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

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Background

In 2012 Defra and the Devolved Administrations published a statement[1] on the expected UK contribution to an ecologically coherent MPA network in the north-east Atlantic. The statement outlined that:

> *UK Governments have committed to providing a 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.*
>
> *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.*

These principles broadly guided the regional Marine Conservation Zone (MCZ) projects[2] when they recommended a suite of potential MCZs in 2011 (using Defra Guidance[3] and the

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

[2] These principles have also guided the MPA identification programmes for the other MPA projects throughout the UK.

[3] Defra. Guidance on selection and designation of Marine Conservation Zones (Note 1). London: Department for Environment, Food and Rural Affairs and the Welsh Assembly Government. 2009. Available at: http://archive.defra.gov.uk/environment/biodiversity/marine/documents/guidance-note1.pdf

MCZ Project Ecological Network Guidance[4]), and subsequently guided JNCC and Natural England in their advice to Defra ahead of the designation of the first tranche of MCZs in 2013.

Introduction

Defra recognised that the first tranche of MCZs that were designated in November 2013[5] did not complete the network and that additional MCZs would be required in the sea area under the jurisdiction of the UK Government's Secretary of State for Environment, Food and Rural Affairs[6]; these are known as 'Secretary of State waters' . Defra asked JNCC to review the options available to fill any potential "big gaps" in the network to assist their planning of future tranches; the term "big gap" was not defined at that stage. Specifically, JNCC was asked to identify which of the remaining recommended MCZs not designated in the first tranche (rMCZs), together with any additional features recently identified within existing MCZs, are important to filling any big gaps. Defra intended to use such information alongside JNCC and Natural England assessments of the confidence in the presence and extent of features within sites and the socio-economic costs of sites to identify a second tranche of potential MCZs for public consultation in 2015. JNCC took forward the preparatory work for both inshore and offshore sites, subsequently providing the inshore information to Natural England to be combined with existing confidence assessments and information on newly available data sets.

JNCC, in conjunction with the other Statutory Nature Conservation Bodies (SNCBs), reviewed the contribution of some types of existing MPAs (Special Areas of Conservation (SACs), MCZs and potential Nature Conservation MPAs (pNCMPAs) in Scotland) to the network for a 'stock take' earlier in 2013. The intention of the stock take work was to provide a standardised catalogue of the UK's MPAs and their protected features. A number of issues arose during that work that prevented a complete MPA inventory at that time. The SNCBs will be continuing to work throughout 2014 to update and complete the catalogue. Appropriate data were only available for existing SACs, MCZs and the pNCMPAs in Scotland for the big gaps work described below.

JNCC developed an approach to identify potential big gaps for this piece of work based on criteria that take into account both the OSPAR principles where appropriate information was available, and wider advice in associated OSPAR guidance. JNCC proposed these minimum criteria to identify potential "big gaps" within the existing sites in Secretary of State waters (i.e. not Scottish territorial and offshore waters, Northern Irish or Welsh territorial waters). The UK devolved administrations in Scotland, Wales and Northern Ireland were not party to the development of the approach and hence the results do not apply to waters under their jurisdiction.

In this approach JNCC used the smaller biogeographic regions developed for the Charting Progress initiatives[7], broad physical divisions of the marine area based on depth and energy, and the predominant habitat divisions put forward under the Marine Strategy

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

[5] More information on the MCZs designated in 2013 is available at: https://www.gov.uk/government/collections/marine-conservation-zone-2013-designations

[6] Secretary of State waters is the marine area where the Secretary of State has responsibility for nature conservation. This area encompasses the territorial waters of England and the offshore waters of England, Wales and Northern Ireland.

[7] Charting Progress 2. Published by the Department for Environment, Food and Rural Affairs on behalf of the UK Marine Monitoring and Assessment Strategy community. Available online at: http://chartingprogress.defra.gov.uk/

Framework Directive (MSFD)[8] implementation programme. JNCC's approach is more fully described in the following sections.

Identifying big gaps in the network

To identify whether there were any big gaps in the existing network, JNCC considered the OSPAR criteria described above to devise some broad benchmarks that could be considered the minimum requirements for an MPA network in Secretary of State waters[9]. For the purposes of the current work, a big gap exists in the network if any of these criteria are ***not*** met:

- **Two examples of each broadscale habitat feature (EUNIS Level 3) are protected within each depth band/energy level in each Charting Progress 2 region:**
  - ensures that all EUNIS Level 3 habitats are represented within the network in each biogeographic region. This is relevant to the OSPAR representativity principle;
  - increases the likelihood that the range of biotopes present within each EUNIS Level 3 habitat are afforded protection within the MPA network. This is relevant to the OSPAR features principle; and
  - ensures a degree of replication of EUNIS Level 3 within the network. This is relevant to the OSPAR resilience principle.
- **Two examples of each MSFD predominant habitat are afforded protection in each Charting Progress 2 region:**
  - ensures that at the predominant habitat level the range of features present within the UK is represented within the network in each biogeographic region. This is relevant to the OSPAR representativity principle and the OSPAR features principle;
  - further helps ensure replication of broadscale features within the network. This is relevant to the OSPAR resilience principle; and
  - helps to link future assessments of MPA feature condition with assessments of environmental status under MSFD.
- **Two examples of each Feature Of Conservation Importance (FOCI)[10] are afforded protection in each Charting Progress 2 region:**
  - ensures that rare and threatened species and habitats are afforded specific protection within the network. This is relevant to the OSPAR features principle; and
  - helps ensure replication of rare and threatened species and habitats within the network. This is relevant to the OSPAR resilience principle.
- **10% by area of each EUNIS Level 3 habitat occurring in each Charting Progress 2 region is afforded protection[11]:**
  - the proportion of each EUNIS Level 3 habitat afforded protection within the network is relevant to the OSPAR features principle.

[8] The MSFD Predominant Habitats are described within Section 8.6 of OSPAR (2012) MSFD Advice Manual and Background Document on Biodiversity. Available at: http://www.ospar.org/documents/dbase/publications/p00581/p00581_advice%20document%20d1_d2_d4_d6_biodiversity.pdf

[9] These broad benchmarks have not been agreed for use at the UK level.

[10] The Features of Conservation Importance are those as listed within Section 4.2 of the MCZ Project Ecological Network Guidance. Available at: http://jncc.defra.gov.uk/pdf/100705_ENG_v10.pdf

[11] The 10% level was identified by the OSPAR Commission (2006) as guideline minimum for representation of EUNIS level 3 habitats in the OSPAR MPA network. OSPAR Commission (2006). Guidance on developing an ecologically coherent network of OSPAR marine protected areas. No. 2006-03.

- **10% by area of each MSFD predominant habitat occurring in each Charting Progress 2 region is afforded protection:**
  - the proportion of each MSFD predominant habitat afforded protection within the network is relevant to the OSPAR features principle.
- **Sites affording protection to the same habitat at EUNIS Level 2 are not further than 80km apart from each other[12]:**
  - ensures that sites with similar features are connected to each other, which is relevant to the OSPAR connectivity principle.

For the purposes of the current work, a big gap exists in the network if ***any*** of these criteria are ***not*** met.

