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Methods for managing Marine Protected Areas: Options for establishing and managing a marine protected area system in the UK

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Abbreviations used in this report:

DOCOB	Documents of Objectives (documents d'objectifs)
EC	European Commission
EMS	European Marine Site
EU	European Union
FCS	Favourable Conservation Status
ICM	Integrated Coastal Management
IUCN	International Union for the Conservation of Nature and Natural Resources
MCS	Marine Conservation Society
MNR	Marine Nature Reserve
MPA	Marine Protected Area
MSP	Marine Spatial Planning
NCA	Nature Conservation Agency
NE	Natural England
NGO	Non-Government Organisation
NTZ	No-Take Zone
OSPAR	Oslo and Paris Convention for the Protection of the Marine Environment of the North-East Atlantic
SAC, mSAC	Special Area for Conservation, Marine Special Area for Conservation
SCI	Site of Community Importance
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
VMCA	Voluntary Marine Conservation Area
WCPA	World Commission on Protected Areas
WWF	World Wide Fund for Nature

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Summary

Principles
The examples presented and the analyses undertaken in this study can be encapsulated in a set of principles of effective marine protected area (MPA) management that are common to other areas and important for the UK, especially:

- strong and purpose built planning and governance legislation,
- a statutory and genuine commitment to stakeholder involvement in management,
- planning at the ecosystem scale incorporating considerations of critical habitat preservation, representative, comprehensive and adequate habitat capture,
- provision of highly protected core zones augmented by buffers within a managed framework,
- and a well-resourced visible, positive management presence.

Recommendations
At the strategic level, the report recommends:

- A statement of objectives for UK MPAs
- Recognition of marine nature conservation as a valid competing use in marine and coastal areas
- Adoption of Marine Spatial Planning as a means of identifying and resolving conflicts in resource use
- Revised, simplified and strengthened MPA designations for the UK, including no take zones, buffers and managed areas.
- Simplified and strengthened management structures for MPAs and marine resource management.
- Purpose-built effective legislation for MSP and MPA declaration

This document presents a review of the available literature concerning management arrangements for Marine Protected Areas (MPAs) in the UK, Europe, and around the world with the object of providing guidance for future management of MPAs, especially European Marine Sites (EMSs), in the UK. This is partly to support the development of effective legislation for UK MPAs through the Marine Bill process, but more broadly to assist UK marine nature conservation and resource management agencies to manage their sites more effectively and to meet the agreed OSPAR goals for a network of well managed marine protected areas to be in place over the next several years. The report follows on from the directions provided in the UK government's "Maritime State of Nature Report" (Covey and Laffoley 2002) particularly: areas free of exploitation, new or revised legislation and ecologically meaningful management (ibid page 8).

A Marine Protected Area is defined by IUCN as "Any area of intertidal or subtidal terrain, together with it's overlying water and associated flora, fauna, historical and cultural features, which has been reserved by law or other effective means to protect part or all of the enclosed environment." This covers a wide range of statutory and voluntary designations around the world - over 350 different types. In the UK, this definition includes the range of familiar designations including mSACs (marine Special Areas of Conservation), SPAs (Special Protection Areas) and MNRs (Marine Nature Reserves), but also VMCAs (Voluntary Marine Conservation Areas) and arguably a range of spatially-implemented fishing gear and effort restrictions. The focus of this report is EMSs (which includes both mSACs and SPAs), but it also considers other possible future MPA designations.

In the context of this report, management encompasses a perhaps surprisingly complex concept which covers the range of tasks that may be undertaken, the tools (technical, organisational and others) that may be used, but also the range of people that may be involved (planners, managers, other stakeholders, the wider public). All of these elements are parts of "management".

MPA establishment and management has a chequered history in the UK, especially when viewed in the context of MPA programs in other parts of the world. Until 1981 there was no statutory mechanism for conservation of marine areas. The Wildlife and Countryside Act (1981) then provided for Marine Nature Reserves, which were intended as the marine equivalent of National Nature Reserves, but the concept proved to be fatally flawed, because the legal provisions of the byelaws by which MNRs were to be designated were insufficient to achieve their objectives – put simply they were toothless in the face of any sustained opposition to the designation. The UK was forced into action by European initiatives, especially the EU Habitats and Birds Directives (Scottish Natural Heritage *et al*. 1997). Within England, 23 Special Areas of Conservation (SACs) and 41 Special Protection Areas (SPAs) (in some cases both designations apply) were designated in the marine and coastal environment, forming 39 European marine sites (EMSs). To contribute to the MPA target in the more recent OSPAR convention, the UK has submitted 56 MPAs, all of which are also SACs (OSPAR 2006).

It is difficult to find detail on approaches to implementing the Natura 2000 model in the mainland European context. In order to do so, this report has examined the literature on MPA implementation and management in Europe (whether identified as Natura 2000 sites or not) and compared it with a range of MPA programs world-wide. Examples from European MPAs are given from Italy, Spain, France, Portugal, Greece, Germany and Belgium. There is a commonality (although not universality) of approach, particularly among Mediterranean states. MPA programs here are mature and apparently successful. The key elements include: inclusion of stakeholders in the planning process, often by statutory or even contractual arrangements; provision for highly protected zones surrounded by buffer areas; effective legal provisions supporting the MPA designation; and a visible on-going management presence.

MPA examples from around the world were summarised in terms of their history and key management elements. The locations considered were New Zealand, the Philippines, East Africa, Belize, South Africa and Australia. In analysing all these examples (UK, European and global), the report presents twenty-one key criteria for MPA management, grouped in three themes: Planning and technical processes, Governance structures and processes, and Effectiveness of management. Each is defined and explained in some detail. The criteria provide a common comparative framework, which enables the examples to be ranked and placed in a conceptual model for MPA management. The key features of this model are that while most MPA models worldwide do a relatively good job of the technical and planning tasks associated with management, they perform less well in the ongoing administrative and governance tasks (including financial support) once the MPA is in place, as assessed by measures of management effectiveness. Overall, the most effective MPA models are those which use structured and quantitative approaches to design, have a purpose-built and effective legislative base, but even more importantly, have significant, well resourced and visible on-going management presence.

