived from all the sample data we held for each habitat type. The proportions were calculated for incremental steps in the percentage of species (50%-90%). JNCC advised Defra that the 70% band equates to the 'majority' of the species and should be used to inform the percentage area targets for the broadscale habitats (see Annex I).

areas from a polygon shape). Patches of FOCI within MCZs should have a minimum diameter (as set out in the ENG);

- MPAs of viable shape and size should maintain the integrity of its features and contain areas of habitat larger enough to sustain species that live attached to the seabed with low of limited mobility. The size of an MPA or feature within an MPA (known as 'viability') is relevant to the OSPAR **features** principle.

VII. Sites affording protection to the same broad habitat type (equivalent to EUNIS Level 2) should not be further than 80km apart to increase the likelihood that sites with similar features are ecologically connected to each other;

- Applying a basic distance separation criterion assesses the likelihood that sites with similar features are ecologically connected to each other, which is relevant to the OSPAR **connectivity** principle.

VIII. Sites should be evenly distributed across different depth zones.

- This criterion is relevant to the OSPAR principle of **representativity** and also has links to the principle of **connectivity**.

3 Scope of the assessment and data available

The scope of the network assessment was defined by the geographic extent of the Defra Secretary of State (SoS) Waters, the features relevant to MPA-based conservation in the ENG[6], the biogeographic regions and MPA designation types occurring in SoS Waters. Datasets listing the sites and protected features in SoS Waters and the wider Charting Progress 2 (CP2) regions were collated to inform the assessment. For the purposes of this study, the extent of SoS waters did not include the UK offshore waters around Wales as the responsibility for nature conservation over this area is likely to transfer to Welsh Government in the near future.

3.1 Biogeographic regions

OSPAR guidance suggested the network should take biogeographic variation into account when considering features. In line with the approach taken for the 2013 and 2014 assessments, the current work used the CP2 reporting regions that overlap with Secretary of State Waters as a proxy for biogeographic regions for MPA network assessment (see Figure 1). These regions are:

- Northern North Sea;
- Southern North Sea;
- Eastern Channel;
- Western Channel and Celtic Sea;
- Irish Sea.

The Northern North Sea includes both Scottish and English waters, the Western Channel and Celtic Sea includes both English and Welsh waters and the Irish Sea includes English, Welsh, Northern Irish and Scottish waters. Consequently, there are MPAs outside of Secretary of State Waters whose data have been included within the assessment.

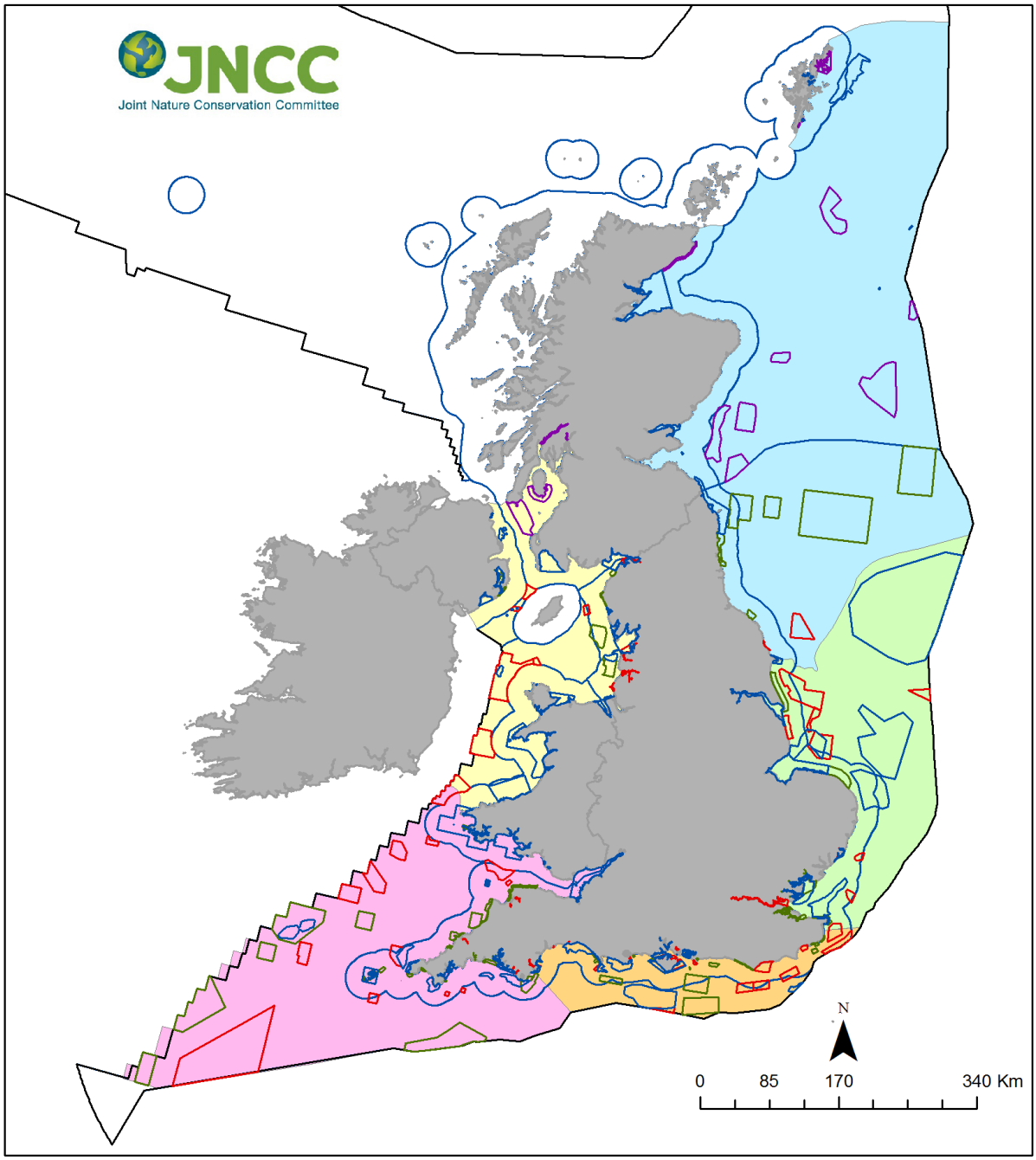

Figure 1. A map showing the CP2 regions and the MPAs included within the 2016 analysis. Note there are further MPAs in northern and western waters of the UK, and in waters around the Isle of Man that were not included in the present analysis.