JNCC proposed these minimum criteria only to identify potential big gaps within the existing network in Secretary of State waters. Meeting these criteria alone will not necessarily ensure the MPAs in that area make an appropriate 'full' contribution to the creation of an ecologically coherent network of MPAs, since the questions do not address all aspects of the OSPAR MPA network principles. For example, the current analysis has not assessed whether the MPAs "best represent" the range of habitats and species as required by the OSPAR principle of representativity. Additional work may be required to identify smaller gaps present in the network that may need to be filled by further new or other existing MPAs.

JNCC reviewed each MCZ site option (rMCZ or proposed new feature within designated MCZ) against the following seven questions:

1. Does the site fill a current gap within the CP2 region for a EUNIS Level 3 feature within a specific depth zone/energy level or an MSFD predominant habitat (i.e. there are currently no examples of that feature protected in those conditions)?
2. Does the site provide a replicate within the CP2 region for a EUNIS Level 3 feature within a specific depth zone/energy level or an MSFD predominant habitat (i.e. there is currently only one existing example of that feature protected in those conditions)?
3. Does the site fill a current gap within the CP2 region for a FOCI feature (i.e. there are currently no examples of that feature protected in the region)?
4. Does the site provide a replicate within the CP2 region for a FOCI feature (i.e. there is currently only one existing example of that feature protected within the region)?
5. Does the site help contribute to at least 10% (by area) of the EUNIS Level 3 feature within the CP2 region being afforded protection within MPAs?
6. Does the site help contribute to at least 10% (by area) of the MSFD predominant habitat within the CP2 region being afforded protection within MPAs?
7. Does the site fill a spatial gap in the network?

The answers to these seven questions were combined to assess whether the site filled a big gap in the network. A commentary was drafted to explain the reasoning behind the response to the simple question "Does this site fill a big gap in the network?". Generally speaking, the justification behind the answers are:

[12] 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

- **Yes:**
    - The site is the only option in the CP2 region to fill a gap, or one of only two options where both are required (i.e. there are no sites currently designated in the region for that feature).
    - The site offers a combination of features that would fill several gaps within the CP2 region.
    - The site is one of the three most important in the CP2 region for its contribution to the quantity of a feature afforded protection.
    - The site is the only option to fill a spatial gap in the network.
- **Maybe:**
    - The site would provide an adequate contribution to fill a big gap in the CP2 region but there are other options available.
- **No:**
    - The site doesn't fill any big gaps.
    - The site fills small gaps but doesn't provide a major contribution (for example, the site would help towards increasing the percentage of habitats afforded protection within the network but not by a large amount).
    - The site fills gaps but there are many other sites available that could fill the same gap, and would be better options (i.e. help to fill more gaps).

In certain circumstances, we applied a degree of expert judgement to the general principles outlined above. Any such case was explained within the site commentary.

Information included within the assessment

Within the time available, it has not been possible to undertake an assessment on the full set of features and to take account of all of the existing sites present within the MPA network. JNCC intend to work with Defra and Natural England to scope out the completion of a more comprehensive assessment of the network in advance of identifying any MCZs for a third tranche in 2016. As such, this present assessment has focussed on the particular elements outlined below.

Features

JNCC assessed:

- Subtidal EUNIS Level 3 habitats (A3 Infralittoral rock and other hard substrata, A4 Circalittoral rock and other hard substrata, A5 Sublittoral sediment, A6 Deep-sea bed);
- MSFD predominant habitats; and
- Features of Conservation Importance (FOCI).

EUNIS Level 3 habitats were originally selected as MCZ broad scale habitat features as a proxy to ensure that the range of biodiversity within UK waters would most likely be represented within the MPA network. However, some Level 3 habitats occur across a range of physical conditions resulting in many detailed biotopes present at EUNIS Level 4 and beyond. Specifically, some Level 3 habitats are known to cover a large depth range and energy levels – two factors that strongly influence the distribution of marine flora and fauna. If only a limited number of MPAs have such EUNIS Level 3 habitats, there is a reasonable likelihood that these MPAs would not encompass the range of more detailed biotopes known to occur within those Level 3 classes. To better represent the full range of biodiversity within UK waters within the network, the current assessment considered the presence of EUNIS Level 3 habitats within sites within a range of depth categories (0-10m, 10-75m, 75-200m, 200m+ as proposed by OSPAR[13]) and at a range of energy levels (low, moderate and high).

The Marine Strategy Framework Directive implementation developed another classification of marine habitats to represent the range of physical conditions present in European seas. The MSFD predominant habitats are based on the type of seabed habitat and its broad location, specifically whether it is littoral, shallow, shelf, bathyal or abyssal. Protecting examples of these predominant habitats within MPAs is another route to trying to achieve best representation of UK marine flora and fauna; such an approach will also help link future assessments of MPA feature condition with assessments of environmental status under MSFD. JNCC translated the MCZ broadscale habitat features to their MSFD predominant habitats to assess whether each MSFD predominant habitat is afforded adequate protection within the network[14]. It should be noted that in many cases the MSFD predominant habitats will already have been afforded adequate protection through the EUNIS habitats protected within the network and therefore this will not always result in additional sites being required.

[13] OSPAR (2013) An assessment of the ecological coherence of the OSPAR network of Marine Protected Areas. Available at: http://www.ospar.org/documents/dbase/publications/p00619/p00619_ecological_coherence_report.pdf

[14] The relationship between MSFD Predominant Habitats and EUNIS Level 3 habitats is documented in Section 8.6 of OSPAR (2012) MSFD Advice Manual and Background Document on Biodiversity. Available at: http://www.ospar.org/documents/dbase/publications/p00581/p00581_advice%20document%20d1_d2_d4_d6_biodiversity.pdf

Regions

OSPAR guidance suggested the network should take into account biogeographic variation in marine features. Previous work within the UK had identified regional seas to best reflect biogeographic variation at the UK scale. Assessments of status by the UK Government and Devolved Administrations for the Charting Progress 1 and 2 projects refined these regional seas to create reporting regions (see Figure 1). The current work used the CP2 reporting regions that overlap with Secretary of State waters as the biogeographic regions for MPA network assessment. 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 but within those CP2 reporting regions that were included within the assessment.

MPAs used for the assessment

The MPAs included within the current assessment are (see Figure 1):

- Special Areas of Conservation (SACs);
- Marine Conservation Zones (MCZs);
- Potential Scottish Nature Conservation MPAs (pNCMPAs) (for the purpose of the assessment these sites were considered to be 'designated sites')[15].

The assessment was based on the MCZ features so any big gaps could be considered by Defra for subsequent MCZ tranches. The listed features within the Special Areas of Conservation and the potential Scottish Nature Conservation MPAs were translated to their equivalent 'MCZ feature'. The information used for the work described in the current paper on feature presence within these existing MPAs was the information that JNCC compiled for the UK MPA 'stock take' work in autumn 2013.

The following MPAs were not included within the current assessment:

- Special Protection Areas (SPAs) – there has not yet been a site-by-site assessment undertaken to identify which marine features might be afforded protection within each SPA;
- Sites of Special Scientific Interest/Areas of Special Scientific Interest –there is not yet an agreed UK list of *SSSIs/ASSIs with marine components* nor a site-by-site

[15] The proposed NCMPAs have been included within the assessments to look at the number of sites afforded protection within the region. However, due to the uncertainty around whether or not these proposed sites will be designated, the adequacy calculations have been undertaken using only SACs and designated MCZs (this is because if these proposed sites aren't designated, and if a different site option is progressed the percentage of habitat afforded protection by any future NCMPAs has more potential to vary). A narrative was included to highlight where it is likely that proposed NCMPAs will help to contribute towards filling a gap in the percentage of habitats afforded protection within the region.

assessment to identify which marine habitat and/or species features might be afforded protection within each SSSI/ASSI;

- Ramsar Sites –there is not yet an agreed UK list of *Ramsar Sites with marine components* nor a site-by-site assessment to identify which marine features might be afforded protection within each Ramsar Site.