1. Introduction

The UK Government is in the process of drafting new legislation (the Marine Bill) which may include provisions for Marine Protected Areas outside the Habitats and Birds Directives, and seeking advice on the appropriate management of new MPAs, as well as those already in existence. To support that process, the Marine Institute at the University of Plymouth was contracted to provide a report to Natural England that:

- Reviews the current literature on Natura 2000 model of managing SACs and SPAs in the UK, and MPAs in the rest of Europe
- Compares this with other MPA management mechanisms from around the world
- Identifies the strengths and weaknesses of all the models
- Makes suggestions on realistic options for managing MPAs in UK waters. (Natural England project specification, our paraphrasing)

What will this document cover?

This document will present a synthesis of the key attributes of MPA management from above, with a focus on the key processes of management and the groups that they involve. Technical level information on the application of particular tools is available in the literature – it will be referred to where relevant and necessary. The reader is directed in particular to the examples given in volume 8, issue 2 of Parks (1998) and Kelleher (1999) for general principles, and examples of current practice such as Leslie *et al.* (2003), Villa *et al.* (2002), Freidlander *et al.* (2003) and Gladstone (2006).

This document will examine the range of MPA management methods that have been implemented in the UK, Europe and around the world, and place them in a comparative framework. The critical elements of management, particularly from the points of view of design and governance, will be distilled from the examples presented and examined to determine which approaches appear to deliver effective outcomes.

MPAs worldwide have been the subject of several recent reviews and ongoing programs from the point of view of management effectiveness (Pomeroy *et al.* 2004, 2005), planning approaches (Leslie 2005), integration of factors (Lundquist and Granek 2005), monitoring and evaluation (Stem *et al.* 2005) and success in conserving and enhancing biodiversity (Gubbay 2006). That MPAs, if well planned, appropriately resourced and properly managed **can** achieve significant benefits across a range of objectives is not really up for debate. The question, and the subject of this report, is what methods of MPA management will provide the best outcomes for the UK.

2. Scope and definitions

What is an MPA?

The generally accepted definition of a Marine Protected Area is: "Any area of intertidal or subtidal terrain, together with its overlying water and associated flora, fauna, historical and cultural features, which has been reserved by law or other effective means to protect part or all of the enclosed environment". (IUCN 1994). MPAs may therefore include a wide range of tenures, management provisions, legal or voluntary instruments, and approaches to management. The World Database on Protected Areas Consortium maintains a global database of protected areas, including MPAs, which recognises more than 350 different MPA designations (WDPA Consortium 2006). In recognition of this complexity, IUCN has defined 6 protected area categories. These apply to MPAs, and represent a scale from (generally) small, highly protected, no-take, no-entry areas to very large areas managed for multiple use (Kelleher 1999). However, many MPAs have not yet been assigned into these categories (below) by their managing agencies at this stage (Bishop *et al*. 2004).

- Category I – **Protected area managed mainly for science or wilderness protection** (Strict Nature Reserve/Wilderness Area);
- Category II – **Protected area managed mainly for ecosystem protection and recreation** (National Park);
- Category III – **Protected area managed mainly for conservation of specific natural features** (Natural Monument);
- Category IV – **Protected area managed mainly for conservation through management intervention** (Habitat/Species Management Area);
- Category V – **Protected area managed mainly for landscape/seascape conservation and recreation** (Protected Landscape/Seascape);
- Category VI – **Protected area managed mainly for the sustainable use of natural ecosystems** (Managed Resource Protected Area). (IUCN, 1994)

In the UK, several different types of areas, planned and designated under differing regimes for a wide range of purposes exist. For the purpose of this report, we focus on the management needs of the 39 areas in England recognised as European Marine Sites (EMSs), as listed in English Nature (2006), but also potential future MPAs in UK waters.

However, it is important to recognise that there is a range of other sites within the UK which impose, by legal or voluntary means, restrictions on human use, to effect some level of protection on the resources encompassed, and therefore fall under the definition of MPAs. Examples include the Devon Inshore Potting Agreement (Blyth *et al.* 2004) and the range of Voluntary Marine Conservation Areas (VMCAs) around the UK coast (Table 1).

MPAs are principally applied to either biodiversity conservation (e.g. Halpern and Warner 2002) or fisheries management issues (e.g. Kaiser 2005). Increasingly, there is a realisation that MPAs can be used to address a broader range of issues, including socio-economic aspects (Ami *et al.* 2005, Dalton 2004) simultaneously within an integrated system of MPAs, or indeed within a single reserve. This has led to the development of increasing sophistication in methods for MPA design that can quantify the costs and stresses of competing objectives in reserve design and suggest optimised solutions based on management constraints (e.g. Leslie *et al.* 2003).

Table 1: UK MPA designations and IUCN protected area category equivalents.
Based on Gubbay 2006, Bishop *et al.* 2004.

UK MPA designation	IUCN Categories	Examples
mSAC, SPA (EMS)	III, IV	III - Fal Estuary mSAC
MNR	I, III, IV, VI	I - No-take zone within Lundy Is MNR VI - Lundy Island MNR
SSSIs	III, IV	III - Dawlish Warren SSSI
VMCA	V	Wembury VMCA
Gear-specific Fisheries Closures	VI	Devon Inshore Potting Agreement; Irish Sea Cod Box

What is included in the term "Management"?