3.2 Features for consideration

Features for consideration in this assessment were:

- Intertidal and subtidal broad-scale habitats (Littoral rock and other hard substrata, Littoral sediments, Infralittoral rock and other hard substrata, Circalittoral rock and other hard substrata, Sublittoral sediment, Deep-sea bed); and
- Habitat and Species Features of Conservation Importance (FOCI).

These features are listed in the Ecological Network Guidance (ENG)[6]. The FOCI comprise OSPAR Threatened and/or Declining habitats and species[8] and Section 42 habitats and species from the Natural Environment and Rural Communities Act 2006[9]. The assessment only included habitats and sessile or low-mobility species (which are considered suitable for protection in MPAs); birds and other mobile species were not considered[10].

Broad-scale habitats were used as a proxy for representing the full range of habitat features within SoS Waters in the absence of complete coverage of more detailed habitat data. In reality some broad-scale habitats occur across a range of physical conditions resulting in many more detailed biotopes present (at EUNIS level 4 and beyond). If there are only a limited number of MPAs protecting a given broad-scale habitat (or a limited total extent of habitat within them), there is a reasonable likelihood that the full range of more detailed biotopes known to comprise that habitat would not be encompassed by the MPAs. This last point was kept in mind when undertaking this assessment and reviewing the results. Taking this extra level of detail in account enabled JNCC to assess the likelihood of the existing sites representing the range of marine flora and fauna known to occur within SoS waters.

This assessment considered the presence and extent of broad-scale habitats within MPAs across biological zones (biozones) predicted in EUSeaMap[11]. These zones divide the subtidal region into the shallow versus deeper shelf areas of the continental shelf (Figure 2)[12]. Using biozones allowed JNCC to better assess the likelihood that existing MPAs represent the marine flora and fauna of both the deeper, offshore areas of SoS waters as well as shallower, inshore waters.

[8] OSPAR Commission (2008). OSPAR List of Threatened and/or Declining Species and Habitats. Ref No. 2008-6. Available online at: http://www.ospar.org/documents?d=32794

[9] Section 42 of the Natural Environment and Rural Communities Act 2006 is available online at: http://www.legislation.gov.uk/ukpga/2006/16/section/42

[10] Birds and other mobile species are a considered a valid component of an ecologically coherent network, but these are not being assessed while SPA and SAC designations are ongoing.

[11] JNCC (2015). EUSeaMap2 (2015) Interim draft North and Celtic Seas biozones.

[12] The division between shallow and shelf waters is defined by a 1.5 to 2.5 wave base (wave length/water depth) fuzzy threshold, predicted using wave energy models and bathymetric data. For more information see the following report and technical appendixes: Cameron, A. (ed). (2012). EUSeaMap maintenance report - preparatory action for development and assessment of a European broad-scale seabed habitat map final report. Available online at: http://www.emodnet-seabedhabitats.eu/outputs

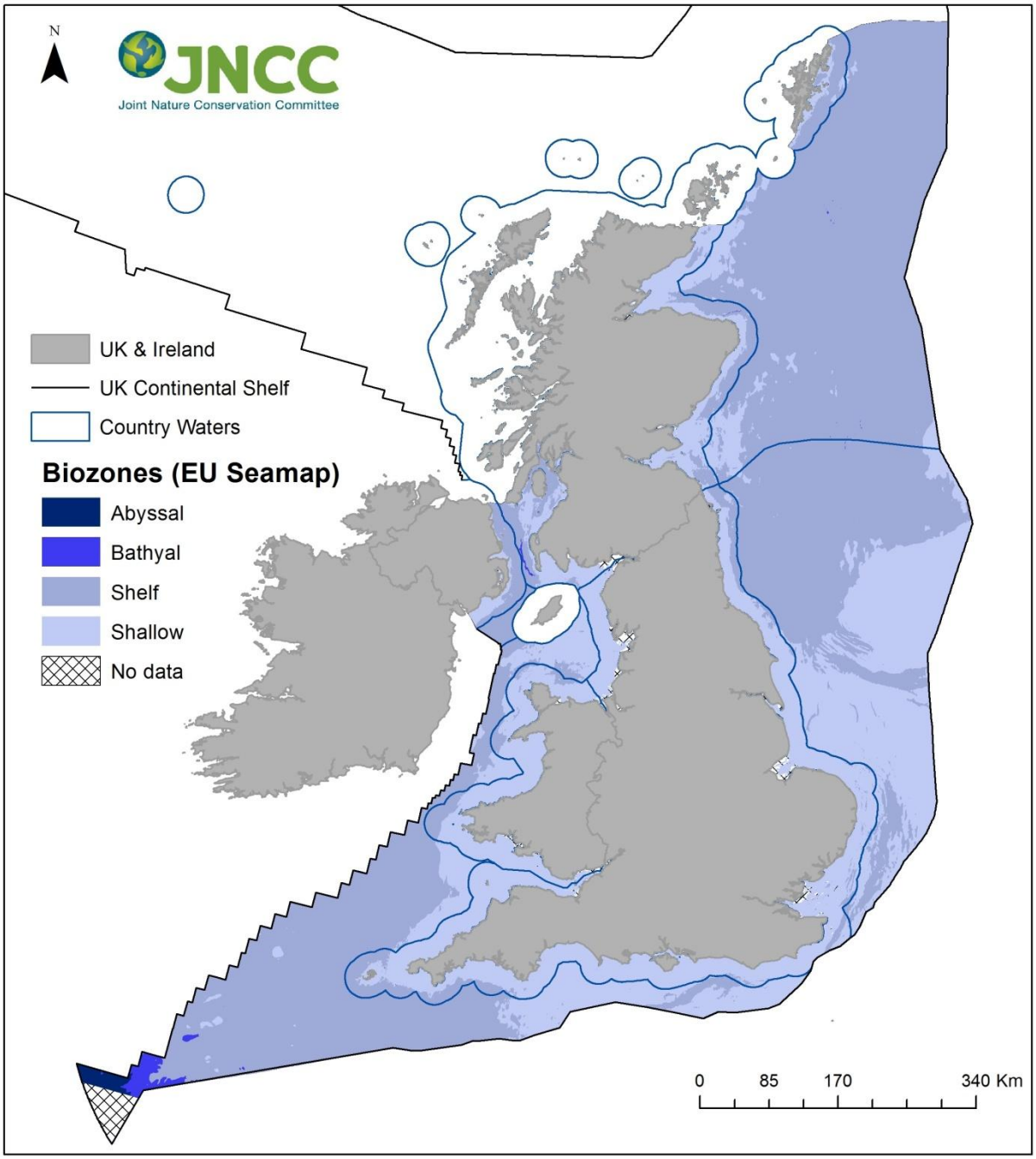

Figure 2. Biological zones in the CP2 regions overlapping with SoS waters, dividing subtidal waters by wave base (shallow versus shelf) and deep-sea waters by seabed depth (bathyal versus abyssal).