As these three types of designation may afford protection to substantial areas of the intertidal zone, JNCC decided that an assessment of big intertidal gaps in advance of the incorporation of these additional existing sites would provide an unrealistic picture of the current levels of protection within the network. Consequently, the assessment focussed on identifying big gaps for subtidal EUNIS Level 3 habitats within the network, noting that some SPAs and Ramsar sites may also protect subtidal habitats.

Site options

The MCZ site options included within the assessment are (see Figure 1):

- Designated MCZs which have additional features not currently designated;
- Recommended and possible MCZs that were not designated in November 2013.

The additional features that these sites could contribute to the network have come from information provided by both Natural England and JNCC, either based on recommendations from the regional MCZ projects or from more recent survey campaigns. For the purposes of this present analysis, we have assumed that those features would be of a suitable quality and provide a viable replicate within the MPA network if designated. We have not undertaken any additional work to assess feature viability or quality at the site level to determine whether the feature is actually fit for designation within the MCZ.

Those rMCZs that Defra have previously indicated will definitely not be progressing to designation were excluded from the current assessment. These sites are East Meridian, Hilbre Island Group, South of Falmouth, Stour and Orwell and Wight-Barfleur Extension.

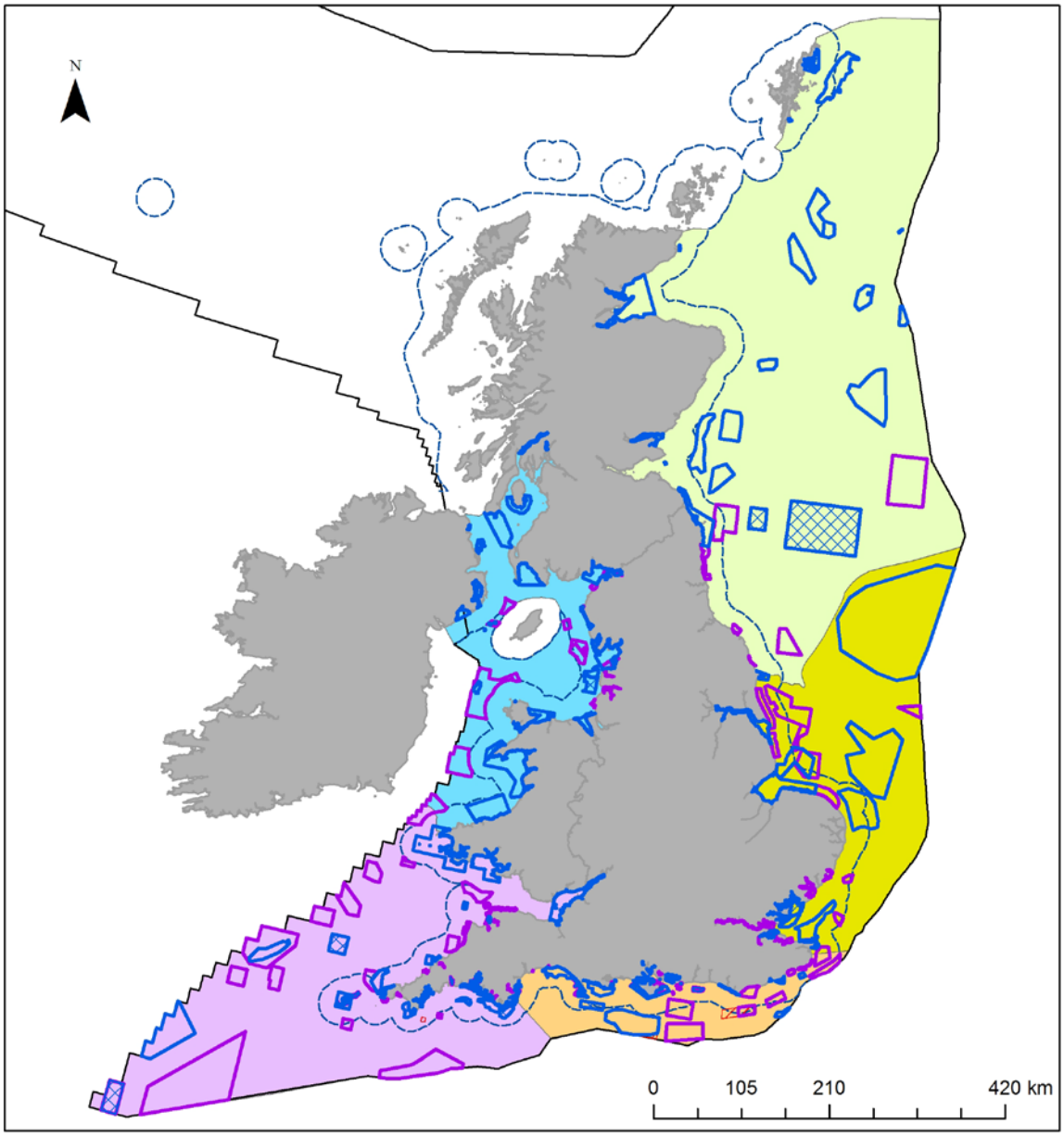

Figure 1. Map outlining the regions and MPAs included within the analysis. Note there are further existing and proposed MPAs in northern and western waters of the UK, and in waters around the Isle of Man that were not included in the present analysis.

Limitations arising from the information included within the assessment

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

- The analysis did not incorporate intertidal broadscale habitats (EUNIS Level 3 A1 (Littoral rock and other hard substrata) and A2 (Littoral sediment)) for the reasons outlined above and therefore did not identify any sites for potential gaps in intertidal broadscale habitats.
- For FOCI which occur in the intertidal zone, the analysis may be identifying gaps where those features are already afforded adequate protection within the region by SSSIs/ASSIs, SPAs or Ramsar sites.
- The analysis did not review habitat patch size or species population size to determine whether all sites flagged as potential replicates for a feature would actually be viable replicates. Therefore, the results could erroneously indicate that features are adequately represented in the network when some examples may not be viable due being only small patches of habitats or small numbers of individuals. Further work on feature viability is required to check any site selected offers a viable contribution.
- The current assessment used a collation of the work undertaken by each of the administrations for their own network reporting in December 2012[16]. Further work is required to ensure the UK MPA 'stock take' data are fully comparable between administrations to create a UK-wide dataset based on a common approach, particularly with regards to compiling a standardised UK-wide dataset on which EUNIS Level 3 habitats and FOCI features are afforded protection within MPAs other than MCZs.
- The current assessment was limited to reviewing previously recommended site options or proposed additional features that could be added to already designated MCZs that could fill gaps in the network. Therefore, the assessment has not looked at where features are present outside of the current suite of MCZ site options and so it is likely there are additional gaps within the network that have not been identified by the current analysis.
- The site options incorporated into the assessment relied on the list of recommended and new features identified through recent field survey as provided by the MCZ Project Managers in Natural England and JNCC in November 2013. Therefore if the information available on the features present within the sites changes following further field survey, so too will any information on what gaps in the network those sites are appropriate to fill.
- At the present time, there is not sufficient information available on the features designated within MPAs in neighbouring nations waters to take account of how they

