Joint Nature Conservation Committee

NATURAL ENGLAND

Marine Conservation Zone Project

Ecological Network Guidance

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Written by Natural England and the
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Summary of guidelines

This guidance document is divided into seven network design principles and five further considerations (which are both ecological and practical) for regional stakeholder groups to follow. This summary is provided as a quick reference to the guidelines for each principle and consideration within the Ecological Network Guidance. Please see the individual sections of this document for the detailed explanation of the guidelines, including the science and evidence behind them and any caveats to their use.

A glossary of terms used is provided at the end of this document. A list of frequently used acronyms is provided at the beginning of this document.

The regional stakeholder groups within each regional Marine Conservation Zone (MCZ) project should follow all of the guidelines for the recommended MCZs to meet the minimum standards of the Science Advisory Panel's (SAP) assessment and be submitted to the Secretary of State (SoS) for public consultation and consideration for designation. These guidelines will promote effective biodiversity conservation and help ensure MCZs contribute to an ecologically coherent MPA network.

The following guidelines have been developed using the best available evidence and have been written so they are applicable rather than theoretical. Please note that although all guidelines below should be followed by the regional MCZ projects, the guidelines for connectivity are considered to be secondary to other guidelines for the network design principles.

Design principle 1 – Representativity (section 4.2, page 30)

1. Examples of each of the 23 broad-scale habitats should be protected within MPAs in each regional MCZ project area, where they occur (Table 1).
2. Examples of each of the 22 habitats of conservation importance should be protected within MPAs in each regional MCZ project area, where they occur (Table 2).
3. Examples of each of the 29 low or limited mobility species of conservation importance should be protected within MPAs in each regional MCZ project area, where they occur (Table 3).
4. The three highly mobile species for which MCZs are an appropriate tool should be protected within MPAs in each regional MCZ project area (Table 4).

Design principle 2 – Replication (section 4.3, page 35)

5. The MPAs within each regional MCZ project area should protect at least two separate examples of each broad-scale habitat where their distribution allows.
6. The MPAs within each regional MCZ project area should protect at least three to five separate examples of each feature of conservation importance where their distribution allows.

Design principle 3 – Adequacy (section 4.4, page 37)

7. For each broad-scale habitat the MPAs within each regional MCZ project area should collectively protect a proportion of habitat known to occur in that area. Proportions for some broad-scale habitats are provided in Table 5, whilst for those broad-scale habitats in Table 6 the proportions will be determined by the application of the guidelines under the principles of replication, viability and connectivity.
8. For features of conservation importance the MPAs within each regional MCZ project area should collectively protect a proportion of each feature of conservation importance known to occur in that area. The proportions will be determined by the application of the guidelines under the principles of replication, viability and connectivity.

Design principle 4 – Viability (section 4.5, page 42)

9. 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.
10. Patches of FOCI within MCZs should have a minimum diameter as specified in Table 7 and Table 8. Where features occur in patches smaller than the minimum diameter, the whole patch or area of combined patches should be protected.

Design principle 5 – Connectivity (section 4.6, page 46)

11. Where species-specific dispersal distances or critical areas for life-cycles of FOCI are known these should be considered in determining the spacing between MPAs.
12. In the absence of species-specific information on connectivity, MPAs of similar habitat should be separated, where possible, by no more than 40 – 80 km (between individual MPA boundaries).
13. Connectivity may be approximated by ensuring that MPAs are well distributed across the regional MCZ project areas.

Design principle 6 – Protection (section 4.7, page 49)

14. Conservation objectives should result in protection levels which ensure the favourable condition of the MCZ features and no further degradation. Features' minimum ecological condition should ultimately be guided by quality objectives under relevant EU Environmental Directives.
15. Conservation objectives for MCZs should be determined by using the best available evidence on i) the current condition of features and/or ii) the pressures to which they are sensitive.
16. Each broad-scale habitat type and FOCI should have at least one viable reference area within each of the four regional MCZ project areas where all extraction, deposition or human-derived disturbance is removed or prevented.

Design principle 7 – Best available evidence (section 4.8, page 52)

17. MCZ identification and designation should be based on the best available scientific evidence.
18. Lack of full scientific certainty should not be a reason for delaying network design and planning, including decisions on site identification.
19. MCZ identification should take account of local and lay knowledge.

Further considerations

Areas of additional ecological importance (section 5.2, page 55)

20. When selecting MCZs for broad-scale habitats and FOCI, particular attention should be given to including important areas for key life cycle stages of species, such as spawning, nursery or juvenile areas; and areas important for behaviours such as foraging, breeding, moulting, loafing, rafting, wintering or resting.

21. When selecting MCZs for broad-scale habitats and FOCI prioritise areas of high natural biodiversity and high natural pelagic productivity.

Impacts and feature vulnerability (section 5.3, page 57)

22. Sites which best contribute to achieving the network design principles and further ecological considerations should be identified as MCZs, regardless of current degradation.

23. Where multiple areas are identified that equally contribute to achieving the network design principles and further ecological considerations, those features which have been less impacted (or are less likely to have been impacted) by human activities should generally be considered a higher priority for MCZ identification than more degraded examples of the same feature.

Scientific value (section 6.2, page 61)

24. When identifying possible MCZs, consider their value for scientific research. Suitable locations may include:

- Areas that have already been subject to long-term research and monitoring as the conditions before designation will be well-known and change can be measured.
- Areas located close to research centres or access points that can facilitate regular research and monitoring.

MCZ boundaries (section 6.3, page 62)

25. MCZ boundaries should follow feature extent (where appropriate) whilst:

- Using a minimum number of straight lines;
- Ensuring as compact a shape as possible;
- Incorporating a margin (where appropriate) to ensure protection of features.

26. Where a feature is present in a number of separate but nearby locations, effort should be made to include all discrete occurrences within site boundaries.

27. For spatially dynamic habitats, boundaries should, where possible, encompass predicted changes in feature distribution to ensure their ongoing protection within MCZs.

28. MCZs for species should be drawn around areas of regular/predictable species concentration, using the best available data. Where there is a clear functional link between the specific habitats and species distribution, habitats can be used as a basis for site delineation.

Geological and geomorphological features of interest (section 6.4, page 65)

29. The 32 coastal GCR sites that have a significant intertidal or subtidal portion and are not currently protected in Sites of Special Scientific Interest (SSSIs) should be considered for MCZ designation (see Table 9).

30. When identifying MCZs for broad-scale habitats and FOCI consider the locations of geological and geomorphological features, especially those features which are considered to be of greatest conservation importance (see Table 10).

Contents

List of tables

List of figures

List of frequently used acronyms

CBD – Convention on Biological Diversity
CCW – Countryside Council for Wales
CEFAS - Centre for Environment and Aquaculture Science
DEFRA – Department for Environment, Food and Rural Affairs
DoE(NI) – Department of Environment (Northern Ireland)
EC – European Community
EEA – European Environment Agency
EHS – Environment and Heritage Service
EMS – European Marine Site
ENG – Ecological Network Guidance
EU – European Union
EUNIS - European Nature Information System
FOCI – Feature of Conservation Importance
GCR – Geological Conservation Review
GIS – Geographic Information System
IAS – Invasive Alien Species
IUCN – International Union for Conservation of Nature
JNCC – Joint Nature Conservation Committee
MNPG – Marine Natura Project Group
MBSMP – Marine Biodiversity Surveillance and Monitoring Programme
MCAA – Marine and Coastal Access Act
MCZ – Marine Conservation Zone
MCZPB – Marine Conservation Zone Project Board
MCZPTSG – Marine Conservation Zone Project Technical Support Group
MFA – Marine and Fisheries Agency (now part of the Marine Management Organisation)
MLPA – Marine Life Protection Act (California)
MPA – Marine Protected Area
MPS – Marine Policy Statement
MSFD – Marine Strategy Framework Directive
NE – Natural England
NECR – Natural England Commissioned Reports
OSPAR – The Convention for the Protection of the marine environment of the North-East Atlantic
SAC – Special Area of Conservation
SAP – Science Advisory Panel
SNCB – Statutory Nature Conservation Body
SNH – Scottish Natural Heritage
SoS – Secretary of State
SPA – Special Protection Area
SSSI – Site of Special Scientific Interest
UK – United Kingdom
UKBAP – UK Biodiversity Action Plan
UKMMAS – UK Marine Monitoring and Assessment Strategy
UNEP – United Nations Environment Programme
WCMC – World Conservation Monitoring Centre
WCPA – World Commission on Protected Areas
WFD – Water Framework Directive
WPC – World Parks Congress
WSSD – World Summit on Sustainable Development

Introduction and status

This guidance document is known as the Marine Conservation Zone (MCZ) Project 'Ecological Network Guidance'. It is provided to the regional stakeholder groups and regional MCZ project teams to enable them to identify MCZs. It does not cover the consideration of socio-economic interests and related information in MCZ identification. The MCZ 'Project Delivery Guidance' outlines the framework for identifying MCZs, including how socio-economic interests will be taken into account[1].

In March 2010, two months after commencement of Part V of the Marine and Coastal Access Act 2009 (MCAA), the Minister for Marine and Natural Environment made a statement to Parliament setting out how the nature conservation clauses of the Act will be implemented (Defra 2010a). The Ecological Network Guidance is Natural England's and the Joint Nature Conservation Committee's (JNCC) statutory advice on what is needed to achieve the goals set out in the Act and associated policy to establish an ecologically coherent network of Marine Protected Areas (MPAs). Defra accept this document as statutory advice. The guidance will be changed, where necessary, to reflect any legislative or policy changes agreed by Government. JNCC and Natural England, in conjunction with the regional MCZ projects, will produce a summary document on the Ecological Network Guidance in summer 2010.

This document has been extensively reviewed, with Natural England and JNCC inviting comments from:

- The Marine Conservation Zone Project Technical Support Group, comprising Natural England, JNCC, Defra, and staff of the four regional MCZ projects;
- The UK Marine Biodiversity Policy Steering Group;
- Defra;
- The MPA Science Advisory Panel;
- Specialists from Natural England and JNCC;
- Regional MCZ projects and wider stakeholders.

Comments provided by these groups, individuals and organisations have been taken account of in the drafting of the Ecological Network Guidance.

Several new research reports (Hill, *et al.* 2010; Roberts, Hawkins, *et al.* 2010; Rondinini in press 2010b) underpinned the development of the Ecological Network Guidance and were subjected to an international peer review exercise by Defra nominated marine scientists. These reviews were used by the Chief Scientists of Defra, JNCC and Natural England to ascertain that the scientific evidence on which the guidance was based was the best available, and its interpretation for application of the ecological principles was appropriate.

[1] The Project Delivery Guidance explains: i) the roles and responsibilities of the organisations involved ii) decision-making structures and organisational accountability iii) the stages and timetable for decision-making iv) how and by whom recommendations and decisions on MCZ locations are to be made and vi) how socio-economic considerations will be taken into account in the process.

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1 Background

1.1 The MPA network

The UK Government and Devolved Administrations are committed to creating an ecologically coherent network of MPAs. In English territorial waters and UK offshore waters adjacent to England, Wales and Northern Ireland - known as the Secretary of State (SoS) waters – the network is seen as a key element of the Government's wider work to recover and conserve the richness of our marine environment and wildlife (Defra 2010b).

MPAs will protect flora and fauna that are rare, threatened or representative of UK biodiversity in order to conserve a diverse ecosystem and improve resilience to human activity (Defra 2010b). MPAs will also be identified and designated to conserve features of geological or geomorphological interest. The Government's MPA Strategy (Defra 2010b) outlines the range of benefits MPAs can deliver.

The network will contribute to the following international commitments for the protection of marine biodiversity through MPA networks:

- The OSPAR Convention;
- The World Summit on Sustainable Development (WSSD);
- The Convention on Biological Diversity.

It will also assist in the achievement of Good Environmental Status under the EU Marine Strategy Framework Directive, Good Ecological Status under the EU Water Framework Directive in estuarine and coastal waters, and Favourable Conservation Status for Annex I habitats and Annex II species under the EC Habitats Directive and Annex I species under the EC Birds Directive (Defra 2010b). The MPA network will also make an important contribution to the Government's vision for 'clean, healthy, safe, productive, and biologically diverse oceans and seas' (Defra 2010b).

The MPA network will comprise existing and new MPAs including European marine sites (EMS) (Special Areas of Conservation (SACs) and Special Protection Areas (SPAs)), the marine components of SSSIs and Ramsar sites, as well as MCZs designated under the Marine and Coastal Access Act 2009 (MCAA). MCZs contributing to the network will be identified on a regional basis by four regional MCZ projects. Each regional MCZ project will recommend to JNCC and Natural England the MCZs for their respective project area to contribute to the MPA network. This guidance sets out the guidelines which the regional stakeholder groups will use to identify MCZs and ensure they contribute to the establishment of an ecologically coherent MPA network.

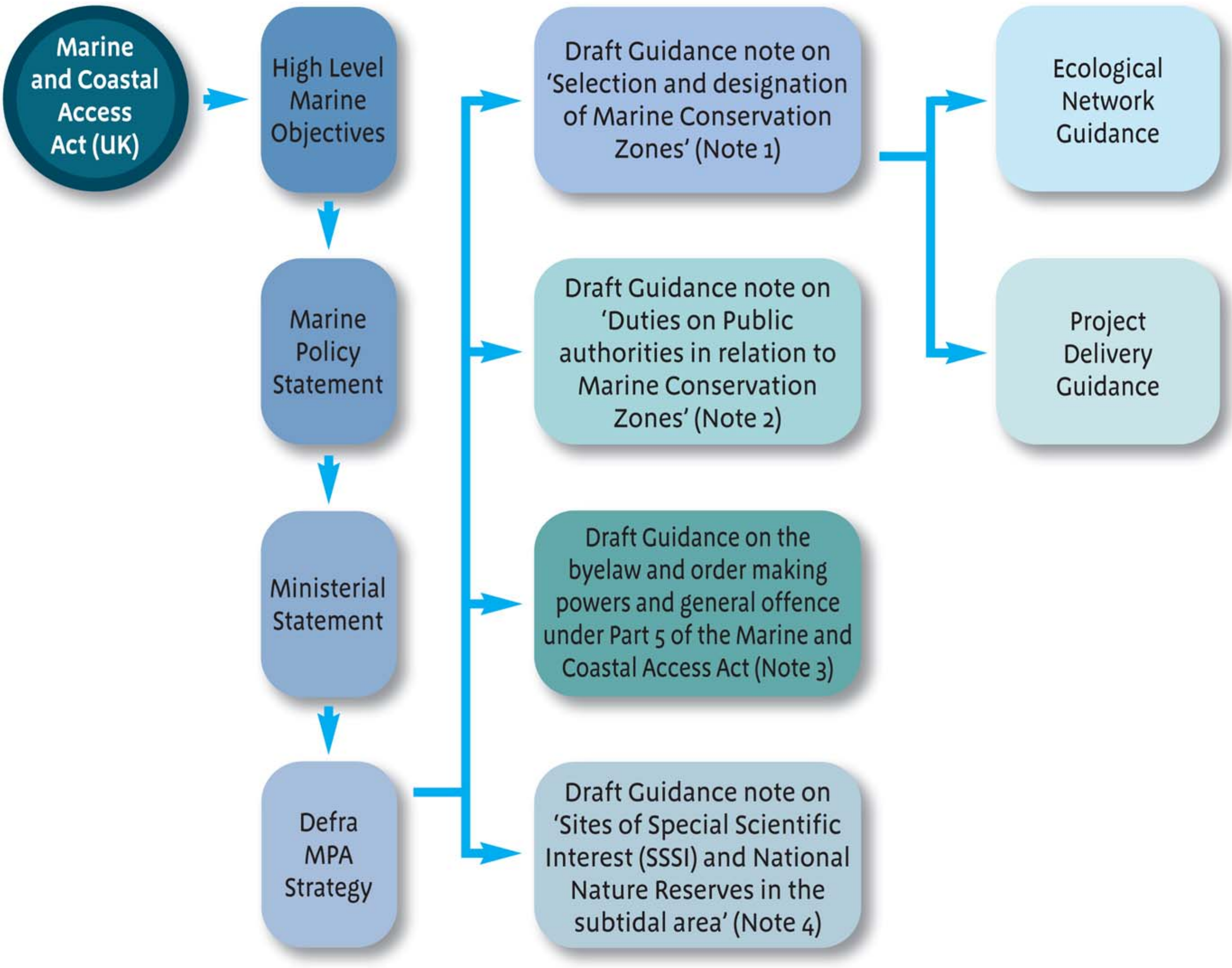
In the UK, the MPA network will be made up of the different MPA designations listed above, and nature conservation MPAs designated under the Marine (Scotland) Act 2010 in Scottish territorial waters as well as sites that may be designated by the Northern Ireland Assembly in Northern Ireland's territorial waters (for further detail see Annex 1).

1.2 Wider context

The Ecological Network Guidance fits within the Government policy framework as outlined in existing policy and legislative documents. These documents are presented in Figure 1 with further details provided in Annex 1 (Annex 1 also contains summaries of the international conventions, European obligations and national commitments to marine nature conservation).

The MPA network will sit within a wider framework of measures aimed at protecting and sustainably managing our seas. These measures include marine planning, marine licensing, and fisheries management (Defra 2010b). Without effective management of the wider marine environment MPAs would only be isolated areas of protection (IUCN-WCPA 2008). We recognise that a network of MPAs alone cannot maintain ecosystem function, provide goods and services, and ensure the persistence of habitats and their communities; effective management of the wider marine environment is also required. However, a well-managed MPA network will play a crucial role in conserving both biodiversity and ecological processes, and can make an essential contribution to sustaining wider ecosystem health.

Figure 1: Government policy and legislative documents relating to the MPA network in the Secretary of State waters.



1.3 Achieving ecological coherence

Ecological coherence is still an evolving concept and there is no universally accepted definition within the scientific community. However, the UK has worked closely with other countries to develop a working understanding of an ecologically coherent MPA network through the OSPAR Convention. The OSPAR Commission and international best practice documents recognise a series of design principles and further considerations that should be followed to deliver an ecologically coherent MPA network (OSPAR 2006; IUCN-WCPA 2008; SCBD 2004; UNEP-WCMC 2008). Defra have identified seven MPA network design principles from this work (Defra 2010a) and the Ecological Network Guidance contains practical guidelines to support the application of these. JNCC and Natural England advise that ecological coherence of the network should be achieved by meeting these guidelines and the further ecological considerations. We recognise that MPAs must be well managed and meeting their conservation objectives to fully achieve ecological coherence.

1.3.1 Purpose of the Ecological Network Guidance

The documents outlined in Figure 1 lay the foundations for this Guidance and provide important context for the approach taken to the delivery of the MCZ Project and identification of MCZs. Defra tasked JNCC and Natural England to further interpret the policy guidance and provide detailed scientific advice for the regional MCZ projects. The Ecological Network Guidance is Natural England and JNCC's statutory advice on how to meet the requirements of the Marine and Coastal Access Act 2009 and Defra policy. It explains our understanding of ecological coherence and describes how this can be achieved by using the seven network design principles and additional considerations to identify MCZs in the Secretary of State waters. It provides the regional stakeholder groups with specific guidelines to identify sites that will protect the range of marine biodiversity within the regional MCZ project areas and contribute to an ecologically coherent MPA network. Using this guidance – as well as the existing knowledge about the marine environment, the activities that occur, and socio-economic values – will enable the regional stakeholder groups to propose a series of MCZs within their project area that contributes to an ecologically coherent MPA network and minimises socio-economic impacts.

The guidelines within the Ecological Network Guidance have been developed using the best available evidence, including recent research, expertise from the Statutory Nature Conservation Bodies (SNCBs) and evidence from the wider scientific community. The guidelines have been written so they are practical rather than theoretical, and can be applied based on our existing knowledge of the marine environment.

1.3.2 Network design principles

The seven network design principles outlined in this document are those listed in the Ministerial Statement (Defra 2010a) and are based on guidance agreed by the OSPAR Commission (OSPAR 2006)[2]. These principles and their definitions are set out below and are explained in detail later in the document:

- **Representativity** – the MPA network should represent the range of marine habitats and species through protecting all major habitat types and associated biological communities present in our marine area.
- **Replication** – all major habitats should be replicated and distributed throughout the network. The amount of replication will depend on the extent and distribution of features within seas.
- **Viability** – the MPA network should incorporate self-sustaining, geographically dispersed component sites of sufficient size to ensure species and habitats persistence through natural cycles of variation.
- **Adequacy** – the MPA network should be of adequate size to deliver its ecological objectives and ensure the ecological viability and integrity of populations, species and communities (the proportion of each feature included within the MPA network should be sufficient to enable its long-term protection and/or recovery).
- **Connectivity** – the MPA network should seek to maximise and enhance the linkages among individual MPAs using the best current science. For certain species this will mean that sites should be distributed in a manner to ensure protection at different stages in their life cycles.
- **Protection** – the MPA network is likely to include a range of protection levels. Ranging from highly protected sites or parts of sites where no extractive, depositional or other damaging activities are allowed, to areas with only minimal restrictions on activities that are needed to protect the features.

[2] http://www.ospar.org/content/content.asp?menu=00700302210000_000000_000000

- **Best available evidence** – Network design should be based on the best information currently available. Lack of full scientific certainty should not be a reason for postponing proportionate decisions on site selection.

Together these seven network design principles aim to deliver widespread ecosystem protection, central to the ecosystem-based approach to environmental management. The ecosystem approach is a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way (CBD 2000). The core of the approach lies in integrating and managing the range of demands placed on our seas so they can support essential needs and provide benefits, without deterioration (Laffoley, *et al.* 2004). Taking steps to ensure the MPA network is ecologically coherent is a key part of the ecosystem approach (Laffoley, *et al.* 2004).

Resilience

The seven network design principles will help create an MPA network that promotes the resilience of marine ecosystems. A resilient ecosystem can absorb, resist, or recover from disturbances and damage caused by natural perturbations and human activities (including climate change) and continues to provide ecosystem goods and services. In contrast, non-resilient ecosystems are prone to irreversible change and are at risk of shifting into other – often undesirable – states (Marshall and Marshall 2007). If ecological communities within an MPA network are resilient, they are not only more likely to rebound from or withstand environmental fluctuations and unexpected catastrophes, but also can potentially replenish other damaged populations (West and Salm 2003).

Resilience is recognised by the OSPAR Commission (2006) and the IUCN-WCPA (2008) as a distinct element of ecological coherence, which is achieved through:

- The inclusion of replicates of representative habitats within the network (see section 4.3);
- Connectivity between sites within the network (see section 4.6);
- Ensuring all sites are of a viable size (see section 4.5);
- Effective protection of features within the network, including full protection of certain areas (see section 4.7).

Specifically, MPA networks that represent (and replicate) all habitat types across their geographical ranges enhance marine ecosystem resilience because they:

- Spread the risk of disturbance (e.g. caused by localized disasters, climate change, or failures in management or other hazards), and thus help to ensure the long-term sustainability of features (IUCN-WCPA 2008; Roberts, Andelman, *et al*. 2003).
- Ensure the protection of biological variation across habitats and species, and genetic variation within species (by protecting different populations across their geographic range).

Assuming all the ecological and biological factors are considered, MPA features will only be resilient through time if the management regime is capable, effective and sustainable (IUCN-WCPA 2008).

1.3.3 Further considerations

To further assist MCZ identification there are a series of further ecological and practical considerations based on guidance from the OSPAR Commission (2003-7) and Defra (2009b). Some of these considerations are already addressed through the seven network design principles in section 4 and those that are not are described in sections 5 and 6 of this document. The ecological and practical considerations are provided below, along with an indication as to where they are considered in the Ecological Network Guidance.

- Ecological considerations[3]
  - Threatened, declining, or rare species and habitats (section 4.2 – Representativity)
  - Important species and habitats
  - Ecological significance
  - High natural biological diversity

    (Jointly covered in section 5.2 – Areas of additional ecological importance)
  - Sensitivity (section 4.2 – Representativity)
  - Naturalness (section 5.3 – Impacts and feature vulnerability)
  - Size and position of site (sections 4.5 - Viability and 6.3 – MCZ boundaries)
- Practical considerations
  - Synergies with other sectors[4]
  - Size (section 4.5 - Viability)
  - Potential for recovery (sections 4.7 – Protection and 5.3 – Impacts and feature vulnerability)
  - Degree of consensus[4]
  - Potential for success of management measures[4]
  - Scientific value (section 6.2 – Scientific value)
  - Accessibility[4]

1.3.4 Priority of the network design principles and additional considerations

All seven network design principles should be met through the guidelines to best ensure ecological coherence of the MPA network. Regional stakeholder groups should aim to meet all the guidelines under the seven network design principles. The guidelines should all be given equal priority, except for connectivity where the guidelines can be considered of secondary importance (see section 4.6).

In cases where multiple possible locations for an MCZ are identified – all of which equally meet the seven network design principles – the guidelines for the further ecological considerations should be used to distinguish between possible sites.

1.3.5 Role of the Science Advisory Panel

Defra recognise the challenges that some decision-making on MCZ identification will inevitably pose (Defra 2010b). Defra have established a Science Advisory Panel (SAP) to help advise the SNCBs and the regional MCZ projects by:

- Providing expert scientific advice and addressing scientific questions raised by the regional MCZ projects and their stakeholder groups;
- Reviewing alternative MCZ proposals against the guidelines within the Ecological Network Guidance;
- Advising on whether MCZ proposals meet the Ecological Network Guidance and, in combination with other MPAs, contribute to an ecologically coherent MPA network.

In practice the regional MCZ projects will submit MCZ proposals to the SAP who will advise on whether they collectively meet the Ecological Network Guidance. Only MCZs that pass the SAP's assessment will be submitted to the Secretary of State by the SNCBs. The Secretary of State will then determine whether the recommendations will be subject to a public consultation and considered for designation.

[3] Note that 'Representativity' is also listed in the OSPAR guidance document (2003-7) as an 'ecological consideration'. It is not included here, as it is already directly addressed as one of the seven network design principles in section 1.3.2.

[4] These are not covered in this document as they are socio-economic considerations and therefore beyond the scope of the ENG. These considerations will be addressed during the regional MCZ project process.

1.3.6 Adaptive management of the MPA network

The MCAA requires the Secretary of State to report on the designation of MCZs and the degree to which MCZs and the MPA network are achieving their objectives every six years, starting in 2012. As part of the report, the Secretary of State must state what further steps might be needed for any MCZ or the MPA network to meet its objectives. The MCAA allows for MCZ designating orders to be amended, revoked or reviewed. Defra (2009b) states that the ecological coherence of the network will be kept under review, which may give rise to new MCZ designations or the de-designation of existing MCZs after 2012. Government has committed to keep its decisions under review and act to introduce necessary measures where evidence supports a change in the boundary, conservation objectives or management of a site (Defra 2010b). This adaptive process will allow new data on the locations of features, condition of features and the effect of pressures to be taken into account. It also allows for any changes required to meet new laws and policies.

As our understanding of ecological coherence grows and marine environmental data improves there may also be a need to review this Ecological Network Guidance.

2 How to use this guidance

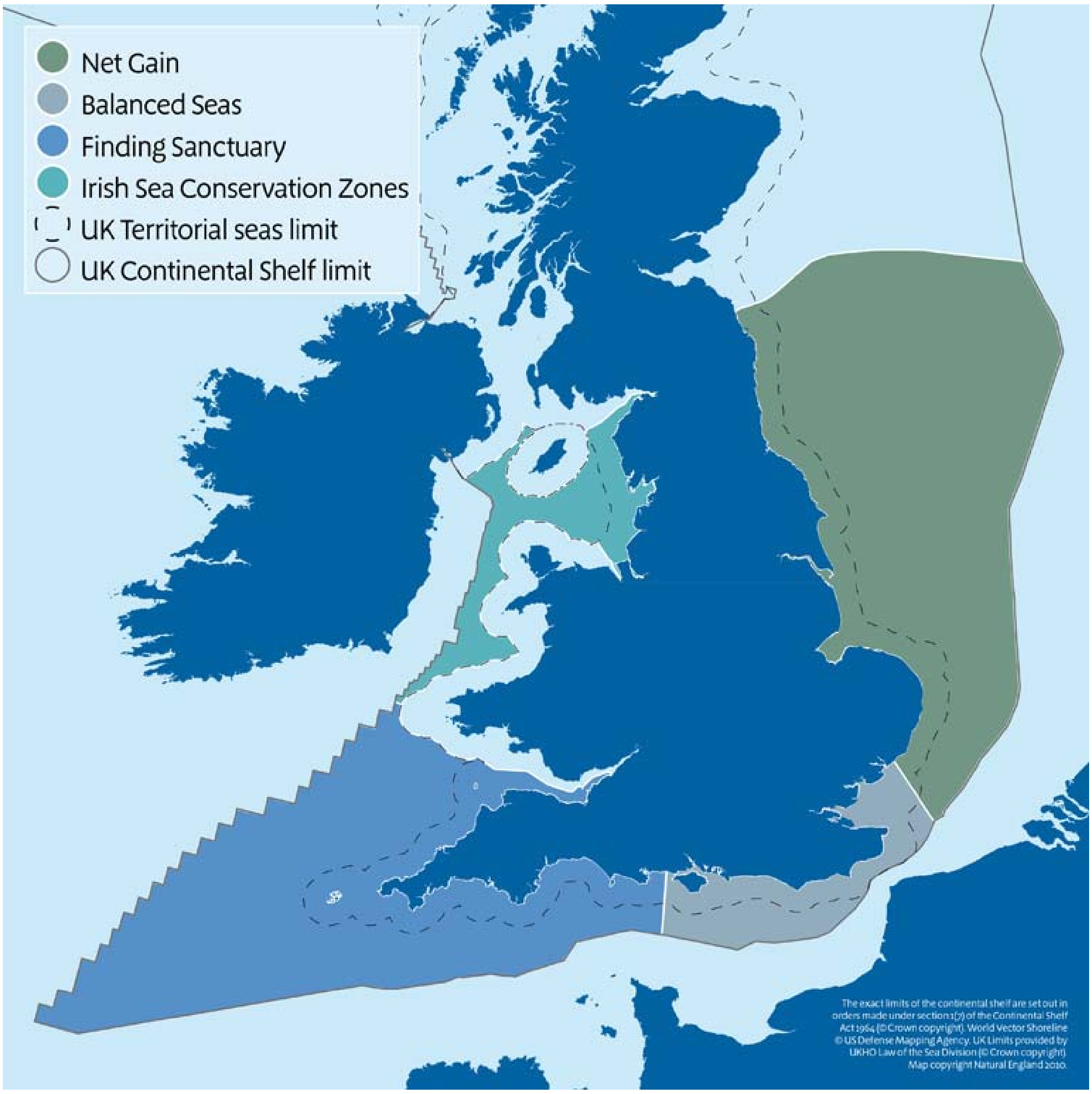
2.1 Geographic scope and audience

The Ecological Network Guidance is primarily written for the regional stakeholder groups and regional MCZ project teams. It is applicable to the area covered by the four regional MCZ projects (see Figure 2), namely:

- Finding Sanctuary (south-west seas);
- Net Gain (English waters of the North Sea);
- Balanced Seas (south-east seas);
- Irish Sea Conservation Zones (English territorial and UK offshore waters of England, Wales and Northern Ireland).

Within these regional MCZ project areas the guidance must be applied from the Mean High Water Spring (MHWS) tide level[5] out to the limits of the UK Marine Area[6] (as defined in the MCAA).

Figure 2: Geographic extent of the four regional MCZ projects.



[5] In estuaries and rivers, MCZs can be identified up to the upper limit of estuarine waters (as far as the tide flows at mean high water spring tide). The upper limits of these transitional waters have been mapped by the Environmental Agency and will be made available to the regional MCZ projects.

[6] This is generally the outer limit of the UK Continental Shelf, or the agreed administrative boundary or median line with neighbouring countries.

2.2 Structure of guidance

The Ecological Network Guidance is structured to lead the regional stakeholder groups through the seven network design principles and five further ecological and practical considerations. Descriptions of each principle/consideration are broken down under the following sub-headings:

- **Definition:** Of the network design principle/consideration.
- **Rationale:** Why is this principle/consideration important for network design?
- **Guidelines:** Straightforward guidelines for each principle/consideration.
- **Justification:** The scientific and policy basis for the guidelines on each principle/consideration with reference to supporting documents and research.

The Ecological Network Guidance contains technical terms that may be unfamiliar to readers. Key terms are explained in the glossary (Section 8) and frequently used acronyms are listed near the beginning of the document.

2.2.1 Following the guidelines

As explained in section 1.3 regional MCZ projects should meet all of the guidelines for the network design principles and further ecological considerations. Figure 3 outlines the suggested steps for identifying MCZs to achieve this. Before identifying possible MCZs, the existing MPAs should be assessed for their contribution towards the guidelines under representativity, adequacy, replication and connectivity.

After assessing the contribution of existing MPAs to the network, the priority is to ensure that the network protects (where MPAs are a suitable mechanism to do so):

- Habitats representing the range of biodiversity present in our seas (section 4.2);
- Habitats and species that are rare, threatened or declining in UK waters (termed Features of Conservation Importance – FOCI) (section 4.2).

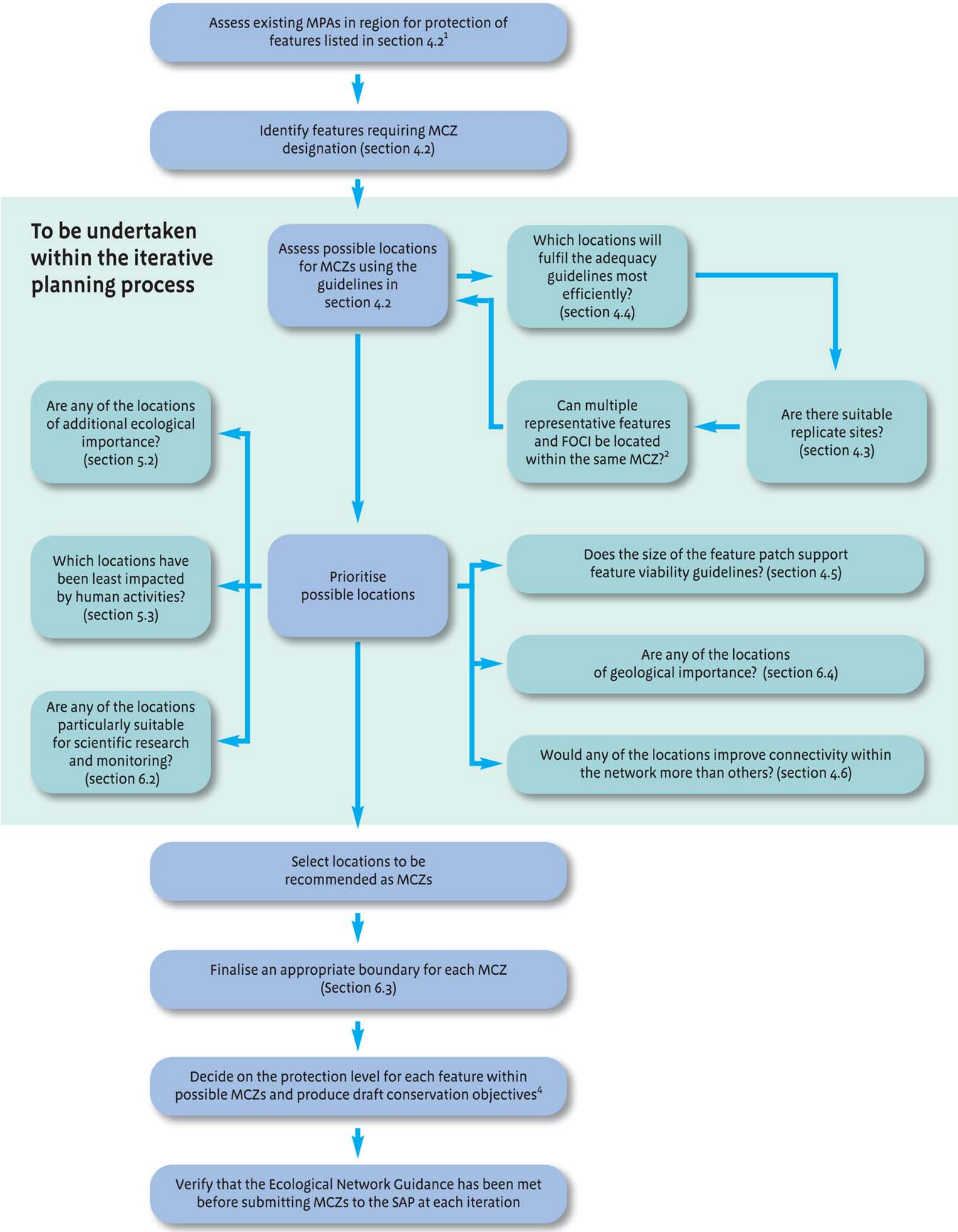
Next, each feature needs to be replicated in two or more MPAs (section 4.3) and an adequate amount of each feature protected to enable its long-term protection and/or recovery (section 4.4).

The remaining network design principles and further ecological and practical considerations will help the regional stakeholder groups choose between areas that are comparable in meeting the principles of representativity, replication and adequacy. This will ensure that MCZs are large enough to ensure viable populations of species and areas of habitat are protected (section 4.5), contribute to maximising connectivity (section 4.6), and include areas of particular ecological importance (section 5.2). Knowledge of the condition of features in specific locations, their vulnerability to impacts (section 5.3), and the value of an area for science and monitoring (section 6.2) will also help regional stakeholder groups discriminate between possible sites.

Once possible MCZs are identified, regional stakeholder groups should address any site-specific considerations. These include drafting conservation objectives for features within the site and proposing appropriate MCZ boundaries (sections 4.7 and 6.3).