3.3 Marine Protected Areas

The following MPA designation types included in the 2016 assessment, and are shown in Figure 1:

- Special Areas of Conservation (SACs);

- Marine Conservation Zones (MCZs);
- Nature Conservation MPAs (NCMPAs).

Additional subsets of data were provided for the following MPA designation types in SoS waters:

- Sites of Special Scientific Interest with marine components (SSSIs) – those SSSIs with marine components making an additional contribution to the MPA network in England (beyond the coverage of the MPAs listed above)[13]; and
- Ramsar Sites – those Ramsar Sites with marine components making an additional contribution to the MPA network in England (beyond the coverage of the MPAs listed above).

The following MPA designation type was not included within the assessment:

- Special Protection Areas (SPAs) – a site-by-site assessment of non-avian marine features afforded protection in each SPA has not yet been undertaken by the Statutory Nature Conservation Bodies;

SSSIs, Ramsar Sites, SPAs and ASSIs afford protection to substantial areas of the intertidal zone, so it is worth noting that the inclusion of only a subset of these sites could underestimate the current degree of protection to this zone within the current MPA network beyond England. However, many of these designation types overlap and underpin others already included in the assessment (particularly ASSIs/SSSIs and Ramsar Sites underpin some SACs) a sizeable amount of their protection would have already been taken into account in this assessment. JNCC note that some SPAs and Ramsar Sites may offer protection to subtidal features. Most management in a SPA will focus on the avian qualifying features and so may not convey full protection to the habitat or benthic species features within the site.

3.4 Protected features of MPAs

An assessment of the contribution of the MPA network requires data on the features afforded protection within the existing MPA network. JNCC used the most up-to-date protected feature data available, however the work to catalogue MPA protected features is at different stages of completion for each designation type and country. Consequently, JNCC collated data from a variety of sources compiled at different dates.

3.4.1 Compiling a catalogue of protected features

JNCC and the Statutory Nature Conservation Bodies (SNCBs) have been undertaking a UK MPA Stocktake exercise to create a standardised catalogue of features protected in UK MPAs. This catalogue provided the most up-to-date protected feature data and was used whenever possible in the present analysis. Datasets already completed and submitted through the UK MPA stocktake were used in this assessment (up until March 2016). Data were available for:

- All offshore MPAs (SACs, MCZs and NCMPAs);

[13] Site-by-site assessments of the marine habitats and species protected in Welsh, Scottish, Northern Irish and other English SSSIs and Ramsar Sites have not yet been undertaken and so data were not avialable for inclusion in the analysis.

- SACs in Welsh inshore waters; and,
- SACs in Scottish inshore waters.

Interim datasets provided for the purpose of this assessment (but still being finalised for the UK MPA stocktake) were available for:

- SACs and MCZs in English inshore waters; and,
- Subsets of SSSIs and Ramsar Sites with marine components in English inshore waters.

Datasets provided for the 2014 Defra network assessment[3] cataloguing only subtidal features were used for:

- SACs and MCZs in Northern Irish inshore waters; and,
- NCMPAs in Scottish inshore waters.

The UK MPA stocktake exercise has a step built into the process to ensure the features protected within the MPAs are *representative examples* that should be considered as contributing a *replicate* to the MPA network. As some of the data used in the assessment were derived from earlier sources prior to this step, JNCC assumed that the protected MPA features identified in the datasets supplied by the SNCBs also comprised viable replicates of those features.

3.4.2 Spatial extent of features not listed in the MCZ Ecological Network Guidance

The boundaries of SACs are often much larger than the extent of their component Annex I features within the site, and so do not necessarily clip tightly to delineated feature extents. Calculating the area of broad-scale habitats protected in these SACs based on the site boundaries would lead to overestimation in the amount of habitat protected. To overcome this issue, the delineated Annex I feature extents within sites were readily available for offshore and Welsh SACs, and so adequacy calculations used this feature-level approach in these sites. Elsewhere, designated feature delineations for SACs and also Nature Conservation MPAs (NCMPAs) in Scotland were not readily available and therefore site boundaries were adopted as a proxy for the spatial extent of protection in all other MPAs.

3.5 Broad-scale habitats map

A broad-scale habitat map[14] was used to undertake calculations of the areal extent of broad-scale habitats to assess the proportion of features protected; these calculations assess progress against the criterion for adequacy. This map (henceforth the 'Combined Map') integrated data from field survey maps, an updated version of EUSeaMap 2012[15], and a recent map product of rock in the English Channel and Celtic Sea[16]. The Combined Map is a single flat layer without overlaps between habitats or component datasets, making it suitable and efficient for area calculations. This map was used to calculate habitat cover within MPAs where feature-level data were not available (see Section 3.4.2 above).

[14] JNCC (2015). EUNIS habitats: full-coverage EUNIS level 3 layer integrating maps from surveys and broad-scale models version 9.6.1.
[15] Using the latest biozone data: JNCC (2015). EUSeaMap2 (2015) Interim draft North and Celtic Seas biozones.
[16] Diesing, M. *et al*. (2015). Semi-automated mapping of rock in the English Channel and Celtic Sea. JNCC report No. 569. Available online at http://jncc.defra.gov.uk/pdf/569_web.pdf

3.6 Potential options to fill gaps

JNCC considered a scenario where site options that could potentially be designated in a Third Tranche of Marine Conservation Zones (MCZs) (hereafter known as T3 options) were treated as if they were designated sites. These T3 options comprised both adding features to existing MCZs and some of the remaining recommended MCZs from the Regional MCZ Projects. Such T3 options were determined by Defra, JNCC and Natural England using JNCC's 2014 analysis of the MPA network in SoS waters[4] and those remaining rMCZs not previously designated. T3 options were then chosen on the basis of whether the site could fill a network gap and whether sufficient data were available for the site to be realistically taken forward for potential designation.

This second scenario would help Defra visualise any remaining shortfalls that may require new additional areas being identified beyond those T3 options to complete the network.