[16] JNCC and Natural England. 2012. Marine Conservation Zone Project: JNCC and Natural England's advice to Defra on recommended Marine Conservation Zones. Peterborough and Sheffield. Available online from: http://www.ccgc.gov.uk/landscape--wildlife/managing-land-and-sea/marine-policies/planning--management/marine-protected-areas.aspx

Scottish Natural Heritage and the Joint Nature Conservation Committee. 2012. Advice to the Scottish Government on the selection of Nature Conservation Marine Protected Areas (MPAs) for the development of the Scottish MPA network. Scottish Natural Heritage Commissioned Report No. 457. Available online from: http://jncc.defra.gov.uk/page-5510

Countryside Council for Wales (CCW), 2012. Welsh Marine Protected Areas: Contribution to the UK Network; CCW Report to Welsh Government to Support Government's Marine Protected Area reporting duty under section 124 of the Marine and Coastal Access Act (2009).

may interact with the UK MPA network in an international context, or by providing connections between existing widely spaced UK MPAs.

Methodology underpinning the answers to each of the seven questions asked in the assessment

As outlined previously, JNCC reviewed each MCZ site option (rMCZ or additional feature within a designated MCZ) against seven questions. The following section outlines the methodology followed for each question.

Question 1: Does this site fill a current gap within the CP2 region for a EUNIS Level 3 feature within a specific depth zone/energy level or an MSFD predominant habitat (i.e. there are currently no examples of that feature protected in those conditions)?

Question 2: Does this site provide a replicate within the CP2 region for a EUNIS Level 3 feature within a specific depth zone/energy level or an MSFD predominant habitat (i.e. there is currently only one example of that feature protected in those conditions)?

The subtidal EUNIS Level 3 habitats afforded protection within each existing site and each site option were classified based upon depth[17] (0-10m, 10-75m, 75-200m, 200+m) and using EU SeaMap[18] 'combined energy' information (this layer uses wave and current energy to indicate whether areas of the seabed are exposed to low, medium or high energy regimes). The MSFD predominant habitats that are afforded protection by each existing site and each site option were also recorded.

A representativity table was created for each subtidal EUNIS feature (A3.1, A3.2, A3.3, A4.1, A4.2, A4.3, A5.1, A5.2, A5.3, A5.4, A5.5, A5.6 and A6), containing all the existing sites and site options broken down by CP2 region. Each feature was then considered individually within each CP2 region to establish any big gaps in occurrence of the feature in the depth and energy categories that occurred within the sites.

If there were currently no sites within the region affording protection to a EUNIS feature within a specific depth or energy level or no sites affording protection to an MSFD predominant habitat then a gap was identified and site options that could fill that gap were flagged (Question 1). In these circumstances, if sufficient site options were available, two sites would need to be designated to meet the minimum network criteria of two examples per region.

If there was currently one site within the region affording protection to a EUNIS feature, within a specific depth or energy level or one site affording protection to an MSFD predominant habitat, a replicate was required to meet the minimum network criteria of having two examples per region. Site options that could provide that replicate were flagged (Question 2).

Limitations:

- Proposed NCMPAs in Scotland were included as if they were existing sites. If any of these sites, or specific features within those sites, are not designated by Scottish Government, then there may be additional gaps that arise within the network in the Northern North Sea and Irish Sea.
- Time constraints and data limitations only permitted the depth and energy categories to be applied at a site-level rather than feature level. When detailed site level

[17] Data from UK Hydrographic Office

[18] Cameron, A. and Askew, N. (eds.). 2011. EUSeaMap - Preparatory Action for development and assessment of a European broad-scale seabed habitat map final report. Available at http://jncc.gov.uk/euseamap

information on feature extent becomes available for all sites, some features may not occur in the depth or energy parameters listed resulting in additional gaps appearing.

Question 3: Does this site fill a current gap within the CP2 region for a FOCI feature (i.e. there are currently no examples of that feature protected in the region)?

Question 4: Does this site provide a replicate within the CP2 region for a FOCI feature (i.e. there is currently only one example of that feature protected within the region)?

To answer these questions, information on the FOCI protected within existing sites and possible site options were considered for each CP2 region.

Where no sites within the region currently afford protection to a FOCI, a gap was identified and possible site options that could fill that gap were flagged (Question 3). In such circumstances, if sufficient options were available, two sites would need to be designated to meet the minimum network criteria of two examples per region.

If there was currently one site within the region affording protection to a FOCI then it was identified that a replicate was required to meet the minimum network criteria of having two examples per region. Possible site options that could provide that replicate were flagged (Question 4).

Limitations:

- Proposed NCMPAs in Scotland were included as if they were existing sites. If any of these sites, or specific features within those sites, are not designated by Scottish Government, then there may be additional gaps that arise within the network in the Northern North Sea and Irish Sea.
- Whilst work progressed through OSPAR[19] recommends a minimum of three replicates for threatened and declining habitats and species within a given biogeographic region, a minimum of two replicates was used in this analysis as a basis for determining big gaps.
- For FOCI which occur in the intertidal the analysis may be identifying gaps where those features are already afforded adequate protection within the region by SSSIs/ASSIs, SPAs or Ramsar sites.

Question 5: Does this site help contribute to ensuring that at least 10% of the EUNIS Level 3 feature within the CP2 region is afforded protection within MPAs?[20]

To answer this question JNCC calculated the area of each subtidal EUNIS Level 3 habitat present within each CP2 region, the area of that habitat that was already afforded protection within existing MPAs and the area of that habitat that would be added to the network by each site option[21].

[19] OSPAR. (2008). A matrix approach to assessing the ecological coherence of the MPA network. Available at: http://jncc.defra.gov.uk/pdf/0506_UK_OSPARMPAsEcoCoherenceAssessmt.pdf

[20] A more technical description of the methodology used to undertake the area assessment is provided within Annex 1 for anyone wishing to repeat the analyses.

[21] Area estimates were calculated in Albers Equal Area Conic Projection.

The main sources of habitat data were the *EUSeaMap model of seabed habitats* (2012 version[22]) and a draft version (dated 18th November 2013) 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 for individual sites and was therefore used to calculate habitat cover within MPAs (SACs, MCZs and MCZ site options) (as many of the MPAs have had targeted survey and detailed habitat maps are present for them). The EUSeaMap habitat map was used to calculate habitat cover outside of MPAs since it provides the only layer that had been generated in a consistent manner at the regional scale. The 'stock take' data on the EUNIS habitats afforded protection by each site was used to ensure that features were excluded if they occurred in MPAs but were not formally protected.

To determine any major gaps in adequacy for each CP2 region, habitat features were assessed against two criteria:

- the subtidal EUNIS feature covers > 0.1% of the CP2 region; and,
- less than 10%[23] of the mapped subtidal EUNIS feature in the CP2 region is currently protected in existing SACs and MCZs.