Figure 3: Flow chart for identifying MCZs using the Ecological Network Guidance.

Note. Human use and socio-economic value of areas can be considered by the regional stakeholder groups throughout the stages outlined below.



Explanatory notes

1. Existing MPAs such as SACs, SPAs, SSSIs and Ramsar sites will already provide protection for some habitats and species listed in section 4.2. For further information on the overlap between Annex I habitats (EC Habitats Directive), broad-scale habitats, and features of conservation importance see Annex 3. The initial assessment of existing protection will be completed by JNCC and Natural England and provided to the regional MCZ projects.
2. MCZs can be established within, or overlapping with, existing SACs/SPAs. MCZs will not duplicate the purposes of the European Directives. There may be circumstances where MCZ and European designations fully or partially overlap to protect different features. Such co-location of designations could seek efficiencies in applying management measures and monitoring activities since they will already be planned for the existing site.
3. Many marine features overlap with each other (e.g. species characteristic of certain habitats) and identifying MCZs that contain multiple features will result in a more spatially efficient MPA network (see Annex 3).
4. JNCC and Natural England will provide further guidance on writing conservation objectives.

3 Biogeography and environmental change

3.1 Biogeography and the MPA network

Biogeography is the study of geographical distributions of species and habitats, and the environmental or historical factors that produce such distributions. In the marine environment, the distribution of species and habitats is determined by factors such as water depth, temperature, salinity, energy levels (currents and waves) and seabed type.

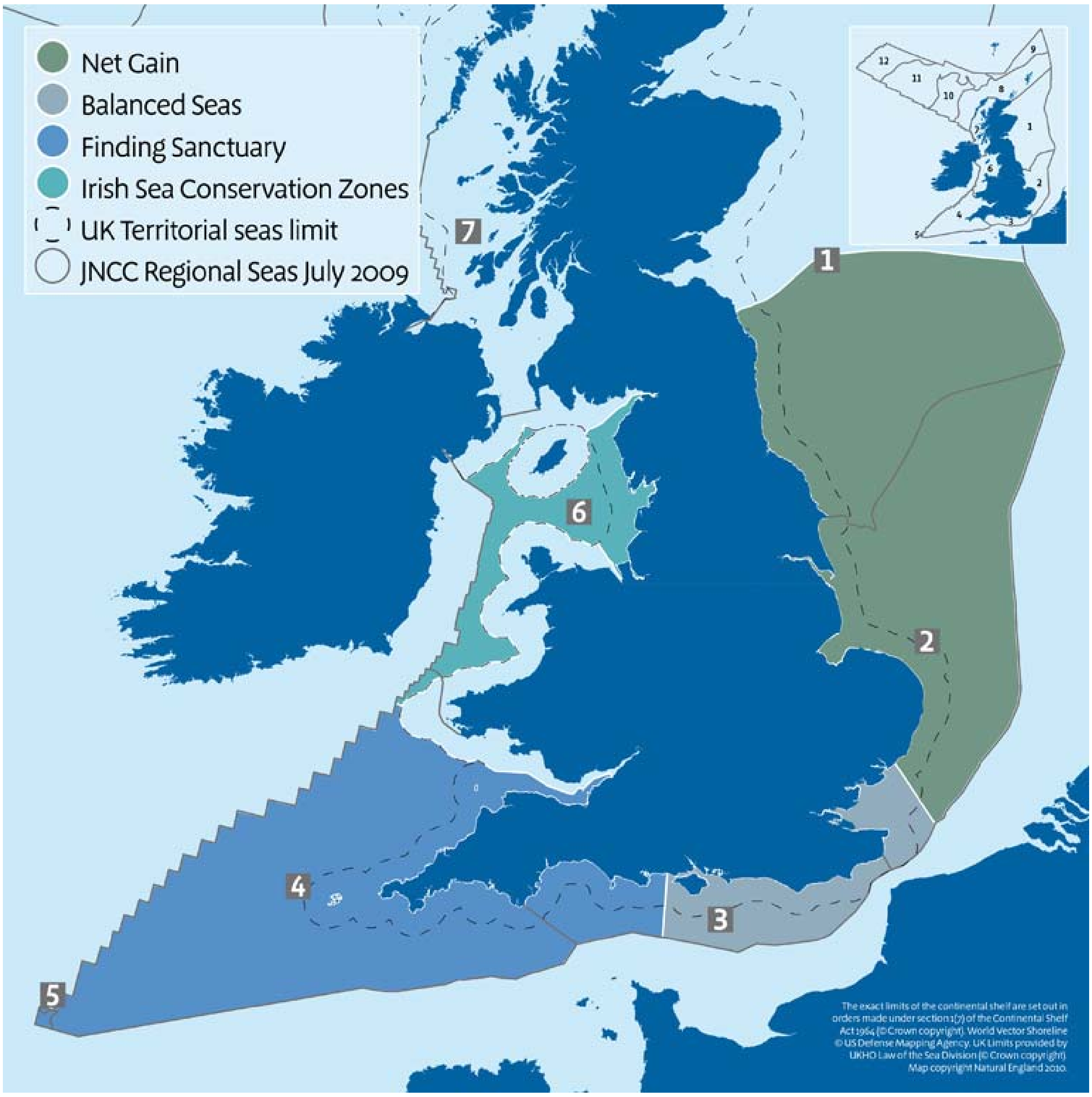
Using biogeography as a tool in MPA network planning has been widely recommended by the IUCN World Commission on Protected Areas (WCPA), the Convention on Biological Diversity (CBD), and the OSPAR Convention (IUCN-WCPA 2008; Mondor 1997; OSPAR 2006; SCBD 2004). The OSPAR Commission recommends that an MPA network 'should reflect biogeographic variation across the OSPAR maritime area by selecting sites for the range of features within each biogeographic area' (OSPAR 2006). Defra state that 'the MPA network should represent the range of marine habitats and species...in our marine area', taking into account 'differences in ecosystems resulting from biogeographical influences where they occur' (Defra 2010b). Biogeography has been used as a network design tool internationally, for example during the development of: i) The Channel Islands Marine Reserves in California (NOAA Channel Islands National Marine Sanctuary 2000), ii) a National Representative System of Marine Protected Areas (NRSMPA) in Australia (ANZECC TFMPA 1998), and iii) the New Zealand MPA network (NZ Department of Conservation and Ministry of Fisheries 2008).

By protecting features within different biogeographic regions, an MPA network is more likely to conserve a representative range of the ecological variation present in our seas. For instance, the typical species of rocky reefs in north-east England will be different to those in south-west England. Therefore, including both these reef types within the network ensures the representation of a greater range of biological diversity compared to only protecting reefs in one biogeographic region. MPA networks that represent (and replicate) all habitat types across their geographical ranges are also more resilient as they spread risk of disturbance and thus help to ensure the long-term sustainability of features (Roberts, Andelman, *et al.* 2003).

A broad scale biogeographic framework for the north-east Atlantic is set out in the EU Marine Strategy Framework Directive (MSFD) and the delineation of the MSFD 'sub-regions' (based on hydrological, oceanographic and biogeographic criteria) is being considered by EU Member States through the OSPAR Convention. At a finer scale, JNCC in collaboration with the SNCBs have identified twelve biogeographic regions in UK waters, referred to as UK Regional Seas (Defra 2004; Verling 2009) (see Figure 4, which shows the six Regional Seas which intersect with the MCZ project area). These regions share physical and biological characteristics and have already been used to develop a network of SACs for Annex I Reefs and Sandbanks in waters away from the UK coast.

The six UK Regional Seas (fine-scale biogeographic regions) which extend over Secretary of State waters and the four regional MCZ project areas do not align (as shown in Figure 4) as the latter were partially determined by administrative and political boundaries (e.g. with Wales and Scotland). The network design principles will therefore initially be applied at a regional MCZ project level to ensure that the regional stakeholder groups have the autonomy to propose a series of MCZs within their project areas at the outset. The SAP will advise on how MCZ proposals (in combination with other MPAs) can best incorporate biogeographic variation at both a broad and fine scale and may propose adjustments to MCZ locations.

Figure 4: Biogeographic 'JNCC Draft Regional Seas' within the MCZ Project area.



3.2 Climate change and the MPA network

Climate change and ocean acidification are altering our marine environment, for example through species range shifts and modified food webs (EPOCA 2009). However, MPAs can help reduce the impacts of climate change – at the scale of both individual sites and across an entire network – by increasing the resilience within marine ecosystems (CCSP 2008; McLeod, *et al.* 2009). The seven network design principles described in the Ecological Network Guidance support resilience of marine ecosystems, as outlined in section 1.3.2.

In addition certain habitats, such as saltmarshes and seagrass beds, lock away carbon from the atmosphere and therefore act as so-called 'carbon sinks' (Nellemann 2009). If managed properly, these carbon sinks can play an important role in mitigating climate change. Protecting these habitats within MPAs may improve their capacity to capture and store carbon.

Following designation, the ecological coherence of the network and the condition of individual MCZs will be continually reviewed by Defra and the SNCBs as outlined in section 1.3.6. Where features protected within MCZs have altered due to natural processes or climate change, it will be possible to revise the features listed for a site, de-designate MCZs, amend the MCZ conservation objectives, or modify the boundaries if such actions are deemed appropriate by Defra and the SNCBs.

3.3 Non-native species and the MPA network

A non-native species is one that has been introduced directly or indirectly by human activities (deliberately or otherwise) to an area where it has not occurred in historical times and where natural range extension would not be expected. The species has become established in the wild and has self-maintaining populations (Eno, *et al.* 1997). The introduction of non-native species to a marine ecosystem and their subsequent establishment may cause effects ranging from the almost undetectable to the domination and displacement of native communities (Eno, *et al.* 1997)[7]. Invasive Alien Species (IAS) are a subset of non-native species which have spread, are spreading or have demonstrated their potential to spread elsewhere, and have an adverse effect on biological diversity, ecosystem functioning, socio-economic values and/or human health (Task Group 2 on Non-indigenous Species 2010). IAS should not be considered as features for MCZ designation. However, the occurrence of an IAS in an area should not necessarily preclude the identification of an MCZ, as long as their presence does not compromise the achievement of feature conservation objectives.

[7] 15 marine algae (including two subspecies of a single species of green alga), five diatoms, one flowering plant and 30 invertebrates have been identified by JNCC as non-native in British waters (Eno, Clark and Sanderson 1997).

4 Seven MPA network design principles

4.1 Introduction

Section 4 of the Ecological Network Guidance outlines the rationale and justification for the guidelines associated with each of the seven network design principles listed below:

- Representativity (Section 4.2)
- Replication (Section 4.3)
- Adequacy (Section 4.4)
- Viability (Section 4.5)
- Connectivity (Section 4.6)
- Protection (Section 4.7)
- Best available evidence (Section 4.8)

In developing the guidelines for these network design principles it was necessary to consider which features of our marine environment the MPA network should conserve and protect. The MCAA allows for designation of MCZs for marine species and habitats, referred to collectively as 'features' in the Ecological Network Guidance[8]. Defra has stated that MCZs identified for habitats will protect both the species assemblage and the physical substratum supporting it. The species assemblage of a habitat may include pelagic species if there is a direct functional link between the species and the habitat (Defra 2009b).

Although MCZs will not be designated for ecological processes directly, species and habitats are considered to be surrogates for ecosystem processes and functions when identifying MCZs. The MCAA allows for SNCBs to provide management advice on human activities that might affect ecological process on which protected features depend.

Guidelines from sections 4.2 (representativity), 4.3 (replication), 4.4 (adequacy), and 4.6 (connectivity) should be applied within each regional MCZ project area, and should consider the contribution of existing MPAs before identifying possible MCZs. Many features will already be protected within existing MPAs. The first stage in network design is therefore to assess how well existing MPAs in each regional MCZ project area protect the features listed in section 4.2 and meet the guidelines for adequacy, replication and connectivity (see process in Figure 3, page 24)[9]. The remaining guidelines for sections 4.5 (viability), 4.7 (protection) and 4.8 (best available evidence) should then be applied to MCZs.

[8] The MCAA also allows for the designation of MCZs to conserve features of geological or geomorphological interest. These are discussed in Section 6.4.

[9] Whilst the features in section 4.2 might occur within existing MPAs the assessment will have to consider whether they are afforded sufficient protection. For example, those features not listed under European legislation occurring within existing site boundaries might not receive sufficient protection.

4.2 Representativity

4.2.1 Definition

To be representative an MPA network needs to protect the range of marine biodiversity found in our seas. This can be achieved by grouping species and habitats into broad-scale habitat types and protecting examples of these across the MPA network. The representativity principle also includes protecting those features of conservation importance (FOCI) that are known to be rare, threatened, or declining in our seas.

4.2.2 Rationale

A key principle of MPA network design is the conservation and protection of the full range of marine biodiversity in a given area (IUCN-WCPA 2008; SCBD 2004). There are thousands of species and habitats present in our marine environment, and comprehensive data on their distribution is not always available. As such it is impractical to seek an MPA network that includes examples of all features and we must use a practical and biologically meaningful method to represent the range of species and habitats in our seas.

To do this species and habitats can be grouped together – or classified – into broad-scale habitat categories based on a shared set of ecological requirements. These broad-scale habitats act as surrogates for biodiversity at finer scales and capture the coarse biological and physical diversity of our seabed. An MPA network that protects examples of all these broad-scale habitats across their geographic and ecological range will therefore also protect the associated species and biotopes (Day, *et al*. 2002; NZ Department of Conservation and Ministry of Fisheries 2008).

The broad-scale habitats must be biologically meaningful (i.e. represent true differences in marine communities) and use a 'common language' (i.e. a recognised classification scheme). Broad-scale habitats are also easier to identify than fine-scale habitats as supporting spatial information is readily available across our whole marine area.

Particular attention should be given to the protection of threatened, rare or declining species and habitats, termed features of conservation importance (FOCI)[10]. Unless action is taken for such features they could become extinct, reduced to small populations, or reduced to residual areas (Defra 2004). By considering FOCI independently we can identify where urgent action is required for their conservation within the broad-scale habitats.

4.2.3 Guidelines

1. **Examples of each of the 23 broad-scale habitats should be protected within MPAs in each regional MCZ project area, where they occur (Table 1).**
2. **Examples of each of the 22 habitats of conservation importance should be protected within MPAs in each regional MCZ project area, where they occur (Table 2).**
3. **Examples of each of the 29 low or limited mobility species of conservation importance should be protected within MPAs in each regional MCZ project area, where they occur (Table 3).**
4. **The three highly mobile species for which MCZs are an appropriate tool should be protected within MPAs in each regional MCZ project area (Table 4)[11].**

[10] FOCI have been identified from the OSPAR List of Threatened and/or Declining Species and Habitats, the UK List of Priority Species and Habitats (UK BAP) and Schedule 5 of the Wildlife and Countryside Act (see Annex 2).

[11] It is recommended that for these highly mobile species spawning, nursery and foraging grounds are most appropriate for protection through MCZs (see Box 1, Annex 2 for further details).

Table 1: Broad-scale habitats to be protected within MPAs in each regional MCZ project area where they occur.

Broad-scale habitat types	**EUNIS Level 3 habitat code**
High energy intertidal rock	A1.1
Moderate energy intertidal rock	A1.2
Low energy intertidal rock	A1.3
Intertidal coarse sediment	A2.1
Intertidal sand and muddy sand	A2.2
Intertidal mud	A2.3
Intertidal mixed sediments	A2.4
Coastal saltmarshes and saline reedbeds	A2.5
Intertidal sediments dominated by aquatic angiosperms	A2.6
Intertidal biogenic reefs	A2.7
High energy infralittoral rock*	A3.1
Moderate energy infralittoral rock*	A3.2
Low energy infralittoral rock*	A3.3
High energy circalittoral rock**	A4.1
Moderate energy circalittoral rock**	A4.2
Low energy circalittoral rock**	A4.3
Subtidal coarse sediment	A5.1
Subtidal sand	A5.2
Subtidal mud	A5.3
Subtidal mixed sediments	A5.4
Subtidal macrophyte-dominated sediment	A5.5
Subtidal biogenic reefs	A5.6
Deep-sea bed***	A6

*Infralittoral rock includes habitats of bedrock, boulders and cobbles which occur in the shallow subtidal zone and typically support seaweed communities.

**Circalittoral rock is characterised by animal dominated communities, rather than seaweed dominated communities.

*** The deep-sea bed broad-scale habitat encompasses several different habitat sub-types, all of which should be protected in the MPA network. The broad-scale deep-sea bed habitat is only found in the south-west of the MCZ Project area and MCZs identified for this broad-scale habitat should seek to protect the variety of habitat sub-types known to occur in the region.

Table 2: Habitat FOCI to be protected within MPAs in each regional MCZ project area where they occur.*

Habitats of conservation importance (Habitat FOCI)
Blue Mussel beds (including intertidal beds on mixed and sandy sediments)**
Cold-water coral reefs***
Coral Gardens***
Deep-sea sponge aggregations***
Estuarine rocky habitats
File shell beds***
Fragile sponge & anthozoan communities on subtidal rocky habitats
Intertidal underboulder communities
Littoral chalk communities
Maerl beds
Horse mussel (*Modiolus modiolus*) beds
Mud habitats in deep water
Sea-pen and burrowing megafauna communities
Native oyster (*Ostrea edulis*) beds
Peat and clay exposures
Honeycomb worm (*Sabellaria alveolata*) reefs
Ross worm (*Sabellaria spinulosa*) reefs
Seagrass beds
Sheltered muddy gravels

Subtidal chalk
Subtidal sands and gravels
Tide-swept channels

*Habitat FOCI have been identified from the OSPAR List of Threatened and/or Declining Species and Habitats and the UK List of Priority Species and Habitats (UK BAP). Those habitats that are known to be sufficiently conserved under the EC Habitats Directive, or are not known to occur in the area covered by the regional MCZ projects are excluded from this list of habitats of conservation importance (see Annex 2 for full details).
**Note that this habitat only covers 'natural' beds on a variety of sediment types, and excludes artificially created mussel beds, and mussel beds which occur on rock and boulders.
***Cold-water coral reefs, coral gardens, deep-sea sponge aggregations and file shell beds currently do not have distribution data which demonstrate their presence in the MCZ Project area, but expert knowledge of their broad geographic distribution suggests they may occur within the MCZ Project area and if new distribution information becomes available they should be protected.

Table 3: Low or limited mobility species FOCI to be protected within MPAs in each regional MCZ project area where they occur.*

Scientific name	Common Name	Taxon group
Padina pavonica	Peacock's tail	Brown alga
Cruoria cruoriaeformis	Burgundy maerl paint weed	Red alga
Grateloupia montagnei	Grateloup's little-lobed weed	Red alga
Lithothamnion corallioides	Coral maerl	Red alga
Phymatolithon calcareum	Common maerl	Red alga
Alkmaria romijni	Tentacled lagoon-worm**	Annelid (worm)
Armandia cirrhosa	Lagoon sandworm**	Annelid (worm)
Gobius cobitis	Giant goby	Bony fish
Gobius couchi	Couch's goby	Bony fish
Hippocampus guttulatus	Long snouted seahorse	Bony fish
Hippocampus hippocampus	Short snouted seahorse	Bony fish
Victorella pavida	Trembling sea mat	Bryozoan (seamat)
Amphianthus dohrnii	Sea-fan anemone	Cnidarian
Eunicella verrucosa	Pink sea-fan	Cnidarian
Haliclystus auricula	Stalked jellyfish	Cnidarian
Leptopsammia pruvoti	Sunset cup coral	Cnidarian
Lucernariopsis campanulata	Stalked jellyfish	Cnidarian
Lucernariopsis cruxmelitensis	Stalked jellyfish	Cnidarian
Nematostella vectensis	Starlet sea anemone	Cnidarian
Gammarus insensibilis	Lagoon sand shrimp**	Crustacean
Gitanopsis bispinosa	Amphipod shrimp	Crustacean
Pollicipes pollicipes	Gooseneck barnacle	Crustacean
Palinurus elephas	Spiny lobster	Crustacean
Arctica islandica	Ocean quahog	Mollusc
Atrina pectinata	Fan mussel	Mollusc
Caecum armoricum	Defolin`s lagoon snail**	Mollusc
Ostrea edulis	Native oyster	Mollusc
Paludinella littorina	Sea snail	Mollusc
Tenellia adspersa	Lagoon sea slug**	Mollusc

*Species FOCI have been identified from the OSPAR List of Threatened and/or Declining Species and Habitats, the UK List of Priority Species and Habitats (UK BAP) [12] and Schedule 5 of the Wildlife and Countryside Act. Those species that are known to be sufficiently conserved under the EC Habitats Directive, or are not known to occur in the area covered by the regional MCZ projects, or are considered to be vagrant to the UK waters are excluded from this list of species of conservation importance (see Annex 2 for full details and Annex 3 for further explanation).
**Those lagoonal species of conservation importance may be afforded sufficient protection through coastal lagoons designated as SACs under the EC Habitats Directive. However, this needs to be assessed by each of the regional MCZ projects.

[12] In the revised 2007/8 lists of UK BAP species and conservation actions, spatial protection was considered to be a priority conservation action for many UK BAP marine species and habitats.

Table 4: Highly mobile species FOCI to be protected within MPAs in each regional MCZ project area, where appropriate spawning, nursery or foraging grounds occur.*

Scientific name	Common Name	Taxon group
Osmerus eperlanus	Smelt	Bony fish
Anguilla anguilla	European eel	Bony fish
Raja undulata	Undulate ray	Bony fish

*Species FOCI have been identified from the OSPAR List of Threatened and/or Declining Species and Habitats, the UK List of Priority Species and Habitats (UK BAP) [12] and Schedule 5 of the Wildlife and Countryside Act. Those species that are known to be sufficiently conserved under the EC Habitats Directive, or are not known to occur in the area covered by the regional MCZ projects, or are considered to be vagrant to the UK waters are excluded from this list of species of conservation importance (see Annex 2 for full details and Annex 3 for further explanation).

4.2.4 Justification

The MCAA states that the MPA network should 'represent the range of features present in the UK marine area' (Clause 123, subsection (3)(b)). The OSPAR Commission recommends that the EUNIS habitat classification[13] developed by the European Topic Centre on Biological Diversity (Davies, Moss and Hill 2004; OSPAR 2006) should be used to characterise the marine environment, and that EUNIS Level 3 habitat types (i.e. broad-scale habitats) reasonably reflect the variation in biological character of the marine environment.

The EUNIS Level 3 habitats are classified according to biologically meaningful physical characteristics (e.g. water depth, substrata and energy levels) following a common classification scheme. Moreover, information on the physical marine environment is readily available for UK waters and by combining several different types of physical data it is possible to produce distribution maps of the EUNIS Level 3 broad-scale habitat types.

JNCC and Natural England advise that 23 of the EUNIS Level 3 broad-scale habitats should be protected within MPAs in each of the regional MCZ project areas to meet the representativity network design principle (Table 1 and Annex 2 for full details). This approach should be combined with more detailed information (where it is available) on the distribution of fine-scale habitats[14] within each of the broad-scale habitats to ensure the known variation within broad-scale habitats, including both FOCI and non-FOCI elements, is encompassed in the MPA network.

As a Contracting Party to the OSPAR Convention the UK is committed to establishing a network of MPAs that protects threatened and/ or declining species and habitats as identified by the OSPAR Commission (OSPAR 2003-7). As a signatory to the Convention of Biological Diversity the UK is committed to establishing national strategies and action plans to conserve, protect and enhance biological diversity. The UK must also protect those marine species listed on Schedule 5 of the Wildlife and Countryside Act. The MCAA makes specific reference to 'conserving any species that is rare or threatened' (Clause 117, subsection (4)) and Defra state that MCZs will conserve and aid the recovery of rare, threatened or declining species and habitats (Defra 2009b).

Species and habitats known to be rare, threatened or declining in our seas have been identified from existing multi-lateral environmental agreements and national legislation, and are termed Features of Conservation Importance (FOCI). This document refers to habitats of conservation importance (habitat FOCI) and species of conservation importance (species FOCI). Specifically, FOCI have been identified from the OSPAR List of Threatened and/or Declining Species and Habitats, the UK List of Priority Species

[13] The EUNIS Habitat types classification is a comprehensive pan-European classification system; it covers all types of habitats from natural to artificial, from terrestrial to freshwater and marine. http://eunis.eea.europa.eu/habitats.jsp
[14] Fine-scale habitats are defined as those habitats or biotopes characterised at Levels 4 – 6 within the EUNIS habitat classification scheme.

and Habitats (UK BAP) [12] and Schedule 5 of the Wildlife and Countryside Act[15]. Many species and habitats occur on more the one list and these duplications are detailed in Annex 2.

For the Ecological Network Guidance only those FOCI that will benefit from site-based protection through MCZs are listed in Tables 2, 3 and 4 (see Annex 2 for further details). Natural England and JNCC recommend that to conserve and aid the recovery of rare, threatened, or declining species and habitats the following should be protected within MPAs in each regional MCZ project area, where they occur:

- 22 habitat FOCI (Table 2);
- 29 low or limited mobility species FOCI (Table 3);
- Three highly mobile species FOCI (Table 4).

It is important to note that some of these features may already be protected within existing MPAs in certain areas and this should be taken into account before new MCZs are identified. Tables in Annex 3 demonstrate how Annex I habitat types as listed in the EC Habitats Directive relate to features listed in the Ecological Network Guidance (broad-scale habitats and FOCI).

The habitats and species that are conserved under European legislation will be features of the MPA network but will not generally require further protection under national legislation (Defra 2010b).These include:

- Annex I habitats and Annex II species of the EC Habitats Directive;
- Annex I species of the EC Birds Directive, and all regularly occurring migratory bird species.

The regional MCZ projects should not consider the features introduced here as a finite list for which MCZs can be designated. The MCAA allows for the designation of MCZs for any marine species or habitat. This Guidance provides JNCC and Natural England's statutory advice as to what is needed to deliver an ecologically coherent network and is intended to promote consistency between the four regional MCZ projects. These guidelines do not prevent the regional MCZ projects from identifying MCZs for other features where there is a strong case for protecting them. For example, there may be species and habitats of local or regional interest that are not listed here as FOCI. Such species and habitats may be listed in the review of Important Plant Areas for algae (Brodie, *et al.* 2007) or the Nationally Important Marine Features list (Hiscock, Harris and Luckey 2006). Particularly sensitive features and/or those defined as 'vulnerable marine ecosystems' (VMEs) (UN General Assembly Resolution 61/105) could also be considered for protection (CBD 2008; United Nations General Assembly 2003)[16].

Climate change may result in changes to the distribution and diversity of marine species. This will, to varying degrees, change the habitat communities. In cases where responses to climate change are significant, it may be appropriate to consider changes to the network as outlined in section 1.3.6 (Adaptive management). Climate induced changes to features will be detected through the anticipated monitoring of MCZs as part of the six-year reporting cycle under the MCAA. The SNCBs will advise any changes to Defra.

[15] Schedule 5 of the Wildlife and Countryside Act lists a number of fully marine species whose distribution extends below the mean low water mark and as such some of the species will benefit from the designation of MCZs.

[16] Note: Many of the FOCI are considered sensitive, and would also meet the definition of VME, in that they are highly susceptible to degradation or depletion by human activity. Therefore sites for FOCI will cover a significant proportion of sensitive features/VMEs in the MCZ Project area.

4.3 Replication

4.3.1 Definition

Replication is the protection of the same feature across multiple sites within the MPA network, taking biogeographic variation into account. All features should be replicated within the MPA network and replicates should be spatially separate.

4.3.2 Rationale

Replication of all features within the MPA network is required:

- To spread the risk of damaging events and long-term change negatively affecting the features of MPAs;
- To safeguard against unexpected disasters or collapse of species populations in one location (Convention on Biological Diversity 2004a; IUCN-WCPA 2008; OSPAR 2006);
- To ensure that natural variation within features is captured.

Quantifying how many examples of each feature should be protected within the MPA network will depend on the features' status and the scale of the biogeographic regions used.

4.3.3 Guidelines

5. **The MPAs within each regional MCZ project area should protect at least two separate examples of each broad-scale habitat where their distribution allows.**
6. **The MPAs within each regional MCZ project area should protect at least three to five separate examples of each feature of conservation importance where their distribution allows.**

4.3.4 Justification

Recommendations made by various conservation organisations on replication vary from two to five replicates within a biogeographic region (or an otherwise defined area). For example, IUCN-WCPA (2008) recommend three replicates per habitat type; OSPAR (2006) and Jackson *et al.* (2009) recommend conserving more than one example of a feature in each biogeographic region; and guidance for selecting SSSIs suggests five examples per area of search are needed (Nature Conservancy Council 1989). Whilst JNCC and Natural England recognise the interdependency between replication and biogeography, the guidelines for replication will be applied at a regional MCZ project level to ensure that the regional stakeholder groups have the autonomy to propose a series of MCZs within their project area (see section 3.1 and Defra 2010b). The two guidelines for replication advised in this guidance by JNCC and Natural England (i.e. for broad-scale habitats and FOCI) reflect the higher level of risk faced by the FOCI which by their definition are rare, threatened or declining.

Replication may be partly achieved through existing MPAs. This is particularly true for SACs designated for Annex I habitats that partially or fully overlap with the broad-scale features listed in the Ecological Network Guidance (see Annex 3 for more detail). The first stage in developing MCZ recommendations will be to assess how well existing MPAs in each regional MCZ project area meet the replication guidelines through protecting broad-scale habitats and FOCI.

Replication of features within MPAs across their biogeographic range can boost the resilience of marine ecosystems (see section 1.3.2). Replication of all features within the MPA network ensures that a proportion of a species' population will remain protected within some sites in the network even if its range or abundance changes. In some cases, where ecological responses to climate change are significant, it may be appropriate to consider changes to the network as outlined in section 1.3.6 (Adaptive management). Climate induced changes to features will be detected through the anticipated monitoring of MCZs as part of the six-year reporting cycle required under the MCAA. The SNCBs will advise any changes to Defra.

4.4 Adequacy

4.4.1 Definition

Adequacy refers to both the overall size of an MPA network and the proportion of each feature protected within the MPA network[17].

4.4.2 Rationale

To be considered adequate an MPA network needs to be of sufficient size and include a large enough proportion of features, in order to:

- Deliver the network's ecological objectives;
- Enable the feature's long-term protection and recovery[18].

Guidelines for adequacy should be based on the biological needs of individual species, communities, and ecosystems so they are scientifically credible and robust (Rondinini in press 2010a).

Both best practice and scientific research recommend that the amount of each feature to be protected in an MPA network should be described numerically (Rondinini in press 2010a). Setting numerical guidelines makes network design more transparent and open to stakeholder involvement (Cowling, *et al.* 2003). It also provides a clear purpose for conservation decisions, lending them accountability and defensibility (Pressey, Cowling and Rouget 2003).

4.4.3 Guidelines

The application of the adequacy guidelines alone will not result in an ecologically coherent MPA network. It is essential, therefore, that the adequacy guidelines are used alongside guidelines from other sections of the Ecological Network Guidance.

7. **For each broad-scale habitat the MPAs within each regional MCZ project area should collectively protect a proportion of habitat known to occur in that area. Proportions for some broad-scale habitats are provided in Table 5, whilst for those broad-scale habitats in Table 6 the proportions will be determined by the application of the guidelines under the principles of replication, viability and connectivity.**
8. **For features of conservation importance the MPAs within each regional MCZ project area should collectively protect a proportion of each feature of conservation importance known to occur in that area. The proportions will be determined by the application of the guidelines under the principles of replication, viability and connectivity.**

[17] Note that adequacy refers to the overall size of the MPA network, whilst viability (see section 4.5) refers to the size of individual MCZs.
[18] Where recovery is a conservation objective for a feature.

Table 5: Proportion of each broad-scale habitat that should be protected by MPAs within each of the regional MCZ project areas.

Broad-scale habitat types	**Proportion**
High energy intertidal rock (A1.1)	21% – 38%
Moderate energy intertidal rock (A1.2)	21% – 38%
Low energy intertidal rock (A1.3)	22% – 39%
Intertidal coarse sediments (A2.1)	25% – 42%
Intertidal sand and muddy sand (A2.2)	25% – 42%
Intertidal mud (A2.3)	25% – 42%
Intertidal mixed sediments (A2.4)	25% – 42%
High energy infralittoral rock (A3.1)	15% – 31%
Moderate energy infralittoral rock (A3.2)	17% – 32%
Low energy infralittoral rock (A3.3)	16% – 32%
High energy circalittoral rock (A4.1)	11% – 25%
Moderate energy circalittoral rock (A4.2)	13% – 28%
Low energy circalittoral rock (A4.3)	16% – 32%
Subtidal coarse sediment (A5.1)	17% – 32%
Subtidal sand (A5.2)	15% - 30%
Subtidal mud (A5.3)	15% – 30%
Subtidal mixed sediments (A5.4)	16% – 32%

Table 6: Broad-scale habitats for which replication, viability and connectivity guidelines will be used to meet the principle of adequacy.*

Broad-scale habitat types	**Component habitats**
Coastal saltmarshes and saline reedbeds	Coastal saltmarsh
Intertidal sediments dominated by aquatic angiosperms	Seagrass beds (intertidal)
Intertidal biogenic reefs	Honeycomb worm (*Sabellaria alveolata*) reefs (intertidal), and blue mussel beds (intertidal).
Subtidal macrophyte-dominated sediment	Maerl beds, and seagrass beds (subtidal)
Subtidal biogenic reefs	Honeycomb worm (*Sabellaria alveolata*) reefs (subtidal), Ross worm (*Sabellaria spinulosa*) reefs, *Modiolus modiolus* beds, blue mussel beds and cold-water coral reefs.
Deep-sea bed	Deep-sea bed

*For all but the deep-sea bed, adequacy will be best achieved for these broad-scale habitats by meeting the viability, replication and connectivity guidelines for their component habitat FOCI listed in this table.

4.4.4 Justification

Best practice and recent scientific research recommend that numerical guidelines should underpin the principle of adequacy (Cowling, *et al*. 2003; Pressey, Cowling and Rouget 2003; Rondinini in press 2010a; Rondinini and Chiozza in press 2010), which can be interpreted as the 'proportion of each feature included within the MPA network' (Defra 2010a).

Numerical guidelines for adequacy should be informed by ecological knowledge of habitats and communities so they are scientifically credible and robust (Rondinini in press 2010a). Numerical gudelines which are not driven by ecological understanding may undermine the goals of biodiversity protection and create a false sense of certainty that sufficient action has been taken to conserve species and habitats (Agardy, *et al.* 2003; Soule and Sanjayan 1998). Specifically, guidelines developed in the absence of biological information may fail to ensure the persistence of populations and the continued functioning of ecological processes (Pressey, Ferrier, *et al.* 1996; Wood 2007). Where ecological knowledge may be limited it is essential that numerical guidelines are reviewed as additional information becomes available and our understanding of the marine environment improves. The adequate amount of habitat to be included in the MPA network is, in part, related to the level of protection received within sites (Roberts, Hawkins, *et al.* 2010).

JNCC and Natural England acknowledge that the proportions presented in the Ecological Network Guidance are subject to uncertainty, and are likely to be reviewed as new information comes to light. This advice from Natural England and JNCC is based on best available evidence for achieving the network design principle of adequacy.

Broad-scale habitats: Research commissioned by JNCC estimated the proportion of each broad-scale habitat required to represent a given number of species (Rondinini in press 2010b)[19]. This research used an established and widely recognised relationship between the extent of a habitat and the number of species that it can support, known as the species-area curve (Rosenzweig 1995). Using this relationship the research calculated the number of species expected to be found in a given percentage of each broad-scale habitat type. For further details of the methodology and information used please refer to Annex 4 and Rondinini (in press 2010b).

Government is committed to halting the decline in biodiversity (Commission of the European Communities 2006) and there is evidence that more diverse communities are more resilient to pressures including climate change (Folke, *et al.* 2004). JNCC and Natural England therefore recommend that the majority (which we define as 70% – 80%) of different species in each broad-scale habitat be protected within the MPA network. As indicated in Table 5 this approach equates to the protection of between 10% and 40% of the total area of broad-scale habitats within MPAs in each regional MCZ project area. Table 5 provides the habitat-specific proportions for each broad-scale habitat to be protected within MPAs in each regional MCZ project area. The lower figures in Table 5 reflect the proportion of habitat required to represent 70% of species known to occur within each habitat type. It is recommended that the lower figures in Table 5 are treated as the minimum proportion of each broad-scale habitat to be protected in MPAs in each of the regional MCZ project areas. In some cases the MPA network will protect greater proportions of broad-scale habitats than the individual ranges indicated in Table 5. This may be due to the requirements of other Directives (e.g. EC Habitat Directive) or as a result of applying the other guidelines within the Ecological Network Guidance.

[19] This report was subjected to an international peer review exercise by Defra nominated marine scientists. The reviews were used by the Chief Scientists of Defra, JNCC and Natural England to ascertain that the scientific evidence on which the research was based was the best available, and its interpretation for application of the ecological principles was appropriate.

For six broad-scale habitats it was not possible to calculate the number of species expected to be found in a given proportion of each habitat type due to the limitations of the available data (Table 6). However, five of the six broad-scale habitats closely correspond to some of the habitat FOCI. Therefore, the proportion of these broad-scale habitats to be protected will be determined by meeting the guidelines under the principles of replication, viability and connectivity *for their component habitats of conservation importance* (see Annex 4 for further details). For the sixth habitat, deep-sea bed, the proportion of this habitat to be protected will be determined by meeting the guidelines under the principles of replication, viability and connectivity for the deep-sea bed.