3.7 Limitations of the MPA data

JNCC identified the following limitations to the information currently available to inform the assessment:

- The assessment did not incorporate data for features protected within SPAs and the majority of SSSIs/ASSIs and Ramsar Sites. Therefore the assessment may have identified shortfalls for features (particularly intertidal features) that are already afforded adequate protection by these MPA designation types beyond England.
- The assessment did not incorporate data for the intertidal features of Scottish NCMPAs or SACs and MCZs in Northern Irish inshore waters. Therefore gaps may have been erroneously identified for intertidal features in the Irish Sea CP2 region that could already be afforded protection in these existing MPAs.
- The assessment used data from a variety of sources of different ages to compile a catalogue of protected features in the existing MPA network. Work is ongoing to build a standardised UK-wide inventory of the entire MPA network (the UK MPA stocktake); the gaps identified in this assessment may be subject to change once this work is complete, providing a more comprehensive and consistent view of the MPA network.
- Input data sources represent the best available data at a snapshot time (Spring 2016). Our understanding of features in MPAs will change over time as new data are gathered. Datasets collated from marine surveys are particularly subject to change as new data become available on a frequent basis. As information is updated on the features present within MPAs in both SoS waters and wider CP2 regions, there is potential for any shortfalls in the MPA network identified in this assessment to also change.

The following limitations apply to the Combined Map specifically:

- The map includes large areas where the habitat distribution is derived from habitat models or interpolation of widely spaced data, and where there may be limited ground-truthing of acoustic data.
- The map is missing intertidal broad-scale habitat data around Northern Ireland and around some parts of Scotland in the Irish Sea CP2 region. Some subtidal broad-scale habitats are missing in near-shore areas around England and Scotland in the Irish Sea and Western Channel and Celtic Sea CP2 regions.

- Some broad-scale habitats designated in existing MPAs were not shown within the site in the Combined Map since their data have yet to be added to the source data sets of the map, or are point data only.
- It is a broad-scale map with a coarse spatial resolution. Habitats typically occurring at a fine scale (e.g. Sublittoral macrophyte-dominated sediment) are likely to be under-represented in these maps and their extent would therefore be underestimated in the analysis.

4 Method for assessing gaps

Each broadscale habitat feature and Feature of Conservation Interest (FOCI) was assessed against the MPA network criteria set out above with a yes/no outcome indicating whether the criterion was met. JNCC use these results to conclude whether or not a shortfall occurred (against any of the criteria) for the given MPA feature. These shortfalls were then reviewed by JNCC and NE to check their validity and to confirm whether they constitute a 'gap' in SoS waters. The outcomes of these more detailed investigations resulted in shortfalls either being identified as a confirmed 'gap' or a 'potential gap'. The latter scenario occurring where a shortfall occurred across a CP2 region where other countries had jurisdiction and although a further contribution on SoS waters could help address this gap, SoS waters was already contributing a proportionate amount to the network.

4.1 Assessment of the MPA network against network criteria

Criteria I - Where present each MCZ feature (broad-scale habitats and FOCI) should be represented within the MPA network in each Charting Progress 2 (CP2) biogeographic region [in SoS waters].

Criteria III - At least two viable examples of each broad-scale habitat (at EUNIS Level 3) are protected within the MPA network in each CP2 biogeographic region.

Criteria IV - At least three viable examples of each Feature of Conservation Importance (FOCI) are protected within the MPA network in each CP2 biogeographic region.

To assess these representation and replication criteria, tables of broad-scale habitats and FOCI were created by CP2 region to identify all of the MPAs in which these features were protected, from which the number of replicates could then be counted. These tables where used to populate replication and representation data in a decision-support tool (based on an pivot table) provided to Defra.

If there were no sites within the CP2 region affording protection to an MPA feature then a gap in representativity was identified. In these circumstances one further example would need to be designated to meet the minimum network requirements for representation. If there was one site within the region affording protection to a broad-scale habitat, or only

one-to-two sites within the region affording protection to a FOCI, then further replicate(s) would need to be designated to meet the minimum network criteria for replication.

In cases where a MPA straddled the boundary between two CP2 regions, the mapped location of protected broad-scale habitat features was examined in the Combined Map to determine for which region(s) the site should count as a replicate for each feature. The presence of any amount of habitat within a given CP2 region within the site was considered sufficient to qualify as a replicate. If the habitat was missing from both CP2 regions within the site (because of limitations with the Combined Map) then it was considered a replicate in both regions[17].

Any overlap between the boundaries of two MPAs in which the same MPA feature(s) was protected was also considered when determining the total number of replicates of a feature to avoid double-counting. The mapped location of a given broad-scale habitat feature protected in two overlapping sites was examined using the Combined Map to confirm if the habitat occurred in the area of overlap between the sites. If the duplication in protection was confirmed then only one replicate was counted from the two sites (regardless of the size of the overlap in area terms). There were no known cases of overlaps in MPA boundaries affecting the counts of FOCI replicates.

Limitations

- For both broad-scale habitats and FOCI occurring in the intertidal zone, this present assessment may have identified gaps where these features are already afforded sufficient representation and replication in the region by MPAs in inshore Northern Irish waters and NCMPAs in inshore Scottish waters.
- It was beyond the scope of the assessment to examine the spatial configuration of replicates, therefore cases of nuanced habitat configurations that might increase or decrease the number of replicates cannot be ruled out. For example, where habitat features might run contiguously between close but geographically separated MPAs, which might result in these features being considered the same replicate.

Criteria II - Where present (and practicable) each broad-scale habitat (at EUNIS Level 3) should be represented in the intertidal, the shallow inshore and deeper shelf areas of each CP2 biogeographic region.

To better represent the full range of biodiversity in SoS Waters, this element of the assessment considered the presence and extent of broad-scale habitats within MPAs across biological zones (biozones), using data from EUSeaMap[18]. These zones divide the subtidal region into the shallow versus deeper shelf areas of the continental shelf[19]. This allowed JNCC to assess the likelihood that existing MPAs represent the marine flora and fauna of deeper, offshore areas of Secretary of State Waters together with the shallower, inshore waters.

[17] There were no cases of Scottish or Northern Irish MPAs straddling two CP2 regions, and no significant cases of an English MPA protecting a FOCI also straddling two CP2 regions.
[18] JNCC (2015). EUSeaMap2 (2015) Interim draft North and Celtic Seas biozones.
[19] The division between shallow and shelf waters is defined by a 1.5 to 2.5 wave base (wave length/water depth) fuzzy threshold, predicted using wave energy models and bathymetric data.