Limitations:

- The analysis did not include pNCMPAs within the Irish Sea or Northern North Sea, but these are likely to become part of the MPA network and contribute to the level of EUNIS habitat protection.
- The Combined Map and EUSeaMap habitat map show large areas where the habitat distribution is derived from a modelling or interpolation over large distances, where there may be limited ground truthing and acoustic data.
- Some EUNIS Level 3 habitats recommended for designation in MCZ site options were not shown within the site boundaries in the EUSeaMap habitat map and/or Combined Map since their data have yet to be added to the combined data sets; these features could not be assessed but will be included in future analyses when the mapped data becomes available. Consequently, the absence of these habitats within the site boundaries of the maps suggests that the presence/extent of other habitats (that were found in the maps) may be erroneous/ exaggerated.
- The EUSeaMap habitat map and the Combined Map are broad-scale maps with a coarse spatial resolution. Habitats typically occurring at a fine scale (e.g. A5.5 Sublittoral macrophyte-dominated sediment) are likely to be under-represented in these maps and their extent would therefore be underestimated in the analysis.
- This analysis assumed that where SAC and MCZ boundaries overlap, different features are protected in the overlapping sites and so the area of protected features will not be counted multiple times. In practice, however, there may be some overlapping sites where a EUNIS habitat that is correlated with an Annex I habitat within the site, is also either a designated or recommended feature of the MCZ (this affects 1-2 features in each of approximately five instances of overlapping SACs and MCZs spread across CP2 regions) so the level of protection may be slightly overestimated for some habitats.

[22] 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

[23] The 10% level was identified by the OSPAR Commission (2006) as guideline minimum for representation of EUNIS level 3 habitats in the OSPAR MPA network. OSPAR Commission (2006). Guidance on developing an ecologically coherent network of OSPAR marine protected areas. No. 2006-03.

- The analysis assumed that where a EUNIS Level 3 habitat was flagged as being afforded protection within an SAC, that the entirety of that EUNIS Level 3 habitat was protected within the boundary. In reality, the EUNIS feature will only be afforded protection within the site boundary wherever the Annex I habitat that it is associated with is present. This means that, particularly for larger sites which might have several Annex I habitats, the current assessment may have over-estimated the amount of EUNIS Level 3 habitats afforded protection within sites.

Question 6: Does this site help contribute to ensuring that at least 10% of the MSFD predominant habitats within the CP2 region are afforded protection within MPAs?[24]

To answer this question JNCC calculated the area of each subtidal MSFD predominant habitat present within each CP2 region, the area of that habitat that was already afforded protection within existing MPAs and the area of that habitat that would be added to the network by each site option[25].

For this analysis the habitat map derived from the EUSeaMap model was the only source of habitat data (as MSFD predominant habitats are not included in Combined Map data). A translation was undertaken from the EUNIS habitats afforded protection within the sites to the MSFD predominant habitats to ensure that only formally protected features were included in existing protection calculations.

To determine the major adequacy gaps in each CP2 region, habitat features were assessed using two criteria (again following question 5):

- the subtidal predominant habitat feature covers > 0.1% of the CP2 region; and,
- less than 10% of the mapped subtidal predominant habitat feature in the CP2 region is currently protected in existing SACs and MCZs.

Limitations:

- The analysis did not include pNCMPAs within the Irish Sea or Northern North Sea, but these are likely to become part of the MPA network and contribute to the level of MSFD predominant habitat protection.
- The analysis assumed that where a EUNIS Level 3 habitat was flagged as being afforded protection within an SAC, that the entirety of that EUNIS Level 3 habitat was protected within the boundary (and consequently the MSFD predominant habitat that it is associated with). In reality, the EUNIS feature (and MSFD predominant habitat) will only be afforded protection within the site boundary wherever the Annex I habitat that it is associated with is present. This means that, particularly for larger sites which might have several Annex I features, the current assessment may have over-estimated the amount of MSFD predominant habitats afforded protection within sites.
- This analysis assumed that where SAC and MCZ boundaries overlap, different features are protected in the overlapping sites and so the area of protected features will not be counted multiple times. In practice, however, there may be some overlapping sites where a EUNIS habitat that is correlated with an Annex I habitat within the site, is also either a designated or recommended feature of the MCZ (this affects 1-2 features in each of approximately five instances of overlapping SACs and

[24] A more technical description of the methodology used to undertake the area assessment is provided within Annex 1 for anyone wishing to repeat the analyses.
[25] Area estimates were calculated in Albers Equal Area Conic Projection.

MCZs spread across CP2 regions) so the level of protection may be slightly overestimated for some habitats.

Question 7: Does this site fill a spatial gap in the network?

To answer this question, JNCC created six data layers in ArcGIS to indicate:

- Existing sites affording protection to A3 (Infralittoral rock and other hard substrata);
- MCZ site options that could afford protection to A3 (Infralittoral rock and other hard substrata);
- Existing sites affording protection to A4 (Circalittoral rock and other hard substrata);
- MCZ site options that could afford protection to A4 (Circalittoral rock and other hard substrata);
- Existing sites affording protection to A5 (Sublittoral sediment); and,
- MCZ site options that could afford protection to A5 (Sublittoral sediment).

Buffers of 40km[26] were calculated for the sites and expert judgement used to visually identify spatial gaps of more than 80km in connectivity at EUNIS Level 2 between existing sites. A spatial gap occurred when the buffers between two adjacent existing sites did not touch each other but a potential site would allow those buffers to touch and therefore improve connectivity.

[26] 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

Overview results of the analysis to identify where the 'big gaps' are within each CP2 region

Table 1: Results that identify where 'big gaps' are present within the MPA network that could be filled by existing MCZ site options for each CP2 region[27]. This table incorporates the results from Questions 1-6.

CP2 Region	Features that are present within at least one of the MCZ site options available and are not currently replicated at least two times	Habitats that do not have 10% (by area of the total area of habitat present within the region) currently afforded protection within MPAs
Northern North Sea	**EUNIS Level 3 habitats[28]:** A4.2 Moderate energy circalittoral rock in 75m-200m water depth (currently 1 example protected by the existing network) A5.4 Subtidal mixed sediments in a low energy environment (currently 1 example protected by the existing network) A5.4 Subtidal mixed sediments in a moderate energy environment (currently 1 example protected by the existing network) A5.4 Subtidal mixed sediments in 0-10m water depth (currently 1 example protected by the existing network) A5.4 Subtidal mixed sediments in 10-75m water depth (currently 1 example protected by the existing network) A5.4 Subtidal mixed sediments in 75-200m water depth (currently 1 example protected by the existing network)	**EUNIS Level 3 habitats:** A3.1 High energy infralittoral rock (currently 0.2% protected by the existing network) A4.2 Moderate energy circalittoral rock (currently 6.0% protected by the existing network) A4.3 Low energy circalittoral rock (currently 0.0% protected by the existing network) A5.1 Subtidal coarse sediment (currently 4.0% protected by the existing network) A5.2 Subtidal sand (currently 4.3% protected by the existing network) A5.3 Subtidal mud (currently < 0.1% protected by the existing network)
	MSFD predominant habitats[29]: Shallow muds (currently 1 example protected by the existing network) Shelf rock or biogenic reef (currently 1 example protected by the existing network)	**MSFD predominant habitats:** Shallow muds (currently 0.2% protected by the existing network) Shallow sands (currently 9.5% protected by the existing network) Shallow coarse or mixed sediments (currently 0.9% protected by the existing network) Shelf rock or biogenic reef (currently 2.9% protected by the existing network) Shelf muds (currently < 0.1% protected by the existing network) Shelf sands (currently 4.2% protected by the existing network) Shelf coarse or mixed sediments (currently 4.8% protected by the existing network)
	FOCI habitats and species[30]: Ocean quahog (*Arctica islandica*) (currently 1 example protected by the existing network) Peat and clay exposures (currently 0 examples protected by the existing network) Smelt (*Osmerus eperlanus*) (currently 0 examples protected by the existing network) Subtidal chalk (currently 1 example protected by the existing network)	
Southern North Sea	**EUNIS Level 3 habitats:** A3.1 High energy infralittoral rock in a high energy environment (currently 1 example protected by the existing network) A3.1 High energy infralittoral rock in 0-10m water depth (currently 1 example protected by the existing	**EUNIS Level 3 habitats:** A3.2 Moderate energy infralittoral rock (currently 3.6% protected by the existing network) A4.2 Moderate energy circalittoral rock (currently 3.3% protected by the existing network)