Features of conservation importance (FOCI): The research commissioned by JNCC found that with currently available information it was not possible to confidently calculate the number of species in a given percentage of each habitat of conservation importance (Rondinini in press 2010b). Recognising that knowledge on distribution of FOCI is limited we do not recommend directly setting proportions. This is because setting proportions based on current distribution will only serve to maintain these features at a threatened or declining state (see Annex 4 for further details). Natural England and JNCC therefore advise that adequacy can best be achieved for FOCI through following the guidelines under the principles of replication, viability and connectivity.

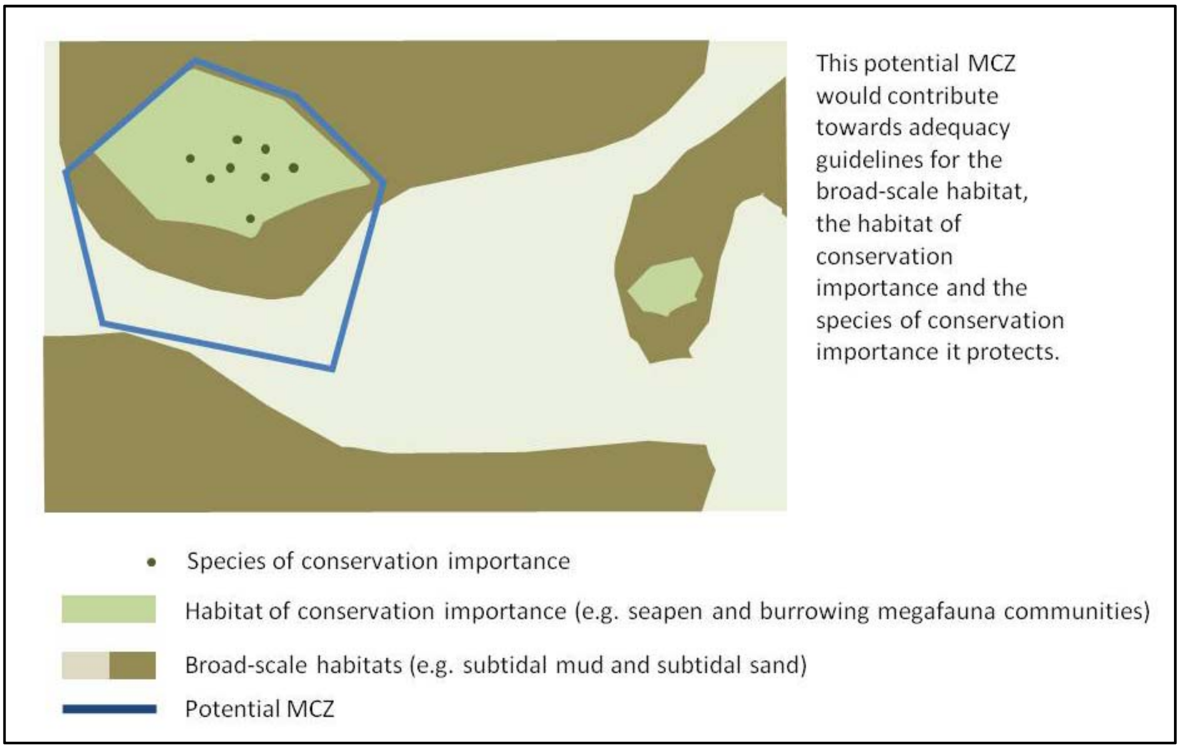
JNCC and Natural England believe that the advice presented in this section on both broad-scale habitats and FOCI will best deliver our national commitments under the MCAA to represent the range of features present in our marine environment in a robust and scientific manner. In addition, the resulting numerical guidelines are similar to those put forward by international agreements (OSPAR 2006; UNEP, CBD and COP 2004; World Parks Congress 2003). For example, the numeric guidelines in Table 5 are comparable to the numeric guidelines suggested by the OSPAR Commission who recommend that at least 10 – 20% of each broad-scale habitat should be protected within the MPA network (OSPAR 2006).

The adequacy guidelines may already be partly achieved through existing MPAs. This is particularly true for SACs designated for Annex I habitats which may partly or fully overlap with the broad-scale habitats listed in the Ecological Network Guidance (see Annex 3 for more detail). It is also expected that SPAs, SSSIs and Ramsar sites will contribute towards meeting the guidelines under the principle of adequacy. The first stage in developing MCZ recommendations will be to assess how well existing MPAs in each regional MCZ project area meet the adequacy guidelines.

It is important to note that FOCI are physically 'nested' within broad-scale habitats. As such, the protection of multiple FOCI and broad-scale habitats can be achieved by a single MCZ (Figure 5). Adequacy targets can be met most efficiently by selecting MCZs for multiple overlapping features, whilst still ensuring that the guidelines under replication (section 4.3) are met.

Table 17 in Annex 3 demonstrates the relationships between individual broad-scale habitats and habitat FOCI.

Figure 5: Spatial overlap between broad-scale habitats, habitat FOCI and species FOCI.



Climate change may result in changes to the distribution and diversity of marine features. In cases where responses to climate change are significant, it may be appropriate to consider changes to the network as outlined in section 1.3.6 (Adaptive management).

4.5 Viability

4.5.1 Definition

For an individual MPA to be viable it must be able to maintain the integrity of its features (i.e. population of the species or condition and extent of the habitat), and be self-sustaining throughout natural cycles of variation. Viability is determined by the size and shape of individual MPAs in conjunction with their effective management[20].

4.5.2 Rationale

MPAs of viable size and shape will provide most benefit to species with low and intermediate mobility[21], and should therefore span the typical movements of those species including adults, juveniles, and larvae (IUCN-WCPA 2008). A viable MPA will also encompass an area of habitat large enough to support populations of species that live attached to the seabed.

4.5.3 Guidelines

Guidelines regarding MPA shape are outlined in section 6.3 – MCZ boundaries.

9. 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.
10. Patches of FOCI within MCZs should have a minimum diameter as specified in Table 7 and Table 8. Where features occur in patches smaller than the minimum diameter, the whole patch or area of combined patches should be protected.

Table 7: Minimum viable patch diameter for habitat FOCI.

Habitats of conservation importance	Minimum viable patch diameter* (km)				
	0.5	1	5	≥10	Whole patch[22]
Blue mussel beds	x				
Cold-water coral reefs					x
Deep-sea sponge aggregations			x		
Estuarine rocky habitats	x				
File shell beds	x				
Fragile sponge & anthozoan communities on subtidal rocky habitats	x				
Honeycomb worm (*Sabellaria alveolata*) reefs	x				
Intertidal underboulder communities	x				
Littoral chalk communities		x			
Maerl beds	x				
Modiolus modiolus beds	x				
Mud habitats in deep water - sea-pen and burrowing megafauna communities		x			
Native oyster (*Ostrea edulis*) beds	x				
Peat and clay exposures	x				
Ross worm (*Sabellaria spinulosa*) reefs	x				

[20] Viability refers to the size of individual MCZS and adequacy (section 4.4) refers to the size of the overall MPA network.
[21] Species that travel large distances will be covered by section 4.6 – Connectivity.
[22] Where the feature occurs in discrete locations Hill *et al.* (2010) recommended the whole patch was required for viability.

Habitats of conservation importance	**Minimum viable patch diameter* (km)**				
Seagrass beds	x				
Sheltered muddy gravels	x				
Subtidal chalk	x				
Subtidal sands and gravels[23]	x			x	
Tide-swept channels	x				

*Where information on habitat extent is lacking and only point data available, stakeholders should take the point to be the centre of the patch.

Table 8: Minimum viable patch diameter for species FOCI.

Species of conservation importance		**Taxon group**	**Minimum viable patch diameter (km)***				
			0.5	**1**	**5**	**≥10**	**Whole patch[24]**
Padina pavonica	Peacock's tail	Brown alga	x				
Cruoria cruoriaeformis	Red seaweed	Red alga	x[24]				
Grateloupia montagnei	Red seaweed	Red alga		x			
Lithothamnion corallioides	Coral maerl	Red alga	x				
Phymatolithon calcareum	Common maerl	Red alga	x				
Alkmaria romijni	Tentacled lagoon-worm	Annelid (worm)	x				
Armandia cirrhosa	Lagoon sandworm	Annelid (worm)					x[25]
Gobius cobitis	Giant goby	Bony fish		x			
Gobius couchi	Couch's goby	Bony fish		x			
Hippocampus guttulatus	Long snouted seahorse	Bony fish	x				
Hippocampus hippocampus	Short snouted seahorse	Bony fish	x				
Victorella pavida	Trembling sea mat	Bryozoan					x[26]
Amphianthus dohrnii	Sea-fan anemone	Cnidarian	x				
Eunicella verrucosa	Pink sea-fan	Cnidarian			x		
Haliclystus auricula	Stalked jellyfish	Cnidarian	x				
Leptopsammia pruvoti	Sunset cup coral	Cnidarian	x				
Lucernariopsis campanulata	Stalked jellyfish	Cnidarian		x			
Lucernariopsis cruxmelitensis	Stalked jellyfish	Cnidarian		x			
Nematostella vectensis	Starlet sea anemone	Cnidarian	x				
Gammarus insensibilis	Lagoon sand shrimp	Crustacean	x				
Gitanopsis bispinosa	Amphipod shrimp	Crustacean		x			
Pollicipes pollicipes	Gooseneck barnacle	Crustacean	x				

[23] The minimum viable size will depend on the specific substratum type. Gravels may have a smaller viable patch size (0.5 km or 1 km diameter) whereas sands require larger patch sizes (10 km or greater).

[24] This alga lives on live maerl and as such a minimum viable patch size will be linked to that of maerl.

[25] This species only occurs in saline lagoons which are discrete features. Therefore, the minimum viable patch will be the whole lagoon.

[26] This species is only known to occur in one location in the MCZ Project area. The site is a lagoon and so the whole feature would need protection to ensure viability of this species.

Species of conservation importance		Taxon group	Minimum viable patch diameter (km)*				
Palinurus elephas	Spiny lobster	Crustacean			x		
Arctica islandica	Ocean quahog	Mollusc	x				
Atrina pectinata	Fan mussel	Mollusc			x		
Caecum armoricum	Defolin`s lagoon snail	Mollusc		x			
Ostrea edulis	Native oyster	Mollusc	x				
Paludinella littorina	Sea snail	Mollusc		x			
Tenellia adspersa	Lagoon sea slug	Mollusc					x[27]

*Where information on extent is lacking and only point data available, stakeholders should take the point to be the centre of the patch.

4.5.4 Justification

The OSPAR Commission recommend that the size of MPAs should take into account species life-history, population structure, habitat quality, the quality of the surrounding areas and connectivity to other sites (OSPAR 2007). OSPAR (2007) also states that in data-poor areas adequate protection may require larger sites than cases where better data are available.

Research commissioned by Natural England investigated the average size of individual MPAs that would be needed to meet the principle of viability (Roberts, Hawkins, *et al.* 2010). The authors examined the distances moved by mature adults of 72 species from a wide range of invertebrate, fish and seaweed groups for which data were available. Results showed that 43% species did not move at all after settlement from the plankton and 38% of species typically moved less than 10 km after reaching maturity. Based on their results the authors recommended the following rules of thumb for identifying MCZs:

- For inshore waters, the average size of MPAs should be no less than 5 km in their minimum dimension, and the average MPA size across the network should be between 10 km and 20 km in their minimum dimension.
- MPAs with a minimum dimension of 1 to 5 km will still be valuable within the network, for example, to protect smaller areas of a habitat FOCI.

Similar rules of thumb have been used in the Great Barrier Reef Marine Park re-zoning (GBRMPA 2002) and California Marine Life Protection Act (MLPA) Initiative (CDFG 2008).

Natural England and JNCC have used the rules of thumb developed through the Roberts *et al.* (2010) research to develop the guidelines for broad-scale habitats.

The viable size for an individual MPA will depend on various aspects of the biology of a species the site is designated to protect (either in their own right or as part of a habitat community). Natural England commissioned research to provide feature-specific recommendations on how large patches need to be in order to meet the viability guidelines for FOCI (Hill, *et al.* 2010)[28]. The authors used the best available information to examine the home ranges, minimal viable population, reproductive strategy, and variability of FOCI over space and time. Their research provides feature-specific recommendations for the minimum size of viable patches (see tables 7 and 8). Where features occur in patches smaller than the recommended minimum diameter then the entire patch or entire area of combined patches should be protected.

[27] This species only occurs in saline lagoons which are discrete features. Therefore, the minimum viable patch will be the whole lagoon.

[28] This report was subjected to an international peer review exercise by Defra nominated marine scientists. The reviews were used by the Chief Scientists of Defra, JNCC and Natural England to ascertain that the scientific evidence on which the research was based was the best available, and its interpretation for application of the ecological principles was appropriate.

The shape of an MPA can be as important as its size in achieving viability. For example, evidence indicates that MPAs with boundaries conforming to natural habitat edges can better protect features than sites that cross habitats (Bartholomew, *et al.* 2007). MPAs for biodiversity conservation should be shaped to minimise edge habitat and maximise their interior (IUCN-WCPA 2008; McLeod, *et al.* 2009). Equally, compact MPAs[29] maximize interior area, diminish 'edge-effects', and reduce the loss of protected species across borders through movement. Further guidance on designing the shape of MPAs, including guidance on when margins might be appropriate is provided in section 6.3.

[29] Note that a compact MPA is not the same as a small MPA.

4.6 Connectivity

4.6.1 Definition

Connectivity is the extent to which populations in different parts of a species' range are linked by the movement of eggs, larvae or other propagules, juveniles or adults (Palumbi 2003).

4.6.2 Rationale

Marine habitats are ecologically connected through movements of species, nutrients and energy. This connectivity between habitats is one of the key principles of ecological coherence (OSPAR 2006). Linkages may include:

- Connections between similar habitats;
- Connections through larvae or spores dispersing between and within MPAs;
- Regular settlement of larvae from one MPA to another;
- Movements of adults and young from one site to another;
- Other ecosystem linkages such as the transfer of nutrients.

Seeking to maximise connectivity between MPAs will improve the ecological coherence of the network and may be crucial for effective conservation and persistence of features within MPAs.

In practice MPAs will be more connected to the nearby wider marine environment than each other. Adults and young will cross MPA boundaries, and larvae or spores will tend to drift out and settle in unprotected areas (Palumbi 2003). This spillover of adults, young, and larvae from inside MPAs mean the network will help support populations in surrounding waters (Defra 2009b; PISCO 2007).

4.6.3 Guidelines

Without more detailed information on connectivity than is currently available, the guidelines are not specific to different features. Detailed connectivity issues should be considered only for species where dispersal distances or a specific path between identified places is known. In most cases therefore, meeting the guidelines on connectivity should be considered of **secondary importance** to other guidelines by the regional stakeholder groups.

11. **Where species-specific dispersal distances or critical areas for life-cycles of FOCI are known these should be considered in determining the spacing between MPAs.**
12. **In the absence of species-specific information on connectivity, MPAs of similar habitat[30] should be separated, where possible, by no more than 40 – 80 km (between individual MPA boundaries).**
13. **Connectivity may be approximated by ensuring that MPAs are well distributed across the regional MCZ project areas[31].**

4.6.4 Justification

The OSPAR Commission has stated that 'the design of a network of Marine Protected Areas needs to recognise aspects of connectivity, and where possible, place protected sites where they have maximum benefit as measured against the objectives of the network' (OSPAR 2006). Where it is available, knowledge of habitat linkages and species movements can inform decision-making for the location of MPAs. However,

[30] Similar habitat for connectivity purposes is considered to be EUNIS level 2 habitats: littoral rock and other hard substrata; littoral sediment; infralittoral rock and other hard substrata; circalittoral rock and other hard substrata; sublittoral sediment; and deep-sea bed.
[31] This includes inshore and offshore waters.

in most cases, information about connections may only emerge over time, especially for those species whose ecology is poorly understood (OSPAR 2006). Detailed connectivity issues should be considered only for species where dispersal distances are known or a specific route between identified places is known (e.g. critical areas of a life cycle). OSPAR also recommend that connectivity may be approximated by ensuring the MPA network is geographically well distributed, with perhaps MPAs in offshore areas being larger and further apart than those in inshore areas (OSPAR 2006).

As the distance dispersed by larvae and spores varies among marine species the spacing of MPAs will provide connectivity for some and not for others. In general MPA network design should seek to reduce the number of features that are left isolated by widely spaced MPAs.

Natural England commissioned research to provide recommendations on how to address connectivity within the MPA network to reduce the number of features that are left isolated (Roberts, Hawkins, *et al.* 2010)[32]. The authors gathered information on the time spent in the plankton by larvae of 67 species and used a simple model (POLCOMS) to predict where and how far larvae are likely to travel before settling out of the water column. Their findings suggest that species that spend a month or more in the plankton may disperse a few tens of kilometres per generation. In general, species that have short larval stages and spend little time in the plankton will be protected effectively within individual MPAs, provided the area is of a viable size (see section 4.5). Based on this research, the recommended guidelines is spacing MPAs 40 – 80 km apart. This corresponds to the distances suggested by other UK and international research on MPA connectivity. Roberts *et al.* (2010) acknowledge that for specialist species, which only live on particular habitats, effective connectivity will be restricted to MPAs that include the required habitat type.

Connectivity within MPA networks needs to be assessed in conjunction with data on habitat distributions and local oceanography. For example, patchy and rare habitats may only occur naturally in areas that are more than 40 – 80 km apart and hence the minimum connectivity guidelines cannot be met. Similarly, effective connectivity will be limited in cases where ocean currents reduce the chances of movement between MPAs even if they are less than 40 – 80 km apart.

It is important to recognise that potential larval dispersal distances depend on various factors including the length of the time spent in the plankton, prevailing oceanographic and current regimes, larval behaviour, and environmental conditions (e.g. temperature and physical barriers to movement) (Gaines, Gaylord and Largier 2003; Shanks, Grantham and Carr 2003) although there is recent evidence to contradict this (Weersing and Toonen 2009). Barriers to movement of larvae or spores in the marine environment can include coastline features, currents and ecological gradients.

Source-sink population dynamics also have a role to play in understanding connectivity and the success of MPAs. A source is a habitat patch where space is limited and individuals (adults, young, larvae or spores) spill out into surrounding areas while a sink area has available space to accept individuals but produces few of its own (Crowder, *et al.* 2000). Therefore, MPAs located in source habitat could increase export of individuals (Crowder, *et al.* 2000). Equally, sink habitats may rely on upstream source habitats for a supply of adults, young, or larvae. Kritzer and Sale (2004) discuss how the effectiveness of protecting local populations of a species depends on demography and linkages with other populations. Tidal flows and currents could be used to indicate the likely direction of larval movement and to identify likely source and sink habitats.

[32] International peer reviewers of this research by Roberts *et al.* (2010) concluded that the recommendations in the report were sound and based on the best available evidence. Following this Defra commissioned peer-review, the Chief Scientists of Defra, Natural England and JNCC noted the widespread support of the Roberts *et al.* report by the reviewers. The Chief Scientists agreed that while the connectivity principle is not unimportant, it should not drive the MPA network design, it would be a secondary consideration, applying a 'rule of thumb' approach derived by Roberts *et al*. (2010).

The understanding of MPA connectivity is expected to improve over the next few years[33]. As such these guidelines remain under review.

The effects of climate change on MPA connectivity should be reviewed through the monitoring programme.

[33] For example, Natural England is funding a PhD at Exeter University to look at population genetics and implications for connectivity for 3 marine species with different life history characteristics. This research will report in 2011.

4.7 Protection

4.7.1 Definition

Protection levels required within MCZs are determined by the nature conservation aspirations for MCZ features, as set out in the conservation objectives. To achieve network aims and site conservation objectives, levels of protection should range from highly protected areas where no extraction, deposition or other damaging activities are allowed, to areas where only minimal restrictions on activities are needed to protect the features (Defra 2010a).

4.7.2 Rationale

Conservation objectives should ensure that MCZs collectively contribute to the protection and recovery of the marine environment, by determining the protection levels which support the favourable condition[34] of all MCZ features. This is in line with the vision for the MPA network which is 'to recover and protect the richness of our marine wildlife and environment' (Defra 2010b), and the MCAA which states that 'conservation' includes reference to 'enabling or facilitating recovery or increase' of marine flora and fauna.

The conservation objectives of MCZs will depend on the features for which they are designated (taking account of their condition and sensitivity) and the role those features will play in achieving the overall network objective of ecological coherence. Differing levels of restriction on human activities will therefore be required to achieve different site objectives.

When afforded adequate protection, MPAs can provide a range of benefits to marine wildlife, as well as wider ecosystem goods and services (Defra 2010b; IUCN-WCPA 2008). Some of these benefits may only be provided in MPAs with high levels of protection, where extraction, deposition and disturbance are not permitted (PISCO 2007; SCBD 2004). Within such highly protected (or reference) areas, removal of anthropogenic pressures should enable features to achieve their reference conditions[35], representing the unimpacted condition of a feature. Reference conditions are important to help us understand the value of the marine environment and the impacts of activities (Defra 2010b). This understanding will also inform wider environmental assessment and management at a national and European level. As such, UNEP-WCMC (2008) and Defra (2010b) support a range of protection levels within MPA networks, including both reference areas (from which all damaging activities will be excluded) and multiple use areas requiring less regulation.

4.7.3 Guidelines

14. Conservation objectives should result in protection levels which ensure the favourable condition of the MCZ features and no further degradation[36]. Features' minimum ecological condition should ultimately be guided by quality objectives under relevant EU Environmental Directives[37].

15. Conservation objectives for MCZs should be determined by using the best available evidence on i) the current condition of features and/or ii) the pressures to which they are sensitive.

[34] The concept of favourable condition is used in the Natura process and is currently being refined by the SNCBs, and further clarification will be provided to the regional MCZ projects as part of the broader guidance on developing MCZ conservation objectives.

[35] Reference condition is a state where there are no, or only very minor, changes to the values of the hydromorphological, physico-chemical, and biological quality elements which would be found in the absence of anthropogenic disturbance (http://www.wfduk.org/wfd_concepts/CIS_Glossary).

[36] Where features are degraded, the objective should be to recover those features to favourable condition.

[37] For example, the Marine Strategy Framework Directive and Water Framework Directive.

16. Each broad-scale habitat type and FOCI should have at least one viable[38] reference area[39] within each of the four regional MCZ project areas where all extraction[40], deposition or human-derived disturbance is removed or prevented.

An example conservation objective is provided in Annex 5.

Conservation objectives for geological and geomorphological features will be set using the same guidelines as for ecological features to ensure consistency in approach.

4.7.4 Justification

Defra's MPA Strategy (Defra 2010b) and the MCAA both emphasize the importance of protection and recovery of the marine environment. In line with this, conservation objectives should result in protection levels that support the favourable condition of all MCZ features, thereby ensuring their conservation and recovery.

The purpose of MCZ conservation objectives is to describe the target ecological condition for the features in a site, and as such, define the desired outcome(s) of designating the area as an MCZ[41]. Condition is a measure of the ecological quality of a feature and will be measured using the scale in Annex 6 aligned to existing designations in the MPA network. Initial condition of a possible MCZ feature will be assessed by the regional MCZ projects. This assessment will be based on available ecological quality data and information on the known pressures that may impact the feature (see Annex 7). In the absence of information on the current condition of the features from recent ecological survey, a risk-based approach should be considered to establish protection levels. This approach will take into account the sensitivities of features, and the potential impacts from different pressures (vulnerability) at the site.

The conservation objectives should identify those pressures to which the feature is sensitive, and which need to be removed, reduced or prevented through management measures to achieve target ecological condition. As a minimum, a site's features should be in (or working towards) favourable condition with no further degradation permitted. In cases where impacts have already taken place, human pressure(s) on MCZ features should be removed or reduced to allow recovery (see proposed approach to assessing likely impact in Annex 9). Where features are assessed as being in favourable condition at designation, existing (sustainable) levels of human pressure may be compatible with the maintenance of the feature in its current condition[42] (unless the objective is to recover to reference condition). Therefore, fewer or no new restrictions may be required, aside from preventing increased pressure. The setting of conservation objectives for geological and geomorphological features will follow the same principles as for ecological features to ensure a consistent approach.

In order to effectively set and achieve conservation objectives for MCZs we need to understand which pressures[43] human activities exert on features and whether these might be having an impact. Many studies have investigated habitat sensitivities to pressures (examples include English Nature; SNH; CCW; EHS (DoE(NI)); JNCC; SAMS 2001; Hiddink, Jennings and Kaiser 2007; and Tyler-Walters, *et al.* 2009). Further research on MCZ feature sensitivities and the distribution and intensity of pressures in UK waters is being undertaken by the SNCBs and through Defra-led research contracts MB0102 and MB0106 (ABPmer

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[38] See section 4.5 on Viability.

[39] Reference areas may be part of, or an entire MCZ.

[40] Of both biological and geological resources.

[41] It is important to recognise that reducing pressures caused by some activities will mean that the composition of species may change over time and at different rates before reaching stable state(s). As such, it may not be possible to set specific, measurable targets for recovery (Defra 2009b). (Defra 2010b).

[42] Note that many marine features are in a long-term state of slow degradation caused by ongoing human activities. Where the conservation objective is to 'maintain' a feature in its current condition, the effects of existing activities should be comprehensively reviewed by competent authorities and the SNCBs to ensure they are not causing chronic decline in the ecological quality and quantity of designated features.

[43] For a list of pressure categories, see Annex 7.

2009a; Defra 2009c), which will help guide the development of conservation objectives and appropriate management measures in MCZs[44]. Where possible, the SNCBs will provide feature-specific descriptions of favourable condition to support conservation objective development.

Each MCZ will have its conservation objectives set out in the site designation order. This provides a basis for identifying and managing activities that may impact the MCZ features. The regional MCZ projects will be responsible for drafting these conservation objectives with guidance from the SNCBs[45]. Guidance for drafting conservation objectives will address assessing condition at designation, the condition descriptor of features and setting objectives for feature recovery. SNCB guidance will build on international best practice as well as experience of setting conservation objectives for existing protected areas, particularly Natura 2000 sites (Davies, *et al.* 2001; EN, SNH, CCW, EHS (DoE(NI)), JNCC & SAMS 2001b). SNCB advice will help to ensure that the likely management implications are as clear as possible, and that conservation objectives are consistent across the regional MCZ projects.

As outlined above, a range of levels of protection should be considered when designing an MPA network and will be necessary to achieve conservation objectives for MCZs across the network. Existing UK MPAs (e.g. EMS), are generally multiple-use sites where activities are only restricted if they significantly affect the designated feature achieving favourable condition. Only the No Take Zone in the Lundy MCZ restricts all fishing activities to give features the best chance of recovery. MCZs can provide higher levels of protection for marine biodiversity, where this is required to meet network objectives.

High levels of protection can boost the resilience of marine ecosystems (Dudley 2008; IUCN-WCPA 2008) and are likely to be needed in areas which:

- Contain extremely vulnerable habitats or species;
- Represent a high level of naturalness;
- Are important for the recovery of biodiversity and ecological processes;
- Are required as reference areas (Defra 2009b).

Areas of reference condition provide a key opportunity to demonstrate the unimpacted state of a broad range of marine features, in the context of prevailing environmental conditions. These areas will therefore be critical in refining concepts such as 'Good Environmental Status' under the Marine Strategy Framework Directive (Task Group 1 on Biological diversity 2010), and sustainable development, which underpins the Government's vision for 'clean, healthy, safe, productive and biologically diverse oceans and seas'. The development of biological reference conditions is also a requirement of the Water Framework Directive. Features in reference condition can serve as a reference (or benchmark) against which other areas of the marine environment can be compared, as part of long-term monitoring and assessment. For areas to be effective reference (or control) areas against which to assess the effects of pressure, the human activities within them need to be managed so that impacts are minimised at the site (i.e. no extraction, deposition or disturbance).

To assess change throughout different components of the marine environment, such reference areas should ideally cover the range of broad-scale habitats and FOCI found throughout the MCZ Project area. Reference areas may be MCZs in their own right or be nested within existing or proposed MPAs (EMS or MCZs) to reduce 'edge-effects' often experienced along the boundaries of highly protected areas (FGDC Marine Boundary Working Group Marine Managed Areas 2006).

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[44] It should be acknowledged that much of the UK's marine environment has been subject to continued degradation over the last few hundred years. National datasets provided to MCZ projects only comprise pressure intensity/distribution information for recent years (a consequence of data availability). Although this represents best available evidence at a UK scale, it cannot provide a complete picture of long-term environmental impact. Where appropriate, regional MCZ projects are encouraged to use additional sources of data on historic decline of marine features to help set feature conservation objectives, particularly in relation to recovery (for example Roberts and Thurstan 2008).

[45] This will be delivered separately from this guidance.

4.8 Best Available Evidence

4.8.1 Definition

A vital element of building an ecologically coherent MPA network is ensuring that best available evidence is used. Uncertainties in our knowledge should be recognised and taken into account throughout the process. However, decisions will need to taken based on the best available evidence and lack of full scientific certainty should not be a reason for postponing proportionate decisions on site selection (Defra 2010a).

4.8.2 Rationale

One of the key principles of ecological coherence is that network design should be based on the best information currently available (Defra 2010b). In order to meet our aims for an ecologically coherent MPA network we need to gather and use a wide range of ecological and socio-economic information in a form that is useful for planning and decision making (IUCN-WCPA 2008).

Insights from around the world suggests that where there is scientific uncertainty a precautionary approach should be taken in designing MPA networks. In this context, the precautionary approach involves using best available information to make decisions rather than waiting for new – and potentially improved – information (CBD 2004). Postponing decisions in anticipation of new information can make network development more difficult and costly. The resulting delays can lead to further degradation of features the network is aiming to protect (UNEP-WCMC 2008). Defra acknowledges the lack of full scientific certainty, and expects this to be explicitly taken into account in the process of designation (Defra 2010b).

4.8.3 Guidelines

17. MCZ identification and designation should be based on the best available scientific evidence.
18. Lack of full scientific certainty should not be a reason for delaying network design and planning, including decisions on site identification.
19. MCZ identification should take account of local and lay knowledge.

4.8.4 Justification

The precautionary approach is reflected in the overarching aim for the OSPAR MPA network, which looks to ‘prevent degradation of and damage to species, habitats and ecological processes, following the precautionary principle’ (OSPAR 2003-7), and in the network design principles which state that ‘lack of full scientific certainty should not be a reason for postponing proportionate decisions on site selection’ (Defra 2010a; Defra 2010b).

We acknowledge that some evidence may be uncertain, old or incomplete, and as a result some decisions on MCZ locations will undoubtedly be challenging. However, to fulfil the commitment to creating a network, Government will need to take decisions based on the best available evidence, both when designating sites and when deciding how best to regulate activities within them (Defra 2010b).

Regional stakeholder groups, in applying the guidelines in the Ecological Network Guidance, should use the best available information to make decisions rather than waiting for new, and potentially improved, information. Best available information may include ecological and socio-economic information from several different sources, which may be held nationally or locally by conservation organisations, marine industries, or individuals. In addition, local and lay knowledge can be incorporated through the regional MCZ projects and their stakeholder groups. Government accepts that, in some cases, decisions will have to rely on expert opinion and science-based assumptions (Defra 2010b).

Defra, JNCC, and Natural England have commissioned a range of research to collate and develop (where required) ecological and socio-economic information about the marine environment[46] to help ensure that the best available evidence is used by the regional MCZ projects. We will continue to commission a range of research to better understand the marine environment and build the evidence base on which decisions are made. This future research, along with work by the wider scientific marine community, will mean our understanding changes over time. These advances in our knowledge and evidence base will be reflected in the six yearly reporting cycle as required by the MCAA.

As already outlined, the MCAA allows for MCZ designating orders to be amended, revoked or reviewed. Government has committed to keep its decisions under review and act to introduce necessary changes when the evidence supports a change in the location, conservation objectives or management of a site (Defra 2010b). This is part of the process of adaptive management of the MPA network (see section 1.3.6).

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[46] For example the Defra contracts MB0102, MB0103, and MB0106 have collated a range of ecological, physical and socio-economic information.

5 Ecological considerations

5.1 Introduction

Section 4 of the Ecological Network Guidance provided guidance on fulfilling the network design principles. Defra guidance (2009b) lists a number of further considerations that regional stakeholder groups should take into account when identifying MCZs. These considerations are based on OSPAR guidance (2003-7). This section provides guidance on prioritising ecologically important areas and on using information on vulnerability and naturalness of MCZ features in site selection (see section 1.3.3. for full listing). Meeting these ecological considerations when identifying MCZs will help enhance the ecological coherence and effective management of the MPA network. Ecological considerations will be particularly relevant in cases where multiple possible locations for an MCZ are identified – all of which equally meet the seven network design principles.

5.2 Areas of additional ecological importance

5.2.1 Definition

Areas of ecological importance are areas which – either by themselves or in a network – make a disproportionately greater contribution than other areas to ecosystem function, biodiversity, or resilience in the marine environment. These include areas that support particular ecological processes, are important for particular life stages and behaviours of species, are highly productive or support high biodiversity.

5.2.2 Rationale

The marine environment provides a wide range of ecosystem services to society (Defra 2010b). Fisher (2009) defines ecosystem services as 'the aspects of ecosystems utilized (actively or passively) to produce human well-being'. The Millennium Ecosystem Assessment (2003) further broke down ecosystem services into supporting, regulating, provisioning and cultural services. Direct services include food, fuel, energy, and recreational opportunities. Indirect services include, climate regulation and nutrient cycling (Hiscock, Marshall, *et al.* 2006). All these goods and services often rely the presence and interactions between marine organisms (Hiscock, Marshall, *et al.* 2006), therefore MPAs may play a key role in providing ecosystem services. Once the full range of ecosystem services is taken into account, benefits of an MPA network often outweigh the economic and social costs of designating it (TEEB 2009).

As an ecosystem-based approach is being used, important ecological areas should be identified and protected. This will further ensure that ecosystem services provided by the marine environment are maintained.

Areas of additional ecological importance could include:

- **Areas for key life cycle stages and behaviours:** Mobile species[47] may aggregate in discrete locations at particular stages within their life cycles or to undertake specific behaviours such as breeding, foraging, moulting, loafing, resting, and wintering (Scott, *et al.* 2010). This may include spawning aggregations and nursery areas for mobile species, which play a crucial role in sustaining populations and maintaining ecosystem function (IUCN-WCPA 2008). Designating areas known to be especially important for species will contribute to the long-term viability of protected populations and help increase connectivity within the MPA network.
- **Areas of high biodiversity:** Areas of high natural diversity may be more resilient to environmental change, and protecting them can help maintain the structure and functioning of the ecosystem (Jackson, Langmead, *et al.* 2009). Focusing conservation effort on areas with high diversity of species and habitats has been important for conservation on land (IUCN-WCPA 2008). Identifying such 'hotspots' at sea may improve the efficiency of achieving an ecologically coherent MPA network, by capturing a greater numbers of features within individual sites.
- **Areas of high productivity:** Productivity – the production of organic material – is a key ecosystem process that underpins ecosystem function. It plays an important role in energy flow and cycling of matter and chemical elements in our ecosystems. Primary production is the basis of the marine food web and is driven by photosynthesis in phytoplankton and to a lesser extent macroalgae, seagrasses and saltmarsh. Areas of high primary productivity may lead to high local densities of herbivorous species feeding on this food source, and thus should be considered as ecologically important areas[48].

[47] For further detail on mobiles species see Box 1 in Annex 2. Features of the MPA network.

[48] However, increased nutrients in coastal and estuarial waters may lead to excessive primary production causing eutrophication and lower environmental quality.

5.2.3 Guidelines

20. **When selecting MCZs for broad-scale habitats and FOCI, particular attention should be given to including important areas for key life cycle stages of species[49], such as spawning, nursery or juvenile areas; and areas important for behaviours such as foraging, breeding, moulting, loafing, rafting, wintering or resting.**
21. **When selecting MCZs for broad-scale habitats and FOCI prioritise areas of high natural biodiversity and high natural pelagic productivity.**

5.2.4 Justification

Damaging the habitat structure, impairing ecosystem functioning, and interfering with ecosystem processes will impact the ecosystem services that society can benefit from (Hiscock, Marshall, *et al.* 2006). Therefore, recommending MCZs for areas that contain both MCZ features and areas of particular ecological importance may help maintain the ecosystem processes and ecosystem services that our seas provide.

Defra state that ecosystem processes will not be the basis for designation but – due to the important role they play in ecosystem functioning – they should be taken into account when identifying MCZs (Defra 2009b). Ecological processes can be physical, chemical, and biological and can act together to influence marine ecosystems.

Information on spawning and nursery areas for commercial species (Cefas 1998) will support identification of important areas for particular species. This information will be updated by Cefas in 2010 through a Defra-led research contract[50].

A study by Scott *et al.* (2010) found that many mobile animals return to discrete foraging areas where prey are abundant. Identifying MCZs in such areas will offer additional protection to these species through targeted management measures aimed at, for example, ensuring food supply or maintaining key habitat features.

The designation of MCZs in areas of comparatively high pelagic productivity would help deliver ecosystem-based management (ABPMer 2009). The location of such areas may be indicated by fronts or thermoclines that concentrate nutrients and/or plankton, and can be mapped using remote sensing techniques.

The ecological importance of areas may alter with climate change, for example locations of spawning and nursery areas may shift northwards. The effects of climate change on the ecological importance of particular areas should be reviewed through the monitoring programmes, and further evidence for changes may come from observations by sea-users such as fishermen.

In cases where multiple areas are identified that equally contribute to achieving the seven network design principles; regional stakeholder groups should consider whether one area can be judged to be more ecologically important than another.

[49] All species may be considered here, not just species FOCI.
[50] Research contract MB0102

5.3 Impacts and feature vulnerability

5.3.1 Definition

Human activities exert pressures on the marine environment which may adversely impact features (See Annex 7 for a list of pressures). By combining information on pressures with information on the sensitivity of species and habitats, it is possible to assess how impacted – or vulnerable to impact – a feature might be (See Annex 8). Less impacted features are considered closer to their natural state.