With respect to MPAs, management can be defined in several ways. One approach is to do so in terms of the tasks undertaken (e.g. Hocking *et al.* 2000), that is, "what" is done. One way to encapsulate this is to use a notional sequence of tasks:

- Determining the reserve system philosophy and basic architecture;
- Setting objectives for management;
- Design phase;
- Establishment;
- Compliance monitoring and enforcement;
- Monitoring of ecological processes and biodiversity status;
- Evaluation of management effectiveness;
- Adapting management to improve its effectiveness.

However, such a definition does not give information about the tools used in management, that is, the "how" elements (see the review by Leslie 2005):

- Spatial planning tools;
- Optimisation algorithms;
- Legislation and management plans;
- Public / stakeholder participation programs;
- Enforcement, education, extension, patrol and survey programs.

A further element that needs to be explicit in any discussion of management of MPAs (or any protected areas) is "who" is involved in managing, e.g.:

- Planners;
- Regulators;
- Legislators;
- Differing levels of government (local, regional, national, international;
- User groups (industry, conservation advocates, recreators);
- Scientific community;
- Wider public.

It can be seen that management is in fact a complex, multidimensional concept in this context. All the elements mentioned are inter-related and it is critical to keep in mind the breadth of the issue.

3. Background: History and practise of MPA management in the UK

Prior to 1981 marine sites could only be protected in the UK on a voluntary basis. The first such voluntary marine conservation area (VMCA) was established around Lundy in 1973 by the Devon Wildlife Trust and over 20 VMCAs were eventually established, some of which are still active. Whilst VMCAs (and other voluntary measures, e.g. Sensitive Marine Areas - SMAs) provide a degree of protection, they lack a systematic approach to selection and management, most VMCAs having exposed rocky reefs as their main focus. They are also entirely reliant on the voluntary cooperation of users, promoted mainly through education and informal codes of conduct, as there are no statutory powers available to the Nature Conservation Agencies (NCAs) to prevent damaging activities and developments. However, they did achieve a considerable degree of protection for the sites recognised as VMCAs, including the enactment of fisheries byelaws in some sites. These were mainly to prevent the introduction of damaging fishing activities such as scallop dredging, and could only be introduced with the cooperation of the local sea fisheries committee, on which a majority vote for such measures was required.

The Wildlife & Countryside Act (1981) included provisions to designate statutory marine nature reserves (MNRs). Section 36(1) of this Act provides for NCAs to designate MNRs out to 12 nautical miles for the purposes of conserving marine flora and fauna, and providing opportunities for study and research. Though it was not explicit, the intention was that MNRs would be the marine equivalents of terrestrial National Nature Reserves. Section 37(2) provides for the NCAs to impose protective byelaws to:-

- prohibit or restrict entry into and movement within the reserve;
- prevent interference with animals and plants in the reserve or damage to the seabed or other objects;
- prevent the depositing of rubbish;
- provide for the issuing of permits authorising entry into or permitting otherwise unlawful activities in the reserve or parts of it.

Whilst these byelaw provisions for MNRs appear robust, they are fundamentally flawed by the critical weakness that none of the byelaws imposed by NCAs to protect MNRs may interfere with the functions of any other relevant authorities or any right of any person (Section 36(6)). This means, for instance, that MNR byelaws cannot be imposed under these provisions to restrict fishing, as this is the responsibility of the government fisheries agency, over which the neither the NCA nor the Secretary of State were granted powers to require such restrictions.

The second critical weakness is related to the process by which decisions concerning MNR proposals are made through the Government's interpretation of Section 36(4) and Schedule 12. Such proposals are required to be advertised and brought to the attention of all potentially interested and affected parties, who are invited to submit expressions of support, neutrality or objection to the NCA. In theory, the Secretary of State can approve an MNR order that has been objected to by one or more parties, provided that these objections have been heard, considered and reported. In reality, the Secretary of State requires the NCA to overcome all

significant objections, by persuasion or by modifying the proposal in order to appease the objectors. In effect, this requirement gives any parties that fears that their interests may be adversely affected by the MNR proposal, such as fishermen, fish farmers, yachtsmen and divers, the power of veto over such proposals.

The weakness of these provisions is arguably no accident. The UK government was strongly of the opinion that marine conservation should continue to be achieved through other sectoral policies, such as shipping controls, pollution prevention and fishing regulations. Whilst intertidal sites could be designated and protected as sites of special scientific interest (SSSIs), the government's view was that there was no need for specific legislation to protect habitats below the low water mark. The MNR provisions under sections 36-37 and Schedule 12 of the 1981 Act were therefore eventually only included as an amendment, following a concerted campaign by the Marine Conservation Society (MCS) and the WWF. The Government reluctantly included these provisions only through fear of losing the entire bill, after what was described by a member of the House of Lords as 'a saga of reluctance and feet dragging'. It is thus not entirely surprising that there are many weaknesses in these provisions.

Despite these weaknesses, the NCAs were keen to use the new MNR provisions as this represented their first opportunity to pursue the statutory protection of sub-tidal marine habitats. A total of ten sites were initially pursued of which only three were eventually designated (Box 1).

Box 1 - MNRs pursued under the 1981 Act (and related provisions for Northern Ireland)

England:	**Lundy** (designated 1986) Isles of Scilly Lindisfarne
Wales:	**Skomer** (designated 1990) Menai Strait Bardsey Island
Scotland:	St Abb's Loch Sween
N. Ireland:	**Strangford Lough** (designated 1995) Rathlin Island

It was intended that further sites would subsequently be pursued, but only slow and very limited progress was made with the 'initial' sites so no further MNRs were pursued. Seven of the initial MNR proposals were unsuccessful as they were blocked by certain users maintaining objections to them, in the face of which the Government refused to approve these proposals. Furthermore, during negotiations on the three MNRs that were designated it was necessary to for the NCAs to make major compromises on the proposed management restrictions in order to appease objectors and gain approval. As such, even the designated sites were conferred only limited protection by the MNR provisions due to the fundamental weaknesses in the wording and interpretation of the 1981 Act. Very few of the proposals to legally protect important habitats within the designated MNRs gained approval. For instance, all the byelaws proposed to protect habitats and species within the Skomer MNR had to be replaced with voluntary codes of conduct in order to gain consensus on the MNR proposal. If

voluntary compliance by users is not forthcoming, the NCAs have no powers under the 1981 Act to require such compliance to protect MNRs.