[27] Please note, there could be additional gaps present within each CP2 region which do not currently have MCZ site options that could fill them. These gaps have not been pulled out by this analysis.
[28] The full list of EUNIS Level 3 habitats for which MCZs have been recommended can be found within the MCZ Project Ecological Network Guidance. Available at: http://jncc.defra.gov.uk/pdf/100705_ENG_v10.pdf
[29] The full list of MSFD Predominant Habitats is described within Section 8.6 of OSPAR (2012) MSFD Advice Manual and Background Document on Biodiversity. Available at: http://www.ospar.org/documents/dbase/publications/p00581/p00581_advice%20document%20d1_d2_d4_d6_biodiversity.pdf
[30] The full list of FOCI habitats and species for which MCZs have been recommended can be found within the MCZ Project Ecological Network Guidance. Available at: http://jncc.defra.gov.uk/pdf/100705_ENG_v10.pdf

CP2 Region	Features that are present within at least one of the MCZ site options available and are not currently replicated at least two times	Habitats that do not have 10% (by area of the total area of habitat present within the region) currently afforded protection within MPAs
	network) A3.1 High energy infralittoral rock in 10m-75m water depth (currently 0 examples protected by the existing network) A3.2 Moderate energy infralittoral rock in 10m-75m water depth (currently 0 examples protected by the existing network) A3.3 Low energy infralittoral rock in 0m-10m water depth (currently 0 examples protected by the existing network) A4.1 High energy circalittoral rock in a high energy environment (currently 1 example protected by the existing network) A4.1 High energy circalittoral rock in 0-10m water depth (currently 1 example protected by the existing network) A4.2 Moderate energy circalittoral rock in 10m-75m water depth (currently 0 examples protected by the existing network) A4.2 Moderate energy circalittoral rock in 75m-200m water depth (currently 0 examples protected by the existing network) A5.1 Subtidal coarse sediment in a low energy environment (currently 0 examples protected by the existing network) A5.1 Subtidal coarse sediment in 75-200m water depth (currently 0 examples protected by the existing network) A5.2 Subtidal sand in a low energy environment (currently 0 examples protected by the existing network) A5.2 Subtidal sand in 75m-200m water depth (currently 0 examples protected by the existing network) A5.3 Subtidal mud in a low energy environment (currently 0 examples protected by the existing network) A5.3 Subtidal mud in 10m-75m water depth (currently 0 examples protected by the existing network) A5.4 Subtidal mixed sediments in a low energy environment (currently 0 examples protected by the existing network) A5.4 Subtidal mixed sediments in 75m-200m water depth (currently 0 examples protected by the existing network) A5.6 Subtidal biogenic reef in a low energy environment (currently 0 examples protected by the existing network)	
	MSFD predominant habitats: Shelf rock or biogenic reef (currently 0 examples protected by the existing network)[31]	**MSFD predominant habitats:** Shallow photic rock or biogenic reef (currently 3.8% protected by the existing network) Shallow aphotic rock or biogenic reef (currently 0.4% protected by the existing network) Shelf sands (currently 3.9% protected by the existing network) Shelf coarse or mixed sediments (currently 2.8% protected by the existing network)
	FOCI habitats and species: European eel (*Anguilla anguilla*) (currently 0 examples protected by the existing network) Honeycomb worm (*Sabellaria alveolata*) reefs (currently 0 examples protected by the existing network) Lagoon sand shrimp (*Gammarus insensibilis*) (currently 1 example protected by the existing network) Lagoon sea slug (*Tenellia adspersa*) (currently 0 examples protected by the existing network)	

[31] Shelf rock or biogenic reef doesn't appear as an MSFD requiring additional protection from an adequacy perspective because it only covers 0.02% of the region and so was not assessed.

CP2 Region	Features that are present within at least one of the MCZ site options available and are not currently replicated at least two times	Habitats that do not have 10% (by area of the total area of habitat present within the region) currently afforded protection within MPAs
	Littoral chalk communities (currently 1 example protected by the existing network) Native oyster (*Ostrea edulis*) (currently 1 example protected by the existing network) Smelt (*Osmerus eperlanus*) (currently 0 examples protected by the existing network) Stalked jellyfish (*Haliclystus auricula*) (currently 0 examples protected by the existing network) Stalked jellyfish (*Lucernariopsis cruxmelitensis*) (currently 0 examples protected by the existing network)	
Eastern English Channel	**EUNIS Level 3 habitats:** A3.3 Low energy infralittoral rock in a low energy environment (currently 1 example protected by the existing network) A4.1 High energy circalittoral rock in 0m-10m water depth (currently 1 example protected by the existing network) A4.1 High energy circalittoral rock in 75m-200m water depth (currently 0 examples protected by the existing network) A4.2 Moderate energy circalittoral rock in 75m-200m water depth (currently 1 example protected by the existing network) A4.3 Low energy circalittoral rock in a low energy environment (currently 0 examples protected by the existing network) A4.3 Low energy circalittoral rock in 10m-75m water depth (currently 0 examples protected by the existing network) A5.1 Subtidal coarse sediment in a low energy environment (currently 0 examples protected by the existing network) A5.1 Subtidal coarse sediment in 0m-10m water depth (currently 1 example protected by the existing network) A5.1 Subtidal coarse sediment in 75m-200m water depth (currently 1 example protected by the existing network) A5.2 Subtidal sand in a low energy environment (currently 0 examples protected by the existing network) A5.2 Subtidal sand in 75m-200m water depth (currently 0 examples protected by the existing network) A5.3 Subtidal mud in a moderate energy environment (currently 1 example protected by the existing network) A5.3 Subtidal mud in a high energy environment (currently 1 example protected by the existing network) A5.3 Subtidal mud in 0m-10m water depth (currently 1 example protected by the existing network) A5.3 Subtidal mud in 10m-75m water depth (currently 1 example protected by the existing network) A5.4 Subtidal mixed sediments in a low energy environment (currently 0 examples protected by the existing network) A5.4 Subtidal mixed sediments in 75m-200m water depth (currently 1 example protected by the existing network) A5.5 Subtidal macrophyte-dominated sediment in a low energy environment (currently 0 examples protected by the existing network) A5.5 Subtidal macrophyte-dominated sediment in 10m-75m water depth (currently 1 example protected by the existing network) A5.6 Subtidal biogenic reef in a low energy environment (currently 1 example protected by the existing network) A5.6 Subtidal biogenic reef in 0-10m water depth (currently 1 example protected by the existing network)	**EUNIS Level 3 habitats:** A3.1 High energy infralittoral rock (currently 6.7% protected by the existing network) A4.2 Moderate energy circalittoral rock (currently 0.9% protected by the existing network) A5.1 Subtidal coarse sediment (currently 5.7% protected by the existing network) A5.2 Subtidal sand (currently 2.7% protected by the existing network) A5.3 Subtidal mud (currently 0.7% protected by the existing network) A5.4 Subtidal mixed sediments (currently 0.9% protected by the existing network)