5.3.2 Rationale

Information on impacts, feature vulnerability and levels of naturalness can help guide MPA selection (OSPAR 2003-7). In cases where multiple areas are identified that equally contribute to achieving the network design principles and further ecological considerations, higher priority should be given to sites containing less impacted examples of the same feature[51] (see Annex 8). This does not mean that vulnerable features should be excluded from the network. Features that are considered to be rare, threatened or declining within the MCZ project area are listed as FOCI, and site selection for these features is obligatory (see section 4.2). Regardless of current degradation, sites must be selected that best contribute to the ecological objectives of the MPA network.

5.3.3 Guidelines

22. Sites which best contribute to achieving the network design principles and further ecological considerations should be identified as MCZs, regardless of current degradation.

23. Where multiple areas are identified that equally contribute to achieving the network design principles and further ecological considerations, those features which have been less impacted (or are less likely to have been impacted) by human activities should generally be considered a higher priority for MCZ identification than more degraded examples of the same feature[52].

A checklist indicating the sensitivity of individual features to particular pressures will be provided to the regional MCZ projects in due course to give an indication of the likely impact of human activities on MCZ features.

5.3.4 Justification

Many human activities cause pressure on the marine environment. The nature of a pressure is determined not only by the type of activity causing it, but also its intensity, duration, and distribution. Human activities *do not necessarily result in ecological impact.* Impacts will be determined by species and habitat sensitivities. For example, low level physical abrasion (from static or set fishing gear use) is unlikely to significantly impact a shallow sandbank, but may impact a biogenic reef. As such, an assessment of the likely impact of a pressure requires information on both the level of exposure and sensitivity of features to that pressure[53] (see Annexes 8 and 9). Impacts may also be measured directly through onsite surveys and monitoring of species and habitats.

Where alternative sites exist, less impacted areas should be preferentially included within the network. OSPAR recommends that naturalness should be used to guide MPA site selection and network designers should therefore prioritise areas that have 'a high degree of naturalness, with species and habitats/biotope types still in a very natural state as a result of the lack of human-induced disturbance or degradation'

[51] It is also important to note that areas of high impact are more likely to have associated human activities and if an alternative site for the same feature can be found which would not conflict with ongoing human activities this would be a preferable choice. For more information on the consideration of socio-economic factors see the MCZ Project Delivery Guidance..

[52] However, evidence of feature resilience and/or potential for recovery should also be taken into account, where possible.

[53] Coarse-scale information on feature sensitivity and pressure intensity will be supplied to the Regional MCZ projects by Defra and JNCC. Where possible this should be supplemented by locally-derived information.

(OSPAR 2003-7). Today, there are few areas in the UK that constitute 'a very natural state'[54]. However, relative levels of impact can be taken into account and selected sites should be as natural as possible. In other words, it would be preferable to choose site X where a feature is only subject (or vulnerable) to moderate impact, rather than site Y where the same feature is subject (or vulnerable) to high impact. Inevitably, some features will frequently be associated with intense human use but still need inclusion within the network to meet the network design principles and further ecological considerations. It is therefore anticipated that the MPA network will comprise sites in various ecological conditions at the outset, before management measures are introduced to achieve feature conservation objectives (see section 4.7).

Although less impacted areas should generally be prioritised, degraded examples of features may be selected as MCZs if their ecological contribution to the network is considered greater than that of less impacted equivalents. For example, if:

- The feature's ecological importance or scientific value is greater than alternative examples (see sections 5.2 and 6.2);
- The feature has shown evidence of high resilience despite exposure to pressures (including climatic change)[55]. More resilient examples of features can be a vital component of MPA networks since they may be able to resist or adapt to both regional disturbances and wider (climatic) changes (IUCN-WCPA 2008);
- Historical and contemporary data gives a strong indication that the feature has good potential for recovery if human pressures were removed[56]. This approach supports the OSPAR MPA selection criterion 'Potential for restoration' (OSPAR 2003-7): '*The area has a high potential to return to a more natural state under appropriate management'*. An important function of MPAs is to help restore impacted marine ecosystems and associated populations to their full productivity and diversity (IUCN-WCPA 2008). For more information on recovery as a conservation objective, see section 4.7.

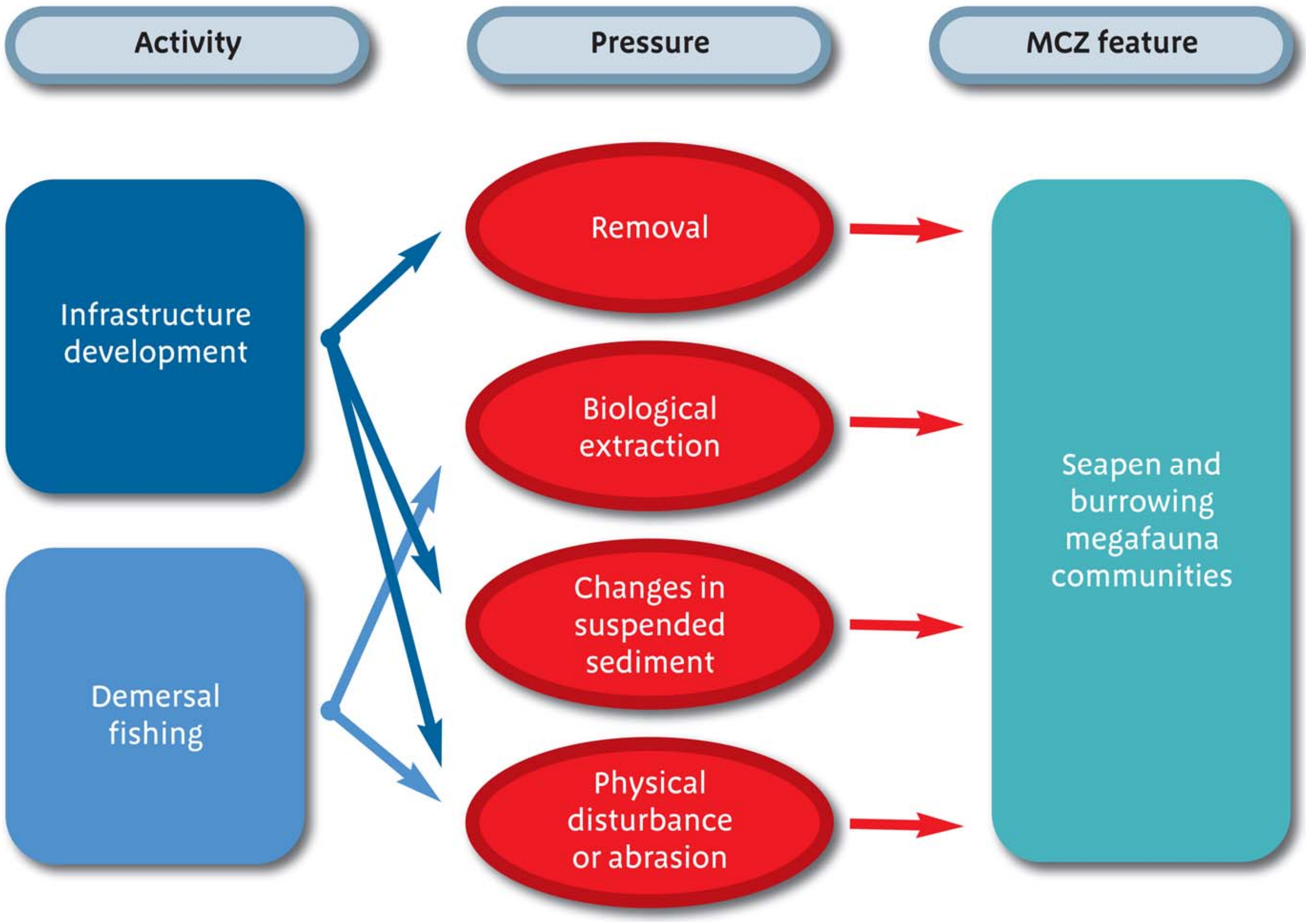
[54] Much of the UK's marine environment has been subject to continual degradation over the last few hundred years. National datasets provided to Regional MCZ Projects only comprise pressure intensity/distribution information for recent years (a consequence of data availability). Although this represents best available evidence at a UK scale, it cannot provide a complete picture of long-term environmental impact. Where appropriate, Regional MCZ Projects are encouraged to use additional sources of data on historic decline of marine features (for example, Roberts and Thurstan 2008). Reference to past condition is important, even if data are not complete or only approximate, to overcome the issue of shifting baselines (OSPAR 2003-7).

[55] Resilience can include both intrinsic factors, such as biological or ecological characteristics of a community (e.g. potential for recruitment success), and extrinsic factors, such as physical features (e.g. current patterns that may favour larval dispersal) (West and Salm 2003).

[56] However, it is important to bear in mind that features that have been very heavily impacted by human activities are less likely to recover to exactly the same ecological state once pressures have been removed.

Figure 6: The relationship between activities, pressures and MCZ features, where pressures are the mechanisms through which activities can have an effect on a habitat or species (after Robinson, Rogers and Frid 2008).

Note: Exposure of an MCZ feature to a pressure (e.g. physical abrasion) *will not necessarily* lead to an impact. Impacts will depend on the intensity of the pressure and the sensitivity of the feature in question to that pressure. Impact is not shown in the figure below.



6 Practical considerations

6.1 Introduction

In parallel to identifying possible MCZs through the application of the network design principles and ecological considerations described in Sections 4 and 5, regional stakeholder groups will need to address site specific practical considerations listed by Defra (2009b). Some of these considerations (see section 1.3.3. for list) are covered in previous sections. Section 6 provides guidance on the two remaining practical considerations: scientific value and drawing boundaries. In addition, this Section provides guidance on selecting MCZs for geological and geomorphological features.

6.2 Scientific value (for research and monitoring)

6.2.1 Definition

Some MPAs may have a high value for scientific research. In particular, reference (or control) areas allow the study of ecological changes resulting from human pressure, by comparing sites of minimal impact with the wider marine environment (Kingsford and Battershill 1998).

6.2.2 Rationale

MPAs have a crucial role to play in improving our understanding of human activities on the marine environment and offer the opportunity to assess the success – or otherwise – of different management approaches. Studying all MCZs in detail is unlikely to be possible but some sites should be identified as the focus for a research and monitoring programme. A central part of that programme will be highly protected sites where activities are highly restricted or excluded. These can be used as reference or benchmark areas to assess the effects of pressures elsewhere (see section 4.7).

Evaluating the scale of impact from an activity may offer the opportunity to determine the acceptable level of human use that would achieve sustainable development which underpins the Government's vision for 'clean, healthy, safe, productive and biologically diverse oceans and seas'.

6.2.3 Guidelines

24. When identifying possible MCZs, consider their value for scientific research. Suitable locations may include:

- **Areas that have already been subject to long-term research and monitoring as the conditions before designation will be well-known and change can be measured.**
- **Areas located close to research centres or access points that can facilitate regular research and monitoring.**

6.2.4 Justification

IUCN's explanation of protected areas categories states that some MPAs 'can serve as indispensable reference areas for scientific research and monitoring' (Dudley 2008). For areas to be effective reference (or control) areas against which to assess the effects of human pressure, the activities within them need to be managed so that human pressures are minimal at the site (i.e. no extraction, deposition or disturbance). These areas can then serve as a standard for comparison (or benchmark) against other areas of the marine environment which are exposed to human pressure.

To assess change throughout different components of the marine environment, scientific research should focus on MCZs in different biogeographic areas, and cover the range of broad-scale habitat types and habitats of conservation importance found throughout the MCZ Project Area.

The achievement of conservation objectives will need to be monitored in order the meet the reporting requirements of the MCAA. JNCC, Natural England and the other country agencies are developing a Marine Biodiversity Surveillance and Monitoring Programme (MBSMP). This programme proposes to cover all UK waters and encompass benthic habitats, seabirds, cetaceans, associated pressures and potentially (under discussion) the approach to monitoring MCZs.

The suitability of particular areas for research and monitoring can depend on factors including historic levels of research; presence of existing restrictions on activities; ease of access to the site by scientists; and economic costs of research (e.g. deep water offshore areas require availability of expensive equipment and boat).

6.3 MCZ boundaries

6.3.1 Definition

The process of drawing MCZ boundaries around habitats, species and features of geological and geomorphological interest.

6.3.2 Rationale

Management of activities within an MPA will only be effective if the boundary is accurately drawn and correctly represented on a map (FGDC Marine Boundary Working Group Marine Managed Areas 2006). A technically robust, defensible, and inclusive boundary-making process will be crucial to the success of MCZs. This process should address future management implications and be understood by stakeholders.

6.3.3 Guidelines

25. MCZ boundaries should follow feature extent (where appropriate)[57] whilst:
- **Using a minimum number of straight lines;**
- **Ensuring as compact a shape as possible;**
- **Incorporating a margin (where appropriate) to ensure protection of features.**

26. Where a feature is present in a number of separate but nearby locations, effort should be made to include all discrete occurrences within site boundaries.

27. For spatially dynamic habitats, boundaries should, where possible, encompass predicted changes in feature distribution to ensure their ongoing protection within MCZs.

28. MCZs for species should be drawn around areas of regular/predictable species concentration, using the best available data. Where there is a clear functional link between the specific habitats and species' distribution, habitats can be used as a basis for site delineation.

The diagrams in Annex 10 help to explain these guidelines.

6.3.4 Justification

MCZ boundaries should be as simple as possible whilst enclosing the minimum area necessary to ensure feature viability (see section 4.5). The boundary should follow the shape or extent of the feature(s) in question (Annex 10, Diagram A) and use a minimum number of straight lines (Annex 10, Diagram B). Evidence indicates that MPAs with boundaries conforming to natural habitat edges can better protect features than sites that cross habitats (Bartholomew, *et al.* 2007). However, this approach may not be appropriate in cases where only a discrete section of an extensive broad-scale habitat is incorporated within an MPA. Using straight lines to delineate sites is important as users of the marine environment find these easier to find and follow than lines following depth contours or distance from land (IUCN-WCPA 2008). This should assist with compliance and enforcement of the MPA network (IUCN-WCPA 2008).

MCZs should also be as compact as possible[58] (Annex 10, Diagram C): compact MPAs maximize interior area and reduce 'edge-effects', thus minimising the movement of protected species across borders into unprotected areas. Where a feature is present in a number of separate but nearby locations, effort should be made to include all occurrences or 'pieces' within a single site boundary to effectively protect the feature and help to maintain its ecological function (Annex 10, Diagram D) (JNCC MNPG 2008). If the 'pieces' are some distance apart within an area of low conservation interest, a composite MPA[59] boundary may be

[57] For broad-scale habitats types, this approach may not be appropriate, particularly where only a discrete section of an extensive broad-scale habitat is being incorporated within an MCZ

[58] Note that a compact MPA is not the same as a small MPA. MPA size is considered in section 4.5 (Viability)..

[59] A composite MPA is one that is made up of a cluster of separately delineated sites.

more appropriate (Annex 10, Diagram E) (JNCC MNPG 2008). Small, isolated 'pieces' of a feature may be excluded from an MCZ if they occur at a significant distance from each other or the main location of the feature. To ensure ongoing protection of spatially dynamic habitats[60], MCZ boundaries should try to encompass predicted changes in feature distribution. If features move beyond existing MCZs, some boundaries may need to be revised in future years (see section 1.3.6. on adaptive management of the MPA network).

To draw effective boundaries, habitats and species need to be accurately identified and mapped. In some cases, particularly in waters away from the coast, this may involve remotely-sensed and modelled data such as seabed geological data and sidescan sonar, acoustic, or bathymetric data. Information on regular/predictable species concentrations will help identify potential areas for species protection. However, where species occur in close association with known habitats (and there is a clear functional link between the two), habitat distribution data can be used as a proxy when delineating MCZs for species (JNCC 2003). The latter approach would be particularly relevant for sessile or low-mobility species, although it may also be applicable for more mobile species at key life-history stages (e.g. feeding and breeding areas).

The types of human activities that are likely to be restricted within a site (to achieve feature conservation objectives) should be taken into account when MCZ boundaries are drawn up. For example, demersal fishing operations taking place outside the MCZ boundaries may, due to the warp length used, deploy mobile gear that encounters MCZ features at the seabed (this is one type of 'edge effect'). Therefore, in the majority of cases, a safety margin should be included around the features to prevent them from being damaged or removed by demersal fishing gear[61] (FGDC Marine Boundary Working Group Marine Managed Areas 2006) (See Annex 10, Diagram F). This will be appropriate for MCZ features known to be sensitive to physical or biological pressures caused by fishing. The width of the margin should take into account water depth (since this determines warp length used by demersal fishing vessels) and possible location of mobile gear on the seabed in relation to a vessel at the sea surface (JNCC MNPG 2008). Annex 11 gives the an indication of the appropriate size of margins relative to water depth. Site margins are incorporated as a minimum measure to reduce the likelihood of feature damage from demersal fishing (JNCC MNPG 2008). Ultimately Competent Authorities, in coordination with the SNCBs, will be responsible for considering which management actions are needed to reduce the risk of feature damage caused by human activities, whether these take place within or outside the site boundary.

In terms of geographic scope, MCZ boundaries can be delineated from the Mean High Water Spring (MHWS) tidemark out to the limits of the UK Marine Area[62] (as defined in the MCAA). In some circumstances MCZs may extend landwards of MHWS, for example to (Defra 2009b):

- Avoid complex, fluctuating, or migrating boundaries (e.g. to incorporate predicted coastal erosion);
- Include a whole intertidal biological community, including the splash zone;
- Incorporate extensions to species MCZs;
- Incorporate features that are dynamic or ephemeral (e.g. geological processes).

In the case of watercourses (such as rivers and estuaries) MCZs can extend up to the freshwater limit[63] (as far as the tide flows at MHWS tide).

[60] These may include features affected by a changing coastline or patterns of erosion and deposition.

[61] Activities which are location specific, always subject to prior consent, and have clear reliable methods of enforcement are already controlled under existing procedures such as licensing of these activities. Mobile activities which may affect seabed habitats, such as fishing and anchoring, are not subject to prior consent procedures and therefore need special consideration.

[62] Generally the outer limit of the UK Continental Shelf, or the agreed administrative boundary or median line with neighbouring countries.

[63] The upper limits of these transitional waters have been mapped by the Environmental Agency and will be made available to the Regional MCZ Projects.

MPAs close to the coast are sometimes described in relation to existing physical features, such as headlands, or by using the distance from a fixed point on land or at sea. However, advancements in marine navigation, enforcement, and management techniques mean that reference to a fixed point is no longer necessary in boundary delineation (FGDC Marine Boundary Working Group Marine Managed Areas 2006). Equally, physically demarcating MCZ boundaries at sea is not usually required. Boundaries are better defined electronically in a Geographic Information System (GIS) by a series of geographic coordinates stated in degrees, minutes, and seconds of an appropriate precision, with a clear description of the horizontal datum. Agreeing a Standard Operating Procedure (SOP) for boundary delineation across regional MCZ projects will ensure consistency in the quality and integrity of the MCZ boundaries.

6.4 Geological and geomorphological features of interest

6.4.1 Definition

Geological and geomorphological parts of the marine environment are the physical structures – the landforms, rocks, sediments – and the processes that shape them, such as landslides. Geological and geomorphological features of interest may include areas of international geological importance, areas containing exceptional geological features, or areas that represent a geological or geomorphological feature or process.

6.4.2 Rationale

British geology is diverse and visually impressive, representing all the major divisions of earth history and is of international importance in the study of Earth sciences (Prosser, Murphy and Larwood 2006). To date, geological conservation has focused on terrestrial and coastal areas[64] even though geology and geomorphology continue into areas beneath the waves. The justification for conserving certain marine geological and geomorphological features remains the same for the marine environment as it does on dry land. Nearly every part of the UK land area has been underwater at some point in the past, and many of the processes that contributed to the creation of geological features on land are active today on, or below, the seabed. The need to preserve our Earth heritage for future generations and to maintain resources for ongoing and future research applies to the same extent beneath the waves as it does terrestrially (Brooks, *et al.* 2009).

The diverse landforms and geological records found in our seas are potentially of great value in understanding linkages between the ocean, atmosphere, cryosphere, and biosphere and for our understanding of climate change (Brooks, *et al.* 2009). This variety of rocks and landforms plays a role in marine biodiversity and a number of internationally important habitats form only on these seabed features (Brooks, *et al.* 2009). This importance is reflected in the MCAA which allows for the designation of MCZs for features of geological or geomorphological interest.

6.4.3 Guidelines

29. The 32 coastal GCR sites that have a significant intertidal or subtidal portion and are not currently protected in Sites of Special Scientific Interest (SSSIs) should be considered for MCZ designation (see Table 9).

30. When identifying MCZs for broad-scale habitats and FOCI consider the locations of geological and geomorphological features, especially those features which are considered to be of greatest conservation importance (see Table 10).

Table 9: Coastal GCR sites that have a significant intertidal or subtidal portion not currently protected by existing SSSIs.

Regional MCZ project areas	GCR Name	Related SSSIs
Balanced Seas	Bognor Regis	Bognor Reef
Balanced Seas	Bracklesham	Bracklesham Bay
Balanced Seas	Clacton	Clacton Cliffs and Foreshore
Balanced Seas	East Head	Chichester Harbour
Balanced Seas	Felpham	Felpham
Balanced Seas	Folkestone Warren	Folkestone Warren
Balanced Seas	Lee-on-Solent	Lee-on-the Solent to Itchen Estuary

[64] See information on the Geological Conservation Review http://www.jncc.gov.uk/page-2947

Regional MCZ project areas	GCR Name	Related SSSIs
Balanced Seas	Pagham	Pagham Harbour
Balanced Seas	Warden Point	Sheppey Cliffs & Foreshore
Finding Sanctuary	Axmouth-Lyme Regis	Axmouth-Lyme Regis Undercliffs
Finding Sanctuary	Black Ven	West Dorset Coast
Finding Sanctuary	Budleigh Salterton	Budleigh Salterton Cliffs
Finding Sanctuary	Dawlish Warren	Dawlish Warren
Finding Sanctuary	Hallsands	Hallsands-Beesands
Finding Sanctuary	Isles of Scilly	Tean
Finding Sanctuary		Eastern Isles
Finding Sanctuary	Slapton Ley	Slapton Ley
Finding Sanctuary	Westward Ho!	Northam Burrows
Finding Sanctuary	Whitsand Bay	Rame Head & Whitsand Bay
Irish Sea Conservation Zones	Walney Island	South Walney & Piel Channel flats
Net Gain	Benacre Ness	Pakefield to Easton Bavents
Net Gain	Gibraltar point	Gibraltar point
Net Gain	Goswick-Holy Island-Bude Bay	Bamburgh coast and hills
Net Gain		Lindisfarne
Net Gain	North Norfolk Coast	Hunstanton Cliffs
Net Gain		Weybourne Cliffs
Net Gain		North Norfolk coast
Net Gain		Morston Cliff
Net Gain	Orfordness	Alde-Ore Estuary
Net Gain	Spurn Head	Humber flats and marshes: (a) Spurn Head to Saltend Flats
Net Gain	Trimmingham Cliffs	Sidestrand and Trimmingham Cliffs
Net Gain	Winterton Ness	Winterton to Horsey Dunes

Table 10: Geological and geomorphological features of importance in the MCZ Project area.

Regional MCZ project area	Feature name
Balanced Seas	Felpham Palaeocene submerged forest
Balanced Seas	English Channel outburst flood features
Finding Sanctuary	Haig Fras rock complex
Finding Sanctuary	Celtic Sea relict sand banks
Finding Sanctuary	Portland deep
Irish Sea Conservation Zones	Esker field
Irish Sea Conservation Zones	Glacial flute field
Irish Sea Conservation Zones	Southern Irish Sea glacial tunnel valleys
Irish Sea Conservation Zones	Morecambe Bay skears
Net Gain	West Runton submerged forest
Net Gain	North Sea glacial tunnel valleys (Outer silver pit)
Net Gain	North Sea glacial tunnel valleys (Swallow hole)

6.4.4 Justification

The Geological Conservation Review (GCR) has identified nationally and internationally important terrestrial and coastal sites (Ellis, *et al.* 1996). These are protected within Sites of Special Scientific Interest

(SSSI). However, 32 coastal GCR sites[65] have a significant intertidal or subtidal portion that is not currently protected by existing SSSIs and should be considered for MCZ designation (see Table 9 for SSSI names and Annex 12 for full details of the 32 coastal GCR sites).

Research commissioned by Defra has identified 6,500 subtidal geological and geomorphological seabed features in UK waters (Brooks, *et al.* 2009). These have been classified into the following five geomorphological and geological feature types:

1. **Glacial Process Features**: Features created as a direct result of physical processes associated with ice.
2. **Marine Process Features**: Features created directly by marine processes such as waves, tides and currents.
3. **Mass Movement Features:** Features created from the movement of sediment or rock, for example a slump or a slide occurring on the seabed. Mass movements can cover large geographical areas and may involve large quantities of material moving at great speed.
4. **Features indicating past change in relative sea level**: These features are markers of historic sea levels which have fluctuated over time.
5. **Geological Process Features**: These features are formed by a variety of past and ongoing geological processes including volcanism, diapirism, fluid and gas seepage from the seabed and tectonism.

These geological and geomorphological features were assessed for their conservation importance including aspects such as rarity, exceptionality, and their sensitivity to pressures (for further details see Brooks *et al.* 2009).

The assessment identified 12 sites in the MCZ Project area that have relatively high conservation value (greater than 50%) for their geological and geomorphological features (see Table 10 and Annex 12). These sites should be considered for MCZ designation based on their features of geological and geomorphological interest.

It should be noted that the features in Table 10 are based on an initial assessment and future research may result in both amendments and additions to this list (Brooks, *et al.* 2009). Further studies may result in scores becoming downgraded if more of the same features are discovered in UK waters or the presence of unknown exceptional attributes revealed (Brooks, *et al.* 2009).

When identifying MCZs for species and habitats, it will be useful to determine if there are also any other geological or geomorphological features of interest since this may offer an efficient way of including different types of features together in the same site.

[65] http://www.jncc.gov.uk/default.aspx?page=4175&block=22

7 Annexes

7.1 Annex 1 – Background to other relevant guidance, legislation and projects

7.1.1 Other MCZ policy and guidance documents

The MCZ Project needs several types of guidance for effective identification of MCZs and delivery of the MPA network. This document, the Ecological Network Guidance, needs to fit within the Government policy framework, the Marine and Coastal Access Act 2009, and the guidance on the structure and delivery process of the regional MCZ projects including the following:-

1. **Government policy documents** Defra have produced several policy documents which outline high level policy guidance for MCZ delivery:
   a) **Marine and Coastal Access Act 2009[66] (MCAA):** This Act provides the legislative tools to enhance the protection of the marine environment and biodiversity; improve management of fisheries in England; and Wales and improve access to the English coast. At the heart of the Act is the integration of the marine users' socio-economic needs with the need to protect the marine environment and conserve biodiversity. Part 5 of the Act provides the Secretary of State, Welsh and Scottish Ministers power to designate MCZs, and a duty to exercise this power in order to contribute to the creation of an MPA network.
   b) **High Level Marine Objectives[67]:** In 2009, the UK Government, Welsh Assembly Government, Northern Ireland Executive and Scottish Government published their joint High Level Objectives for the UK marine area. The High Level Marine Objectives take forward the UK vision for the marine environment of 'clean, healthy, safe, productive and biologically diverse oceans and seas', and set out the outcomes that all UK Administrations are seeking to achieve in the UK marine area. These objectives will steer the development of policies to achieve sustainable development in the UK marine area and will be used to underpin the development of the joint Marine Policy Statement (expected to be completed in 2011), which is provided for in the MCAA.
   c) **Marine Policy Statement (MPS):** The MPS will set out the policies that will contribute to the achievement of sustainable development in the UK marine area. It will provide the framework for preparing marine plans and taking decisions that affect the marine environment. Defra and the Devolved Administrations aim to publish the final version of the MPS in spring 2011.
   d) **Ministerial Statement:** In March 2010 the then Secretary of State laid in Parliament his statement on 'the creation of a network of Marine Protected Areas'. This statement describes the principles and other matters that the Government intends to follow when contributing to a network of MPAs in English territorial and UK offshore waters adjacent to England, Wales and Northern Ireland. It fulfils the obligation set out in section 123 (6) of the MCAA.
   e) **Defra's MPA Strategy[68]:** 'The Government's strategy for contributing to the delivery of a UK network of marine protected areas'. The strategy sets out how Government's commitment to produce an ecologically coherent network of MPAs fits within the Government's wider marine policy framework and the expected benefits over the next 40 years (Defra 2010b). The strategy explains how existing obligations for MPAs under European Directives together with MCZs under the MCAA and other designated sites will deliver an ecologically coherent MPA network by 2012.
   f) **Draft Guidance on the MCAA[69]**: Defra, with the Welsh Assembly Government, has prepared draft guidance to accompany Part 5 of the MCAA. These guidance documents explain how Government intend for the powers and duties to be used to designate and manage MCZs. These guidance

[66] http://www.opsi.gov.uk/acts/acts2009/pdf/ukpga_20090023_en.pdf
[67] http://www.defra.gov.uk/environment/marine/documents/ourseas-2009update.pdf
[68] http://www.defra.gov.uk/environment/marine/documents/mpa-strategy100330.pdf
[69] http://www.defra.gov.uk/environment/marine/protected/mcz/guidance.htm

documents may be amended to reflect any policy modifications. Final versions will be published in Summer 2010. They comprise:

- Draft Guidance note on 'Selection and designation of Marine Conservation Zones' (Note 1)
- Draft Guidance note on 'Duties on public authorities in relation to Marine Conservation Zones' (Note 2)
- Draft guidance on the byelaw and order making powers and general offence under Part 5 of the Marine and Coastal Access Act (Note 3)
- Draft Guidance note on 'SSSIs and National Nature Reserves in the subtidal area' (Note 4)

2. **Project Delivery Guidance on the process to select MCZs:** This document provides the framework for the constitution and delivery of the regional MCZ projects. It includes guidance on how and when to engage stakeholders, establish stakeholder groups and making decisions on MCZs, as well as setting out the role of the SAP. This guidance will promote consistency and communication among the regional MCZ projects.

3. **Conservation objective guidance:** Natural England and JNCC will produce further guidance on how to set conservation objectives for MCZ features and assess feature condition at designation.

7.1.2 Other relevant legislation and conventions

A number of international conventions, European obligations, and national local commitments provide for protection of marine biodiversity. These include:

- Wildlife and Countryside Act 1981, as amended
- EC Habitats and Birds Directives (and their transposition into UK law)
- EU Marine Strategy Framework Directive (MSFD)
- EU Water Framework Directive (WFD)
- Natural Environment and Rural Communities Act (NERC)
- Oslo-Paris Convention (OSPAR)
- The Ramsar Convention
- Convention on Biological Diversity (CBD)
- World Summit on Sustainable Development (WSSD)

Most of these require or recommend the identification of protected areas for biodiversity conservation. Sites of Special Scientific Interest (SSSIs) are designated under the Wildlife and Countryside Act 1981, while Natura 2000 sites are designated under the EC Birds and Habitats Directives to protect habitats and species of European importance. The EU MSFD explicitly refers to MPAs as an important contribution to achievement of Good Environmental Status, and under this Directive, the UK is required to have a coherent and representative network of MPAs by 2016. The EU WFD's principle aim is to achieve Good Ecological Status in waterbodies by 2015; the designation of MCZs could help towards achieving Good Ecological Status in transitional and coastal waters out to 1 nm.

Internationally, the UK is committed to contributing to an ecologically coherent MPA networks in the North East Atlantic by 2010 under the OSPAR Convention, and establish a representative MPA network by 2012 under the CBD and WSSD. Government policy is to aim for the 2012 target. The UK has also designated wetlands of international importance as Ramsar sites under the international Ramsar Convention.

7.1.3 Links to other MPA projects in the UK

7.1.3.1 MPA identification in the Devolved Administrations

The MCAA provides for the designation of MCZs in English and Welsh territorial waters, and UK offshore waters (though they will be called MPAs in offshore waters adjacent to Scotland).

In Welsh territorial waters there are already a significant number of existing MPAs but in order to have an ecologically coherent network, giving a high level of protection to a small number of ecologically important sites is desirable in order to promote healthy functioning and resilient marine ecosystems. The 'MCZ Project Wales' will designate a small number of highly protected MCZs. Site selection will be managed by the Welsh Assembly Government in collaboration with the Countryside Council for Wales and will engage widely with the public and sea user interests.

The Marine (Scotland) Act[70] gained Royal Assent in March 2010. It makes provision for Scottish Ministers to designate nature conservation MPAs in Scottish territorial waters. Under the MCAA the Scottish Government has executive devolution of marine nature conservation and marine planning functions in offshore waters adjacent to Scotland. In Scottish waters new MPAs will be designated for the protection of nationally important marine habitats and species, and features of geological and geomorphological interest. Marine Scotland, Scottish Natural Heritage and JNCC are working in partnership on the Scottish MPA Project. This Scottish MPA project will facilitate a science based process with integral stakeholder engagement to develop recommendations on the sites required to complete the MPA network in the offshore waters adjacent to Scotland.

Northern Ireland hopes to introduce a Northern Ireland Marine Bill to the Northern Ireland Executive by 2012. This will outline proposals for nature conservation in Northern Ireland's territorial waters.

In summary, the UK Government and the Devolved Administrations are committed to working together to deliver an ecologically coherent network of MPAs within the context of the current devolution arrangements. The UK Government will continue to liaise with the Scottish Government, the Welsh Assembly Government and the Northern Ireland Executive, as well as internationally, to deliver an effective MPA network.

70 http://www.opsi.gov.uk/legislation/scotland/acts2010/pdf/asp_20100005_en.pdf

7.2 Annex 2. Features of the MPA network

7.2.1 Broad-scale habitats

JNCC and Natural England advise that 23 broad-scale habitats (taken from Level 3 of the EUNIS habitat types classification scheme) should be protected within MPAs in each regional MCZ project area to '*represent the range of features present'* in our seas.

In total there are 56 marine EUNIS Level 3 habitat types. For the purposes of the Ecological Network Guidance the nine EUNIS Level 3 deep-sea bed habitat types have been combined into a single habitat termed 'deep-sea bed' as this habitat is only found in the south-west tip of the Finding Sanctuary Project area. A further 25 EUNIS Level 3 habitat types have been excluded from the Ecological Network Guidance including:

- Four ice-associated marine habitats as they do not occur in UK waters;
- Six Baltic habitat types as they do not occur in UK waters;
- Ten pelagic water column features as not only is there limited data for these features, they are extremely mobile both in time and space and as such they are unlikely to directly benefit from site based protection measures[71]; and
- Five feature habitat types (features of intertidal rock, intertidal sediment, infralittoral rock, circalittoral rock and subtidal sediments) as they are not considered to be broad-scale habitat types.

7.2.2 Features of conservation importance (FOCI)

Features of conservation importance been identified from the OSPAR List of Threatened and/or Declining Species and Habitats, the UK List of Priority Species and Habitats (UK BAP)[72] and Schedule 5 of the Wildlife and Countryside Act[73]. Species and habitats on the OSPAR List were identified based on evidence of threat and decline. Rarity and sensitivity were also considered when determining whether features were threatened (OSPAR 2003). Criteria for the listing of species and habitats on UK BAP include international importance, high risk or rapid decline, and habitats that are important for key species (Biodiversity Reporting and Information Group 2007). Criteria for the listing of species on the Wildlife and Countryside Act specifically make reference to species that are endangered in Great Britain, likely to become extinct unless conservation measures are taken, or are subject to an international obligation for protection.

7.2.2.1 Habitats

JNCC and Natural England recommend that 22 habitats of conservation importance (referred to as habitat FOCI) should be protected within MPAs in each of the regional MCZ project areas to conserve and aid the recovery of rare, threatened or declining habitats.

Habitat FOCI were identified from the OSPAR List of Threatened and/or Declining Species and Habitats and the UK List of Priority Species and Habitats (UK BAP). The habitats on these lists overlap to some extent as identified in Table 11.

It should be noted that eight habitat FOCI are excluded from the Ecological Network Guidance (greyed text in Table 11) including:

[71] Note that section 5.2 recommends the identification of areas of ecological importance including those areas with high productivity or biodiversity (e.g. frontal systems) where these features are predictable in the occurrence, both in time and space.).

[72] In the revised 2007/8 lists of UK BAP species and conservation actions, spatial protection was considered to be a priority conservation action for many UK BAP marine species and habitats.

[73] Schedule 5 of the Wildlife and Countryside Act lists a number of fully marine species whose distribution extends below the mean low water mark and as such some of the species will benefit from the designation of MCZs.

- Oceanic ridges with hydrothermal vents/fields, *Cymodocea* meadows, Carbonate mounds and Seamounts (OSPAR Threatened and/ or Declining habitats) as these do not occur in the MCZ Project area;
- Serpulid reef (UK BAP habitat) as it is only known to occur in Scottish territorial waters;
- Coastal saltmarsh, intertidal mudflats and saline lagoons as these are also considered to be Annex I habitats under the EC Habitats Directive and as such will be conserved under European legislation (Defra 2010b). These habitats will not generally require further protection under national legislation (Defra 2010b).

There is no data available on the occurrence in the MCZ Project area of a further three habitat FOCI: cold-water coral reefs, coral gardens and deep-sea sponge aggregations. However, expert knowledge of their broad geographic distribution suggests they may occur within the MCZ Project area and new information may become available. As such, these habitats are still included in the Ecological Network Guidance, though it is understood the regional MCZ projects do not currently have distribution data to identify sites for these habitat FOCI.