The MNR provisions were never strengthened nor were the requirements for consensus on MNR proposals relaxed. The response to a House of Commons debate on MNRs in 1985 stated that the Government considered that the voluntary approach implicit in the MNR provisions had not been exhausted and that the introduction of compulsion would be counter-productive. It was concluded that the Government had no immediate plans to pursue further MNRs beyond the 'initial' ten sites and that future efforts would be focused on the designation of marine special areas of conservation (mSACs) under the Habitats Directive. In the light of this announcement, along with the lack of progress in designating MNRs, the extreme weaknesses in the MNR provisions, and the emerging priority of designating mSACs, the NCAs quietly shelved any further MNR initiatives. Meanwhile, all three of the designated MNRs and most of the proposed MNRs were included within the boundaries of proposed mSACs. Given this history, it is clear why the Habitats Directive (below) was enthusiastically welcomed by marine conservationists, given it's stronger legal basis for designating and protecting mSACs and the potential for interventions from Whitehall and Brussels to require marine conservation measures.

European legal influences on UK MPAs

The EC Directive on the Conservation of Natural Habitats and of Wild Flora and Fauna (92/43/EEC) was enthusiastically welcomed by marine conservationists in the UK as the previous policy framework had led to the designation of very few MPAs and these were weakly protected (see previous section). The Directive places an unprecedented obligation on EU Member States to designate mSACs as a means of maintaining the favourable conservation status (FCS) of certain listed marine habitats and species, as part of the Natura 2000 network across the EU. Within England, 39 EMSs (23 mSACs and 41 SPAs – both designations can apply to the same area) have been established, whereas for the UK the figure is approximately twice that, representing more than 5% of the UK territorial waters area (JNCC figures, July 2004).

The requirements of the Habitats Directive have been transposed into UK legislation through the Conservation (Natural Habitats etc.) Regulations (1994) and the Conservation (Natural Habitats etc.) (Northern Ireland) Regulations (1995), hereafter referred to collectively as the Habitat Regulations. On land above the low water mark, habitat conservation is underpinned by legislation to protect Sites of Special Scientific Interest. However, there was no existing legislative framework for implementing the Habitats Directive below the low water mark. The Habitat Regulations, therefore, provide specific new responsibilities and measures in relation to EMSs. They require RAs[1] to work together to establish a single management scheme (hereafter 'scheme') for each EMS and it is expected that one RA will normally take the lead. All 'Competent Authorities' (including RAs) have a responsibility to exercise their functions in a manner that ensures compliance with the Habitats Directive by maintaining the FCS of the features for which EMSs have been designated.

[1] 'Relevant Authorities' for EMSs are listed as (current equivalents) nature/landscape conservation agencies, local planning authorities, Environment Agency/Scottish Environment Protection Agency, statutory sewage/water/drainage undertakers, navigation/harbour authorities and government fisheries agencies, including Sea Fisheries Committees (Regulation 5). *Any* public body or office with powers/duties potentially applicable to the management of EMSs, known as 'Competent Authorities', may also be involved in EMS management (Regulation 6), *eg* The Ministry of Defence and the Police Service are examples of CAs that are not also RAs.

The Habitat Regulations do not provide any one RA with an overriding power over other RAs in the development and implementation of a scheme. The process, therefore, relies upon cooperation amongst the RAs for each EMS, albeit cooperation based on the statutory obligation to develop a single scheme. However, certain powers are reserved to Ministers to direct the RAs to take specific actions in the event that a scheme is failing to conserve EMS features. The policy guidance for EMSs (DETR 1998) advises that RAs should form themselves into a management group to oversee the process of establishing a scheme for a site. The guidance strongly recommends that other groups, including riparian owners/occupiers, marine resource users, industry, local people and interest groups, be involved in developing the scheme. To achieve this, the guidance suggests the formation of advisory groups and regular stakeholder consultations during the development and operation of the scheme (Scottish Natural Heritage *et al*. 1997, English Nature *et al*. 2001).

The Habitat Regulations provide two advisory roles for the UK's NCAs but give them no overall executive powers in EMS management processes. At an operational level, the NCAs are responsible for advising their partner RAs as to the conservation objectives of the site, and of the types of operations which are likely to cause deterioration or disturbance to conservation features. At a strategic level, the NCA's National Council formally approves each EMS scheme put forward, and if it considers that the scheme will not achieve the maintenance of FCS, it can request that appropriate measures be taken. Failing this, Council may advise the Environment Minister to exercise his/her powers under the Habitat Regulations and require such measures be taken by the RAs. Ultimately, the European Court of Justice may step in and require the UK government to take steps to maintain the FCS of EMSs. Furthermore, the policy guidance states that the voluntary principle should apply as far as possible when securing the compliance of EMS users. Statutory enforcement of schemes should only be used as a last resort when it becomes clear that voluntary measures are not proving effective. The policy guidance also directs the NCAs to presume that compatible day-to-day uses of the areas will continue.

