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MARINE CONSERVATION ZONES

The proposed Draft UK Marine Bill[1] aims to combine legislation on activities and conservation in the marine environment into a single framework. This includes the designation of a network of Marine Conservation Zones (MCZs) in UK waters, a form of marine protected area (MPA). MPAs are described as any area of intertidal or subtidal terrain, together with its overlying water and associated flora or fauna, historical or cultural features, which are protected by legal or other effective means. This POSTnote examines the possibility of using a MCZ network to manage the impacts of human activities on the marine environment.

Background

To protect marine biodiversity from human activities (Box 1), the UK is required to implement a network of marine protected areas under a number of international and European agreements (Box 2). The UK coastline stretches approximately 20,000 km and its maritime environment extends over 710,000 km^2 of sea and seabed habitats down to a depth of 2,000 m.[2] The UK inshore waters extend out to 12 nautical miles (22.22 km) from the low tide water mark, and offshore waters, from 12 to 200 nautical miles (22.22 to 370.4 km). The UK has declared an Exclusive Fishing Zone and Renewable Energy Zone out to 200 nautical miles (370.4 km).

Existing marine Protection

Marine Nature Reserves (MNRs) can be designated using the Wildife and Countryside Act 1981. Reserves so designated can extend to 3 nautical miles (5.56 km) from shore. Only three MNRs have been designated in the UK: Lundy, Skomer and Strangford Lough. Within these, only 3.2 km^2 of Lundy is highly protected, through a byelaw introduced by the local Sea Fisheries Committee in 2003. Highly protected marine areas prohibit all damaging activities, including dumping, dredging, construction and the extraction of all resources. In Strangford Lough, an extensive horse mussel bed that provided habitat for other species (the main reason it was designated) was destroyed by permitted fishing activities. Designation of MNRs has been limited, as the Act effectively requires consensus between all stakeholders before a site is designated by the Secretary of State.

Box 1. Impacts of human activities

Modelling of the global oceans indicates that no area is unaffected by human influence and that 41% is strongly affected by multiple impacts from human activities, with the English Channel and North Sea being among the most heavily impacted areas.[3] The two largest human induced impacts on marine biodiversity are fishing (POSTnote 251) and climate change (POSTnote 295). The ecological impacts incurred from fishing depend on the type, location and intensity of fishing. Impacts include direct removal of target species, bycatch of other marine organisms and damage to habitats caused by fishing gear that is dragged across the seabed. Marine ecosystems in UK seas have been extensively modified through selective removal of fish species, such as cod, and a reduction in the total biomass of larger species and individuals.[4]

Biodiversity in areas with the lowest rates of natural disturbance is most negatively affected by human activities that disrupt the seafloor.[5] Muddy sediments tend to occur in locations with low disturbance and have lower rates of biodiversity recovery from physical impacts. Biodiversity on coarser sediments in areas with high levels of natural disturbance, such as strong currents or wave action, tend to have higher rates of recovery. Fragile seabed habitats, such as horse mussel beds, maerl and sea grass beds are not only prone to physical disturbance, but also at risk from the diffuse pollution impacts of suspended sediments, nutrient enrichment and toxic chemicals.

Mean temperature in European continental shelf seas is rising faster than on adjacent land masses. Warming seas have led to warmer water species moving northwards.[6] Whether cold water communities are also shifting northwards or occupying a reduced habitat area is unclear.

Strangford Lough has also been designated as a Marine Special Area of Conservation (SAC). SACs and Special Protection Areas (SPAs) for birds are a form of multiple use MPA, as are MNRs (Box 3).