Table 11: Habitats of conservation importance (habitat FOCI).
Note. Those excluded from section 4.2 appear in grey text.

Habitat FOCI	**UK List of Priority Species and Habitats (UK BAP)**	**OSPAR List of Threatened and/or Declining Species and Habitats**
Blue Mussel beds (including intertidal beds on mixed and sandy sediments)[74]	Yes	Yes
Carbonate mounds	Yes	Yes
Coastal saltmarsh	Yes	
Cold-water coral reefs	Yes	Yes
Coral Gardens		Yes
Cymodocea meadows	Yes	
Deep-sea sponge aggregations	Yes	Yes
Estuarine rocky habitats	Yes	
File shell beds	Yes	
Fragile sponge & anthozoan communities on subtidal rocky habitats	Yes	
Intertidal underboulder communities	Yes	
Intertidal mudflats	Yes	Yes
Littoral chalk communities	Yes	Yes
Maerl beds	Yes	Yes
Horse mussel (*Modiolus modiolus*) beds	Yes	Yes
Mud habitats in deep water	Yes	
Sea-pen and burrowing megafauna communities		Yes
Oceanic ridges with hydrothermal vents/fields	Yes	
Native oyster (*Ostrea edulis*) beds		Yes
Peat and clay exposures	Yes	
Honeycomb worm (*Sabellaria alveolata*) reefs	Yes	
Ross worm (*Sabellaria spinulosa*) reefs	Yes	Yes
Saline lagoons	Yes	

[74] The UK BAP habitat 'Blue mussel beds' has a wider definition than the OSPAR habitat 'Intertidal *Mytilus edulis* beds on mixed and sandy sediments', which is restricted only to blue mussel beds on intertidal mixed and sandy sediments.

Habitat FOCI	UK List of Priority Species and Habitats (UK BAP)	OSPAR List of Threatened and/or Declining Species and Habitats
Seagrass beds	Yes	Yes
Seamounts	Yes	Yes
Serpulid reef		Yes
Sheltered muddy gravels	Yes	
Subtidal chalk	Yes	
Subtidal sands and gravels	Yes	
Tide-swept channels	Yes	

7.2.2.2 Species

JNCC and Natural England recommend that 29 low or limited mobility species and three highly mobile species of conservation importance (referred to as species FOCI) should be protected within MPAs in each regional MCZ project area to conserve and aid the recovery of rare, threatened or declining species.

Species FOCI were identified from the OSPAR List of Threatened and/or Declining Species and Habitats, the UK List of Priority Species and Habitats (UK BAP), and Schedule 5 of the Wildlife & Countryside Act (1981). A number of species occur on two or more lists, as identified in Table 12.

It should be noted that a significant number of species FOCI were excluded from the Ecological Network Guidance including:

- Species listed under the EC Birds Directive[75] or the EC Habitats Directive as these are conserved under European legislation and will not generally require further protection under national legislation (Defra 2010b) (see Table 13 and Table 14);
- Species not known to occur in the MCZ Project area (see Table 15);
- Species considered to be vagrant to UK waters, since they are unlikely to benefit from spatial protection through MCZs (see Table 16);
- Dog whelk, *Nucella lapillus*, the only species known to be sensitive to a threat that is considered unmanageable through site-based protection – in this case the threat is tributyltin (TBT), a component of antifouling paints;
- Highly mobile species for which MCZs are not an appropriate tool (see Box 1 and Table 17).

Defra and the Welsh Assembly Government have recently completed a consultation on the fifth quinquennial review of Schedules 5 and 8 of the Wildlife and Countryside Act. The results of the consultation are not yet available. However, JNCC have advised on behalf of the conservation agencies that the lagoon snail (*Paludinella littorina*) is removed from Schedule 5. If this decision is approved then the lagoon snail will be removed from the list of FOCI in section 4.2 on Representativity.

2.2.3 Other features of the MPA network

In Secretary of State waters the MPA network will comprise existing MPAs including Special Areas of Conservation (SACs), Special Protection Areas (SPAs), the marine components of SSSIs and Ramsar sites, as well as new MCZs designated under the Marine and Coastal Access Act (MCAA). Features of the existing sites will contribute towards the MPA network. These features include:

[75] There may be a protection shortfall for some bird species, particularly migratory species. Data is not currently available to identify areas for their protection within the time available for the regional MCZ projects. However, where new evidence or information becomes available they may subsequently be added to the species list in section 4.2.

- 13 marine habitats that are listed in Annex I of the EC Habitats Directive;
- 8 marine species that are listed on Annex II of the EC Habitats Directive; and
- Species listed on Annex I of the EC Birds Directive, and all regularly occurring migratory bird species.

Box 1: Highly mobile species

Defra is committed to taking action to protect highly mobile marine species, and foresees a range of measures to achieve this (Defra 2009b). For wide ranging pelagic species at sea, such as fish, sharks and rays, marine mammals, reptiles and birds, MCZs are not usually suitable protection mechanisms and the representation of these species in the network will therefore not be prioritised (Defra 2010b). Furthermore, MCZs are not fisheries management tools for commercial species (Defra 2009b).

MCZs may be appropriate for highly mobile species where there is a clear conservation benefit. Natural England and JNCC, along with experts from the other SNCBs, Cefas, Defra, the Environment Agency and the MFA, adopted a three-stage approach to assess the potential conservation benefit of MCZs for highly mobile species of conservation importance (Natural England and JNCC in draft 2010). These stages are outlined below:

Stage 1. The group considered the current knowledge of the highly mobile species' ecology and behaviour. Each species was classified according to its potential for conservation through protected areas. This included, for example, those species that are known to have localised distributions, exhibit site fidelity or aggregate at some point in their life cycles.

Stage 2. The group considered the availability of applicable and useable spatial data for each species, and whether areas could be identified where these species aggregate, have localised distributions or exhibit site fidelity in our waters.

Stage 3 The group then considered whether MCZs were the most appropriate tool to provide species conservation benefits.

The assessment showed that for many highly mobile species our current knowledge of their ecology and behaviour suggests that site-based protection may be appropriate, but there is no spatial data to support the clear identification of relevant areas in our waters. As such, many highly mobile species are not included in section 4.2. However, as new information becomes available they may subsequently be added to the species list in section 4.2. For a list of those highly mobile species not currently listed in section 4.2 please refer to Table 16.

Section 5.2 recommends that areas of additional ecological importance be included within the MPA network. This includes those areas that are important foraging, breeding (including nursery and spawning grounds), moulting, wintering and resting areas. Such areas are not restricted to species FOCI listed in section 4.2, and could be identified for any marine species. Such areas are likely to be important for a wide range of species.

Table 12: Species of conservation importance (species FOCI).

Scientific name	Common Name	Taxon group	UK List of Priority Species and Habitats (UK BAP)	OSPAR List of Threatened and/or Declining Species and Habitats	Wildlife and Countryside Act 1981 (Schedule 5)
Ascophyllum nodosum ecad mackaii	Wig wrack or sea-loch egg wrack	Brown alga	Yes		
Fucus distichus	Brown algae	Brown alga	Yes		
Anotrichium barbatum	Bearded red seaweed	Red alga	Yes		
Cruoria cruoriaeformis	Burgundy maerl paint weed	Red alga	Yes		
Grateloupia montagnei	Grateloup's little-lobed weed	Red alga	Yes		
Lithothamnion corallioides	Coral maërl	Red alga	Yes		
Padina pavonica	Peacock's tail	Brown alga	Yes		
Phymatolithon calcareum	Common maërl	Red alga	Yes		
Alkmaria romijni	Tentacled lagoon-worm	Annelid (worm)			Yes
Armandia cirrhosa	Lagoon sandworm	Annelid (worm)	Yes		Yes
Alcedo atthis	Common kingfisher	Bird			Yes
Anas acuta	Northern pintail	Bird			Yes
Anser anser	Greylag goose	Bird			Yes
Aythya marila	Greater scaup	Bird	Yes		Yes
Bucephala clangula	Common goldeneye	Bird			Yes
Calidris maritima	Purple sandpiper	Bird			Yes
Chlidonias niger	Black tern	Bird			Yes
Clangula hyemalis	Long-tailed duck	Bird			Yes
Eremophila alpestris	Shore lark	Bird			Yes
Falco columbarius	Merlin	Bird			Yes
Falco peregrinus	Peregrine falcon	Bird			Yes
Gavia arctica	Black-throated diver	Bird	Yes		

Scientific name	Common Name	Taxon group	UK List of Priority Species and Habitats (UK BAP)	OSPAR List of Threatened and/or Declining Species and Habitats	Wildlife and Countryside Act 1981 (Schedule 5)
Haliaeetus albicilla	White-tailed eagle	Bird			Yes
Larus fuscus	Lesser black-backed gull	Bird		Yes	
Larus melanocephalus	Mediterranean gull	Bird			Yes
Larus minutes	Little gull	Bird			Yes
Limosa limosa	Black-tailed godwit	Bird			Yes
Melanitta fusca	Velvet scoter	Bird			Yes
Melanitta nigra	Common scoter	Bird	Yes		Yes
Numenius arquata	Eurasian curlew	Bird	Yes		
Numenius phaeopus	Whimbrel	Bird			Yes
Oceanodroma leucorhoa	Leach's storm-petrel	Bird			Yes
Pagophila eburnean	Ivory gull	Bird		Yes	
Pandion haliaetus	Osprey	Bird			Yes
Phalaropus lobatus	Red-necked phalarope	Bird	Yes		Yes
Philomachus pugnax	Ruff	Bird			Yes
Platalea leucorodia	Eurasian spoonbill	Bird			Yes
Plectrophenax nivalis	Snow bunting	Bird			Yes
Podiceps auritus	Slavonian grebe	Bird			Yes
Podiceps nigricollis	Black-necked grebe	Bird			Yes
Polysticta stelleri	Steller's eider	Bird		Yes	
Puffinus assimilis baroli	Little shearwater	Bird		Yes	
Puffinus mauretanicus	Balearic shearwater	Bird	Yes	Yes	
Pyrrhocorax pyrrhocorax	Red-billed chough	Bird			Yes
Recurvirostra avosetta	Pied avocet	Bird			Yes
Rissa tridactyla	Black-legged kittiwake	Bird		Yes	
Stercorarius parasiticus	Arctic skua	Bird	Yes		
Sterna dougallii	Roseate tern	Bird	Yes	Yes	Yes

Scientific name	Common Name	Taxon group	UK List of Priority Species and Habitats (UK BAP)	OSPAR List of Threatened and/or Declining Species and Habitats	Wildlife and Countryside Act 1981 (Schedule 5)
Sternula albifrons	Little tern	Bird			Yes
Tringa nebularia	Common greenshank	Bird			Yes
Uria aalge	Common guillemot	Bird		Yes	
Uria lomvia	Thick-billed murre	Bird		Yes	
Vanellus vanellus	Northern lapwing	Bird	Yes		
Acipenser sturio	Common sturgeon	Bony fish	Yes	Yes	Yes
Alosa alosa	Allis shad	Bony fish	Yes	Yes	Yes
Alosa fallax	Twaite shad	Bony fish	Yes		Yes
Ammodytes marinus	Lesser sandeel	Bony fish	Yes		
Anguilla anguilla	European eel	Bony fish	Yes	Yes	
Aphanopus carbo	Black scabbardfish	Bony fish	Yes		
Clupea harengus	Herring	Bony fish	Yes		
Cobitis taenia	Spined loach	Bony fish	Yes		
Coregonus oxyrhynchus	Houting	Bony fish		Yes	
Coryphaenoides rupestris	Roundnose grenadier	Bony fish	Yes		
Gadus morhua	Cod	Bony fish	Yes	Yes	
Gobius cobitis	Giant goby	Bony fish			Yes
Gobius couchi	Couch's goby	Bony fish			Yes
Hippocampus guttulatus	Long snouted seahorse	Bony fish	Yes	Yes	Yes
Hippocampus hippocampus	Short snouted seahorse	Bony fish	Yes	Yes	Yes
Hippoglossus hippoglossus	Atlantic halibut	Bony fish	Yes		
Hoplostethus atlanticus	Orange roughy	Bony fish	Yes	Yes	
Lophius piscatorius	Sea monkfish	Bony fish	Yes		
Merlangius merlangus	Whiting	Bony fish	Yes		
Merluccius merluccius	European hake	Bony fish	Yes		
Micromesistius poutassou	Blue whiting	Bony fish	Yes		

Scientific name	**Common Name**	**Taxon group**	**UK List of Priority Species and Habitats (UK BAP)**	**OSPAR List of Threatened and/or Declining Species and Habitats**	**Wildlife and Countryside Act 1981 (Schedule 5)**
Molva dypterygia	Blue ling	Bony fish	Yes		
Molva molva	Ling	Bony fish	Yes		
Osmerus eperlanus	Smelt (sparling)	Bony fish	Yes		
Pleuronectes platessa	Plaice	Bony fish	Yes		
Reinhardtius hippoglossoides	Greenland halibut	Bony fish	Yes		
Salmo salar	Atlantic salmon	Bony fish	Yes	Yes	
Scomber scombrus	Mackerel	Bony fish	Yes		
Solea solea	Sole	Bony fish	Yes		
Thunnus thynnus	Blue-fin tuna	Bony fish	Yes	Yes	
Trachurus trachurus	Horse mackerel	Bony fish	Yes		
Victorella pavida	Trembling seamat	Bryozoan (seamat)	Yes		Yes
Amphianthus dohrnii	Sea-fan anemone	Cnidarian	Yes		
Arachnanthus sarsi	Scarce tube-dwelling anemone	Cnidarian	Yes		
Edwardsia ivelli	Ivels sea anemone	Cnidarian	Yes		Yes
Edwardsia timida	Timid burrowing anemone	Cnidarian	Yes		
Eunicella verrucosa	Pink sea-fan	Cnidarian	Yes		Yes
Funiculina quadrangularis	Tall sea pen	Cnidarian	Yes		
Haliclystus auricula	Stalked jellyfish	Cnidarian	Yes		
Leptopsammia pruvoti	Sunset cup coral	Cnidarian	Yes		
Lucernariopsis campanulata	Stalked jellyfish	Cnidarian	Yes		
Lucernariopsis cruxmelitensis	Stalked jellyfish	Cnidarian	Yes		
Nematostella vectensis	Starlet sea anemone	Cnidarian	Yes		Yes
Pachycerianthus multiplicatus	Fireworks anemone	Cnidarian	Yes		
Pachycordyle navis	Brackish hydroid	Cnidarian	Yes		Yes
Swiftia pallid	Northern sea fan	Cnidarian	Yes		
Arrhis phyllonyx	Deep-sea shrimp	Crustacean	Yes		

Scientific name	Common Name	Taxon group	UK List of Priority Species and Habitats (UK BAP)	OSPAR List of Threatened and/or Declining Species and Habitats	Wildlife and Countryside Act 1981 (Schedule 5)
Gammarus insensibilis	Lagoon sand shrimp	Crustacean	Yes		Yes
Gitanopsis bispinosa	Amphipod shrimp	Crustacean	Yes		
Megabalanus azoricus	Azorean barnacle	Crustacean		Yes	
Pollicipes pollicipes	Gooseneck barnacle	Crustacean	Yes		
Palinurus elephas	Spiny lobster	Crustacean	Yes		
Lampetra fluviatilis	River lamprey	Jawless fish	Yes		
Petromyzon marinus	Sea lamprey	Jawless fish	Yes	Yes	
Lutra lutra	Otter	Marine mammal (semi-aquatic)	Yes		
Odobenus rosmarus	Walrus	Marine mammal (semi-aquatic)			Yes
Phoca vitulina	Common seal	Marine mammal (semi-aquatic)	Yes		Yes
Arctica islandica	Ocean quahog	Mollusc		Yes	
Atrina pectinata	Fan mussel	Mollusc	Yes		Yes
Caecum armoricum	Defolin`s lagoon snail	Mollusc			Yes
Heleobia stagnorum	Lagoon spire snail	Mollusc	Yes		
Nucella lapillus	Dog whelk	Mollusc		Yes	
Ostrea edulis	Native oyster	Mollusc	Yes	Yes	
Paludinella littorina	Sea snail	Mollusc			Yes
Patella ulyssiponensis aspera	Azorean limpet	Mollusc		Yes	
Tenellia adspersa	Lagoon sea slug	Mollusc	Yes		Yes
Thyasira gouldi	Northern hatchet-shell	Mollusc			Yes
Caretta caretta	Loggerhead turtle	Reptile	Yes	Yes	Yes
Chelonia mydas	Green turtle	Reptile			Yes
Dermochelys coriacea	Leatherback turtle	Reptile	Yes	Yes	Yes
Eretmochelys imbricate	Hawksbill turtle	Reptile			Yes
Lepidochelys kempii	Kemp`s ridley turtle	Reptile			Yes

Scientific name	Common Name	Taxon group	UK List of Priority Species and Habitats (UK BAP)	OSPAR List of Threatened and/or Declining Species and Habitats	Wildlife and Countryside Act 1981 (Schedule 5)
Lepidochelys olivacea	Olive ridley turtle	Reptile			Yes
Centrophorus granulosus	Gulper shark	Sharks and rays	Yes	Yes	
Centrophorus squamosus	Leafscraper shark	Sharks and rays	Yes	Yes	
Centroscymnus coelolepsis	Portuguese dogfish	Sharks and rays	Yes	Yes	
Cetorhinus maximus	Basking shark	Sharks and rays	Yes	Yes	Yes
Dalatias licha	Kitefin shark	Sharks and rays	Yes		
Dipturus batis	Common skate	Sharks and rays	Yes	Yes	
Galeorhinus galeus	Tope shark	Sharks and rays	Yes		
Isurus oxyrinchus	Shortfin mako	Sharks and rays	Yes		
Lamna nasus	Porbeagle shark	Sharks and rays	Yes	Yes	
Leucoraja circularis	Sandy ray	Sharks and rays	Yes		
Prionace glauca	Blue shark	Sharks and rays	Yes		
Raja clavata	Thornback skate / ray	Sharks and rays		Yes	
Raja montagui	Spotted ray	Sharks and rays		Yes	
Raja undulata	Undulate ray	Sharks and rays	Yes		
Rostroraja alba	White or bottlenosed skate	Sharks and rays	Yes	Yes	
Squalus acanthias	Spiny dogfish	Sharks and rays	Yes	Yes	
Squatina squatina	Angel shark	Sharks and rays	Yes	Yes	Yes
Styela gelatinosa	Loch goil sea squirt	Tunicate (sea squirts)	Yes		
Balaena mysticetus	Bowhead whale	Whales and dolphins		Yes	
Balaenoptera acutorostrata	Minke whale	Whales and dolphins	Yes		Yes
Balaenoptera borealis	Sei whale	Whales and dolphins	Yes		Yes
Balaenoptera musculus	Blue whale	Whales and dolphins	Yes	Yes	Yes
Balaenoptera physalus	Fin whale	Whales and dolphins	Yes		Yes
Delphinapterus leucas	White whale	Whales and dolphins			Yes
Delphinus delphis	Common dolphin	Whales and dolphins	Yes		Yes
Eubalaena glacialis	Northern right whale	Whales and dolphins	Yes	Yes	Yes

Scientific name	Common Name	Taxon group	UK List of Priority Species and Habitats (UK BAP)	OSPAR List of Threatened and/or Declining Species and Habitats	Wildlife and Countryside Act 1981 (Schedule 5)
Globicephala melas	Long-finned pilot whale	Whales and dolphins	Yes		Yes
Grampus griseus	Risso`s dolphin	Whales and dolphins	Yes		Yes
Hyperoodon ampullatus	Northern bottlenose whale	Whales and dolphins	Yes		Yes
Kogia breviceps	Pygmy sperm whale	Whales and dolphins			Yes
Lagenorhynchus acutus	Atlantic white-sided dolphin	Whales and dolphins	Yes		Yes
Lagenorhynchus albirostris	White-beaked dolphin	Whales and dolphins	Yes		Yes
Megaptera novaeangliae	Humpback whale	Whales and dolphins	Yes		Yes
Mesoplodon bidens	Sowerby`s beaked whale	Whales and dolphins	Yes		Yes
Mesoplodon europaeus	Gervais' beaked whale	Whales and dolphins			Yes
Mesoplodon mirus	True`s beaked whale	Whales and dolphins	Yes		Yes
Monodon monoceros	narwhal	Whales and dolphins			Yes
Orcinus orca	Killer whale	Whales and dolphins	Yes		Yes
Phocoena phocoena	Harbour porpoise	Whales and dolphins	Yes	Yes	Yes
Physeter catodon	Sperm whale	Whales and dolphins	Yes		Yes
Stenella coeruleoalba	Striped dolphin	Whales and dolphins	Yes		Yes
Tursiops truncates	Bottlenosed dolphin	Whales and dolphins	Yes		Yes
Ziphius cavirostris	Cuvier`s beaked whale	Whales and dolphins	Yes		Yes

Table 13: Species FOCI (listed on UK BAP and the OSPAR List of Threatened and/ or Declining species) that are also listed on Annex I of the EC Birds Directive or are regularly occurring migratory seabirds.

Scientific name	Common Name	Taxon group	EC Birds Directive
Alcedo atthis	Common kingfisher	Bird	Annex 1
Anas acuta	Northern pintail	Bird	Migratory
Anser anser	Greylag goose	Bird	Migratory
Aythya marila	Greater scaup	Bird	Migratory
Bucephala clangula	Common goldeneye	Bird	Migratory
Calidris maritima	Purple sandpiper	Bird	Migratory
Chlidonias niger	Black tern	Bird	Annex 1
Clangula hyemalis	Long-tailed duck	Bird	Migratory
Eremophila alpestris	Shore lark	Bird	Migratory
Falco columbarius	Merlin	Bird	Annex 1
Falco peregrinus	Peregrine falcon	Bird	Annex 1
Gavia arctica	Black-throated diver	Bird	Annex 1
Haliaeetus albicilla	White-tailed eagle	Bird	Annex 1
Larus fuscus	Lesser black-backed gull	Bird	Migratory
Larus melanocephalus	Mediterranean gull	Bird	Annex 1
Larus minutes	Little gull	Bird	Annex 1
Limosa limosa	Black-tailed godwit	Bird	Migratory
Melanitta fusca	Velvet scoter	Bird	Migratory
Melanitta nigra	Common scoter	Bird	Migratory
Numenius arquata	Eurasian curlew	Bird	Migratory
Numenius phaeopus	Whimbrel	Bird	Migratory
Oceanodroma leucorhoa	Leach's storm-petrel	Bird	Annex 1
Pandion haliaetus	Osprey	Bird	Annex 1
Phalaropus lobatus	Red-necked phalarope	Bird	Annex 1
Philomachus pugnax	Ruff	Bird	Migratory
Platalea leucorodia	Eurasian spoonbill	Bird	Annex 1
Plectrophenax nivalis	Snow bunting	Bird	Migratory
Podiceps auritus	Slavonian grebe	Bird	Annex 1
Podiceps nigricollis	Black-necked grebe	Bird	Migratory
Puffinus assimilis baroli	Little shearwater	Bird	Annex 1
Puffinus mauretanicus	Balearic shearwater	Bird	Annex 1
Pyrrhocorax pyrrhocorax	Red-billed chough	Bird	Annex 1
Recurvirostra avosetta	Pied avocet	Bird	Annex 1
Rissa tridactyla	Black-legged kittiwake	Bird	Migratory
Stercorarius parasiticus	Arctic skua	Bird	Migratory
Sterna dougallii	Roseate tern	Bird	Annex 1
Sternula albifrons	Little tern	Bird	Annex 1
Tringa nebularia	Common greenshank	Bird	Migratory
Uria aalge	Common guillemot	Bird	Migratory
Vanellus vanellus	Northern lapwing	Bird	Migratory

Table 14: Species FOCI (listed on UK BAP and the OSPAR List of Threatened and/ or Declining species) that are also listed on Annex II of the EC Habitats Directive.

Scientific name	**Common Name**	**Taxon group**
Acipenser sturio	Common sturgeon	Bony fish
Alosa alosa	Allis shad	Bony fish
Alosa fallax	Twaite shad	Bony fish
Cobitis taenia	Spined loach	Bony fish
Salmo salar	Atlantic salmon	Bony fish
Lampetra fluviatilis	River lamprey	Jawless fish
Petromyzon marinus	Sea lamprey	Jawless fish
Lutra lutra	Otter	Marine mammal (semi-aquatic)
Phoca vitulina	Common seal	Marine mammal (semi-aquatic)
Caretta caretta	Loggerhead turtle	Reptile
Phocoena phocoena	Harbour porpoise	Whales and dolphins
Tursiops truncates	Bottlenosed dolphin	Whales and dolphins

Table 15: Species of conservation importance (listed on UK BAP and the OSPAR List of Threatened and/ or Declining species) that are not known to occur in the MCZ Project area.

Scientific name	**Common Name**	**Taxon group**
Ascophyllum nodosum ecad mackaii	Wig wrack or sea-loch egg wrack	Brown alga
Fucus distichus	Brown algae	Brown alga
Anotrichium barbatum	Bearded red seaweed	Red alga
Coregonus oxyrhynchus	houting	Bony fish
Arachnanthus sarsi	Scarce tube-dwelling anemone	Cnidarian
Edwarsia ivelli	Ivels sea anemone	Cnidarian
Edwardsia timida	Timid burrowing anemone	Cnidarian
Funiculina quadrangularis	Tall sea pen	Cnidarian
Pachycerianthus multiplicatus	Fireworks anemone	Cnidarian
Pachycordyle navis	Brackish hydroid	Cnidarian
Swiftia pallida	Northern sea fan	Cnidarian
Arrhis phyllonyx	Deep-sea shrimp	Crustacean
Megabalanus azoricus	Azorean barnacle	Crustacean
Heleobia stagnorum	Lagoon spire snail	Mollusc
Patella ulyssiponensis aspera	Azorean limpet	Mollusc
Thyasira gouldi	Northern hatchet-shell	Mollusc
Styela gelatinosa	Loch goil sea squirt	Tunicate (sea squirts)
Balaena mysticetus	Bowhead whale	Whales and dolphins

Table 16: Species FOCI (listed on UK BAP and the OSPAR List of Threatened and/ or Declining species) considered to be vagrants to UK waters.

Scientific name	**Common Name**	**Taxon group**
Pagophila eburnean	Ivory gull	Bird
Polysticta stelleri	Steller's eider	Bird
Uria lomvia	Thick-billed murre	Bird
Odobenus rosmarus	Walrus	Marine mammal (semi-aquatic)
Chelonia mydas	Green turtle	Reptile
Eretmochelys imbricate	Hawksbill turtle	Reptile

Scientific name	Common Name	Taxon group
Lepidochelys kempii	Kemp`s ridley turtle	Reptile
Lepidochelys olivacea	Olive ridley turtle	Reptile
Balaenoptera musculus	Blue whale	Whales and dolphins
Delphinapterus leucas	White whale	Whales and dolphins
Eubalaena glacialis	Northern right whale	Whales and dolphins
Kogia breviceps	Pygmy sperm whale	Whales and dolphins
Mesoplodon europaeus	Gervais' beaked whale	Whales and dolphins
Monodon monoceros	Narwhal	Whales and dolphins

Table 17: Highly mobile species (listed on UK BAP and the OSPAR List of Threatened and/ or Declining species) for which MCZs are not thought to be appropriate given current information.

Scientific name	Common Name	Taxon group
Ammodytes marinus	Lesser sandeel	Bony fish
Aphanopus carbo	Black scabbardfish	Bony fish
Clupea harengus	Herring	Bony fish
Coryphaenoides rupestris	Roundnose grenadier	Bony fish
Gadus morhua	Cod	Bony fish
Hippoglossus hippoglossus	Atlantic halibut	Bony fish
Hoplostethus atlanticus	Orange roughy	Bony fish
Lophius piscatorius	Sea monkfish	Bony fish
Merlangius merlangus	Whiting	Bony fish
Merluccius merluccius	European hake	Bony fish
Micromesistius poutassou	Blue whiting	Bony fish
Molva dypterygia	Blue ling	Bony fish
Molva molva	Ling	Bony fish
Pleuronectes platessa	Plaice	Bony fish
Reinhardtius hippoglossoides	Greenland halibut	Bony fish
Scomber scombrus	Mackerel	Bony fish
Solea solea	Sole	Bony fish
Thunnus thynnus	Blue-fin tuna	Bony fish
Trachurus trachurus	Horse mackerel	Bony fish
Balaenoptera acutorostrata	Minke whale	Whales and dolphins
Balaenoptera borealis	Sei whale	Whales and dolphins
Balaenoptera physalus	Fin whale	Whales and dolphins
Delphinus delphis	Common dolphin	Whales and dolphins
Globicephala melas	Long-finned pilot whale	Whales and dolphins
Grampus griseus	Risso`s dolphin	Whales and dolphins
Hyperoodon ampullatus	Northern bottlenose whale	Whales and dolphins
Lagenorhynchus acutus	Atlantic white-sided dolphin	Whales and dolphins
Lagenorhynchus albirostris	White-beaked dolphin	Whales and dolphins
Megaptera novaeangliae	Humpback whale	Whales and dolphins
Mesoplodon bidens	Sowerby`s beaked whale	Whales and dolphins
Mesoplodon mirus	True`s beaked whale	Whales and dolphins
Orcinus orca	Killer whale	Whales and dolphins
Physeter catodon	Sperm whale	Whales and dolphins
Stenella coeruleoalba	Striped dolphin	Whales and dolphins
Ziphius cavirostris	Cuvier`s beaked whale	Whales and dolphins
Centrophorus granulosus	Gulper shark	Sharks and rays
Centrophorus squamosus	Leafscraper shark	Sharks and rays
Centroscymnus coelolepsis	Portuguese dogfish	Sharks and rays
Cetorhinus maximus	Basking shark	Sharks and rays

Scientific name	Common Name	Taxon group
Dalatias licha	Kitefin shark	Sharks and rays
Dipturus batis	Common skate	Sharks and rays
Galeorhinus galeus	Tope shark	Sharks and rays
Isurus oxyrinchus	Shortfin mako	Sharks and rays
Lamna nasus	Porbeagle shark	Sharks and rays
Leucoraja circularis	Sandy ray	Sharks and rays
Prionace glauca	Blue shark	Sharks and rays
Raja clavata	Thornback skate / ray	Sharks and rays
Raja montagui	Spotted ray	Sharks and rays
Rostroraja alba	White or bottlenosed skate	Sharks and rays
Squalus acanthias	Spiny dogfish	Sharks and rays
Squatina squatina	Angel shark	Sharks and rays
Dermochelys coriacea	Leatherback turtle	Reptile

7.3 Annex 3: Relationships between habitat features

JNCC have developed correlation tables[76] which demonstrate the relationships between habitats listed in different classification schemes including:

- Broad-scale habitats (EUNIS Level 3) and habitats of conservation importance (FOCI);
- Broad-scale habitats (EUNIS Level 3) and EC Habitats Directive Annex I habitats;
- Habitats of conservation importance (FOCI) and EC Habitats Directive Annex I habitats.

Please note that there is not always a clear relationship between habitats in different classification schemes as the individual habitat definitions can be subtly different from each other. As such, a degree of caution should be used in applying the correlation tables in this Annex.

Also, even where there are significant overlaps between Annex I habitats and broad-scale habitats and/ or FOCI we cannot assume that the broad-scale habitats and/ or FOCI will receive sufficient protection through SACs designated for Annex I habitats. For example, the broad-scale habitat low energy circalittoral rock (A4.3) may occur in Annex I Reef, but not consistently so. Whilst some low energy circalittoral rock is protected in the existing SACs it is likely that MCZs for low energy circalittoral rock are required to meet the guidelines for adequacy, replication and connectivity. Alternatively for example, the broad-scale habitat intertidal mud (A2.3) occurs in Annex I Mudflats and sandflats not covered by seawater at low tide. A significant proportion of intertidal mud is already protected in existing SACs and as such it is unlikely MCZs will generally be needed for intertidal mud to meet the guidelines for adequacy (section 4.4).

Each regional MCZ project will need to identify how well the existing SACs in their area meet the representativity, adequacy, replication, and connectivity guidelines for broad-scale habitats and habitat FOCI.

The exceptions are three habitat FOCI (coastal saltmarsh, intertidal mudflats and saline lagoons) since these are considered to be equivalent to, or sufficiently represented by, Annex I habitats under the EC Habitats Directive.

7.3.1 Relationships between broad-scale habitats (EUNIS Level 3) and habitat FOCI

In general, the definitions of broad-scale habitats are broader than for habitat FOCI. There are two possible relationships between broad-scale habitats and habitats FOCI:

1. Broad-scale habitat Y *contains* habitat FOCI X (i.e. the habitat FOCI only occurs in one broad-scale habitat type) (Diagram A, Figure 7); or
2. Broad-scale habitat Y *may contain* habitat FOCI X (i.e. the habitat FOCI occurs in more than one broad-scale habitat type) (Diagram B, Figure 7).

The specific relationships between individual broad-scale habitats and habitat FOCI are detailed in Table 18.

[76] For full versions of the correlation tables see http://www.jncc.gov.uk/pdf/EUNIS_Correlation_2006_20090924.pdf

Figure 7: Relationships between broad-scale habitats and habitat FOCI.

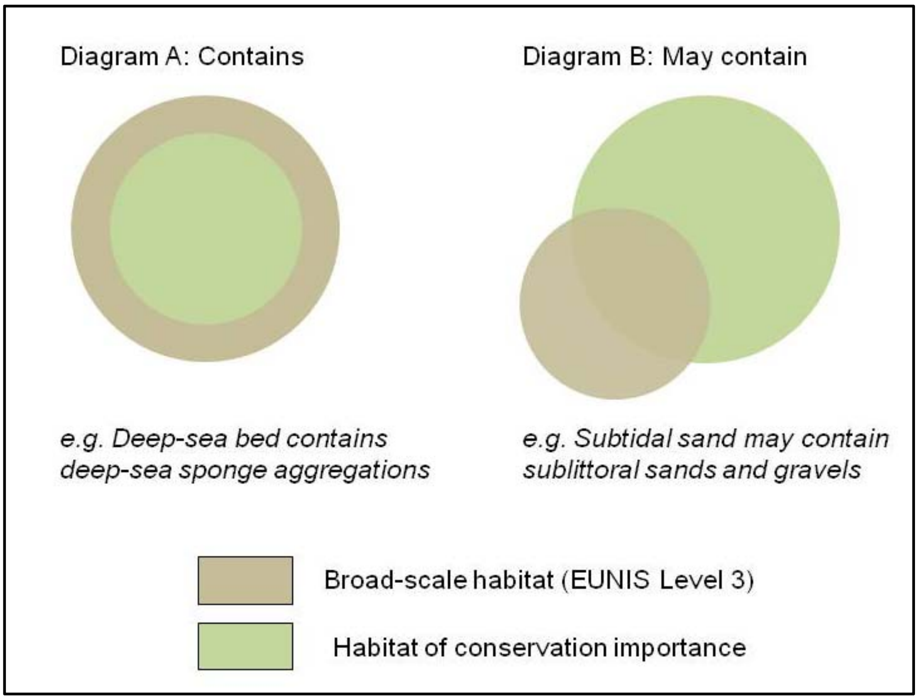


Table 18: Relationships between broad-scale habitats and habitat FOCI.*

Broad-scale habitat (EUNIS Level 3)	**Broad-scale habitat relationship to habitat of conservation importance**	**Habitat FOCI**
High energy intertidal rock (A1.1)	May contain	Peat and clay exposures
		Littoral chalk communities
Moderate energy intertidal rock (A1.2)	May contain	Peat and clay exposures
		Littoral chalk communities
		Intertidal underboulder communities
Low energy intertidal rock (A1.3)	May contain	Estuarine rocky habitats
Intertidal mixed sediments (A2.4)	May contain	Sheltered muddy gravels
		Estuarine rocky habitats
Intertidal sediments dominated by aquatic angiosperms (A2.6)	May contain	Seagrass beds
Intertidal biogenic reefs (A2.7)	May contain	Honeycomb worm (*Sabellaria alveolata*) reefs
		Blue mussel beds
Moderate energy infralittoral rock (A3.2)	May contain	Subtidal chalk
		Intertidal underboulder

Broad-scale habitat (EUNIS Level 3)	**Broad-scale habitat relationship to habitat of conservation importance**	**Habitat FOCI**
		communities
High energy circalittoral rock (A4.1)	May contain	Fragile sponge and anthozoan communities on subtidal rocky habitats
Moderate energy circalittoral rock (A4.2)	May contain	Subtidal chalk
		Ross worm (*Sabellaria spinulosa*) reefs
		Fragile sponge and anthozoan communities on subtidal rocky habitats
Subtidal coarse sediment (A5.1)	May contain	Sublittoral sands and gravels
Subtidal sand (A5.2)	May contain	Sublittoral sands and gravels
		Saline lagoons
Subtidal mud (A5.3)	Contains	Mud habitats in deep water
		Sea-pen and burrowing megafauna communities
Subtidal mixed sediments (A5.4)	May contain	Sheltered muddy gravels
	Contains	File shell beds
		Native oyster (*Ostrea edulis*) beds
Subtidal macrophyte-dominated sediment (A5.5)	May contain	Seagrass beds
	Contains	Maerl beds
Subtidal biogenic reefs (A5.6)	Contains	Horse mussel (*Modiolus modiolus*) beds
	May contain	Honeycomb worm (*Sabellaria alveolata*) reefs
		Cold-water coral reefs
		Blue mussel beds
		Ross worm (*Sabellaria spinulosa*) reefs
Deep-sea bed (A6)	Contains	Deep-sea sponge aggregations

Broad-scale habitat (EUNIS Level 3)	Broad-scale habitat relationship to habitat of conservation importance	Habitat FOCI
	May contain	Cold-water coral reefs

*Note some broad-scale habitats are excluded from this table because their definitions are not known to contain any habitats of conservation importance.