The contrast between the powers afforded to the NCAs to manage EMSs compared with those for terrestrial conservation sites could not be clearer. Terrestrial policies are underpinned by private property rights which enable the NCAs to enforce statutory management agreements on specific owners/occupiers, restrict the activities of visitors, and, as a last resort, purchase land in order to promote appropriate conservation management. Marine policies, without the historic basis of private property rights, are essentially based on a partnership approach amongst RAs and stakeholders which relies largely on voluntary cooperation in order to achieve statutory obligations, with legitimate coercive powers available only on a back-up basis. The management of EMSs thus presents challenges to the NCAs, whose experiences and expertise have been developed and honed through terrestrial conservation.

A detailed list of the international and national policy drivers for MPAs in the UK is given in Appendix A.

4. Examples of available management models

In this section we present a brief overview of some examples of MPA management approaches. It is not intended to be an exhaustive account, but an illustration of the range of approaches currently in use in the UK, Europe and further afield. The examples presented were selected according to the following criteria: They have mature MPA programs with a track record of establishment and management; these are well represented and described in the available literature; and some MPAs from the region have been subject to evaluation of their management effectiveness.

Natura 2000 - Management of European sites in the UK

In the UK, management of EMSs is based on the Natura 2000 model (Laffoley *et al*. 1994, SNH *et al*. 1997) and subsequent guidelines (English Nature *et al*. 2001). Sites are managed according to a management scheme, jointly prepared by the Relevant Authorities (RAs) having statutory powers over the marine area. A scheme may be established by one or more of the RAs although one will normally take the lead. Once established, all the RAs have an equal responsibility to exercise their functions in accordance with the scheme. Each site can have only one management scheme. Whilst only RAs have the responsibility for establishing a management scheme, government policy strongly recommends that other groups, including owners and occupiers, users, industry and interest groups be involved in developing the scheme. To achieve this, it suggests the formation of advisory groups and a process for regular consultation during the development and operation of the scheme (Scottish Natural Heritage *et al*. 1997).

The nature conservation bodies have a special duty to advise the other RAs as to the conservation objectives for a site and the operations that may cause deterioration or disturbance to the habitats or species for which it has been designated. This advice forms the basis for developing the management scheme. The scheme will encourage the wise use of an area without detriment to the environment, based on the principle of sustainability. Within the UK SACs may have many activities occurring within sites. Only those activities that would cause obvious deterioration or disturbance to the features for which a site has been designated are subject to restrictions under a management scheme. It is not the aim within the UK to exclude human activities from SACs, but to ensure that they are undertaken in ways that do not threaten the nature conservation interest.

The primary focus of a management scheme is to manage operations and activities taking place within a SAC, promoting its sustainable use. However, it may also provide guidance for the assessment of plans and projects, particularly those of minor or repetitive nature. A plan or project is any operation, which requires an application to be made for a specific statutory consent, authorisation, licence or other permission. Not all types of plan or project fall within the statutory functions of relevant authorities, but are consented or authorised by other statutory bodies, termed competent authorities (e.g. central government departments).

Implementing Natura 2000 and other MPA models in mainland Europe

General information about the implementation of Natura 2000 MPA model in Europe is rather dated (e.g. BfN & EC 2001) and general. Specific instances of implementation are not well reported in the literature; where MPA design and implementation studies are reported (see below) they do not make reference to the Natura 2000 model (SNH *et al*. 1997, English Nature *et al*. 2001), based on the generic model proposed by Laffoley *et al*. (1994), which was used to give direction to the form of UK legislation implementing the Habitats Directive. However, the recent OSPAR Commission report on the status of the OSPAR Network of Marine Protected Areas (2006), lists 81 designations received by OSPAR (table 2). Seventy-five of these were implemented by EU member states (Norway is not an EU member) and are therefore Natura 2000 sites.

Table 2: MPA designations received by OSPAR up to March 2006
Source: OSPAR Commission 2006

OSPAR Contracting Parties	No of MPA designations received	Approx Area
Belgium	0	0
Denmark	0	0
France	8	243
Iceland	0	0
Ireland	0	0
Germany	4	11 923
Netherlands	0	0
Norway	6	1 905
Portugal	1	525
Spain	0	0
Sweden	6	639
UK*	56	9 858
TOTAL*	81	25 093

*Areas for the UK sites in this table are estimates based on Natura 2000 marine area. At the time of compilation, actual UK OSPAR numbers were not available but were expected to be somewhat higher.

Not all of these are completely new MPAs; there appears to be a trend in Europe towards redesignation of existing MPAs as Natura 2000 sites rather than new designations. Therefore, it is difficult to comment specifically on Natura 2000 implementation in Europe. However, several countries have active and successful MPA programs, as described below.

Spain

Although no specific information is available on the management of marine Natura 2000 sites in Spain the following information has been gathered from reviewing the management of Natura 2000 sites in general (Report to the European Commission, 2003). Within Spain regional governments propose Sites of Community Interest (SCIs – roughly equivalent to SACs), under a process managed by the State government. The latter is responsible, in partnership with the regions, for evaluating the proposals according to an agreed methodology, and for fusing them into a set of national proposals. Regional governments are then responsible for the management, surveillance and monitoring of SCIs as is the case for all other forms of protected area. Management plans are still being developed for protected areas notified under existing legislation. In some regions, where these protected areas

coincide with proposed SCIs, management plans are being developed so as to meet the objective of the protected area and fulfil the requirements of the Habitats Directive for the SCIs concerned (for example, in Extremadura). A few regions have started to develop plans specifically for proposed SCIs. For example, Galicia has several management plans well advanced, including for sites partially or totally outside existing protected areas.

Information specific to marine protected areas (http://www.medpan.org/) suggest the system of management is similar to that of terrestrial sites. In general MPAs in Spain are managed by the appropriate Regional Department of Environment. However, some are managed by a combination of national and regional authorities. This is the case with larger MPAs, where the regional government is responsible for the marine area up to a certain distance from the coast, after which the jurisdiction passes to a national authority. Although one authority appears to have responsibility for the management of sites, in most cases management is achieved through a committee of stakeholders.