Box 2. International requirements

The UK is committed to implementing "an ecologically coherent network of well-managed marine protected areas" by 2010 under the Convention on the Protection of the Marine Environment of the North-East Atlantic (OSPAR). In addition, it is expected to implement networks of MPAs by 2012, through agreements at the World Summit on Sustainable Development (2002) and the Convention on Biological Diversity (2004). Under the OSPAR Convention, the UK is committed to delivering a network of "ecologically coherent" Marine Protected Areas[7]:

- to protect, conserve, and restore the range of species, habitats and ecological processes that have been adversely affected by human activities
- to prevent degradation of, and damage to, species, habitats, and ecological processes, following the precautionary principle
- to protect and conserve areas that best represent the range of species, habitats, and ecological processes in the maritime area.

EU Marine Strategy Directive

The EU Thematic Strategy on the Protection and Conservation of the Marine Environment (COM(2005)504 final) aims to protect the resource base upon which marine-related economic and social activities depend. The draft Marine Strategy Directive (COM(2005)505 final) establishes European Marine Regions on the basis of geographical and environmental criteria. Each member state, in close cooperation with the relevant other member states and third countries within a Marine Region, is required to develop strategies for its marine waters. These will apply an ecosystem-based approach to the management of human activities and the sustainable use marine resources (Box 4). The designation of marine protected areas by 2013 will be a mandatory aspect of the national marine strategies under the Directive. Similar to the Water Framework Directive (which applies out to 1 nautical mile, 1.85 km), Marine Waters will be expected to achieve "good environmental status". The strategies will have a detailed assessment of the state of the environment, a definition of "good environmental status" at regional level and the establishment of clear environmental targets and monitoring programmes.

Multiple use marine protected areas permit activities as long as they do not impact on the biodiversity interest of the given site. The UK also has voluntary MPAs such as Voluntary Marine Conservation Areas and Voluntary Marine Nature Reserves, as well as areas closed to fishing to preserve fish stocks under the Common Fisheries Policy (CFP).

Marine Conservation Zones

The measures set out in the Marine Bill seek to minimise impacts on marine ecosystems while allowing sustainable use of the marine resources. Within a regional spatial planning framework, it proposes a network of flexible, objective based marine protected areas, known as Marine Conservation Zones (MCZs). Defra intends the network to halt the decline in biodiversity by including the full range of UK habitats and species and conserving areas where there are rare and threatened species and habitats and "to ensure that the marine environment is healthy and able to deliver the many goods and services we rely on".[8] However, within the Marine Bill, there is no statutory requirement on any UK body to ensure that a network of Marine Conservation Zones is created, nor a target for the proportion of UK seas that will be within them, or how many will be highly protected (highly restricted MCZs) as opposed to multiple use protected areas.

Box 3. Habitat and Bird Directives

The Habitats Directive (92/43/EEC) requires the creation of a network of protected areas (marine and terrestrial) known as Natura 2000. This network consists of SACs to protect habitats and species listed under the habitats Directives and SPAs to protect wild birds as set out under the Wild Birds Directive (79/409/EEC). The powers under the Directives apply to only a small number of habitats and species. Marine habitats and species which may be designated include:

- habitats - estuaries, lagoons, shallow inlets and bays, submerged or partly submerged sea caves, shallow sandbanks, tidal mud and sandflats, reefs, submarine structures made by leaking gases
- species – grey seal, common seal, harbour porpoise, bottlenose dolphin, otter, loggerhead turtle, sea lamprey, lamprey and shad species.

Many UK Marine SACs do not yet meet the standard of protection required under the Habitats Directive. While the Statutory Nature Conservation Organisations (SNCOs), such as Natural England, give advice on the activities licensed in SACs and SPAs, the government department/agency issuing the licence does not have a statutory obligation to take this advice into account. To be licensed, any new activity has to show that it will have no impact on the protected habitat through relevant environmental monitoring. If a licensed activity is shown to be having an impact on a protected habitat or species, it can be subject to judicial review or the member state infracted for breach of the directive. However, where such activities have been taking place historically, it can be difficult to show that continued impacts will be detrimental. Sites can also exclude damaging fishing activities through specifically invoked local byelaws, ministerial orders or measures under the CFP. In addition, under the Environmental Limits Directive, the risk of damage beyond a certain threshold to the habitats and species listed in the Annexes of the Birds and Habitats directives will require commercial operators to take preventative, and if it occurs, remediative measures. Implementation of the directive in England and Wales excludes fishing activities carried out in accordance with the CFP.