7.3.2 Relationships between broad-scale habitats (EUNIS Level 3) and EC Habitats Directive Annex I habitats

Annex I habitats are typically very broad, encompassing many different habitat sub-types and sub-features, and in general, are broader than the definitions of the broad-scale EUNIS Level 3 habitats. However, it is important to distinguish between three different possible relationships:

1. Annex I habitat Y is *contains* broad-scale habitat X (i.e. the broad-scale habitat is only known to occur within one Annex I habitat type) (Diagram A, Figure 8);
2. Annex I habitat Y is *contained within* broad-scale habitat X (i.e. the Annex I habitat is only known to occur within one broad-scale habitat type) (Diagram B, Figure 8); or
3. Annex I habitat Y *may contain* broad-scale habitat X (i.e. the broad-scale habitat occurs in more than one Annex I habitat type) (Diagram C, Figure 8).

The specific relationships between individual Annex I habitat types and broad-scale habitats are detailed in Table 19.

Figure 8: Relationships between broad-scale habitats and Annex I habitat types.

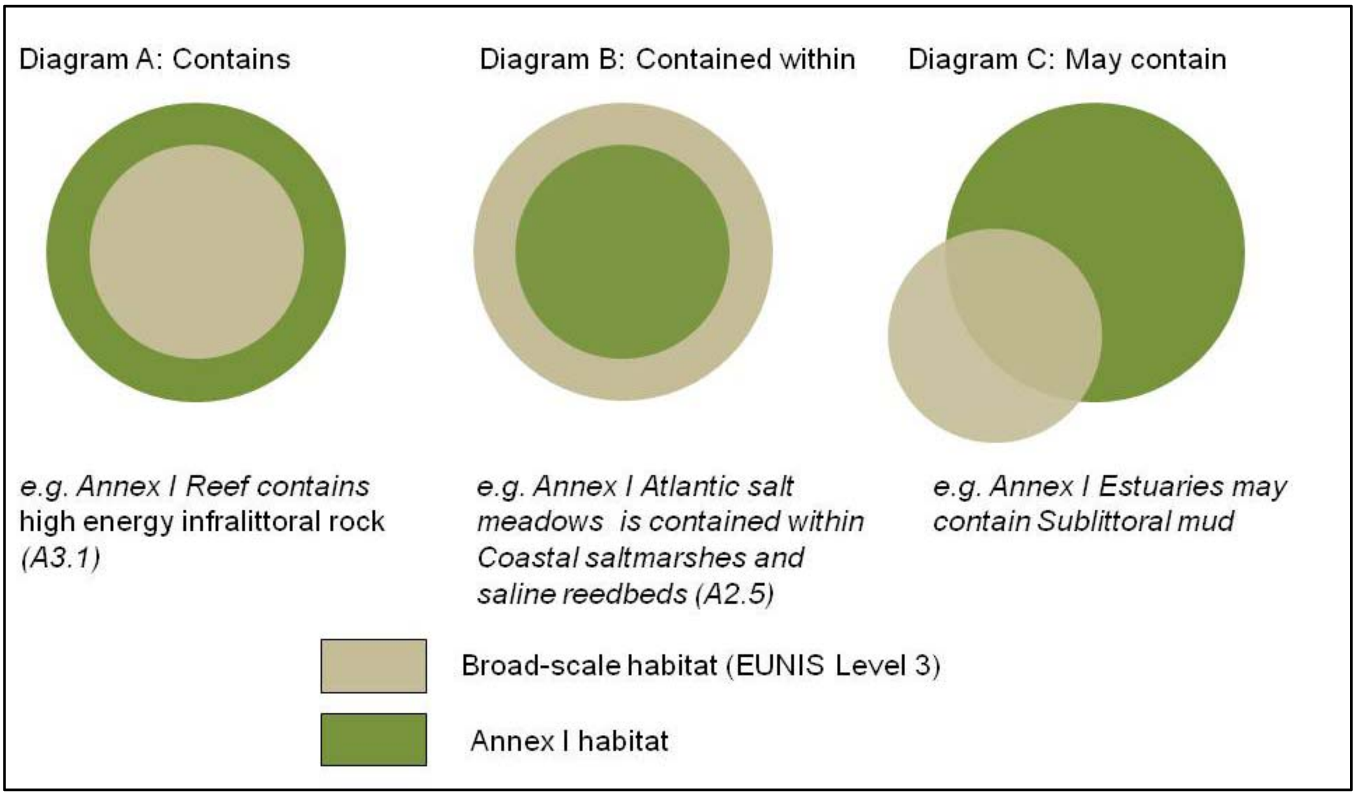


Table 19: Relationships between Annex I habitat types and broad-scale habitats.

Annex I habitat type	Annex I habitat relationship to broad-scale habitat	Broad-scale habitat (EUNIS Level 3)
Atlantic salt meadows	Contained within	Coastal saltmarshes and saline reedbeds (A2.5)
Estuaries	May contain	Intertidal coarse sediment (A2.1)
		Coastal saltmarshes and saline reedbeds (A2.5)
		Sublittoral sand (A5.2)
		Sublittoral mud (A5.3)
		Sublittoral mixed sediments (A5.4)
Lagoons	May contain	Sublittoral sand (A5.2)
		Sublittoral mud (A5.3)
		Sublittoral mixed sediments (A5.4)
		Sublittoral macrophyte-dominated sediment (A5.5)
Large shallow inlets and bays	May contain	Intertidal mixed sediments (A2.4)
		Coastal saltmarshes and saline reedbeds (A2.5)
		Sublittoral mud (A5.3)
		Sublittoral macrophyte-dominated sediment (A5.5
Mediterranean and thermo-Atlantic halophilious scrubs	Contained within	Coastal saltmarshes and saline reedbeds (A2.5)
Mudflats and sandflats not covered by seawater at low tide	Contain	Intertidal sand and muddy sand (A2.2)
		Intertidal mud (A2.3)
	May contain	Intertidal mixed sediments (A2.4)
		Intertidal sediments dominated by aquatic angiosperms (A2.6)
		Sublittoral macrophyte-dominated

Annex I habitat type	Annex I habitat relationship to broad-scale habitat	Broad-scale habitat (EUNIS Level 3)
		sediment (A5.5)
Reefs	Contain	High energy infralittoral rock (A3.1)
		Moderate energy infralittoral rock (A3.2)
		Low energy infralittoral rock (A3.3)
		High energy circalittoral rock (A4.1)
		Moderate energy circalittoral rock (A4.2)
		Low energy circalittoral rock (A4.3)
		Sublittoral biogenic reefs (A5.6)
	May contain	High energy intertidal rock (A1.1)
		Moderate energy intertidal rock (A1.2)
		Low energy intertidal rock (A1.3)
		Intertidal biogenic reefs (A2.7)
Salicornia and other annuals colonising mud and sand	Contained within	Coastal saltmarshes and saline reedbeds (A2.5)
Sandbanks which are slightly covered by sea water all the time	May contain	Sublittoral coarse sediment (A5.1)
		Sublittoral sand (A5.2)
		Sublittoral macrophyte-dominated sediment (A5.5)
Spartina swards	Contained within	Coastal saltmarshes and saline reedbeds (A2.5)

7.3.3 Relationships between habitat FOCI and EC Habitats Directive Annex I habitats

The definitions of Annex I habitats are typically very broad, encompassing many different sub-types and sub-features. Habitat FOCI can be equivalent to Annex I habitat types themselves or to the sub-features or sub-types of the Annex I habitats. There are four different possible relationships between Annex I habitats and habitat FOCI:

1. The Annex I habitat X is *equivalent to* habitat FOCI Y (i.e. the definitions and descriptions for the Annex I habitat and the habitat FOCI are the same) (Diagram A, Figure 9);

2. The Annex I habitat X *contains* the habitat FOCI Y (i.e. the habitat FOCI is only known to occur within an Annex I habitat type) (Diagram B, Figure 9);
3. The Annex I habitat X *may contain* the habitat FOCI Y (i.e. (Diagram C, Figure 9) (i.e. the habitat FOCI is known to occur in more than one Annex I habitat type, or in non-Annex I habitat); or
4. The Annex I habitat X is *contained within* the habitat FOCI Y (i.e. the Annex I is only known to occur within a single habitat FOCI) (Diagram D, Figure 9).

The specific relationships between individual Annex I habitat types and individual broad-scale habitats are detailed in Table 20.

Figure 9: Relationships between habitat FOCI and Annex I habitat types.

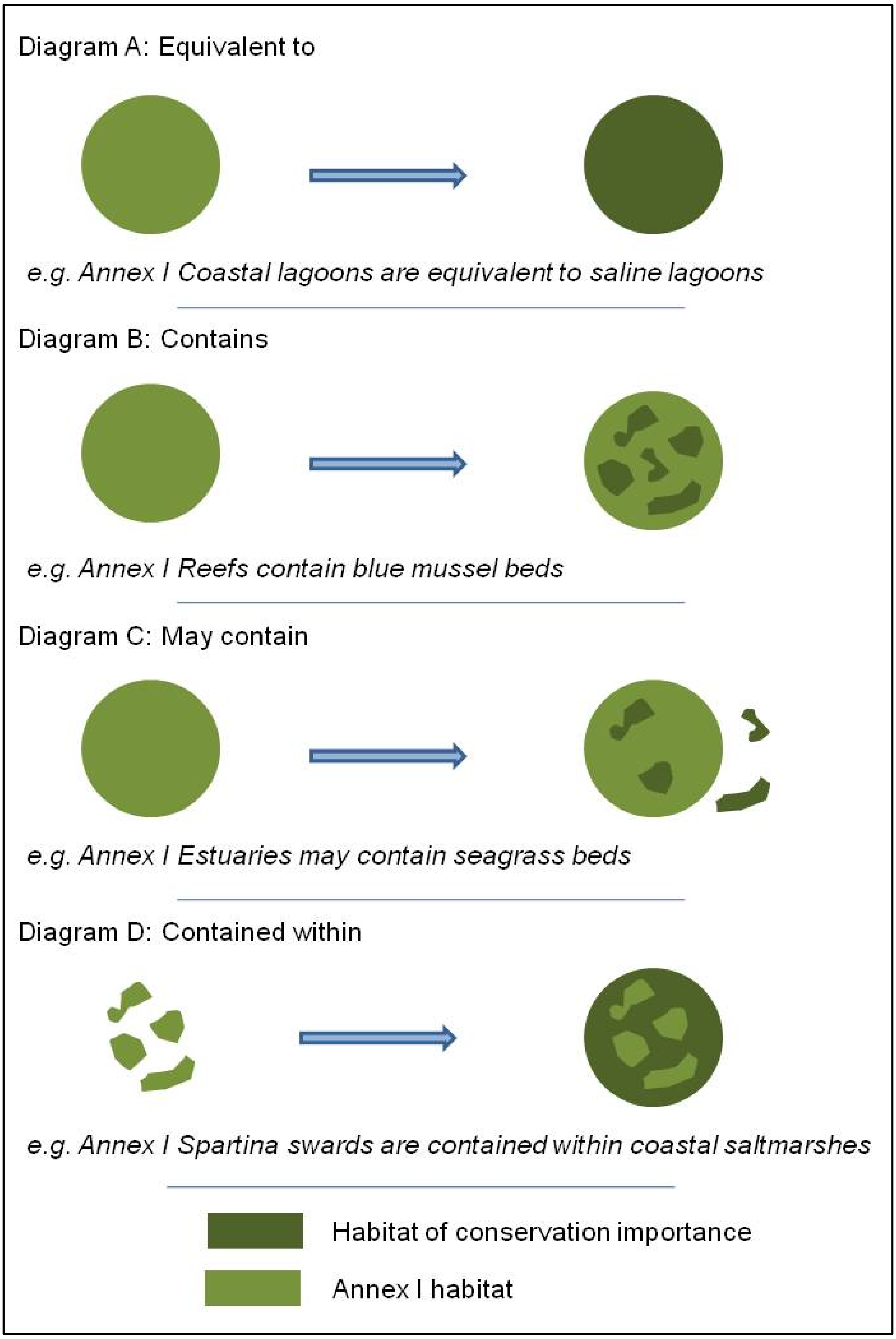


Table 20: Relationships between habitat FOCI and Annex I habitat types.*

Annex I habitat type	Relationship	Habitat FOCI
Atlantic salt meadows	Contained within	Coastal saltmarsh
Coastal lagoons	Equivalent to	Saline lagoons
Estuaries	Contain	Estuarine rocky habitats
	May contain	Coastal Saltmarsh
		Intertidal mudflats
		Seagrass beds
		Sheltered muddy gravels
		Native oyster (*Ostrea edulis*) beds
		Subtidal sands and gravels
Large shallow inlets and bays	May contain	Intertidal underboulder communities
		Native oyster (*Ostrea edulis*) beds
		Seagrass beds
		Subtidal sands and gravels
		Seagrass beds
		Tide-swept channels
		Sheltered muddy gravels
Mediterranean and thermo-Atlantic halophilous scrubs	Contained within	Coastal saltmarsh
Mudflats and sandflats not covered by seawater at low tide	Contain	Intertidal mudflats
	May contain	Seagrass beds
		Sheltered muddy gravels
Reefs	Contain	Blue mussel beds
		Cold-water coral reefs
		Fragile sponge & anthozoan communities on subtidal rocky habitats

Annex I habitat type	**Relationship**	**Habitat FOCI**
		Modiolus modiolus beds
		Honeycomb worm (*Sabellaria alveolata*) reefs
		Coral gardens
		Ross worm *(Sabellaria spinulosa*) reefs
	May contain	Deep-sea sponge aggregations
		Intertidal underboulder communities
		Littoral chalk communities
		Subtidal chalk
		Tide-swept channels
Salicornia and other annuals colonising mud and sand	Contained within	Coastal saltmarsh
Sandbanks which are slightly covered by sea water all the time	May contain	Maerl beds
		Seagrass beds
		Subtidal sands and gravels
Spartina swards	Contained within	Coastal saltmarsh
Submerged or partially submerged caves	May contain	Littoral chalk communities
		Subtidal chalk

* Note that where habitats of conservation importance are excluded from this table their definitions are not known to be included in the definitions of any Annex I habitat types.

7.3.4 Relationships between species FOCI and broad-scale habitats and habitat FOCI

All species FOCI will occur within one of more of the broad-scale habitats. Many species FOCI will also be associated with habitat FOCI. Species FOCI may occur in multiple broad-scale habitats and habitat FOCI. There are two possible relationships between the species and habitats:

1. The broad-scale habitat or habitat FOCI Y *contains* species FOCI X (i.e. the species FOCI is only known to occur within one broad-scale habitat or habitat FOCI); or
2. The broad-scale habitat or habitat FOCI Y *may contain* species FOCI X (i.e. the species FOCI occurs in more than one broad-scale habitat or habitat FOCI).

The specific relationships between individual Annex I habitat types and broad-scale habitats are detailed in Table 21. Note that only the most common relationships are listed and species may occasionally be found in other habitats.

Table 21: Relationships between broad-scale habitats and habitat FOCI and species FOCI.

Habitat	Broad-scale habitat (EUNIS Level 3) or habitat FOCI	Habitat relationship to species of conservation importance	Scientific name	Common Name	Taxon group
High energy intertidal rock	EUNIS Level 3	May contain	*Mitella pollicipes*	Gooseneck barnacle	Crustacean
			*Gobius cobitis**	Giant goby	Bony fish
			*Gobius couchi**	Couch's goby	Bony fish
			*Paludinella littorina**§	Sea snail	Mollusc
Moderate energy intertidal rock	EUNIS Level 3	May contain	*Padina pavonica*	Peacock's tail	Brown alga
			*Gobius cobitis**	Giant goby	Bony fish
			*Gobius couchi**	Couch's goby	Bony fish
			*Paludinella littorina**§	Sea snail	Mollusc
Low energy intertidal rock	EUNIS Level 3	May contain	*Padina pavonica*	Peacock's tail	Brown alga
			*Gobius cobitis**	Giant goby	Bony fish
			*Gobius couchi**	Couch's goby	Bony fish
			*Paludinella littorina**§	Sea snail	Mollusc
Intertidal coarse sediment	EUNIS Level 3	May contain	*Caecum armoricum*	Defolin`s lagoon snail	Mollusc

Habitat	Broad-scale habitat (EUNIS Level 3) or habitat FOCI	Habitat relationship to species of conservation importance	Scientific name	Common Name	Taxon group
Intertidal sand and muddy sand	EUNIS Level 3				
Intertidal mud	EUNIS Level 3				
Intertidal mixed sediments	EUNIS Level 3	May contain	*Atrina pectinata*	Fan mussel	Mollusc
Coastal saltmarshes and saline reedbeds	EUNIS Level 3	May contain	*Victorella pavida*	Trembling sea mat	Bryozoan (seamat)
Intertidal sediments dominated by aquatic angiosperms	EUNIS Level 3				
Intertidal biogenic reefs	EUNIS Level 3				
High energy infralittoral rock+	EUNIS Level 3				
Moderate energy infralittoral rock+	EUNIS Level 3				
Low energy infralittoral rock+	EUNIS Level 3	May contain	*Victorella pavida*	Trembling sea mat	Bryozoan (seamat)
			Haliclystus auricula	Stalked jellyfish	Cnidarian
			Lucernariopsis campanulata	Stalked jellyfish	Cnidarian
			Lucernariopsis cruxmelitensis	Stalked jellyfish	Cnidarian
High energy circalittoral rock§	EUNIS Level 3	May contain	*Amphianthus dohrnii*	Sea-fan anemone	Cnidarian

Habitat	Broad-scale habitat (EUNIS Level 3) or habitat FOCI	Habitat relationship to species of conservation importance	Scientific name	Common Name	Taxon group
			Eunicella verrucosa	Pink sea-fan	Cnidarian
			Leptopsammia pruvoti	Sunset cup coral	Cnidarian
			Palinurus elephas	Spiny lobster	Crustacean
Moderate energy circalittoral rock§	EUNIS Level 3	May contain	*Amphianthus dohrnii*	Sea-fan anemone	Cnidarian
			Eunicella verrucosa	Pink sea-fan	Cnidarian
			Leptopsammia pruvoti	Sunset cup coral	Cnidarian
			Palinurus elephas	Spiny lobster	Crustacean
Low energy circalittoral rock§	EUNIS Level 3				
Subtidal coarse sediment	EUNIS Level 3	May contain	*Grateloupia montagnei*	Grateloup's little-lobed weed	Red alga
Subtidal sand	EUNIS Level 3	May contain	*Lithothamnion corallioides*	Coral maerl	Red alga
			Phymatolithon calcareum	Common maerl	Red alga
			Arctica islandica	Ocean quahog	Mollusc
			Armandia cirrhosa	Lagoon sandworm	Annelid (worm)

Habitat	**Broad-scale habitat (EUNIS Level 3) or habitat FOCI**	**Habitat relationship to species of conservation importance**	**Scientific name**	**Common Name**	**Taxon group**
			Atrina pectinata	Fan mussel	Mollusc
Subtidal mud	EUNIS Level 3	May contain	*Lithothamnion corallioides*	Coral maerl	Red alga
			Phymatolithon calcareum	Common maerl	Red alga
			Alkmaria romijni	Tentacled lagoon-worm	Annelid (worm)
			Nematostella vectensis	Starlet sea anemone	Cnidaria
			Ostrea edulis	Native oyster	Mollusc
			Atrina pectinata	Fan mussel	Mollusc
Subtidal mixed sediments	EUNIS Level 3	May contain	*Cruoria cruoriaeformis*	Burgundy maerl paint weed	Red alga
		May contain	*Grateloupia montagnei*	Grateloup's little-lobed weed	Red alga
			Lithothamnion corallioides	Coral maerl	Red alga
			Phymatolithon calcareum	Common maerl	Red alga
			Arctica islandica	Ocean quahog	Mollusc
			Atrina pectinata	Fan mussel	Mollusc

Habitat	Broad-scale habitat (EUNIS Level 3) or habitat FOCI	Habitat relationship to species of conservation importance	Scientific name	Common Name	Taxon group
			Hippocampus hippocampus	Short snouted seahorses	Bony fish
			Gobius couchi	Couch's goby	Bony fish
			Ostrea edulis	Native oyster	Mollusc
			Caecum armoricum	Defolin`s lagoon snail	Mollusc
Subtidal macrophyte-dominated sediment	EUNIS Level 3	May contain	*Cruoria cruoriaeformis*	Burgundy maerl paint weed	Algae
			Grateloupia montagnei	Grateloup's little-lobed weed	Red alga
			Lithothamnion corallioides	Coral maerl	Algae
			Phymatolithon calcareum	Common maerl	Algae
			Hippocampus guttulatus	Long snouted seahorse	Bony fish
		May contain	*Hippocampus hippocampus*	Short snouted seahorses	Bony fish
			Haliclystus auricula	Stalked jellyfish	Cnidarian
			Gammarus insensibilis	Lagoon sand shrimp	Crustacean
			Tenellia adspersa	Lagoon sea slug	Mollusc

Habitat	Broad-scale habitat (EUNIS Level 3) or habitat FOCI	Habitat relationship to species of conservation importance	Scientific name	Common Name	Taxon group
			Lucernariopsis campanulata	Stalked jellyfish	Cnidarian
Subtidal biogenic reefs	EUNIS Level 3				
Deep-sea bed	EUNIS Level 2				
Blue Mussel beds (including intertidal beds on mixed and sandy sediments)	Habitat FOCI				
Coastal saltmarsh	Habitat FOCI				
Cold-water coral reefs	Habitat FOCI				
Coral Gardens	Habitat FOCI				
Deep-sea sponge aggregations	Habitat FOCI				
Estuarine rocky habitats	Habitat FOCI	May contain	*Hippocampus hippocampus*	Short snouted seahorses	Bony fish
			Ostrea edulis	Native oyster	Mollusc
File shell beds	Habitat FOCI				
Fragile sponge & anthozoan communities on subtidal rocky habitats	Habitat FOCI	May contain	*Amphianthus dohrnii*	Sea-fan anemone	Cnidarian
			Eunicella verrucosa	Pink sea-fan	Cnidarian

Habitat	Broad-scale habitat (EUNIS Level 3) or habitat FOCI	Habitat relationship to species of conservation importance	Scientific name	Common Name	Taxon group
			Leptopsammia pruvoti	Sunset cup coral	Cnidarian
Honeycomb worm (*Sabellaria alveolata*) reefs	Habitat FOCI				
Horse mussel (*Modiolus modiolus*) beds	Habitat FOCI				
Intertidal mudflats	Habitat FOCI				
Intertidal underboulder communities	Habitat FOCI	May contain	*Paludinella littorina*	Sea snail	Mollusc
		May contain	*Gobius couchi*	Couch's goby	Bony fish
Littoral chalk communities	Habitat FOCI				
Maerl beds	Habitat FOCI	May contain	*Cruoria cruoriaeformis*	Burgundy maerl paint weed	Red alga
			Grateloupia montagnei	Grateloup's little-lobed weed	Red alga
		Contains	*Lithothamnion corallioides*	Coral maerl	Red alga
			Phymatolithon calcareum	Common maerl	Red alga
Mud habitats in deep water	Habitat FOCI				
Native oyster (*Ostrea edulis)* beds	Habitat FOCI	Contains	*Ostrea edulis*	Native oyster	Mollusc

Habitat	Broad-scale habitat (EUNIS Level 3) or habitat FOCI	Habitat relationship to species of conservation importance	Scientific name	Common Name	Taxon group
Peat and clay exposures	Habitat FOCI				
Ross worm (*Sabellaria spinulosa*) reefs	Habitat FOCI				
Seagrass beds	Habitat FOCI	May contain	*Hippocampus guttulatus*	Long snouted seahorse	Bony fish
			Hippocampus hippocampus	Short snouted seahorses	Bony fish
			Haliclystus auricula	Stalked jellyfish	Cnidarian
			Lucernariopsis campanulata	Stalked jellyfish	Cnidarian
			Atrina pectinata	Fan mussel	Mollusc
Sea-pen and burrowing megafauna communities	Habitat FOCI				
Sheltered muddy gravels	Habitat FOCI	May contain	*Nematostella vectensis*	Starlet sea anemone	Cnidarian
			Atrina pectinata	Fan mussel	Mollusc
			Ostrea edulis	Native oyster	Mollusc
Subtidal chalk	Habitat FOCI				
Subtidal sands and gravels	Habitat FOCI	May contain	*Arctica islandica*	Ocean quahog	Mollusc

Habitat	Broad-scale habitat (EUNIS Level 3) or habitat FOCI	Habitat relationship to species of conservation importance	Scientific name	Common Name	Taxon group
		May contain	*Atrina pectinata*	Fan mussel	Mollusc
		May contain	*Ostrea edulis*	Native oyster	Mollusc
Tide-swept channels	Habitat FOCI				
Saline lagoons	Habitat FOCI	May contain	*Alkmaria romijni*	Tentacled lagoon-worm	Annelid (worm)
			Armandia cirrhosa	Lagoon sandworm	Annelid (worm)
			Victorella pavida	Trembling sea mat	Bryozoan (seamat)
			Nematostella vectensis	Starlet sea anemone	Cnidarian
			Gammarus insensibilis	Lagoon sand shrimp	Crustacean
			Caecum armoricum	Defolin`s lagoon snail	Mollusc
			Paludinella littorina	Sea snail	Mollusc
			Tenellia adspersa	Lagoon sea slug	Mollusc

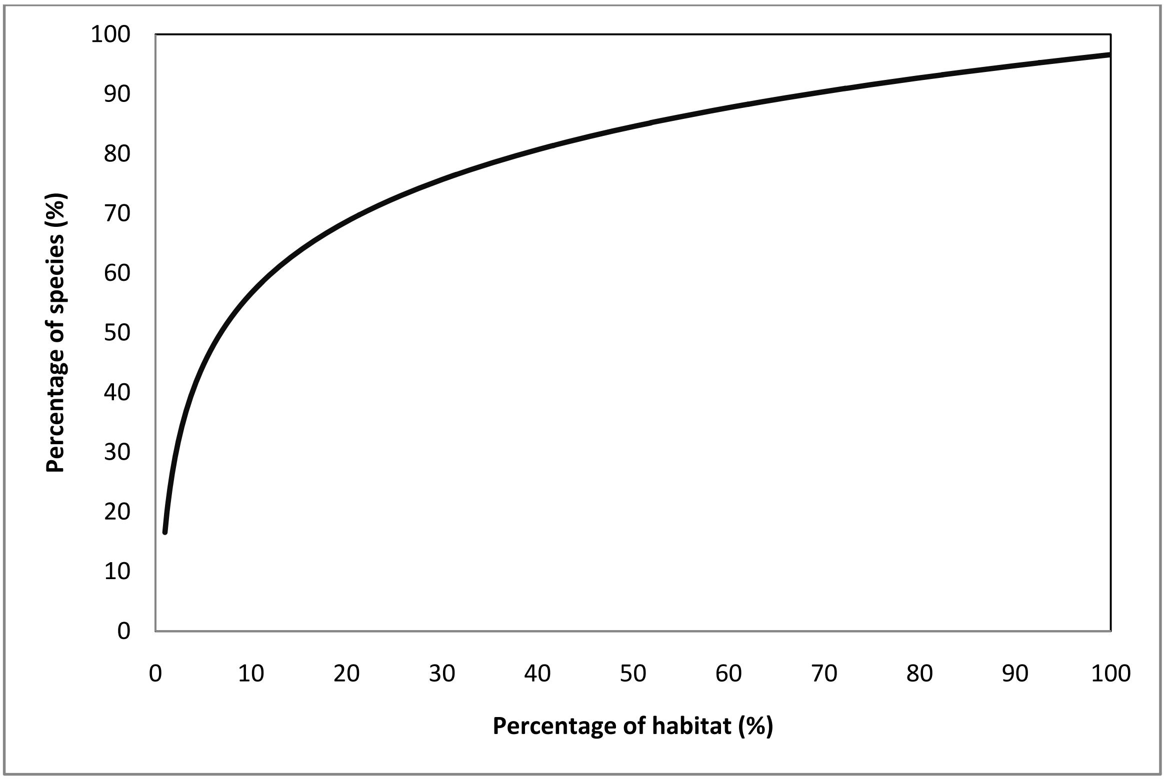
*These species are generally found in rock pools in intertidal rock.
§ This species may be found in intertidal caves.

7.4 Annex 4: Further details on meeting the principle of adequacy

Broad-scale habitats: Species-area relationship

There is a well-established relationship between habitat area and the number of species that an area can support, generally represented as the species-area curve (Rosenzweig 1995). Using this relationship the number of species that are expected to be recorded in a given percentage of the original habitat can be calculated. The relationship follows a law of diminishing returns where the larger the area of a habitat sampled, the less likely it becomes to find previously un-recorded species. This relationship is illustrated in Figure 10 for intertidal sediments (A2).

Figure 10: Example of the species-area relationship for intertidal sediments.



Research commissioned by JNCC estimated the percentage of each broad-scale habitat required to represent a given number species in each habitat (Rondinini in press 2010b). An extract of results from this research are presented below in Table 20. Table 20 shows the habitat-specific percentage ranges of broad-scale habitat area necessary to represent increasing numbers of species occurring in each of these habitats. JNCC and Natural England recommend that the majority (taken to be 70 – 80%) of species known to occur in each broad-scale habitat be protected within the MPA network. In general, this approach equates to the protection of between 10% and 40% of the total area of most broad-scale habitats within MPAs in each regional MCZ project area (shown in the shaded boxes in Table 22).

Table 22: Percentage ranges of broad-scale habitat area necessary to represent increasing percentages of the known species occurring in each broad-scale habitat type (after Rondinini in press 2010).

Broad-scale habitat types		Percentage of species (10% incremental steps)				
		50%	**60%**	**70%**	**80%**	**90%**
High energy intertidal rock (A1.1)	**Percentage of total broad-scale habitat area**	4.9	10.8	21.2	37.9	63.2
Moderate energy intertidal rock (A1.2)		4.9	10.9	21.3	38.0	63.3
Low energy intertidal rock (A1.3		5.4	11.6	22.2	39.0	64.1
Intertidal coarse sediments (A2.1)		6.69	13.6	24.8	41.8	66.3
Intertidal sand and muddy sand (A2.2)		6.3	13.0	24.8	41.8	65.7
Intertidal mud (A2.3)		6.3	13.0	24.8	41.8	65.7
Intertidal mixed sediments (A2.4)		6.3	13.0	24.8	41.8	65.7
High energy infralittoral rock (A3.1)		2.5	6.6	15.0	30.5	57.1
Moderate energy infralittoral rock (A3.2)		3.0	7.5	16.5	32.4	58.7
Low energy infralittoral rock (A3.3)		2.8	7.1	15.9	31.6	58.0
High energy circalittoral rock (A4.1)		1.4	4.3	11.2	25.4	52.3
Moderate energy circalittoral rock (A4.2)		1.9	5.4	13.0	27.9	54.7
Low energy circalittoral rock (A4.3)		2.7	7.1	15.7	31.5	57.9
Subtidal coarse sediment (A5.1)		3.0	7.6	16.5	32.4	58.7
Subtidal sand (A5.2)		2.3	6.3	14.5	29.9	56.6
Subtidal mud (A5.3)		2.3	6.2	14.5	29.8	56.5
Subtidal mixed sediments (A5.4)		2.8	7.3	16.1	31.9	58.3

Six broad-scale habitats including the deep-sea bed; coastal saltmarshes and saline reedbeds; intertidal sediments dominated by aquatic angiosperms; intertidal biogenic reefs; subtidal macrophyte-dominated sediment; and subtidal biogenic reefs are not included in Table 22. It was not possible to develop species-area curves for these broad-scale habitats due to the limitations of the available data. However, five of the six broad-scale habitats closely correspond to some of the habitat FOCI. Therefore, the percentage of these broad-scale habitats to be protected will be determined by meeting the guidelines under the principles of replication, viability and connectivity for their component habitats of conservation importance (see Table 23). For the sixth habitat, deep-sea bed, the percentage of this habitat to be protected will be determined by meeting the guidelines under the principles of replication, viability and connectivity for the deep-sea bed.

Table 23: Component habitat FOCI for broad-scale habitats (see Annex 3 for a full explanation of the relationships between different habitats).

Broad-scale habitat types	**Component habitat FOCI**
Coastal saltmarshes and saline reedbeds	Coastal saltmarsh
Intertidal sediments dominated by aquatic angiosperms	Seagrass beds (intertidal)
Intertidal biogenic reefs	Honeycomb worm (*Sabellaria alveolata*) reefs (intertidal), and blue mussel beds (intertidal)
Subtidal macrophyte-dominated sediment	Maerl beds, and seagrass beds (subtidal)
Subtidal biogenic reefs	Honeycomb worm (*Sabellaria alveolata*) reefs (subtidal), Ross worm (*Sabellaria spinulosa*) reefs, *Modiolus modiolus* beds, blue mussel beds and cold-water coral reefs.

It is worth noting that the percentage range guidelines shown in Table 22 are comparable to those put forward by international agreements including the:

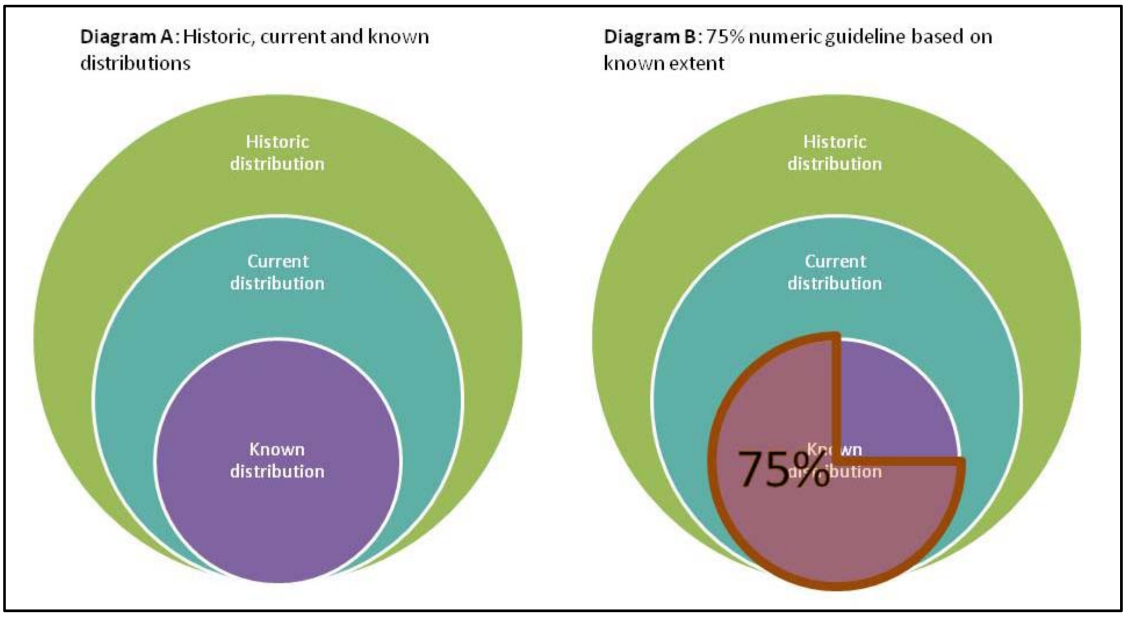
- Convention on Biological Diversity who recommend that 'at least 10% of each of the world's ecological regions [are] effectively conserved' (UNEP, CBD and COP 2004);
- World Parks Congress who recommend that minimum targets for the protection of marine biodiversity features should be 20-30% of each habitat in highly protected sites (World Parks Congress 2003);
- OSPAR Commission who recommends that at least 10% – 20% of each broad-scale habitat should be protected within the MPA network (OSPAR 2006).

Features of conservation importance: the sum of other principles

The research commissioned by JNCC found that it was not possible to estimate the percentage of each habitat FOCI required to represent a given number of species due to a lack of information on community structure (Rondinini in press 2010b). FOCI are known to be rare, threatened or declining and as such it is likely their historic distribution was significantly greater than their current or known distribution. Therefore, the known distribution of these species and habitats is likely to be a fraction of their historical distribution (Figure 11, Diagram A). We do not have, and may never have, information that allows us to determine the historic distributions of FOCI. If percentage range guidelines for adequacy were applied only to the known extent of FOCI they will be misleading, failing to provide adequate protection for these features and create a false sense of certainty that sufficient action has been taken (Figure 11, Diagram B).

As such Natural England and JNCC advise that adequacy can best be achieved for species and habitats FOCI by following the guidelines under the principles of replication and viability primarily, but also connectivity. In some cases this may lead to the majority of known occurrences of FOCI being protected within the MPA network.

Figure 11: Diagram showing the differences between historic extent, current extent and known extent.



7.5 Annex 5: Example Conservation Objectives: sea-pen and burrowing megafauna communities[77]

> Subject to natural change, [maintain] or [allow the recovery of][78] the sea-pen and burrowing megafauna communities to favourable condition, such that:
>
> - the extent, diversity, community structure, typical species and natural environmental processes representative of sea-pen and burrowing megafauna communities in the biogeographic region are [maintained] or [allowed to recover].
>
> Sea-pen and burrowing megafauna communities are known to be sensitive to the following pressures:
>
> - physical loss,
> - physical damage,
> - toxic and non-toxic contamination,
> - and biological disturbance (including biological extraction).
>
> Human activities which cause these pressures will need to be managed if they prevent the conservation objectives from being achieved.