Representation, replication and adequacy were assessed relative to shallow and shelf biozones within the subtidal region, providing a more refined picture of the protection afforded to marine biodiversity by broad-scale habitats in the MPA network. The biozones were overlaid with site boundaries to determine whether broad-scale habitats protected in MPAs occurred in the shallow and/or shelf biozone. Counts of broad-scale habitat replicates per biozone were then assessed relative to the target of two replicates per CP2 region (criteria ii). The biozones were also included in the adequacy spatial analysis, providing a breakdown of the percentage (by area) of each broad-scale habitat protected in shallow and shelf waters. These results provided a quick comparison of the MPA network in shallow versus deeper areas of the continental shelf.

As intertidal broad-scale habitats only occur within the intertidal zone, it can be assumed that this criterion is met as long as all intertidal habitats where known to occur are represented in the MPA network in each CP2 region

Criteria V - The proportion by area of each broad-scale habitat within MPAs should exceed the minimum OSPAR guideline (10%), and ideally attain the targets set out in the Ecological Network Guidance (ENG) (for 70% of species level) within each CP2 region [in SoS waters].

JNCC calculated the area of each broad-scale habitat present within each CP2 region and in SoS waters, together with the area of each habitat that was afforded protection within existing MPAs. The first step in this spatial analysis divided the Combined Map into to the various geographic units required for assessment:

- CP2 regions as a whole
- SoS waters, subdivided by CP2 region

Units for calculating total areas of habitats protected in MPAs (in addition to the above):

- MPA boundaries
- Annex I feature extents in Welsh and offshore SACs

The areas of broad-scale habitats were then calculated for each of these units in Microsoft SQL-Server Management Studio (2008 R2)[20]. The total areas of broad-scale habitats present within each CP2 region were calculated by summing together the areas of all habitat polygons found in the Combined Map for each region or section of SoS waters. The total areas of habitats protected in MPAs were calculated by adding together the areas of habitat polygons within MPA boundaries (MCZs, NCMPAs and English, Scottish and Northern Irish SACs) and within Annex I feature extents (Welsh and offshore SACs only)[21]. Habitat areas were then cross-referenced with the source data listing those broad-scale habitats afforded protection by each of the MPAs to ensure that habitats were excluded if they were present within a site but not formally protected. The areas of broad-scale habitats afforded protection in overlapping MPAs were included only once. Further details on the methods used to calculate broadscale habitat areas are given in Annex 2.

[20] Area estimates were calculated in Albers Equal Area Conic Projection with modified standard parallels.
[21] The overlap between Annex I feature extents within MPAs was accounted for in the analysis; duplicate habitat areas were removed.

The percentage (by area) of habitat protected in MPAs, relative to the total area of habitat occurring in and beyond MPAs, was used to determine any shortfalls against the adequacy criterion in each CP2 region. For those CP2 regions containing other countries' waters JNCC took a further step to subdivide by country to only consider the SoS waters part of the CP2 region. A shortfall was flagged in cases where less than 10% of a broad-scale habitat was protected in MPAs and also where the targets set out in the ENG were not yet achieved. A shortfall was not considered a gap if either of these targets were not met but the total area of the broad-scale habitat in the CP2 region or in SoS waters was minimal (< 0.1% of the region or section of SoS waters). This rule was based on the assumption that any area of unprotected habitat occurring outside of existing MPAs would be tiny and unlikely to be suitable for further protection.

JNCC advised Defra about the degree of uncertainty in the energy layers contained within EUSeaMap (a component of the Combined Map) and that the application of this finer scale information for calculating the areas of rock habitats could result in adequacy gaps being identified erroneously, particularly for subtidal (infralittoral and circalittoral) rock habitats where modelled data may be more prevalent than survey data. The adequacy of subtidal rock habitat protection was also assessed at the coarser resolution of broad habitat (EUNIS level 2) (*Infralittoral rock* and *Circalittoral rock*), where energy is not a factor. Results at broad-scale habitat are still presented the results report, but conclusions on whether any network gaps remain were based on the aggregated broad habitat assessment.

Limitations:

- Data for some broad-scale habitats protected in existing MPAs were not shown within the site in the Combined Map. The contribution of these features could not be assessed and consequently their extent was underestimated. Correspondingly, the extent of habitats shown in their place within the Combined Map will have been overestimated.
- Many parts of the Combined Map are derived from habitat models or interpolations of widely spaced data, and in a minority of other locations data may be lacking altogether (see Section 3.7). These factors limited the accuracy of habitat area calculations and in some cases low confidence data will have informed the identification of an adequacy shortfall. Scrutiny of these data (following this assessment) may reveal that this evidence is inadequate to support further designation of the feature, and therefore it may not be possible to address any gap in the network.
- In cases where the extent of Annex I or Scottish NCMPA features were not available, the analysis assumed that protected broad-scale habitat features of MPAs were afforded protection to their entire extent within site boundaries[22]. In practice a broad-scale habitat will only be protected where the designated feature is present within the site. Therefore the number and area of habitats may have been overestimated in SACs and NCMPAs where the extents of designated Annex I and Scottish priority marine features (respectively) may not encompass all of the habitats found within the site boundary[23]. Likewise, small patches of broad-scale habitats that do not constitute viable replicates will have contributed to adequacy calculations where site boundaries were used to determine the extent of broad-scale habitats protected in MPAs.
- The areas of broad-scale habitats that typically occur as small patches or within narrow depth bands such as *Sublittoral macrophyte-dominated sediment* are likely to have been

[22] Applies to MCZs, NCMPAs and English/Scottish/Northern Irish inshore SACs only. Welsh and offshore SACs were assessed using Annex I feature extents and therefore this limitation did not apply.
[23] The assumption is safer for MCZs in which broad-scale habitats are formally designated features of the sites and therefore mapped extents of broad-scale habitats in the Combined Map will align well with designated features and the actual area of protected habitat.

underestimated. These habitats may be under-represented in a coarse resolution map such as the Combined Map.

Criteria VI - At least 80% of MCZs for broad-scale habitats should have a minimum diameter of 5 km with the average size being between 10 and 20 km in diameter (or equivalent areas from a polygon shape). Patches of FOCI within MCZs should have a minimum diameter (as set out in the ENG).