Spanish MPAs, unlike UK MPAs, are usually zoned. This zoning scheme is based on a gradation of two or three levels, with the distinction of a central (core) zone, where all uses and human activities are generally prohibited, except for the mandatory intervention of managers. The size of these zones of reinforced protection is always relatively small (65–100 ha, comprising around 7–10% of the total reserve area). This central zone is bordered by an intermediate (buffer) zone where certain uses are forbidden (generally spear-fishing, but sometimes also scuba diving and amateur line fishing) or are subject to other limitations or controls. Small-scale professional fishing is usually allowed in this latter zone, but this is generally controlled by limitations on the fishing gear used, and/or by a system of permit limitation which is equivalent to reserving this zone for local fishermen and thus to maintaining the status quo of resource use. Where a third peripheral (general use) zone exists the regulation of activities there is not very restrictive (Francour *et al.*, 2001).

Box 2: Case study: Freus d'Eivissa

The following is taken from the website of the Government of the Balearic Islands (http://dgpesca.caib.es/user/reserva/i_descripcio.ct.htm). Freus d'Eivissa marine reserve was created in May 1999 through fisheries management policy of the Autonomous Community of Balearic Islands principally for the conservation of *Posidonia oceanica* and *Pinna nobilis* but also for the conservation/management of *Dasyatis sp*, *Epinephelus costae*, *Xyrichthys novacula*. The reserve is divided into three zones with different levels of protection. The integral reserve or zone of maximum protection, is approximately 4km^2. Within this zone all extraction of resources is prohibited as well as anchoring and diving. A second zone, in which recreational fishing is temporarily (possibly seasonally) banned, occupies 25% of the area of the reserve. The final zone occupies the remainder of the reserve area. Within this region trawling, other types of fishing, and the capture of fish and invertebrates whose populations are threatened is prohibited.

The site is managed by the Conselleria de Agricultura and Pesca (the Commission / Council for Agriculture and Fishing in consultation with a group of stakeholders including city councils, professional and recreational fishermen, conservationists, divers, the reserve guards and others. The management body is also responsible for undertaking monitoring of the site and enforcement of management regulations. The reserve currently has three guards who patrol waters with a well equipped speed boat. Day to day management of the site consists of recording daily information of all the activities that are undertaken within the limits of the reserve, communicating information to the public on the aims, objectives and the regulation of activities within the reserve, coordination of tasks with the fishing inspectors of Ibiza and Formentera and with the Civil Guard, control of the veracity of logbook data, and the development of a data base containing all this information.

Those vessels authorised to fish in the reserve are required to provide details of their activities, e.g. fishing positions, gear used, capture and landing and any other information of interest. These data are then used to monitor the effectiveness of the management measures within the reserve. Authorisation for fishing and diving within the reserve is obtained from the Main directorate of Fishing on a yearly basis. Requests for scientific diving must include a report of the specific activities involved, the objectives, methodology and time frame. The results must also be made available to the management body.

France

As with Spain, very little information is available on the management of marine Natura 2000 sites. The following is taken from a report to the European commission on the implementation of the Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (2003) and the website of the Conseil Général de Pyrenees-Orientales (http://www.cg66.fr/environnement/natura_2000/index.html). In terms of the management of Natura 2000 sites in general (both terrestrial and marine) France has opted for a contract-based approach to management of Natura 2000 sites, supplemented by regulatory measures under existing protection and management regimes For each Natura 2000 site the State appoints a local technical operator (*opérateur technique*), in consultation with the local stakeholders, who is charged with writing a management plan for the site, also known as "documents of objectives" (*documents d'objectifs* or DOCOB). The aim of the DOCOB is to provide a framework for coherent public and private conservation measures for the site, and the habitats and species warranting its proposed designation. DOCOBs are not statutory or regulatory documents, but basic working documents to guide those involved in managing and monitoring the sites (landowners, farmers, local elected representatives, forest managers, anglers/fishermen, hunters, NGOs, municipalities, etc.) in making decisions prior to the contract development stage. The DOCOB provides a framework of dialogue and reference with stakeholders to allow the local operator to take into account the multiple interests on the site. The management plan states: the initial assessment of the natural environment and the human activities occurring (phase 1); the objectives of MPA developed to ensure the conservation of the habitats and the safeguard the socio-economic activities (phase 2); the proposals for management and regulation of activities (phase 3). For each site, Natura 2000 steering committees (*comités de pilotage*) are set up and chaired by *department* Prefects. These committees are consultative bodies bringing together all the local stakeholders involved. They play an actively role in the development of DOCOBs. and act as the central body of the process of dialogue. The committee's role is to examine, amend and validate, with each stage of the development of the management plan, the documents and proposals produced by the site operator. The management measures validated by the steering committee are applied in the form of administrative contracts known as "Natura 2000 contracts" concluded between landowners or site managers, and *département* Prefects. The contracts run for a minimum of five years and draw on the terms of reference for the management measures laid out in the DOCOB, stipulating site management commitments and the corresponding funding arrangements (financial support for the work undertaken and services rendered to the community resulting from compliance with the environmental commitments). The Natura 2000 contracts are formally established in Article L 414-3 of the Environment Code.