Conservation objective descriptors

The following are examples of conservation objective descriptors that it may be appropriate to use for MCZs (Defra 2009b):

a) **Maintain or Recover** - maintain implies that the feature is at its desired condition level and will, subject to natural change, remain so at designation. If the feature is achieving its desired condition, it is likely that *existing* activities will *not impact* the feature and can continue. There may be instances where the feature is assessed in favourable condition but will require some management to ensure that it does not decline into unfavourable condition.

Recover implies that the feature is degraded[79] to some degree and that activities will have to be managed to reduce or eliminate negative impact(s). Recovery in the marine environment generally refers to natural recovery through the removal of unsustainable physical, chemical and biological pressures from human activities, rather than intervention (as is possible with terrestrial features).

It is considered that maintenance/recovery of the following parameters will take account for the maintenance or recovery of natural structure and function, and ecological processes.

b) **Extent** - the area covered by the habitat and communities.

c) **Diversity** - the number of different biological communities.

d) **Community structure** - e.g. age classes, sex ratios, distribution of species, abundance, biomass, reproductive capacity, recruitment, range and mobility.

[77] More detailed examples of conservation objectives for MCZ features will be provided in a separate SNCB guidance document on developing MCZ conservation objectives.

[78] Either 'Maintain' OR 'Recover' would need to be selected as an objective for the feature. Recovery will be required where the feature has been subject to degradation prior to designation. Degraded implies that the feature has been subject to pressures to which the feature is sensitive.

e) **Typical species -** for example, a species that is consistently associated with, but not necessarily restricted to, the feature. Identification of a species as typical is not in itself sufficient to indicate the importance of the species or any need for management. The importance of the species should be judged on the contribution made by the species to ecological integrity of the feature.

f) **Natural environmental processes** – e.g. circulation, sediment deposition and erosion etc. should not deviate from baseline at designation or reference conditions (depending on whether the objective).

7.6 Annex 6: Condition scale for the MPA network

Natural England and JNCC currently[80] recommend that MCZs should follow the same condition scale used for other sites within the MPA network (notably SACs, SPAs and SSSIs). This will help align monitoring and reporting on all sites within the MPA network and provide for the development of clear network objectives.

Table 24: Condition scales for the designations within the MPA network.

	Condition scale for features within the MPA network low – high					
Natura 2000 (SACs & SPAs)	**Destroyed / Partially Destroyed**	**Unfavourable declining**	**Unfavourable maintained**	**Unfavourable recovering**	**Favourable maintained**	
SSSI	**Destroyed / Partially Destroyed**	**Unfavourable declining**	**Unfavourable maintained**	**Unfavourable recovering**	**Favourable maintained**	
MCZ	**Destroyed / Partially Destroyed**	**Unfavourable declining**	**Unfavourable maintained**	**Unfavourable recovering**	**Favourable**	**Reference conditions**

Threshold for reaching MCZ conservation objectives

Definitions[81]

Favourable condition – the objectives for that feature are being achieved. Natural England and JNCC will provide advice, where possible, on what minimum favourable condition looks like for each MCZ feature.

Reference condition – the state where there are no, or only very minor, changes to the values of the hydromorphological, physico-chemical, and biological quality elements which would be found in the absence of anthropogenic disturbance.

The term **Favourable** encompasses a range of ecological condition depending on the objectives for individual features. At the lower end of favourable, sites may be at risk of declining into unfavourable condition. Where all extractive, depositional and other damaging activities are prevented, the feature should reach **Reference conditions** within several reporting cycles[82].

Unfavourable condition – the state of the feature is currently unsatisfactory and management is required to enable favourable condition to be achieved.

Destroyed (partially or completely) – the feature is no longer present and there is no prospect of being able to restore it.

Where the feature is **Unfavourable,** a further assessment is made as to whether the state of the feature is:

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[80] This recommendation needs to be confirmed by Defra.

[81] The majority of these are taken from JNCC Common Standards Monitoring guidance http://www.jncc.gov.uk/page-2219 apart from reference condition which is taken from http://www.wfduk.org/wfd_concepts/CIS_Glossary

[82] This may depend on the initial degree of degradation and feature recovery rates.

Recovering – moving towards the desired state (management will have been implemented).

Declining – moving away from the desired state (pressures on the features are increasing or management measures are ineffective in mitigating the adverse effect of a pressure).

Maintained – neither improving nor declining (management requirements have not been implemented, or are not effective in improving status).

For an example conservation objective, see Annex 5. If at the time of MCZ recommendation and designation there is insufficient direct information on ecological quality, then condition of features will be assessed using information on pressures and sensitivities.

7.7 Annex 7. Physical, chemical and biological pressures in the marine environment

Table 25: List of pressures.

Pressure theme	Pressure
Climate change	Atmospheric climate change
	pH changes
	Temperature changes - regional/national
	Salinity changes - regional/national
	Water flow (tidal & ocean current) changes - regional/national
	Emergence regime changes (sea level) - regional/national
	Wave exposure changes - regional/national
Hydrological changes (inshore/local)	Temperature changes - local
	Salinity changes - local
	Water flow (tidal current) changes - local
	Emergence regime changes - local
	Wave exposure changes - local
	Water clarity changes
Pollution and other chemical changes	Non-synthetic compound contamination (incl. heavy metals, hydrocarbons, produced water)
	Synthetic compound contamination (incl. pesticides, anti-foulants, pharmaceuticals)
	Radionuclide contamination
	Introduction of other substances (solid, liquid or gas)
	De-oxygenation
	Nutrient enrichment
	Organic enrichment
Physical loss	Physical loss (to land or freshwater habitat)
	Physical change (to another seabed type)
Physical damage	Habitat structure changes - removal of substratum (extraction)
	Penetration and/or disturbance of the substrate below the surface of the seabed

	Heavy abrasion, primarily at the seabed surface
	Light abrasion at the surface only
	Siltation rate changes
Other physical pressures	Litter
	Electromagnetic changes
	Underwater noise changes
	Introduction of light
	Barrier to species movement
	Death or injury by collision
Biological pressures	Visual disturbance
	Genetic modification & translocation of indigenous species
	Introduction or spread of non-indigenous species
	Introduction of microbial pathogens
	Removal of target species
	Removal of non-target species

7.8 Annex 8: Vulnerability of MCZ features

The likely impact of a pressure on an MCZ feature (also termed 'vulnerability') can be determined by combining information on sensitivity and exposure. In the table below, example scores for 'sensitivity' and 'exposure to pressures' are multiplied to derive a coarse grading for feature vulnerability.

Table 26: Matrix of vulnerability.

Relative exposure of the MCZ feature to a specific pressure	Relative sensitivity of the MCZ feature to a specific pressure				
		High (3)	Moderate (2)	Low (1)	None detectable (0)
	High (3)	9	6	3	0
	Medium (2)	6	4	2	0
	Low (1)	3	2	1	0
	Exposure at an unknown level				0
	None (0)	0	0	0	0

Note the level of likely impact (vulnerability) will always be categorised 'insufficient information to make any assessment' in cases where there is inadequate information to assess either the exposure OR sensitivity of a given feature.

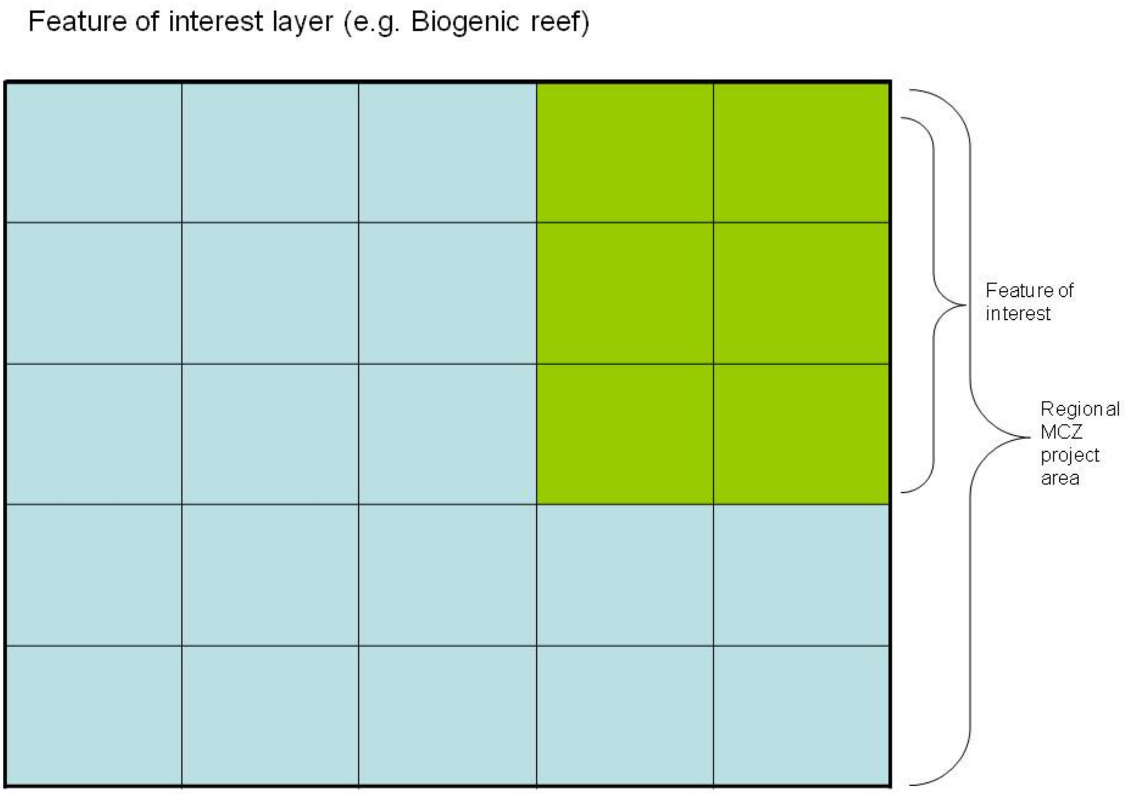
Table 27: Categories of vulnerability.

High vulnerability	**6 to 9**
Moderate vulnerability	**3 to 5**
Low vulnerability	**1 to 2**
Vulnerability identified, but not quantified as level of exposure unknown.	
No known vulnerability	**0**
Insufficient information to make any assessment	

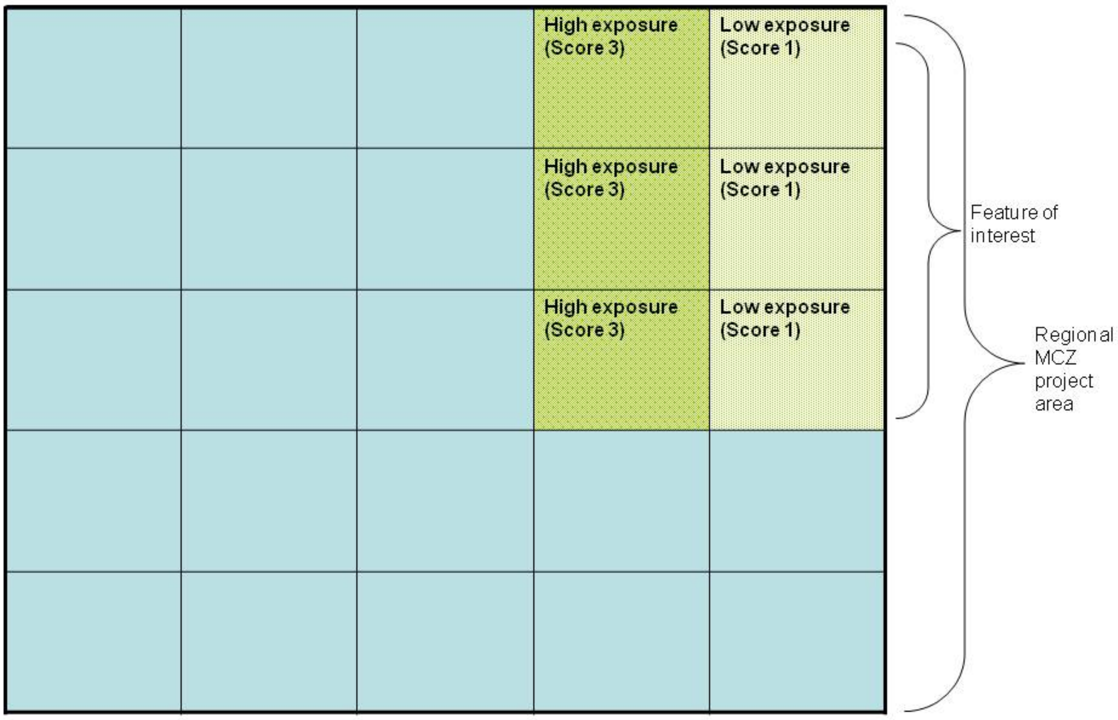
7.9 Annex 9: Using information on impacts and feature vulnerability to help guide MCZ selection

Information on impacts, feature vulnerability and naturalness can help guide MCZ selection. Higher priority should generally be given to a feature that is known to be less impacted in a particular area compared to a more impacted example of the same feature. The following example of a simple assessment is designed to help inform site selection. Please note that the vulnerability scores are hypothetical and generated solely for the purpose of illustrating how this approach might be used by the regional MCZ projects.

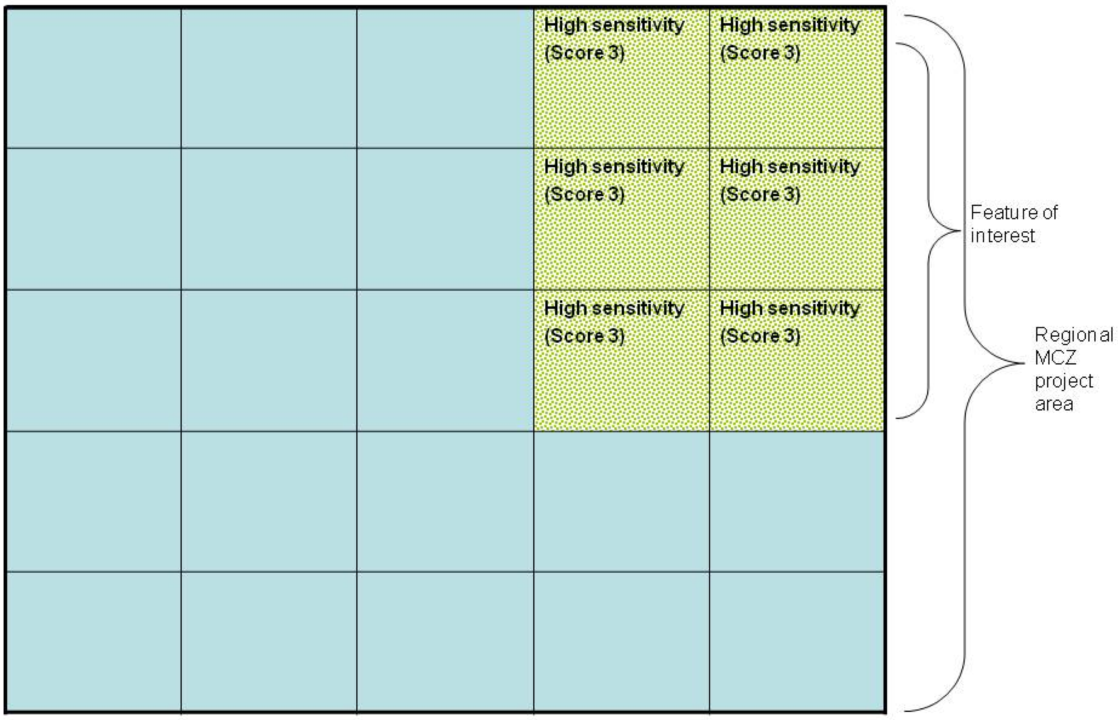
Figure 12: Example vulnerability assessment.



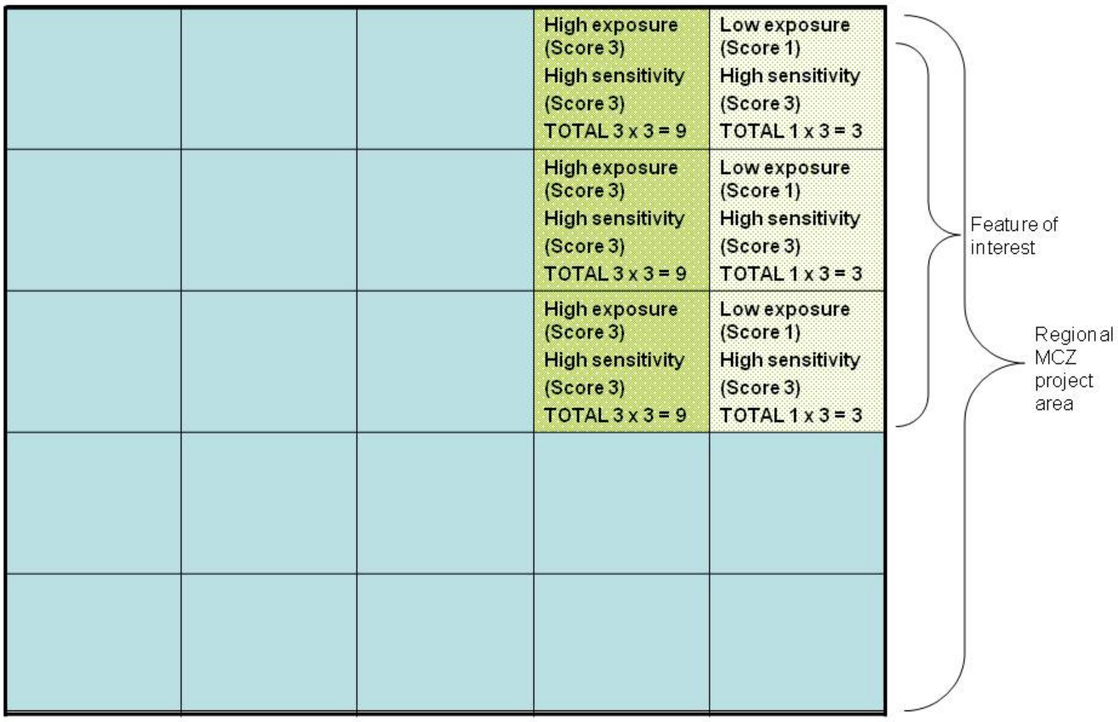
Exposure to environmental pressure (e.g. physical damage)



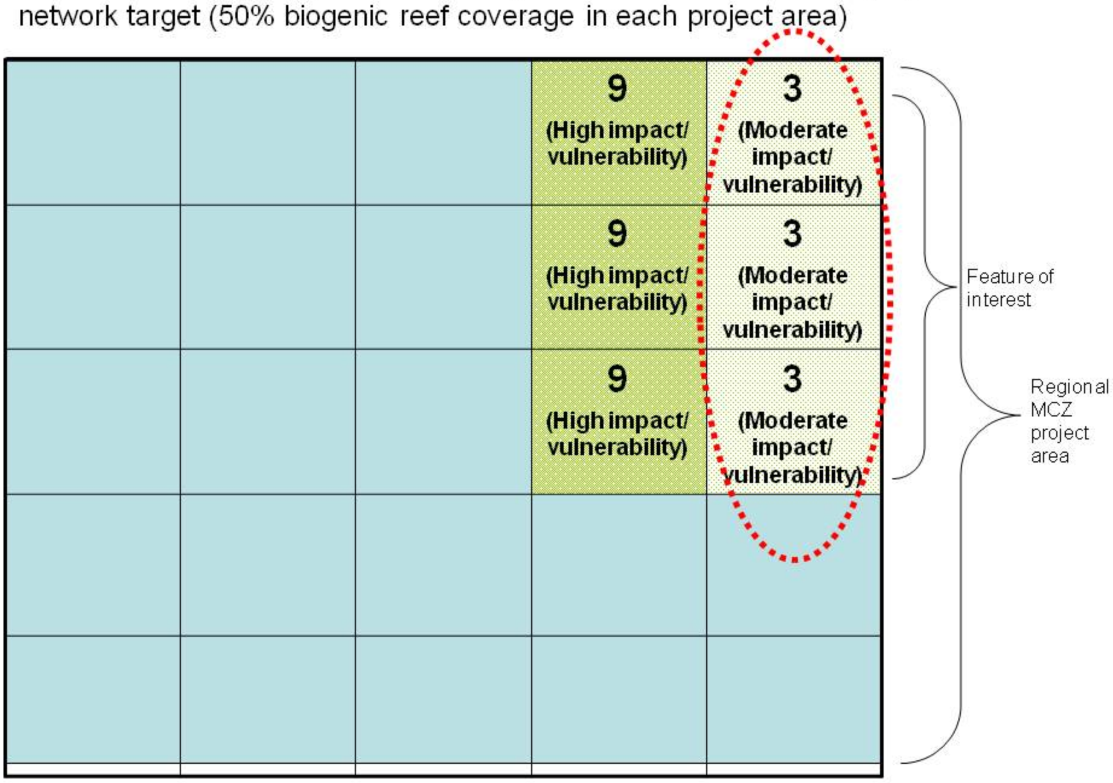
Sensitivity to environmental pressure (e.g. physical damage)



Exposure and sensitivity information combined

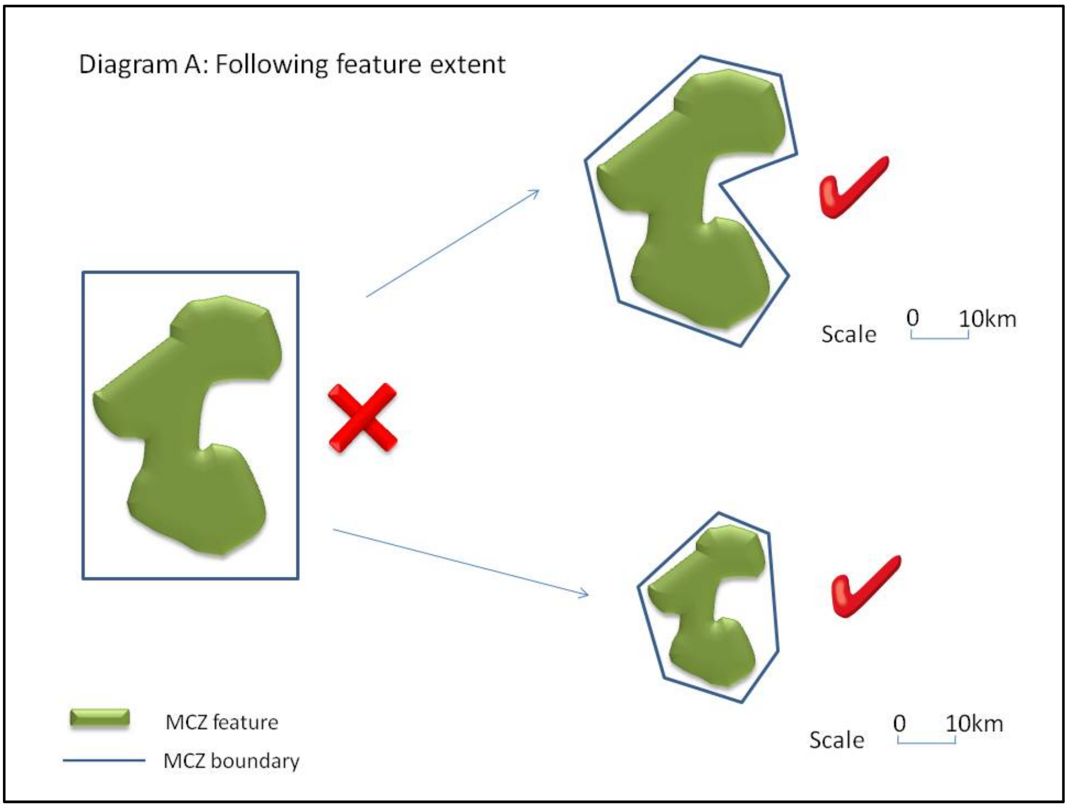


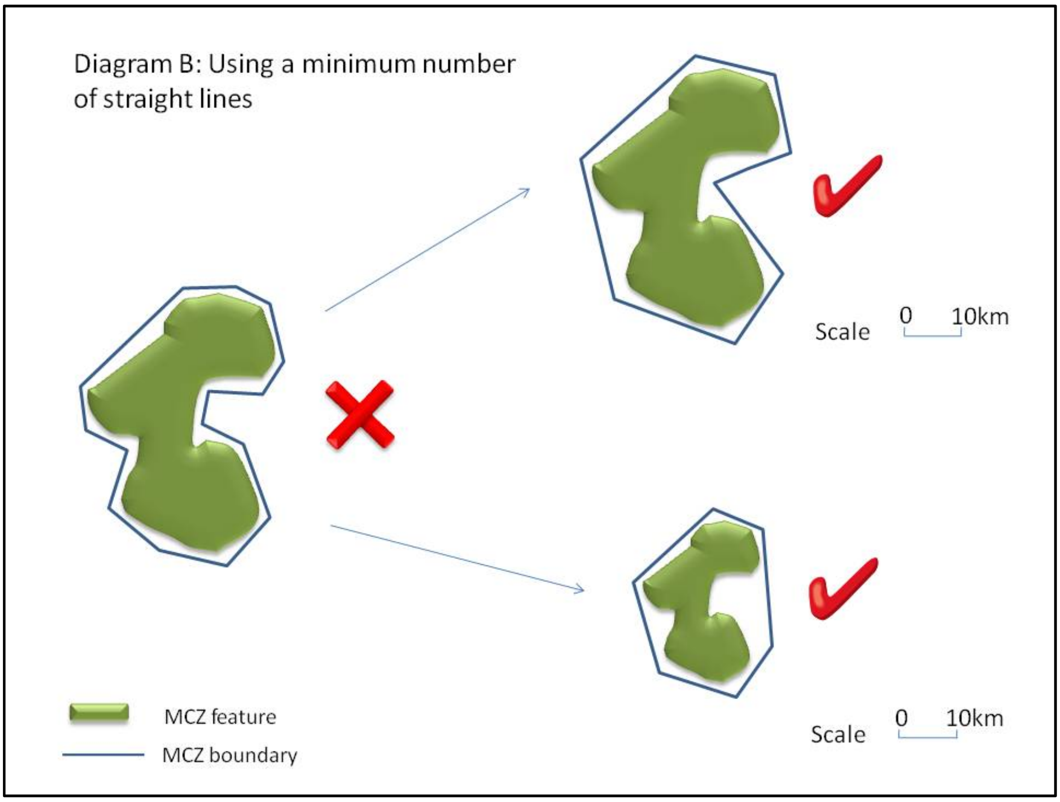
Area of lowest likely impact/vulnerability identified as MCZ, meeting *hypothetical* network target (50% biogenic reef coverage in each project area)



7.10 Annex 10: MCZ boundary delineation guidance

Figure 13: Examples of good practice in drawing MPA boundaries.





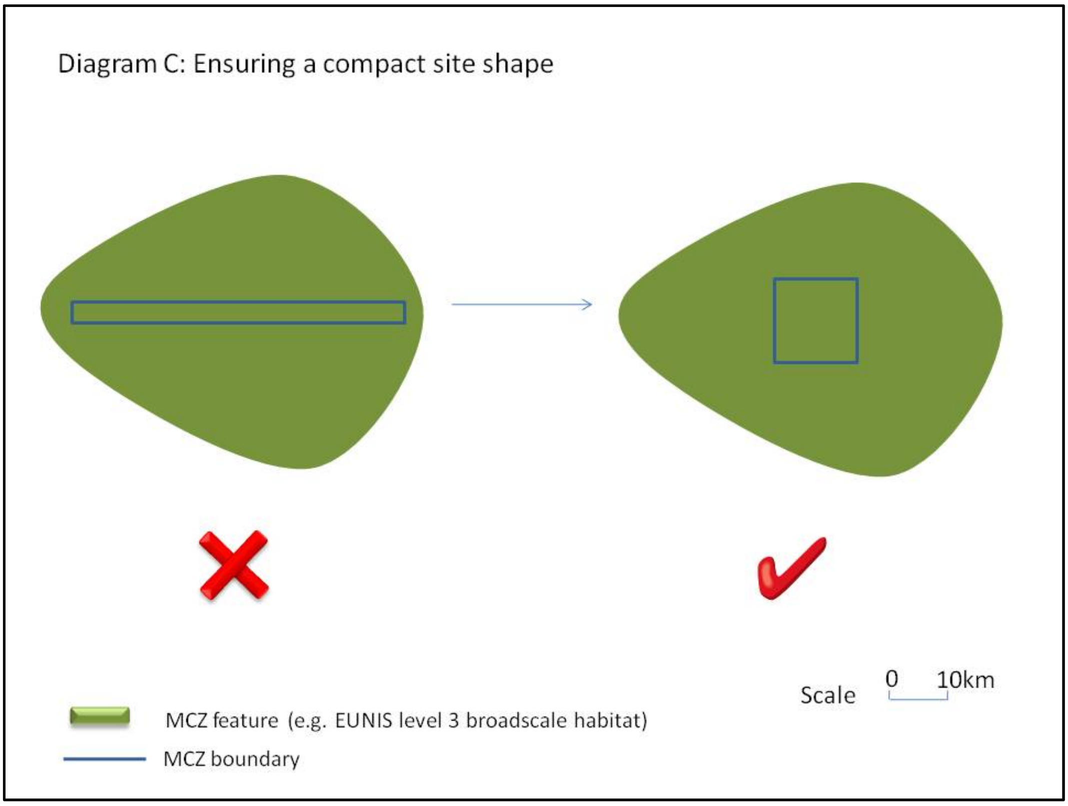


Diagram C: Ensuring a compact site shape
Scale
0
10km
MCZ feature (e.g. EUNIS level 3 broadscale habitat)
MCZ boundary

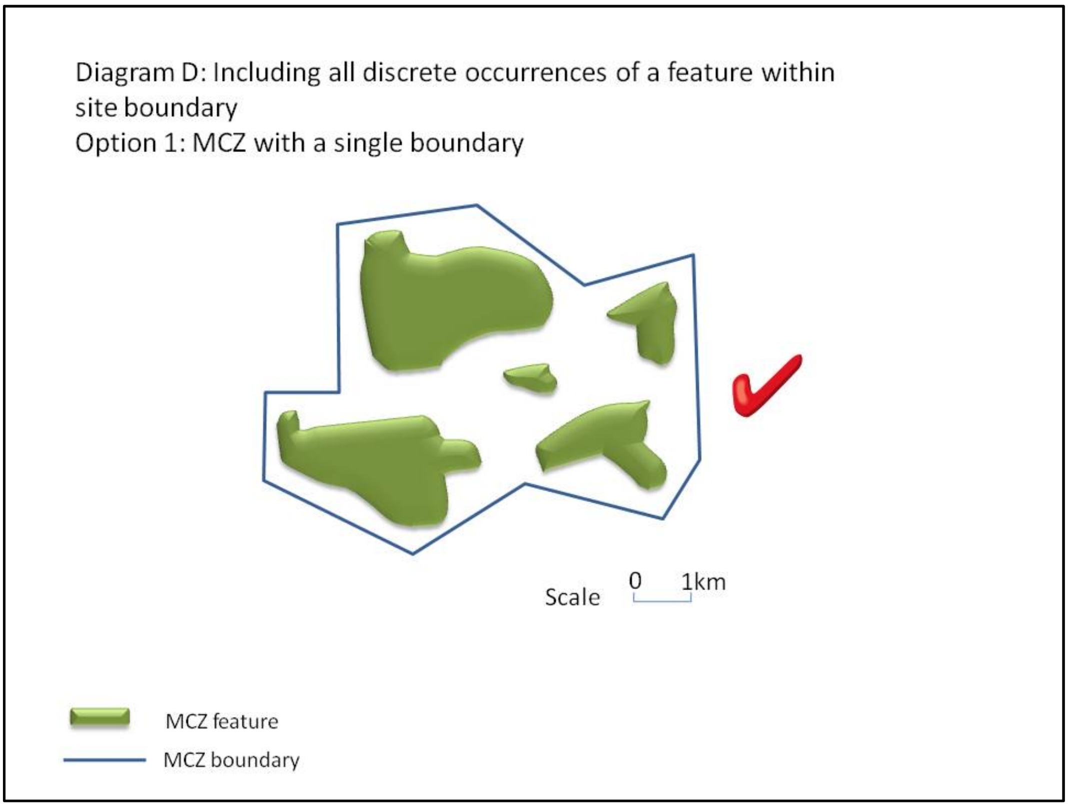


Diagram D: Including all discrete occurrences of a feature within site boundary
Option 1: MCZ with a single boundary
Scale
0
1km
MCZ feature
MCZ boundary

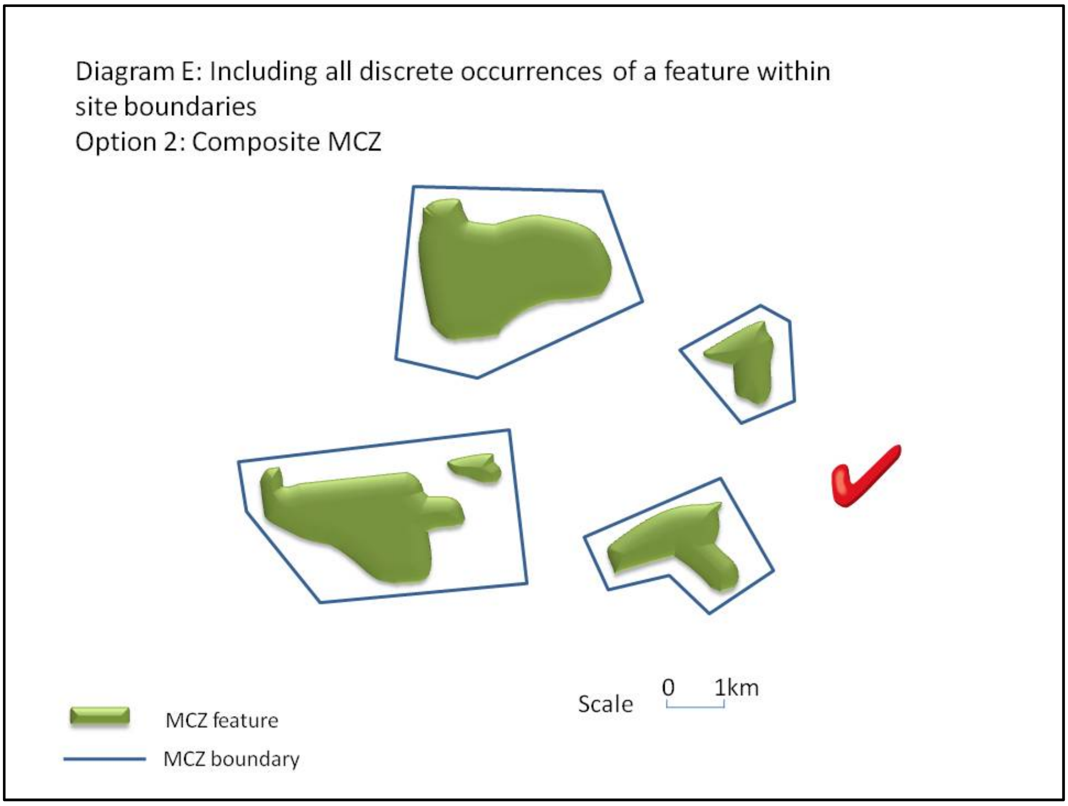


Diagram E: Including all discrete occurrences of a feature within site boundaries
Option 2: Composite MCZ
Scale
0
1km
MCZ feature
MCZ boundary

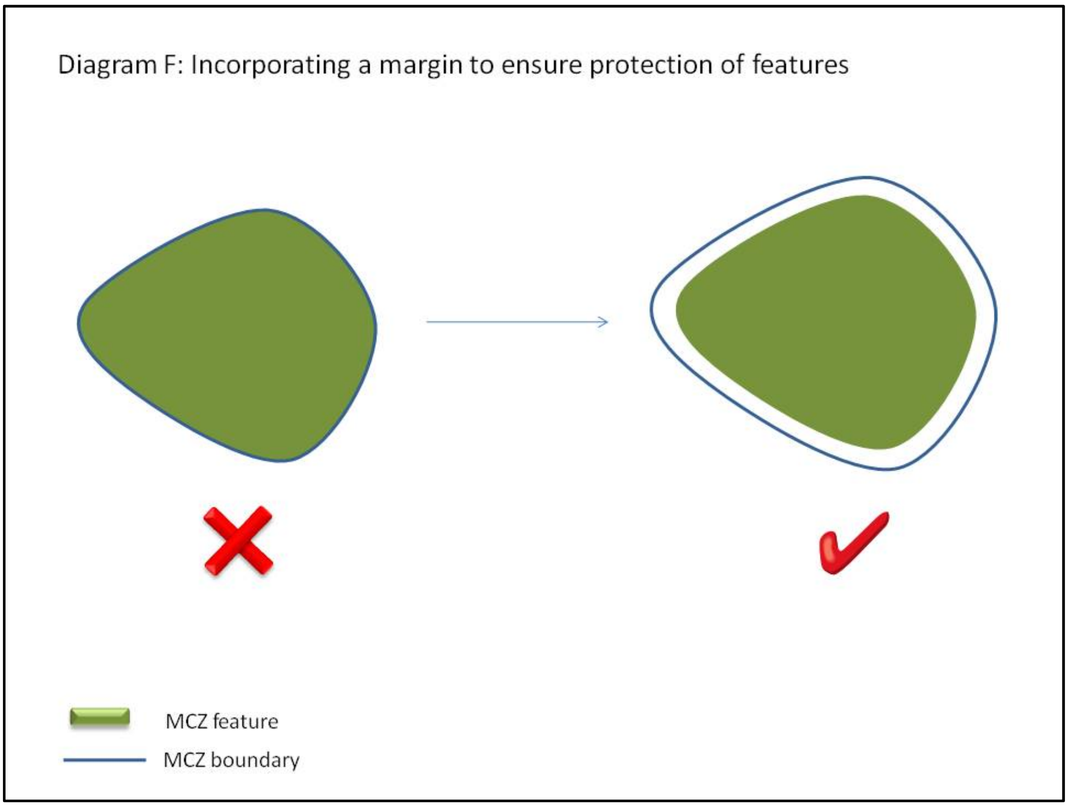


Diagram F: Incorporating a margin to ensure protection of features
MCZ feature
MCZ boundary

7.11 Annex 11: Appropriate distance to extend the site boundary at the sea surface beyond MCZ habitat

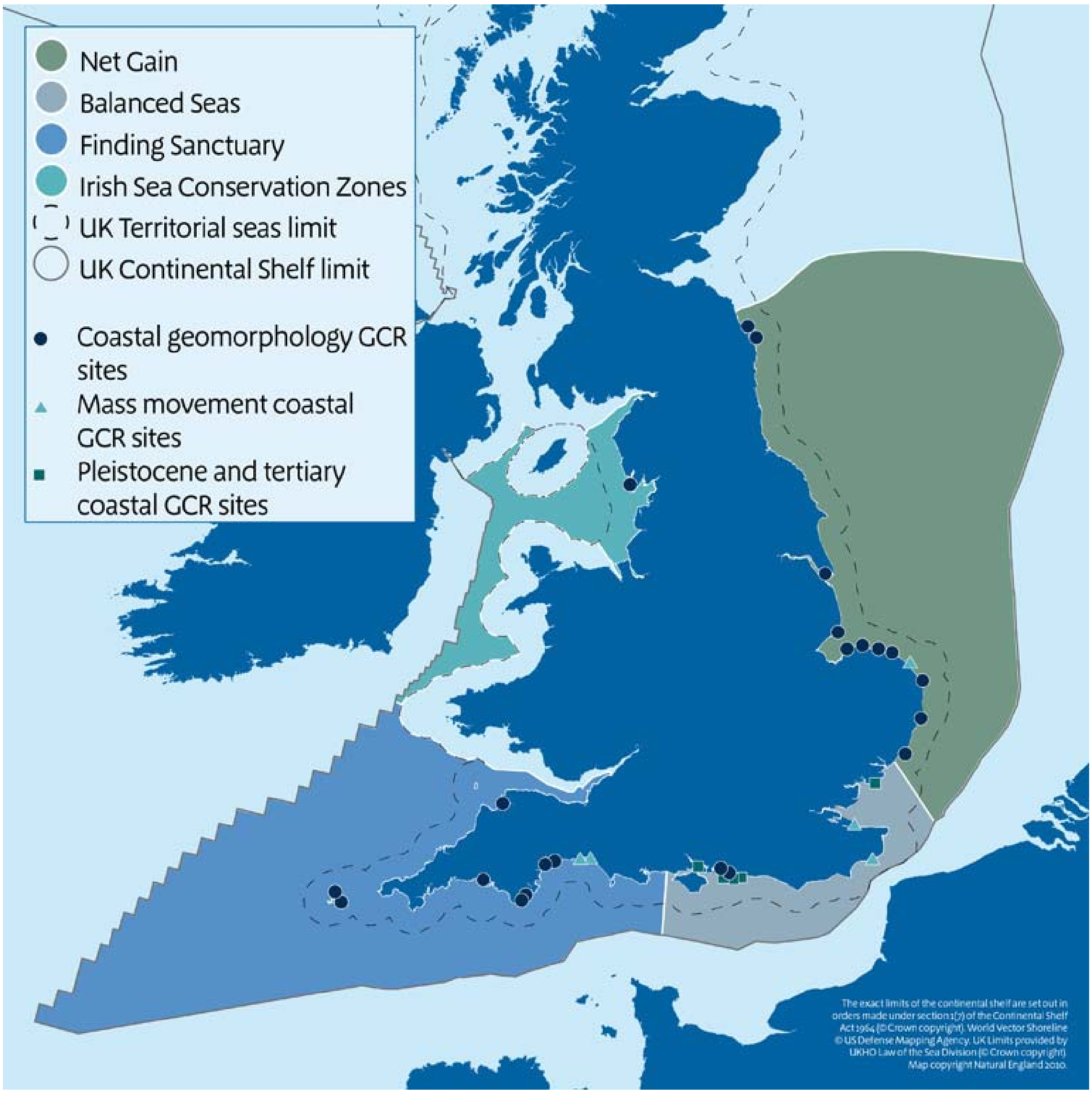
This is based on generalised trawl warp lengths (JNCC MNPG 2008; SERAD 2001).