Issues

The primary aim of a network of marine protected areas in inshore and offshore UK waters would be to protect a range of representative species, habitats and ecosystems from human impacts. Theoretically, it should allow marine ecosystems to recover from the effects of human activities (Box 4).

Biodiversity benefits of MPAs

There have been several reviews of marine protected areas in temperate marine areas, and their likely biodiversity benefits.[9] Many of the precise benefits of marine protected area networks, including Highly Protected Marine Reserves, depend on a variety of factors and evidence of biodiversity benefits will accrue over time following implementation.[10] The evidence available suggests that an extensive network of protected areas may be required, between 20 to 40% of any given marine area, depending on the effectiveness of other measures to manage the level of impacts from human activities. [11] Protection can reduce direct human impacts on most habitats within the closed area. Species responses depend on impacts prior to closure and the species' life history and ecology, but within the closed

area higher densities, biomass and species richness of marine biota can be achieved.[12]

Box 4. MPAs and the ecosystem approach

The ecosystem-based approach to marine management has been defined as "the comprehensive integrated management of human activities, based on the best available scientific knowledge about the ecosystem and its dynamics, in order to identify and take action on influences which are critical to the health of marine ecosystems, thereby achieving sustainable use of ecosystem goods and services and maintenance of ecosystem integrity".[13] The UK has obligations to institute the approach under the Rio Convention on Biological Diversity, the Jakarta Mandate on Marine and Coastal Biodiversity, the Reykjavik Declaration on Responsible Fisheries in the Marine Ecosystem and the EC Commons Fisheries Policy.

Marine organisms interact with each other and their environment to maintain the flow of materials and energy through ecosystems. This gives rise to ecological processes that interact to provide the ecosystem goods and services that directly or indirectly benefit humans (POSTnote 281). The economic benefits from marine goods and services, such as atmospheric gas and climate regulation, nutrient cycling, bioremediation of waste, raw materials, food provision and biodiversity for societal uses, equate to many billions of pounds.[14] For example, filter-feeding shellfish are important in removing sediment from the water column, increasing the rate of particle deposition to the seafloor and in large numbers can provide habitats for other organisms. Reduction of their biomass may change the energy flow through marine ecosystems.[15] The protection of ecological processes and the habitats associated with them is a key element of applying the ecosystem approach. Available data indicate that the establishment of the marine conservation zone network would have ecosystem benefits with significant economic value. [16] However, there is limited knowledge of which elements of biodiversity and the interactions between them are key to ecological processes, and few data to give a comprehensive quantitative assessment of the impact of human activities on them. Despite regular assessment of the state of exploited fish stocks and monitoring of some other marine ecosystem components such as marine plankton, the JNCC estimates that there is about 10 to 15% of the biological data required to regulate effectively human activities in relation to the UK continental shelf waters.[17] The knowledge gaps about marine biodiversity and the provision of ecosystem goods and services have been the subject of a recent UK Biodiversity Research Advisory Group report.[18]

More mobile animals, such as many finfish species and cetaceans, do not consistently benefit from small closed areas, and are better favoured by wider management measures. However, habitats that are important for various lifecycle stages of mobile species, such as sites for spawning and early development, could be incorporated into networks if vulnerable to human impacts. Although indirect human impacts, such as climate change, nutrient enrichment and other diffuse pollution, can also only be addressed through wider management measures, the resilience (Box 6) of habitats to indirect impacts may be increased by removing direct ones.

Selection of sites for MPA networks

Planning of MPA networks requires good knowledge of the distribution and status of marine habitats. Nationally-important areas of high species and habitat richness, which include representative, rare and threatened features, should be incorporated into the MCZ network.[2]

The network sites must be representative of the full range of UK marine ecosystems and biodiversity to maintain marine ecosystem goods and services.[19] For about 80% of the UK seas, there are sufficient data for the Joint Nature Conservation Committee (JNCC) to produce maps of the marine environment (Box 5), that may predict biodiversity distribution in UK seas.