In the broader context of French marine reserves in general (Augier, 1985) there are 5 different types of marine protected area in France: Fisheries, Fishery preserves, nature reserves, national parks and strict nature reserves. The first two are concerned with fisheries management and will not be considered further. Nature reserves can be established on a

proposal from the government, from private individuals or from nature conservation organisations. For both nature reserves and national parks the decision to establish a reserve is issued in the form of a decree which sets out the special restraints applicable to each reserve in order to achieve the desired protection. For nature reserves management may be entrusted to local authorities, NGOs, or a public institution set up for purpose. For national parks management is undertaken by a governing board, which includes representatives of relevant public services and local residents. The board is assisted by a scientific committee that has purely advisory status. On the ground management is achieved by a park director assisted by a team of individuals including administrators and wardens. The parks are financed almost entirely by the state. The coordination of scientific studies is entrusted to the scientific committee which draws up yearly and five yearly research programmes. Strict nature reserves (highly protected marine reserves) are in general very small and nested within larger nature reserves or national parks. There are recent examples of robustly-constructed assessments of MPA effectiveness (e.g. Claudet *et al.*2006).

Box 3: Case study: Cerbère-Banyuls Marine Nature Reserve

The following is taken from the website of the Conseil Général de Pyrenees-Orientales (http://www.cg66.fr/environnement/reserve_marine/index.html). Cerbère-Banyuls Marine Nature Reserve is a 650ha site that was established in 1974, but has more recently been notified as a Natura 2000 site within the larger Côte des Albères N2K site. The site is notified for the conservation of *Posidonia oceanica*, *Corallium rubrum*, and to a lesser degree the sea fan *Eunicella sp*, and sting ray *Dasyatis sp*, but also for the management of commercial fish species *Epinephelus marginatus* and *Sciaena umbra*.

The reserve is managed by the regional government, the Department of Pyrénées. However management is achieved though a '*consultative committee*' composed of representatives of the local communities concerned, the State, users, nature conservation organisations and scientists. This committee is established for periods of three years, where after membership is reviewed. The committee is consulted upon the operation of the reserve, its management and applications for undertaking activities that are managed within the reserve. The committee decide and agree on the management plan for the reserve with the aim of ensuring the conservation, protection and/or the restoration of the natural environment. It also has powers to request scientific studies and refer difficult issues to appropriate sub-committees (e.g. the scientific bodies, legal bodies, etc...). The operating costs of the reserve are shared equally between the department and the state.

The day to day running of the reserve is led by a conservation manager who is responsible for overseeing and implementing the decisions and proposals of the Consultative Committee. The site manager undertakes the administrative management of the site in collaboration with the Department of Pyrénées. This includes preparing the budgets and annual progress reports, coordinating enforcement, supervising scientific studies and other technical programmes, informing and educating the public, and monitoring indicator species, environmental parameters and use of the reserve. The Coastguard, French Customs, the Maritime ONCFS, and others collaborate in the monitoring of vessels and practices within the reserve.

In the preparation of a management plan for the larger Côte des Albères N2K site in which Cerbère-Banyuls sits, phase 1 of the plan development included producing a bibliography of the scientific publications related to the region, a biological inventory (map of the habitats present), and a census of the human activities (terrestrial and marine). Phase 1 was carried out with the assistance of several experienced scientific teams. The inventory of the habitats and their characterisation was achieved using aerial photography (delimitation of the sea grass beds), grab sampling for infauna and acoustic survey (to allow the production of habitat maps). The census of human activities was carried out in collaboration with all stakeholder groups (commercial fishing, diving, yachting/boat associations etc).

The development of objectives for the site involves first defining the vulnerability of the site. Habitat maps (determination of the sensitivity), are combined with maps of human activities (risk) to determine the most vulnerable sectors (Sensitivity/risk=Vulnerability). Zones are then identified based on vulnerability and suitable management measures are then proposed for each zone and eventually adopted in dialogue with stakeholders.

In terms of legislation France has recently (30/03/06) formally adopted a law to allow for the first time marine reserves to be set up in its national waters. The law also creates an agency to manage protected marine areas, including Natura 2000 sites.

Italy

Again very little information is available specifically on the management of marine Natura 2000 sites in Italy. Italian MPAs are conventionally implemented according to 3 protection levels: an integral reserve in which only authorised personal are allowed access; a general reserve where low impact tourism is allowed; and a partial reserve, usually a buffer between the exterior of the park and more restrictively protected zones, where some fishing activities are permitted. These can cover both the open sea and coastal (intertidal and dry land) areas (Tunesi and Diviacco 1993). This system does not provide for "look-but-don't-take" areas as are implemented elsewhere, although there have been calls for their introduction (Villa *et al.*2002). Quantitative approaches to MPA design are in use, for example for the Asinara Island National Marine Reserve (Villa *et al.*2002).

Box 4: Case study: Miramare Marine Nature Reserve (Italy)

The following is taken from the website of the Miramare Marine Reserve (http://www.riservamarinamiramare.it/golfo_eng/index.htm). Miramare was one of the first Italian MPAs to be officially established (1986), and includes a coastline of 1,700 meters and an offshore area of 120 hectares, divided into a core zone (30 hectares) and a buffer zone (90 hectares). The level of human presence at Miramare is extremely high being placed between the major tourist areas of Grignano and Barcola. The site is notified for:

- tidal flats with significant tidal range (about 2 m)
- high temperature variation in the water column
- fresh water flows from rain and several watershed systems (Isonzo, Timavo and Tagliamento rivers)
- coastal currents influenced by strong winds
- both soft and hard bottoms represented along the coast
- input of new oxygenated water into Mediterranean Sea (in winter)
- euryhaline and eurythermal benthic communities, some of them adapted to intertidal conditions.

Despite being one of the smallest MPAs in the Mediterranean Sea, Miramare has always been a model for effective and up-to-date management, where socio-economic and conservation issues are tackled with an integrated and comprehensive approach. The reserve is managed by the Italian World Wildlife Fund (WWF) on behalf of Italy's Ministry of the Environment and Protection of the Territory (MEPT). The WWF has promoted the Reserve development and has invested in its management, often supporting innovative environmental policy programmes. The reserve also has three control bodies and one implementing body:

1) protected area commission (11-12 people): approves annual program, confirms and controls all activities of the reserve.
2) private management committee (3 people): WWF staff that arrange daily activities on the site and confronts field management problems. This body gives the technical approval to the site manager for all management activities.