CP2 Region	Features that are present within at least one of the MCZ site options available and are not currently replicated at least two times	Habitats that do not have 10% (by area of the total area of habitat present within the region) currently afforded protection within MPAs
	MSFD predominant habitats: Shallow muds (currently 1 example protected by the existing network) Shelf coarse or mixed sediments (currently 1 example protected by the existing network) Shelf sands (currently 1 example protected by the existing network)	**MSFD predominant habitats:** Shallow muds (currently 1.0% protected by the existing network) Shallow sands (currently 1.1% protected by the existing network) Shallow coarse or mixed sediments (currently 3.0% protected by the existing network) Shelf sands (currently 0.0% protected by the existing network) Shelf coarse or mixed sediments (currently < 0.1% protected by the existing network)
	FOCI habitats and species: Estuarine rocky habitats (currently 0 examples protected by the existing network) European eel (*Anguilla anguilla*) (currently 0 examples protected by the existing network) Honeycomb worm (*Sabellaria alveolata*) reefs (currently 1 example protected by the existing network) Intertidal under boulder communities (currently 1 example protected by the existing network) Long snouted seahorse (*Hippocampus guttulatus*) (currently 1 example protected by the existing network) Maerl beds (currently 0 examples protected by the existing network) Mud habitats in deep water (currently 0 examples protected by the existing network) Native oyster beds (*Ostrea edulis*) (currently 0 examples protected by the existing network) Peacock's tail (*Padina pavonica*) (currently 0 examples protected by the existing network) Peat and clay exposures (currently 0 examples protected by the existing network) Ross worm (*Sabellaria spinulosa*) reefs (currently 1 example protected by the existing network) Sea pens and burrowing megafauna (currently 0 examples protected by the existing network) Short snouted seahorse (*Hippocampus hippocampus*) (currently 1 example protected by the existing network) Spiny lobster (*Palinurus elephas*) (currently 1 example protected by the existing network) Stalked jellyfish (*Haliclystus auricula*) (currently 0 examples protected by the existing network) Stalked jellyfish (*Lucernariopsis cruxmelitensis*) (currently 0 examples protected by the existing network) Sunset cup coral (*Leptopsammia pruvoti*) (currently 1 example protected by the existing network) Undulate ray (*Raja undulata*) (currently 0 examples protected by the existing network)	
Western Channel and Celtic Seas	**EUNIS Level 3 habitats:** A5.3 Subtidal mud in a low energy environment (currently 1 example protected by the existing network) A5.5 Subtidal macrophyte-dominated sediment in a low energy environment (currently 1 example protected by the existing network)	**EUNIS Level 3 habitats:** A4.2 Moderate energy circalittoral rock (currently 8.3% protected by the existing network) A4.3 Low energy circalittoral rock (currently 0.2% protected by the existing network) A5.1 Subtidal coarse sediment (currently 3.2% protected by the existing network) A5.2 Subtidal sand (currently 7.3% protected by the existing network) A5.3 Subtidal mud (currently 2.2% protected by the existing network)
	MSFD predominant habitats: Shelf muds (currently 1 example protected by the existing network)	**MSFD predominant habitats:** Shallow coarse or mixed sediments (currently 6.4% protected by the existing network)

CP2 Region	Features that are present within at least one of the MCZ site options available and are not currently replicated at least two times	Habitats that do not have 10% (by area of the total area of habitat present within the region) currently afforded protection within MPAs
		Shelf rock or biogenic reef (currently 0.3% protected by the existing network) Shelf muds (currently < 0.1% protected by the existing network) Shelf sands (currently 6.2% protected by the existing network) Shelf coarse or mixed sediments (currently 2.0% protected by the existing network) Bathyal sands (currently 7.7% protected by the existing network)
	FOCI habitats and species: Burgundy maerl paint weed (*Cruoria cruoriaeformis*) (currently 0 examples protected by the existing network) Giant goby (*Gobius cobitis*) (currently 0 examples protected by the existing network) Honeycomb worm (*Sabellaria alveolata*) reefs (currently 1 example protected by the existing network) Horse mussel (*Modiolus modiolus*) (currently 0 examples protected by the existing network) Long snouted seahorse (*Hippocampus guttulatus*) (currently 0 examples protected by the existing network) Mud habitats in deep water (currently 0 examples protected by the existing network) Native oyster beds (*Ostrea edulis*) (currently 1 example protected by the existing network) Peacock's tail (*Padina pavonica*) (currently 0 examples protected by the existing network) Peat and clay exposures (currently 0 examples protected by the existing network) Smelt (*Osmerus eperlanus*) (currently 1 example protected by the existing network) Stalked jellyfish (*Lucernariopsis campanulata*) (currently 0 examples protected by the existing network) Stalked jellyfish (*Lucernariopsis cruxmelitensis*) (currently 0 examples protected by the existing network) Tentacled lagoon-worm (*Alkmaria romijni*) (currently 0 examples protected by the existing network)	
Irish Sea	**EUNIS Level 3 habitats:** A4.2 Moderate energy circalittoral rock in 75m-200m water depth (currently 1 example protected by the existing network) A4.3 Low energy circalittoral rock in a low energy environment (currently 1 example protected by the existing network) A4.3 Low energy circalittoral rock in 75m-200m water depth (currently 1 example protected by the existing network) A5.2 Subtidal sand in 75m-200m water depth (currently 1 example protected by the existing network) A5.4 Subtidal mixed sediments in 75m-200m water depth (currently 1 example protected by the existing network)	**EUNIS Level 3 habitats:** A3.3 Low energy infralittoral rock (currently < 0.1% protected by the existing network) A4.2 Moderate energy circalittoral rock (currently 5.2% protected by the existing network) A4.3 Low energy circalittoral rock (currently 1.8% protected by the existing network) A5.1 Sublittoral coarse sediment (currently 9.1% protected by the existing network) A5.3 Sublittoral mud (currently 0.8% protected by the existing network)
	MSFD predominant habitats: N/A	**MSFD predominant habitats:** Shallow muds (currently 1.6% protected by the existing network) Shelf rock or biogenic reef (currently 3.7% protected by the existing network) Shelf muds (currently < 0.1% protected by the existing network) Shelf sands (currently < 0.1% protected by the existing network) Shelf coarse or mixed sediments (currently 0.5% protected by the existing network)

CP2 Region	Features that are present within at least one of the MCZ site options available and are not currently replicated at least two times	Habitats that do not have 10% (by area of the total area of habitat present within the region) currently afforded protection within MPAs
	FOCI habitats and species: Mud habitats in deep water (currently 0 examples protected by the existing network) Sea pens and burrowing megafauna (currently 0 examples protected by the existing network) Smelt (*Osmerus eperlanus*) (currently 1 example protected by the existing network)	