Box 5 Mapping UK marine habitats

The Irish Sea Pilot Project evaluated the management framework proposals made in the Defra Review of Marine Nature Conservation. This included the production of environmental maps to inform policy and management issues. Geological, physical, hydrographical and ecological information was modelled to map broadly-defined seabed habitat types or 'marine landscapes'. This process was extended to the whole of UK waters in the UK SeaMap project. The JNCC project involved a consortium of UK government departments, devolved administrations, government agencies and NGOs. The maps represent the best available data coverage for UK waters and are intended to inform an ecosystem-based approach to management of the marine environment. Wherever possible, the mapping has been validated using biological sampling of the mapped areas. However, extensive areas of seabed around the UK remain unmapped and unsurveyed for their biology, with a greater degree of uncertainty for predictions for offshore areas. The UK Seamap outputs are at a much broader scale than that used within the current Mapping European Seabed Habitats (MESH) project, which has more detailed outputs that will be the basis for selecting MCZ sites. Many specific sites are already well described and known to need protection, but where uncertainties remained, MCZ sites could be designated on a precautionary and adaptive basis.

Selection criteria

There are criteria that may be used to select a network of MPA sites (Box 6). They seek to ensure that networks:

- are connected by movements of water that transport materials, larvae and adult animals and plants between sites
- encompass sufficient representation of biodiversity types
- reflect differing requirements of marine organisms in the distribution and size of component sites.

Although oceanographic modelling can be used to assess the degree of possible connectivity between individual protected areas, there are difficulties in obtaining quantitative dispersal data for many marine species. It is difficult to derive generic rules, but it is clear that many species have limited dispersal ability and so need to be conserved in their existing locations.[20]

Economic criteria

The network design can also consider existing and future economic uses of areas, such as fishing. Some NGOs contest that MCZ sites should be chosen on scientific criteria alone and their economic use considered only as part of site management regimes. However, designation of intensively used areas, by damaging activities such as bottom trawling, may result in an overall loss of biodiversity. These activities may be displaced to areas that have previously been little impacted, with consequent impacts on biodiversity, unless other management measures are taken in tandem to reduce the overall level of activity. [21] There is also uncertainty about

whether heavily impacted habitats can recover to previously reported states.

Box 6. Scientific criteria for network selection

There is a range of scientific and pragmatic criteria that can be applied to ensure that representative species and habitats are protected from human impacts within a network of MPAs for a given area. Examples of such criteria include:

- **representativeness** – networks should represent the full range of UK marine and coastal habitats and species
- **replication** – all habitats in each region are replicated within the network and distributed throughout
- **viability** – the sites within the networks should contain self-sustaining populations
- **precautionary design** – a precautionary approach to network design where data are limited
- **permanence** – network design must provide long-term protection to conserve and replenish effectively
- **maximum connectivity** – the network design should maximise and enhance linkages between site;
- **resilience** – the level of replication and connectivity should allow adaptation to environmental impacts
- **size** – the size of a MPA should be sufficient to minimise the impacts of activities outside the area boundary.

Finding sanctuary

A process for selecting MCZs, the 'Finding Sanctuary' initiative,[22] has been tasked with designing the MCZ network for the waters of south-west England. A stakeholder panel was set up through the South West of England Regional Development Agency, which includes fishing, industry, tourism and conservation interests. The designation process is expected to be iterative, with stakeholders asked to consider scientific as well as economic criteria, and to provide local knowledge of biodiversity features and use of areas. The derived selection criteria and relevant data (maps of seabed habitats, Box 6, and other marine biodiversity data) will be used in a decision support system (Marxan) to identify a number of potential site networks, which the stakeholder panel will then discuss. The boundaries of the sites selected and agreed upon by stakeholders may need to be validated through definitive habitat maps where they exist, or video technology.