The size of MPAs (across all MPA designation types) in the relevant CP2 regions were calculated using ArcGIS v10.1[1]. Only those MPAs which protected broad-scale habitats were assessed (167 sites in total). The average size of sites across all CP2 regions was calculated to determine whether a 5km minimum diameter threshold was met (equating to an approximate area of 19.6km^2), and then whether 80% of the sites met this threshold. The results were considered in combination with the results from the proximity assessments undertaken for principle of Connectivity to provide a complete picture of size and distribution of sites.

JNCC concluded it was not necessary to assess the FOCI patch size within MCZs against the ENG minimum diameters. Apart from the complexity of such an exercise, JNCC assumed that only viable examples of features would have been selected for designation within MPAs. For all features protected through association with designated features, the UK MPA stocktake exercise includes a step to ensure those features protected within the MPAs are representative viable examples that could be considered as a replicate in the MPA network. Consequently, JNCC assumed that the protected MPA features identified in the datasets supplied by the SNCBs comprised viable replicates of those features. For MCZs in particular this factor would have been taken into consideration when sites were identified and designated.

Limitations:

- The area benchmark of 19.6km^2 was calculated on the basis of a hypothetical spherical MPA whilst in practice MPAs are not spherical and therefore applying a benchmark diameter of 5km (and the benchmark 19.6 km^2 area derived from it) is crude, especially in the case of marine sites that often follow naturally long and narrow physiographical features such as estuaries.
- A general view expressed in the literature is that larger MPAs can deliver more conservation benefits. Recognising both socio-economic and spatial constraints in inshore areas this approach may not always be possible.
- Although all sites were assessed against this criterion it should be considered a 'soft target' because this was set out in the ENG for MCZs only. Other designation types such as SSSIs and Natura sites may be smaller because there size criteria did not apply to their designation type.

Criteria VII - Sites affording protection to the same broad habitat type (equivalent to EUNIS

[1] Area estimates were calculated in Albers Equal Area Conic Projection with modified standard parallels.

Level 2) should not be further than 80km apart to increase the likelihood that sites with similar features are ecologically connected to each other.

JNCC undertook a simple assessment of connectivity using ArcGIS to examine the spatial distance between the MPAs that protected the same broad features. This high level assessment uses proximity of the broadscale habitats as a proxy to assume similarity between habitats and species composition due to the complex and feature specific nature of the connectivity principle. Five data layers were constructed to show the MPAs affording protection to the following five broad habitats:

- Littoral rock and other hard substrata;
- Littoral sediment;
- Infralittoral rock and other hard substrata;
- Circalittoral rock and other hard substrata; and,
- Sublittoral sediment.

Buffers of 40km radius[24] were applied to site boundaries in ArcGIS for each of the MPAs protecting the same broad features in these layers. JNCC identified any spatial gaps of more than 80km between the broad habitats in these sites. Sites were deemed not connected when the buffers between two adjacent existing sites holding the same habitat did not meet. Areas of CP2 regions or SoS waters that did not fall within these buffers but where the habitat was known to be present were flagged as gaps that could be addressed.

Limitations:

- This analysis assumes that linear distance (or proximity) between MPAs is the only factor affecting connectivity. In reality connectivity is very complex influenced by a number of physical factors (such as tidal and oceanographic currents) and biological factors (e.g. location and productivity of propagule source areas) and will vary between habitats and species.

Criteria VIII – Sites should be evenly distributed across different depth zones.

To further understand the relative protection to shallow versus deeper waters in the MPA network, JNCC undertook a simple assessment of the distribution of MPAs in relation to seabed depth bands. This analysis used bathymetry as a proxy for the different biotopes/species known to occur in the deeper waters of the CP2 regions. Depth bands of 0-10m (coastal zone); 10-75m (shelf seas); 75-200m (deeper shelf seas); and 200-2000m (slope/upper bathyal zone) were selected; these zones followed a recent study of the

[24] The 80km spacing was identified by Roberts et al (2010) as a guideline for the greatest distance between sites supporting similar habitats to ensure sufficient ecological connectivity. Roberts, C.M., Hawkins, J.P., Fletcher, J., Hands, S., Raab, K. and Ward, S. 2010. Guidance on the size and spacing of Marine Protected Areas in England. NECR037, Sheffield: Natural England, 2010. Available at: http://publications.naturalengland.org.uk/publication/46009

ecological coherence of the OSPAR MPA network[25]. Site boundaries were overlaid onto EMODnet bathymetric data[26] to calculate the percentage (by area) of each depth band occurring within MPAs per CP2 region.

4.2 Reviewing shortfalls to identify gaps

JNCC and NE further investigated any shortfalls generated by the analysis, to assess whether they could be considered a confirmed 'gap' in the network. The limitations identified above clearly offer potential for shortfalls to appear but on further investigation are erroneous. Defra requested clear advice on any gaps for which some further action could be taken in a further tranche of MCZ designations.

JNCC and NE reviewed all apparent MPA network shortfalls for both broad-scale habitats and FOCI to verify whether these could be practically addressed in Secretary of State Waters, thereby confirming any gaps. In some cases the assessment process had suggested representation/replication shortfalls for a feature at either/both the wider CP2 region scale and at SoS waters scales, yet closer examination revealed that these shortfalls cannot be addressed as:

- There are either no records of the feature or no further records beyond those already protected in MPAs the SoS waters part of the region; or,

- There is limited or no evidence for any viable patches/populations that are not already protected by MPA(s).

JNCC and NE used the following sources to check for evidence of the FOCI occurring in areas outside of existing MPAs:

- UK offshore habitat features of conservation importance layers (JNCC draft v.0.3);
- Marine Recorder snapshot version 5.1[27];
- Natural England Marine Evidence Base (2016); and,
- OSPAR data base of threatened and declining species and habitats (2015).

Limitations:

- It was beyond the scope of this brief review to thoroughly review every habitat patch or determine the size of all species populations occurring outside of existing MPAs to confirm whether further, (thus far unprotected), viable replicates occurred. Further work on feature viability, and perhaps also further evidence collection, will be required to check that any potential new replicate could offer a viable contribution to the MPA network. Such work might result in changes to the gaps identified by this assessment and brief review.