Water depth	Ratio warp length:depth	Approx. length of trawl warp	Boundary extension to be added to the habitat area of interest
Shallow waters (≤ 25 m)	4:1	100 m at 25 m depth	4 x actual depth
Continental shelf (25-200 m)	3:1	600 m at 200 m depth	3 x actual depth
Deep waters (200 to over 1000 m)	2:1	2000 m at 1000 m depth	2 x actual depth

7.12 Annex 12: Geological and geomorphological features

The Geological Conservation Review (GCR) has identified nationally and internationally important terrestrial and coastal sites (Ellis, *et al.* 1996). These are protected within Sites of Special Scientific Interest (SSSI). There are 32 coastal GCR sites[83] that have a significant intertidal or subtidal portion not currently protected by existing SSSIs that should be considered for MCZ designation (see Figure 14 and Table 28).

Figure 14: Map of coastal GCR sites that have a significant intertidal or subtidal portion not currently protected by existing SSSIs.



[83] http://www.jncc.gov.uk/default.aspx?page=4175&block=22

Table 28: Coastal GCR sites that have a significant intertidal or subtidal portion not currently protected by existing SSSIs.

Regional MCZ project area	GCR Name	Related SSSIs	Site type	Description
Balanced Seas	Bognor Regis	Bognor Reef	Pleistocene and Tertiary	The foreshore here is one of the few places where the whole thickness of the London Clay can be studied in sequence, although favourable tides occur infrequently and some exposures remain constantly under water.
Balanced Seas	Bracklesham	Bracklesham Bay	Pleistocene and Tertiary	Extensive early to middle Eocene succession exposed on lower foreshore and below MLW includes large and diverse fossil plant and fish assemblages.
Balanced Seas	Clacton	Clacton Cliffs and Foreshore	Pleistocene and Tertiary	One of the most important Pleistocene interglacial channel deposits in Britain.
Balanced Seas	East Head	Chichester Harbour	Coastal Geomorphology	1. A low cliff line at high water mark exhibits a complex of Brickearth and Coombe Rock deposits 2. There is a sizeable sand dune and shingle system both of which are of geomorphological importance.
Balanced Seas	Felpham	Felpham	Pleistocene and Tertiary	An outstanding site unusual for its diverse and unique Palaeocene-Eocene plant assemblages in a variety of preservational states, including *in situ* tree stumps.
Balanced Seas	Folkestone Warren	Folkestone Warren	Mass Movement	The site has a long history of detailed study and is fundamental in the development of understanding of both translational and rotational slips, and the relationship between them. Topography, hydrology, geology and marine attack all contribute to the process of mass movement.
Balanced Seas	Lee-on-Solent	Lee-on-the Solent to Itchen Estuary	Pleistocene and Tertiary	Diverse middle Eocene fossil fish assemblages Eocene and fossil birds (generally rarely preserved as fossils).
Balanced Seas	Pagham	Pagham Harbour	Coastal Geomorphology	Significant both as a classic shingle spit landform and for the links that have been demonstrated between the coastal near shore and offshore forms and sediments.
Balanced Seas	Warden Point	Sheppey Cliffs & Foreshore	Mass Movement	This is the only locality in Britain to observe the cycle of rotational landslip, typical of soft coasts, still in operation.
Finding Sanctuary	Axmouth-Lyme Regis	Axmouth-Lyme Regis Undercliffs	Mass Movement	Axmouth – Lyme Regis displays an exceptional variety and richness of mass movement types and the 1839 Bindon landslip was the first in the world to be described and interpreted in detail.
Finding Sanctuary	Black Ven	West Dorset Coast	Mass Movement	This site has a long and well documented history of landslide activity. Particularly noted for its active mudslides it is one of

				the most active and complex landslide sites in the British Isles. It includes rotational slides, topples, rockfalls and slumps in upper Greensand above mudslides, mudflows and sand flows feeding down to the beach across the Lias.
Finding Sanctuary	Budleigh Salterton	Budleigh Salterton Cliffs	Coastal Geomorphology	A magnificent coastal section exposing the full thickness of the Lower Triassic Budleigh Salterton Pebble Beds, - texturally mature conglomerates deposited by braided rivers.
Finding Sanctuary	Dawlish Warren	Dawlish Warren	Coastal Geomorphology	A complex sand-spit and ridge system at the mouth of the Exe Estuary influenced by extensive seaward sand bank and interrupted sediment supply from the southwest.
Finding Sanctuary	Hallsands	Hallsands-Beesands	Coastal Geomorphology	The site is regarded as a classic locality for both its geomorphological interest and as an example of the implications of coastal sediment extraction. The site is strongly influenced by offshore bank focusing of wave energy and the influence of buried cliff forms and associated sediments.
Finding Sanctuary	Isles of Scilly	Tean	Coastal Geomorphology	Best example of tied island development in England and Wales including a range of beach ridge and beach development – these classic landforms are both common and well developed.
Finding Sanctuary		Eastern Isles	Coastal Geomorphology	
Finding Sanctuary	Slapton Ley	Slapton Ley	Coastal Geomorphology	Study of the sediments that have built up in the lagoon allow a detailed reconstruction of the development of the site since the last glaciation, first as an estuary open to the sea and, from about 2,900 years ago, as a lagoon occasionally flooded by the sea during major storm events.
Finding Sanctuary	Westward Ho!	Northam Burrows	Coastal Geomorphology	The cobble ridge is a classic coastal feature noted in particular for the large size of the sediments present. Some of the cobble material derives from sources to the south, and sand, gravel and cobbles have moved to the distal end of the spit forming a spatulate feature in the Taw-Torridge Estuary.
Finding Sanctuary	Whitsand Bay	Rame Head & Whitsand Bay	Coastal Geomorphology	Typical of a beach aligned to south-west swell, where the beach volume is small, the sediment sandy, and the contemporary input of sediment negligible.
Irish Sea Conservation Zones	Walney Island	South Walney & Piel Channel flats	Coastal Geomorphology	Walney Island is exceptional in being the product of erosion and reworking of glacial sediments rather than coastal deposition.
Net Gain	Benacre Ness	Pakefield to Easton Bavents	Coastal Geomorphology	Example of a shingle ness comprising three landform units – cliffs, a beach ridge and Benacre Ness – and is of considerable importance for the study of coastal form-process

				dynamics.
Net Gain	Gibraltar point	Gibraltar point	Coastal Geomorphology	Gibraltar Point is particularly important for the dynamism of the coastal environment and also the relationships that can be studied over different timescales between landforms and the processes responsible for their evolution.
Net Gain	Goswick-Holy Island-Bude Bay	Bamburgh coast and hills	Coastal Geomorphology	The site comprises a range of dune systems and barrier and sandy beaches. It is noted for extensive progradation of sandy beaches, the influence of Holy Island on wave energy on beach development and the mix of contemporary and older coastal features
Net Gain		Lindisfarne	Coastal Geomorphology	
Net Gain	North Norfolk Coast	Hunstanton Cliffs	Coastal Geomorphology	The North Norfolk Coast, extending from Hunstanton to Sheringham, has considerable importance for its coastal geomorphology. It includes Blakeney Point and Scolt Head Island and a number of significant beaches linked to long-shore drift. It forms one of the most outstanding assemblages of coastal land form in Britain.
Net Gain		Weybourne Cliffs	Coastal Geomorphology	
Net Gain		North Norfolk coast	Coastal Geomorphology	
Net Gain		Morston Cliff	Coastal Geomorphology	
Net Gain	Orfordness	Alde-Ore Estuary	Coastal Geomorphology	Orfordness is one of three major shingle landforms in the British Isles and is the only one which combines a shingle spit with a cuspate foreland.
Net Gain	Spurn Head	Humber flats and marshes: (a) Spurn Head to Saltend Flats	Coastal Geomorphology	Spurn is an outstanding example of a dynamic spit system which is very unusual in Europe in that the massive supply of sediment resulting from the erosion of the Holderness coast to the north has enabled it to extend across the mouth of a macro-tidal estuary.
Net Gain	Trimmingham Cliffs	Sidestrand and Trimmingham Cliffs	Mass Movement	The entire length of these cliffs has a substantial history of impressive rotational slumping affecting the Pleistocene deposits and a significant source of beach sediment.
Net Gain	Winterton Ness	Winterton to Horsey Dunes	Coastal Geomorphology	Noted for well formed dunes and the presence of a surplus sediment budget. There are both erosion and deposition within the site and an important aspect of the interest is the dynamism of the features present.

Subtidal geological and geomorphological features in UK waters were assessed for their conservation importance, which included aspects such as their rarity and exceptionality; and their sensitivity to pressures (Brooks *et al.* 2009).

The assessment determined that 12 sites in the MCZ Project Area showed relatively high conservation value (greater than 50%) (see Figure 15 and Table 29). These sites should be considered a higher priority for designating MCZs for their geological or geomorphological interest.

Figure 15: Map of geological and geomorphological features of importance in the MCZ Project area.

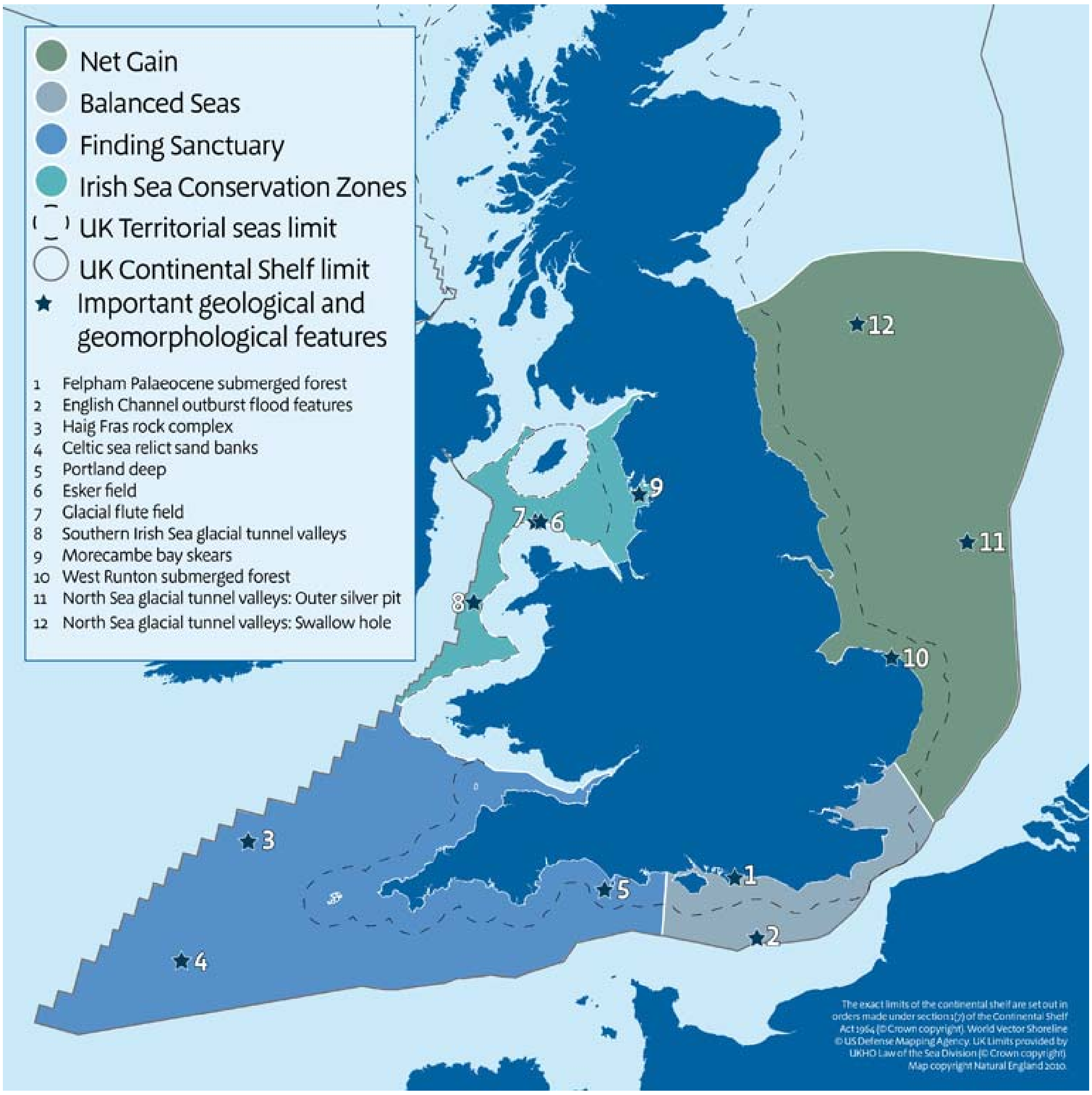


Table 29: Geological and geomorphological features of importance in the MCZ Project area.

Regional MCZ project area	Feature				
	Name	**Type**	**Description**	**Score (%)**	**Figure 15 map number**
Balanced Seas	Felpham Palaeocene submerged forest	Features indicating past change in relative sea level	The Palaeocene fossil forest at Felpham, near Bognor Regis in West Sussex, is an important example where fossilised palm tree stumps and stems can be found.	86	1
Balanced Seas	English Channel outburst flood features	Glacial process features	Geologists believe that sometime between 500,000 and 125,000 years ago, a dam across the Dover Strait burst and released an enormous glacial lake. There are several islands and channels which are characteristic of outburst floods.	79	2
Finding Sanctuary	Haig Fras rock complex	Geological process features	Haig Fras is a rocky reef found about 100km north-west of the Isles of Scilly. The seabed surrounding Haig Fras is 100m deep, and it is this that makes the feature unique – it is the only example of a substantial rocky reef found in the deeper waters of the Celtic Sea.	79	3
Finding Sanctuary	Celtic Sea relict sand banks	Marine process features	These sandbanks are the largest of their kind found anywhere on Earth. They are found at depths of 130-200m deep. The smaller ridges in the Celtic Sea field are about 40km long and 20m high, while the largest can be 200km long, 15km wide and more than 50m high.	66	4
Finding Sanctuary	Portland deep	Marine process features	The Portland Deep lies about 2km south-west of Portland Bill in Dorset. Up to 100m in depth, it is substantially deeper than the surrounding seabed.	50	5
Irish Sea Conservation Zones	Esker field	Glacial process features	Eskers are long, narrow, ridges that weave across the landscape. They were formed by streams flowing in ice-walled tunnels within, or underneath, glaciers. The	86	6

Regional MCZ project area	Feature				
	Name	Type	Description	Score (%)	Figure 15 map number
			eskers in the Irish Sea are about 1m high.		
Irish Sea Conservation Zones	Glacial flute field	Glacial process features	Flute fields are an important element of the seabed morphology. The flutes themselves are on average 500m long, although some can reach over 1km in length.	86	7
Irish Sea Conservation Zones	Southern Irish Sea glacial tunnel valleys	Glacial process features	Tunnel valleys are steep-sided, flat-bottomed features that were created as meltwater flowed beneath retreating glaciers	66	8
Irish Sea Conservation Zones	Morecambe Bay skears	Glacial process features	As sea-levels rose after the last ice advance, the sea washed away the clay, sand and gravel that formed drumlins and left behind cobbles and boulders. In Morecambe Bay these patches of boulders, in what is otherwise a huge sand flat, are known as 'skears'.	64	9
Net Gain	West Runton submerged forest	Features indicating past change in relative sea level	The West Runton Submerged Forest is approximately 500,000 years old. The presence of trees stumps in the West Runton Submerged Forest shows that this deposit was formed on land.	86	10
Net Gain	North Sea glacial tunnel valleys	Glacial process features	The tunnel valleys in the North Sea are between 250m and 2.5km wide, and their steep sides may fall to more than 150m below the surrounding seabed. Outer Silver Pit and Swallow Hole are examples of North Sea tunnel valley systems.	66	11 & 12

8 Ecological Network Guidance – Glossary

Activity: A human action which may have an effect on the marine environment e.g. fishing, energy production (Robinson, Rogers and Frid 2008).

Adequacy: To be considered adequate, the overall size of the MPA network and the amount of each feature protected within it, must be large enough to ensure the delivery of ecological objectives, and the features' long-term protection and recovery.

Algae: Marine photosynthetic organisms, excluding angiosperms, which include red, brown and green macro-algae, commonly known as seaweeds, and microscopic algae known as phytoplankton.

Angiosperms: Flowering plants. Seagrasses are the only truly marine angiosperms.

Anthropogenic: Caused by humans or human activities; usually used in reference to environmental degradation (JNCC 2009a).

Benthic: A description for animals, plants and habitats associated with the seabed. All plants and animals that live in, on or near the seabed are benthos (e.g. sponges, crabs, seagrass beds) (Defra 2007).

Biodiversity: The variety of life forms, including plants, animals and microorganisms, the genes that they contain, and the biotopes and ecosystems that they form (Finding Sanctuary 2009).

Biogenic reef: Any structure that has been formed from living material. It is normally used to describe living structures such as those created by the cold-water coral *Lophelia pertusa*, colonial worms such as *Sabellaria* spp and molluscs, including the horse mussel *Modiolus modiolus* (Anon 2001).

Biogeography: Biogeography is the study of geographical distributions of species and habitats, and the environmental or historical factors that produce such distributions.

Biogeographic region: An area of animal and plant distribution having similar or shared characteristics throughout (IUCN-WCPA 2008).

Biotope: The physical habitat with its associated, distinctive biological communities. A biotope is the smallest unit of a habitat that can be delineated conveniently and is characterised by the community of plants and animals living there (for example, deep sea, *Lophelia pertusa* reef) (Anon 2001). Usually, several biotopes will constitute an ecosystem.

Circalittoral: The subtidal zone characterised by animal dominated communities. The depth at which the circalittoral zone begins is directly dependent on how much light reaches seabed.

Connectivity: The extent to which populations in different parts of a species' range are linked by the exchange of eggs, larvae, spores or other propagules, juveniles or adults (Palumbi 2003).

Conservation objective: A statement of the nature conservation aspirations for the feature(s) of interest within a site and an assessment of those human pressures likely to affect the feature(s).

Convention on Biological Diversity (CBD): An international legally-binding treaty with three main goals: conservation of biodiversity; sustainable use of biodiversity; fair and equitable sharing of the benefits arising from the use of genetic resources. Its overall objective is to encourage actions which will lead to a sustainable future.

Deep-sea: The seabed generally below 200m depth (in the context of the EUNIS habitat classification system).

Defra: The UK government department responsible for the environment, for food and farming, and for rural matters.

Defra area MPA network: The Defra area MPA network will comprise existing MPAs including European marine sites (SACs and SPAs) and the marine components of SSSIs and Ramsar sites plus MCZs designated under the MCAA. The Defra area MPA network will extend across the territorial waters of England and UK offshore waters adjacent to England and Wales; and will contribute to the UK MPA network in these areas.

Demersal: Species that live on, or in close proximity to, the seabed, e.g. flat fish. The term also applies to fishing gear that is used on the seabed (e.g. trawling) (Anon 2001).

EC Habitats Directive: The EC Habitats Directive (Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora) aims to promote the maintenance of biodiversity by requiring Member States to take measures to maintain or restore natural habitats and wild species at a favourable conservation status, introducing robust protection for those habitats and species of European importance.

EC Birds Directive: The Council Directive 79/409/EEC on the conservation of wild birds (PDF 209KB) (the 'Birds Directive') provides a framework for the conservation and management of, and human interactions with, wild birds in Europe. Through this Directive, the European Community meets its obligations for bird species under the Bern Convention and Bonn Convention.

(Areas of) Ecological importance: Areas that are important for particular life stages or behaviours of species, areas of high productivity and areas of high biodiversity.

Ecology: The study of the interrelationships between living and non-living components of the environment (Anon 2001).

Ecosystem: A set of living things inhabiting a given space, the interactions between the different species, and the interactions between the species and their physical environment. It is defined at a much broader scale than the term biotope i.e. an ecosystem would commonly contain many biotopes. A functioning ecosystem is based on a balance of interactions, such as food webs. Every component of an ecosystem (living things, physical environments, biotopes) has a particular role or function, meaning that its loss or disruption can have knock-on effects that reverberate around the whole ecosystem (Finding Sanctuary 2009).

Ecosystem Approach: A decision making framework for looking at whole ecosystems and valuing the ecosystem services they provide, to ensure that we can maintain a healthy and resilient natural environment now and for future generations.

Ecosystem goods and services: Indirect or direct benefits to human society that derive from marine ecosystems. Examples would include food provision, recreation, nutrient cycling, gas and climate regulation (Defra 2007).

Environment: The physical surroundings and climatic conditions that influence the behaviour, growth, abundance and overall health of a population or species (Anon 2001).

EUNIS: A European habitat classification system developed by the European Topic Centre on Biological Diversity, covering all types of habitats from natural to artificial, terrestrial to freshwater and marine.

European marine site: The marine areas of both Special Areas of Conservation (SACs) and Special Protection Areas (SPAs).

Favourable condition: This is when the ecological condition of a species or habitat is in line with the conservation objectives for that feature. The term 'favourable' encompasses a range of ecological conditions depending on the objectives for individual features.

Feature: A species, habitat, geological or geomorphological entity for which an MPA is identified and managed.

Features of conservation importance (FOCI): Habitats and species that are rare, threatened or declining in our waters.

Front: A boundary or transition zone between two water masses of different properties.

Geographic Information System (GIS): A system of hardware, software, and procedures designed to support the capture, management, manipulation, analysis, modelling, and display of spatially referenced data for solving complex planning and management problems (NOAA 2009).

Habitat: the place where an organism lives, as characterised by the physical features. for example rocky reefs, sandbanks and mud holes all provide particular habitats that are occupied by animals or algae adapted to live in or on one of them but probably cannot thrive, or even survive in the others (Anon 2001).

Habitats of conservation importance (habitat FOCI): Habitats that are rare, threatened or declining in our waters.

Heuristics: 'Rules of thumb' derived from scientific knowledge and understanding.

Home range: The geographic area in which an animal normally ranges.

Impact: The consequence of pressures (e.g. habitat degradation) where a change occurs that is different to that expected under natural conditions (Robinson, Rogers and Frid 2008).

Impact Assessment: An Impact Assessment reports on the anticipated environmental, economic and social costs, benefits and impacts of a proposed policy or range or policies. These impacts are assessed against a baseline scenario in which the proposed policy interventions do not take place. It is a process for analysing and selecting policy options and a tool for communicating how preferred options have been chosen.

Infralittoral zone: The shallowest subtidal zone (closest to the shore) characterised by plant dominated communities.

Intertidal: The foreshore or area of seabed between high water mark and low water mark which is exposed each day as the tide rises and falls. Also called the littoral zone (Anon 2001).

Invasive alien species (IAS): A subset of established non-native species which have spread, are spreading or have demonstrated their potential to spread elsewhere, and have an adverse effect on biological diversity, ecosystem functioning, socio-economic values and/or human health in invaded regions (Task Group 2 on Non-indigenous Species 2010)

Joint Nature Conservation Committee (JNCC): The statutory adviser to Government on UK and international nature conservation. Its specific remit in the marine environment ranges from 12-200nm. JNCC delivers the UK and international responsibilities of the four country nature conservation agencies of the devolved regions, including Natural England.

Juvenile: An immature organism, i.e. one that has not reached sexual maturity (Anon 2001).

Larvae: The developing animal after it has hatched from its egg but before it has reached the juvenile or adult stage. Many marine larvae drift in the plankton (Anon 2001).

Littoral: The edge of the sea, but particularly the intertidal zone (Anon 2001).

Maerl: Twig-like, calcified red algae that act as keystone species and form a particular habitat (Anon 2001).

Marine Conservation Zone (MCZ): A new type of MPA to be designated under the MCAA. MCZs will protect nationally important marine wildlife, habitats, geology and geomorphology and can be designated anywhere in English and Welsh inshore and UK offshore waters.

Marine Conservation Zone (MCZ) Project: A project established by Defra, Natural England and the Joint Nature Conservation Committee to identify and recommend MCZs to Government. The MCZ Project will be delivered through four regional MCZ projects covering the South-West, Irish Sea, North Sea and Eastern Channel and will work with sea users and interest groups to identify MCZs.

MCZ Project team: All those involved in the day-to-day running of the MCZ Project. This includes individuals from Defra, Natural England, JNCC and the regional MCZ projects.

Marine Protected Area (MPA): A generic term to cover all marine areas that are 'A clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values' (Dudley 2008). MPAs may vary in their objectives, design, management approach or name (e.g. marine reserve, sanctuary, marine park) (IUCN-WCPA 2008). See also 'Protected Area' and 'OSPAR MPA'.

Marine Protected Area (MPA) Network: A system of individual MPAs operating cooperatively and synergistically, at various spatial scales, and with a range of protection levels, in order to fulfil ecological aims more effectively and comprehensively than individual sites could acting alone. The system will also display social and economic benefits, though the latter may only become fully developed over long time frames as ecosystems recover (IUCN-WCPA 2008).

Monitoring: The regular and systematic collection of environmental and biological data by agreed methods and to agreed standards. Monitoring provides information on current status, trends and compliance with respect to declared standards and objectives (Anon 2001).

Natura 2000: The EU network of nature protection areas (classified as SPAs and SACs) established under the 1992 EC Habitats Directive.

Natural England: The statutory advisor to Government established to conserve and enhance the natural environment, for its intrinsic value, the wellbeing and enjoyment of people and the economic prosperity that it brings. Natural England has a statutory remit for England out to 12 nautical miles offshore.

Network: Collection of individual MPAs or reserves operating cooperatively and synergistically, at various spatial scales and with a range or protection levels that are designed to meet objectives that a single reserve cannot achieve (IUCN-WCPA 2008).

Non-native species: A species that has been introduced directly or indirectly by human agency (deliberately or otherwise) to an area where it has not occurred in historical times and which is separate from and lies outside the area where natural range extension could be expected (Eno, *et al.* 1997) .

Nursery area: An area readily identified as one of particular importance, year-on-year, for juvenile fish (Anon 2001).

OSPAR: The Convention for the Protection of the Marine Environment of the North-East Atlantic (http://www.ospar.org).

OSPAR MPA: An area within the OSPAR maritime area for which protective, conservation, restorative or precautionary measures, consistent with international law have been instituted for the purpose of protecting and conserving species, habitats, ecosystems or ecological processes of the marine environment (OSPAR 2003).

Pelagic: Living in the water column (Finding Sanctuary 2009).

Phytoplankton: Microscopic photosynthetic living things (including plants and algae) floating in the water column that drift to-and-fro with the tides and currents.

Plankton: Organisms that float in mid water and drift to-an-fro with the tides and currents.

Pressure: The mechanism through which an activity has an effect on any part of the ecosystem (e.g. physical abrasion caused by trawling). Pressures can be physical, chemical or biological and the same pressure can be caused by a number of different activities (Robinson, Rogers and Frid 2008).

Primary production: The organic matter produced by organisms on the bottom of the food chain (mostly from photosynthetic organisms including plants and algae), which fuels the rest of the food chain.

Productivity: The total biomass generated by a population, stock or species each year as a result of growth and reproduction – less the quantity lost through mortality (Anon 2001).

Propagule: A plant seed or spore, egg or larva.

Protected Area: A clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values (Dudley 2008).

Ramsar: Sites designated under the Convention for Wetlands of International Importance, signed in Ramsar, Iran in 1971. http://www.ramsar.org

Rarity: A rare feature that is restricted to a limited number of locations or to small, few and scattered locations in UK waters.

Recovery: The absence of pressures to which the feature is sensitive, combined with evidence of ongoing improvement of the condition of the feature until a favourable stable state has been reached[84].

Reference area: An area in an experiment where the factor being tested (e.g. exposure to human pressure) is not applied (for example, within an MPA). As such, the control site serves as a standard for comparison against other areas where the factor *is* applied (those areas of the marine environment which are exposed to human pressure). Also referred to as benchmark sites.

Regional MCZ project: Any one of the four projects that have been set up to deliver the MCZ Project (covering English inshore and English, Welsh and Northern Irish offshore waters), namely Finding Sanctuary (south west), Irish Sea Conservation Zones (Irish Sea), Net Gain (North Sea) and Balanced Seas (south east).

Regional MCZ project area: The area of sea covered by the four regional MCZ projects.

[84] Tentative definition not yet formally agreed amongst SNCBs and Defra

Regional MCZ project team: All those involved in the day-to-day running of any one of the four regional MCZ projects.

Regional Profile: Each regional MCZ project team will produce a Regional Profile that will provide an overview of the data available for that project area which will support decision-making. The Regional Profile will include for example, distribution maps for features of conservation importance and information about existing MPAs.

Regional stakeholder group: A group of sea users, regulators and interest groups that will decide upon the MCZ recommendations of the regional MCZ projects. (Note. Finding Sanctuary calls their regional stakeholder group the 'Steering Group'; Net Gain calls their regional stakeholder group the 'Stakeholder Advisory Panel').

Representativity: The concept of protecting the full range of marine biodiversity within an MPA network by including examples of all habitats (and therefore the species associated with them) across their full geographic and ecological range.

Resilience: The ability of an ecosystem to maintain key functions and processes in the face of stresses or pressures by either resisting or adapting to change (IUCN-WCPA 2008).

Science Advisory Panel (SAP): The SAP will provide the scientific knowledge, advice and judgement necessary to assist the regional MCZ projects in identifying MCZs and the Secretary of State in designating these sites as a contribution to an ecologically coherent network. Members and chair of the SAP will be appointed by Defra.

Sensitivity: An assessment of the intolerance of a species or habitat to damage from an external factor and the time taken for its subsequent recovery. For example, a very sensitive species or habitat is one that is adversely affected (killed/destroyed, 'high' intolerance) by an external factor arising from human activities or natural events and is expected to recover over a very long period of time, i.e. >10 or up to 25 years ('low'; recoverability). Intolerance and hence sensitivity must be assessed relative to change in a specific factor (MarLIN 2009).

Sessile: An organism that does not move, but stays attached to one place on the sea floor, such as a mussel, sea fan or seaweed.

Site of Special Scientific Interest (SSSI): Sites designated under the Wildlife and Countryside Act 1981 (as amended 1985, and superseded by the Countryside and Rights of Way Act 2000, and the Nature Conservation (Scotland) Act (2004)).

Shifting baselines: Refers to the fact that people measure ocean health against the best that they have experienced in their own lifetimes (even if those measures fall far short of historical ones) which causes a lowering of standards from one generation to the next. One generation sets a baseline for what is 'healthy' and 'natural' based on their own experience. Successive generations see even more degraded ecosystems as 'healthy,' and therefore set their standards for ecosystem health even lower (Pauly 1995 cited in IUCN-WCPA 2008).

Source-sink population dynamics: Refers to changes in populations due to movements of individuals between source and sink. In this context a source is a habitat patch where space is limited and individuals (adults, young or larvae) spill out into surrounding areas, while a sink area has available space to accept individuals but produces few of its own (Crowder, *et al.* 2000).

Special Areas of Conservation (SAC): Protected sites designated under the European Habitats Directive for species and habitats of European importance, as listed on Annex I and II of the Directive.

Special Protection Areas (SPA): Protected sites designated under the EC Birds Directive, for rare and vulnerable birds (as listed on Annex I of the Directive), and for regularly occurring migratory species.

Species of conservation importance (species FOCI): Habitats and species that are rare, threatened or declining in our waters.

Spawning aggregation: A collection of individuals which converge to mate; this collection is unusually concentrated and, thus, highly vulnerable to fishing effort (NOAA 2006).

Stakeholder: Individuals (including members of the public), groups of individuals, organizations, or political entities interested in and/or affected by the outcome of management decisions. Stakeholders may also be individuals, groups, or other entities that are likely to have an effect on the outcome of management decisions.

Substrate/Substratum: The surface or medium on which an organism grows or is attached (e.g. seabed sediment).

Subtidal: Depths greater than the intertidal zone (Anon 2001).

Surrogate feature: A feature that functions as an ecological substitute for another feature.

Thermocline: The layer which separates warmer surface water from cold deep water, and at which temperature decreases rapidly with increasing depth.

UK Biodiversity Action Plan (UK BAP): The UK BAP is the Government's response to the Convention on Biological Diversity (CBD) signed in 1992. The UK BAP includes a number of specific plans for species and habitats afforded priority conservation action.

UK MPA network: The UK MPA network will comprise existing MPAs including European marine sites (SACs and SPAs) and the marine components of SSSIs and Ramsar sites; and new national MPAs, which the UK Government and Devolved Administrations have introduced through the Marine Acts. The UK MPA network will extend across UK territorial waters and UK offshore waters.

Viability: The ability of an MPA to maintain the integrity of the features (i.e. population of the species or condition and extent of the habitat), for which it is designated, and to ensure individual sites are self-sustaining throughout natural cycles of variation.

Vulnerability: The likely exposure of a feature to a pressure to which it is sensitive. The term vulnerability is sometimes used instead of impact where evidence of both feature sensitivity and exposure to a pressure strongly suggests an impact will occur (or has occurred), but no direct verification has been possible.

Vulnerable marine ecosystem: Defined by the United Nations as an ecosystem that is particularly susceptible to disruption, damage or destruction due to its physical characteristics. Examples of vulnerable marine ecosystems include seagrass beds, seamounts and hydrothermal vents (United Nations General Assembly 2003).

The Wildlife and Countryside Act 1981: A UK act which consolidates and amends existing national legislation to implement the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention) and Council Directive 79/409/EEC on the Conservation of Wild Birds (Birds Directive) in Great Britain.

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