Similar projects will be set up for other marine areas around the UK, excluding the inshore sea areas adjacent to Scotland and Northern Ireland. Inshore sites in Scotland will be initially designated by the criteria set by Scottish Natural Heritage, until the Scottish government brings forward a Marine Bill. In Wales, a stakeholder process has been initiated to identify potential locations for Highly Protected Marine Reserves. Measures to protect offshore sites from damaging fishing activities would require agreement from the EU Agriculture and Fisheries Council, as would sites beyond 6 nautical miles (11.11 km) fished other Member States vessels.

Site objectives

The designation of MCZ sites should have taken place by the end of 2012. The conservation objectives for each site will be set out in the designation order, determining the level of protection. All competent authorities will be responsible for management and enforcement of these objectives, the authority varying according to the location of the site and the nature of the activity.[1]

Monitoring

The statutory nature conservation agencies will be responsible for measuring the condition of MCZ sites. Effective assessment of the performance of the network of MCZs against conservation objectives, will require a suitable set of targets and indicators. In addition, to provide baseline data against which the performance of multiple use MPAs can be monitored, a proportion of sites will need to be highly protected. Monitoring a proportion of MCZs in detail to determine their environmental status may be more effective than a more limited network-wide programme. Despite the low level of knowledge about marine ecosystems, environmental status could be approximated through measures of species abundance and richness, with consideration of indicator species that are sensitive to specific impacts. Presence of certain species can indicate the likely status of ecological processes, for example, deep burrowing seabed species have higher rates of nutrient fixation than shallow burrowing species.

Overview

- The MCZ network proposed in the Draft Marine Bill will minimise the impacts of human activities on marine biodiversity and facilitate recovery within sites designated by 2012.
- Adequate provision of data on marine habitats and species is critical to determining the selection of an effective network of MCZs.
- To assess whether the network maintains marine biodiversity and ecosystem services will require the development of a monitoring programme.

Endnotes

1 Draft Marine Bill. 2008. Defra, Cm7351.
2 Hiscock, K. and Breckels, N. 2007. Report to WWF.
3 Halpern et al. 2008, *Science*, Vol. 319. no. 5865, 948 - 952
4 Royal Commission on Environmental Pollution. 2004. 25th Report.
5 Hiddink et al. 2006. *Can. J. Fish Aquat. Sci*. 63: 721-736
6 Harris et al. 2007. *Marine Biology*, 151:973-983
7 Ardon, J. 2008. *Hydrobiologia*, 606: 45-53
8 www.defra.gov.uk/marine/pdf/legislation/protect-marine-env-leaflet.pdf
9 Sweeting, C. and Polunin, N. 2005. Report to Defra.
10 Gubbay, S. 2006. CCW Contract Science Report No. 762
11 Roberts, C., and Mason, L. 2008. Report to WWF
12 Stewart et al. 2008. *Systematic Review No. 23*. CEBC, Bangor.
13 Conference on the Development of a European Strategy for the Protection and Conservation of the Marine Environment, Køge, Denmark, 4-6 December 2002.
14 Beaumont at al. 2008. *Marine Pollution Bulletin* 56: 386 -396
15 Tillin et al. 2006. *Marine Ecology Progress Series*. 318: 31-45
16 Paramor, O. and Frid, C. (2006). Report to Defra
17 Science and Technology Committee, Tenth Report of Session 2006-07. HC 470
18 Austen et al. 2008. Paper prepared for UK BRAG
19 Vincent et al. 2004. Report to Defra by the JNCC.
20 Lester et al. 2007. *Ecology Letters*, 10:745-758.
21 Hiddink et al. 2006. *ICES Journal of Marine Science*, 63:822-830.
22 http://www.finding-sanctuary.org/index.php

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POST is grateful to all contributors and reviewers of this POSTnote. For further information on this subject, please contact Dr Jonathan Wentworth at POST.

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