[25] OSPAR, (2013). An assessment of the ecological coherence of the OSPAR network of Marine Protected Areas. Available online at: http://www.ospar.org/documents/dbase/publications/p00619/p00619_ecological_coherence_report.pdf
[26] EMODnet Digital Elevation Model 2015.
[27] Marine Recorder data are available online at: http://jncc.defra.gov.uk/page-1599

4.3 Determining final outcomes

JNCC provided an overall conclusion as to whether there was any gap in the network for each MCZ feature by CP2 region, or for the SoS waters part of those CP2 regions shared with other countries. Final outcomes in terms were categorised as ‘yes‘, ’no‘, ’potential‘ or ’not applicable‘ according to the circumstances relevant to each MPA feature and in the context of the review of initial potential shortfalls identified (section 4.2). Any feature showing ‘yes’ or ‘potential’ represents a gap in the MPA network in SoS waters.

Broad-scale habitat outcomes summarised the representation, replication and adequacy targets. Defra indicated they would seek to represent each broad-scale habitat within SoS waters and replicate the feature at least twice within those CP2 regions solely contained within SoS waters. For CP2 regions shared with other countries, Defra indicated they would consider further protection of features if closing a replication gap at the CP2 region level was possible or wholly dependent on SoS waters (for example where all known records of a feature outside of existing MPAs occur in SoS waters). These latter cases were considered ‘potential’ gaps. Defra indicated they would seek to adequately protect each broad-scale habitat in proportion to the area of SoS waters within the wider CP2 region. Where these targets were not met a broad-scale habitat gap was identified. Potential gaps were also highlighted where adequacy targets had been achieved in SoS waters but further contributions could be made to help fill any adequacy gaps remaining in the wider CP2 regions shared with other countries.

FOCI outcomes summarised the representation and replication targets. Defra indicated they would seek to represent each of these features within SoS waters, and replicate each feature at least three times within those CP2 regions solely contained within SoS waters. For those CP2 regions shared with other countries, Defra indicated they would consider further protection of features if closing a replication gap at the CP2 region level was possible or wholly dependent on SoS waters (where all known records of a feature outside of existing MPAs occur in SoS waters). These latter cases were considered ‘potential’ gaps.

4.4 Evidence Quality Assurance

The JNCC Evidence Quality Assurance policy and guidance was applied throughout the different stages of this assessment, with quality control checks made to data used in the assessment and quality assurance checks of the both initial results and results presented in the final products. JNCC’s conclusions were reviewed by Natural England (for inshore waters). The final report was reviewed by JNCC’s MPA Sub Group, a non-Executive group of independent scientists who provide oversight and strategic direction to JNCC’s MPA work.

Annex 1 JNCC advice on how to assess progress towards an ecologically coherent network of MPAs in Secretary of State waters - May 2016

Issue

Defra requested advice from JNCC on what criteria should be used in 2016 to assess progress towards the policy target for an ecologically coherent network of MPAs in Secretary of State Waters.

Key points

- In 2010, Defra identified seven MPA network design principles. JNCC and Natural England developed practical guidelines - the Ecological Network Guidance (ENG), to guide the MCZ project. JNCC and Natural England advised that an ecologically coherent network could be achieved by meeting these guidelines along with the further ecological considerations set out in the ENG.
- The ENG was JNCC's and Natural England's statutory scientific advice on how to meet the obligations of the Marine and Coastal Access Act 2009 (particularly Section 123) and Defra's policy target to achieve an Ecologically Coherent Network of MPAs.
- Assessing progress requires *success criteria* with appropriate *targets*. There is no unequivocal scientific evidence to define targets. Similarly, there is no universally agreed scientific/policy judgement on what constitutes an ecologically coherent network.
- In 2013 Defra asked JNCC to assess progress towards the MPA network in Secretary of State waters. Defra requested JNCC follow a set of high-level network criteria that drew on international guidance, mainly that provided by the OSPAR Commission. JNCC used these high-level criteria to identify what were termed 'Big Gaps' in the MPA network at that time. Subsequently a second network assessment was completed in 2014 against a slightly refined set of high-level criteria.
- In Autumn 2015, Defra requested JNCC and Natural England to provide advice on what sites might be required through a third Tranche of MCZs to 'complete' the MPA network in Secretary of State waters. Supporting advice was needed on the criteria for the assessment of progress in 2016, particularly on whether there was any recent scientific information to update the targets set out in the ENG.
- JNCC advise that the criteria discussed below only address four design elements of the OSPAR principles and do not consider the principle of 'Management'. For an MPA network to be considered ecologically coherent, the constituent MPAs must be well managed. The results of the 2016 network analysis cannot be considered a complete picture until the effectiveness of management is assessed.

Background

Defra asked JNCC for advice on the criteria for an assessment of progress towards an ecologically coherent network of MPAs in Secretary of State Waters in 2016. Defra questioned whether the 20% target for feature adequacy used in JNCC's 2014 advice was 'scientifically justified'. JNCC explained that the 20% target was drawn from OSPAR guidance on what constitutes an ecologically coherent network of MPAs that suggested '*Contracting Parties may wish to include 20% of the total extent of each EUNIS level 3 habitat or species population (where considered appropriate) with at least 10% included within the network*'. Whilst the OSPAR guidance took account of prevailing scientific information and opinion, it remains a 'policy target' since there was no clear scientific

evidence to justify the targets. There are other similar 'policy targets' emanating out of international agreements to which the UK is a signatory. For example, the Aichi Biodiversity Target 11[28] of the Convention on Biological Diversity (CBD) calls for 10% of 'coastal and marine waters' to be contained within 'protected areas and other area-based measures'. Similarly, there is no empirical scientific evidence to support a target of 10%. These 'policy targets' should be viewed as societal decisions that represent an acceptable degree of protection within the context of wider sustainable management of the environment.

Research has shown that protecting 10% by area of habitats may not be sufficient to conserve the 'majority' of species and so a higher target for the proportion by area of each habitat feature included within the network may be more appropriate. Using research commissioned during the MCZ Project, JNCC and Natural England estimated the likely proportions of the total number of species previously recorded within each habitat type that would be protected if a proportion of the known extent of that habitat that were included within the MPA network. JNCC and Natural England recommended that the network should aim to protect the *majority* of species known to occur in each EUNIS Level 3 habitat (where we defined 'majority' as 70-80%). We emphasise that the definition of 'majority' to be 70-80% is a *science-based judgement* rather than an unequivocal *scientific fact*. JNCC reviewed more recently scientific information and concluded the advice provided in the ENG generally reflected contemporary scientific views.