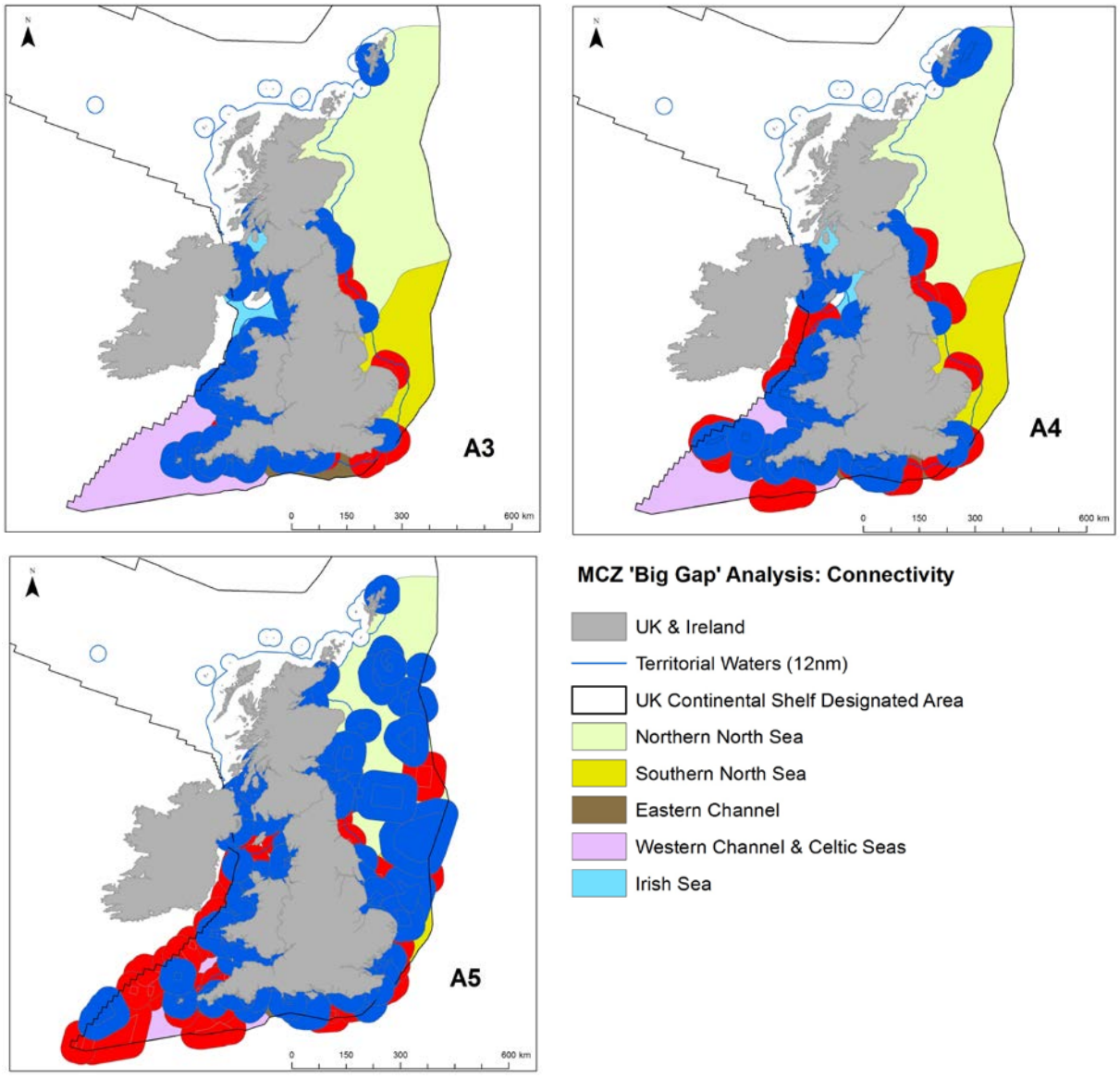

Figure 2[32]. Maps indicating potential connectivity between sites with habitats aggregated to EUNIS Level 2 (Question 7). The blue areas on the map outline 40km buffers around the existing MPAs, the red areas on the map outline the 40km buffers around the MCZ site options which could be added to the network to improve connectivity. A3 = Infralittoral rock and other hard substrata; A4 = Circalittoral rock and other hard substrata; A5 = Sublittoral sediment.

[32] The 80km distance threshold used in the analysis shown in Figure 2 is not an accepted policy approach in Scotland.

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Annex 1: Technical details of work undertaken to complete area calculations for Questions 5 and 6[33]

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 EUNIS Level 3 habitat per Charting Progress 2 reporting region
- total area of each subtidal EUNIS Level 3 habitat within existing MPAs per Charting Progress 2 reporting region
- total area of each subtidal EUNIS Level 3 habitat within each site option per Charting Progress 2 reporting region
- total area of each Charting Progress 2 reporting region

As outlined above, the main sources of habitat data were the *EUSeaMap* model of seabed habitats (2012 version[34]) and a draft version (dated 18th November 2013) 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 for individual sites and was therefore used to calculate habitat cover within MPAs (SACs, MCZs and MCZ site options) (as many of the MPAs have had targeted survey and detailed habitat maps are present for them). The EUSeaMap habitat map was used to calculate habitat cover outside of MPAs since it provides the only layer that had been generated in a consistent manner at the regional scale.

JNCC processed habitat maps, a CP2 reporting regions layer and SAC, MCZ and rMCZ site boundary layers in ArcGIS v.10.1 to calculate the estimated area of all polygons in each site and region. Habitat polygons from the Combined Map were subdivided using the boundaries of intersecting CP2 regions and/or 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 (if applicable) and the area of the polygon (km^2). Area estimates were calculated with the integrated map projected in Albers Equal Area Conic Projection. The integrated output was cropped down to only the areas within MPAs and these data were exported to an MS Access database. The same process was repeated for the habitat map derived from the EUSeaMap model but in this case, two datasets were imported to Access: habitats within MPAs and habitats in the region as a whole (inside and outside MPAs).

Data for all polygons of each habitat type were aggregated to estimate the total area of each EUNIS Level 3 habitat per site, per region, or protected in the MPA network per region, using Access database queries of the CP2 region and MPA name attribute data. To estimate the total areas of protected habitats, area data were joined with a secondary 'stock take' dataset listing the EUNIS Level 3 habitat features protected in existing SACs and MCZs. This join ensured that features were excluded if they occurred in MPAs but were not formally protected. EUSeaMap area data for habitats inside MPAs were subtracted from area data for the whole region, leaving the area of habitats outside of MPAs. This result was added to Combined Map areas for habitats inside MPAs to create the final estimate of the total areas per habitat per CP2 region. These area totals were used to calculate the percentage cover of each EUNIS Level 3 habitat per region, the proportion of each habitat protected by MPAs

[33] Please note that any major limitations associated with these methodologies are described above within the main body of the report.

[34] 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

per region, and the percentage of each habitat available for further protection in a recommended site option.

Document Version Control

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4.0	Amy Ridgeway, JNCC	Amendments made to text throughout to incorporate comments from the MPA Technical Group.	Jon Davies	11/02/2014
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