There is general agreement across the scientific community that *representativity* and *replication* are fundamental aspects of a MPA network. *Connectivity* is similarly widely accepted as a network concept although there remains limited agreement on its practical implementation. How much of the environmental should be included in a network remains the most difficult and contentious aspect of MPA network implementation. In JNCC's advice on criteria provided alongside advice on the network in 2014, we noted that international policy' guides such as OSPAR, Aichi etc offered 'rules of thumb' rather than hard scientific facts. Whilst the targets for the criteria *adequacy* in the Ecological Network Guidance (ENG) were based on evidence from research, they reflected 'science logic' and judgement to determine the target. There is no clear *scientific evidence* to determine when a MPA network is 'ecologically coherent'; any success criteria will be a societal judgement that will seek a balance between environmental policy and policies covering exploitation of the environment.

If Defra want the final tranche of MCZs to essentially 'complete' their contribution to the MPA network, the criteria to be used in the network assessment need to be agreed to allow any gaps to be identified. JNCC seek confirmation from Defra on what approach we should adopt for the target for *adequacy*: *s*pecifically, whether to adopt an ENG-type approach, or whether to follow the 'international policy' approach with a single target.

Recommendations

JNCC recommends progress with the implementation of a MPA network in Secretary of State waters in 2016 is assessed using the criteria set out below. Such an assessment should identify any shortfalls that could be addressed by a third tranche of MCZ designations.

[28] Aichi Biodiversity Targets come from the CDB's Strategic Plan for Biodiversity 2011-2020: See: https://www.cbd.int/sp/targets/. Target 11 states: *By 2020, at least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes.*

- Where present each MCZ feature (broadscale habitats and FOCI) should be represented within the MPA network in each biogeographic region [of Secretary of State waters];
- Where present (and practicable) each broadscale habitat should be represented in the intertidal, the shallow inshore and deeper shelf areas of each biogeographic region;
- At least two viable examples of each broadscale habitat feature and three viable examples of each Feature of Conservation Importance (FOCI) are protected within the MPA network in each biogeographic region;
- JNCC recommends that viability is assessed against the criteria set out in the ENG; where at least 80% of MCZs for broad-scale habitats should have a minimum diameter of 5 km with the average size being between 10 and 20 km in diameter (or equivalent areas from a polygon shape). Patches of FOCI within MCZs should have a minimum diameter (as set out in the ENG);
- Adequacy is reviewed using the targets set out in the ENG for the 70% of species level (updated new information for deep-sea beds), and presented alongside an assessment against the 10% and 20% by MPA area policy targets;
- Sites affording protection to the same broad habitat (EUNIS Level 2) should not be further than 80km apart to increase the likelihood that sites with similar features are ecologically connected to each other; and,
- Sites should be proportionately distributed across different depth zones.

It is also important to reflect that the principles set out in guidance from the OSPAR Commission on an ecologically coherent network includes Features, Representativity, Resilience, Connectivity **and** Management. The criteria set out above only relate to the first four principles. It is imperative to achieving an ecologically coherent network that MPAs be managed to ensure the features for which they were selected are effectively protected and therefore contribute to the functioning of the network. Appropriate management of human activity needs to be implemented if the target for an 'ecologically coherent network of well-managed MPAs' is to be achieved.

Given prevailing constraints on resources, JNCC suggest there would be a greater conservation gain in the short to medium term for offshore waters though implementing management on existing sites rather than making up shortfalls against all network criteria, particularly *adequacy*.

Annex 2 - Technical details of work undertaken to complete area calculations for assessing adequacy

Calculating the percentage cover of features within each region, the percentage cover of protection provided by the existing MPA network, and the percentage cover of habitat eligible for further protection in each site required the following information:

- Total area of each subtidal broad-scale habitat per Charting Progress 2 reporting region;
- Total area of each subtidal broad-scale habitat within existing MPAs per Charting Progress 2 reporting region;
- Total area of each subtidal broad-scale habitat within each site option per Charting Progress 2 reporting region
- Total area of each Charting Progress 2 reporting region

The source of habitat data was the draft version (dated 1st October 2014) of the *EUNIS level 3 seabed habitat map integrating data originating from maps from field surveys and the EUSeaMap model* (henceforth called the 'Combined Map'). The Combined Map has greater detail than the EUSeaMap model of seabed habitats[29] and was used to calculate habitat cover within MPAs (SACs, NCMPAs, MCZs and MCZ/rMCZ site options), and habitat cover outside of MPAs at the regional scale. However, the biozone attribute of the EUSeaMap model (2012 version) giving broad depths (shallow, shelf/offshore, bathyal and abyssal) was merged into the Combined Map to further refine the broad-scale habitats by depth.

JNCC processed the Combined Map, a CP2 reporting regions layer (modified to the latest UK continental shelf) and SAC, NCMPA, MCZ and rMCZ site boundary layers in ArcGIS v.10.1 to calculate the area of all polygons in each site and region.

Habitat polygons from the Combined Map were subdivided using the boundaries of intersecting CP2 regions to create an integrated map, with each habitat polygon attributed with a CP2 region name and the area of the polygon (as km^2). This map covered the full extent of each of the five CP2 regions within the MCZ project area.

In a separate layer the habitat polygons from the Combined Map were also subdivided and clipped to MPA site boundaries to create an integrated map with data from all input layers (i.e. final habitat polygons were the smallest common denominator of the overlaid layers). Each habitat polygon was attributed with CP2 region name, MPA site name, MPA designation status and the area of the polygon. MPAs that overlap with each other and currently or potentially[30] protect the same features were integrated together so that the area of overlap was only represented once in the map (not duplicated by each of the sites). Area estimates were calculated with the integrated map projected in Albers Equal Area Conic Projection.

Attribute data from the two integrated maps were imported to a SQL-Server database. Data for all polygons of each habitat type were aggregated to estimate the total area of each broad-scale habitat per site option, per region, or protected in the MPA network per region, using SQL database queries of the CP2 region, MPA name attribute and MPA designation status data. To estimate the total area of protected habitats within existing MPAs, area data

[29] EU SeaMap is a broad-scale modelled habitat map that covers over 2 million square kilometres of European seabed. It is available to download from: http://jncc.defra.gov.uk/page-5040

[30] Potentially protected refers to the features proposed for designation in recommended site options.

were joined with a secondary ‘stock-take’ dataset listing the broad-scale habitat features protected in existing SACs, NCMPAs and MCZs. This join ensured that features were excluded if they occurred in MPAs but were not formally protected, or if they were intertidal features. The area values for habitat polygons and CP2 regions were used to calculate the percentage cover of each broad-scale habitat per region, the percentage of each habitat protected by MPAs relative to its total extent per region, and the percentage of each habitat available for further protection in a recommended site option.

Document Version Control

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