3) scientific committee (3-4 people): supports all the annual monitoring and research activities and the educational programs and advises the site manager on technical issues on the MPA activities.
4) Shoreline cooperative (private institution): implement all management activities under a contract with WWF.

Miramare is the only MPA managed by a private institution in Italy, all others are managed by local public institutions. As such it provides an interesting, and apparently successful, example of the partnership approach to MPA management (e.g. Jones and Burgess 2005). In the MPA, managers, researchers and educators work daily full-time. Graduate students (MS and PhD) undertake research in collaboration with the MPA staff under the supervision of the Biology Department at the University of Trieste. All the employees have graduate degrees in biological or natural sciences with backgrounds in environmental protection and biological conservation; many of them previously trained as researchers at Miramare. Although the staff have experience in performing public opinion survey, the site does not employ any social or governance professionals. However despite this a large effort has been made in informing and educating the general public.

Portugal

The Decree Law No. 140/99 of 24 April 1999 transposes the Birds and Habitats Directives into national law and provides for the preparation of a sectoral plan designed to establish the scope and framework of measures needed to guarantee the conservation of natural habitats and species, having regard to the environmental assets to be protected and the socio-economic development of the areas included in Natura 2000. In terms of site management no systematic approach to establishing management objectives was mentioned in the report to the European Commission (2003), although management measures are proceeding in several sites, on the basis of site-specific objectives.

In the Azores Archipelago, 17 Special Areas of Conservation (SAC) have been designated and an integrated program of management, planning and enforcement launched.

While in the UK the management of SACs is seen as separate to any other form of MPA management, the Azores have taken a more holistic approach. Rather than focussing on isolated groups or a particular species, the management plans are designed to function for a complex of areas and species which may be protected by different legislation e.g. the focus is on the site rather than purely the species /habitats of conservation interest.

Initially a scientific inventory of the species and habitats present are undertaken. Activities are then assessed as to whether and what regulations are required, there is then a period of public inquiry before the final management plans are prepared and eventually implemented. In addition some effort is focused on environmental education with the aim of informing the different stakeholders and actively involving them in the management measures.

In terms of the legal framework Article 8 of Decree Law No. 140/99 lists the activities affecting sites that are subject to a binding opinion from the authority responsible for nature conservation. These include new building developments, changes of land-use affecting areas over 5 hectares, changes of use to wetlands and marine areas, new or widened transport links, new energy and communications lines above ground, motor-sports, mountaineering and reintroduction of native species. The Environmental Impact Assessment system has been applied wherever justified by the nature of the projects. This is similar to the current system in use in the UK.

Greece

In Greece management of SCIs appears to be undertaken by site specific management bodies that are established through legislation introduced in 1999. This legislation establishes the procedure for setting up management bodies in protected areas and specifies their responsibilities and method of functioning. The management bodies are given various powers and responsibilities, including the compilation of management plans and operating regulations, monitoring and assessment of the application of the regulations, control over human activities, the delivery of opinions concerning preliminary planning authorisation and the adoption of environmental conditions for projects and activities. The first Greek management body was established in 2000 for the Lagana Bay National Marine Park in Zakynthos. This body has already started implementing management actions, although it has not yet drafted an integrated management plan. (Report to the European Commission (2003).

No systematic surveillance or monitoring arrangements are reported at the national level. However it is envisaged that systematic monitoring of habitats and species, as well as of the important abiotic parameters which can significantly affect them, will be conducted at local level by the management bodies. No formal system for *monitoring of the incidental capture and killing* of species of fauna has been introduced. In the case of marine species, the services of the Ports Corps record the numbers of cetaceans, turtles and seals that are found dead, the locations at which they are found and the opinions delivered by veterinarians, and they forward the information to the Ministry of Merchant Shipping, the Ministry of the Environment and the relevant nongovernmental organisations.

As part of the management of sites, programmes have been undertaken to develop visitor management studies, information centres, equipment, and environmental interpretation. It is felt that these programmes play an important part in winning acceptance by local communities and in encouraging them to cooperate towards successful application of the measures proposed in the assessments.

Germany

(Taken directly from the 2003 Report to the European Commission). In Germany, the constitutional responsibility for the site selection and notification process lies with the 16 Bundesländer (state level, the Federal Republic of Germany being comprised of 16 states), although it is not clear if this also applies to marine sites. Site selection has been taken forward in accordance with the rules of the Directive and with the support of the Federal Agency for Nature Conservation (Bundesamt für Naturschutz). Some, but not all, pSCIs are designated under one or more existing categories, most notably as nature reserves (Naturschutzgebiet), national parks (Nationalpark), biosphere reserves (Biosphärenreservat), landscape protection areas (Landschaftsschutzgebiet), water protection areas (Wasserschutzgebiet), or as biotopes protected by law (art. 20c Federal Nature Conservation Act, BNatSchG).

For some of these sites, management plans have been in place for some time (Pflege- und Entwicklungspläne), and habitat and species inventories are readily available. Many management plans further comprise specific conservation targets, and regular assessment of the impact of management measures on the conservation status of concerned sites is undertaken by the relevant authorities at the local level (behördliche Erfolgskontrolle). As with France site management frequently takes a contractual form. Efforts to produce coherent management criteria for pSCIs at the Länder (state) level are increasingly common. Meanwhile, management objectives and targets are commonly set independently for

individual sites by the relevant local authorities (e.g. National Park authorities). This mainly concerns previously established conservation sites such as national parks and nature reserves. Management plans that are more specifically tailored to the management of Natura 2000 sites are being developed in many Länder. The protection of sites is ensured by a host of general rules set out in the federal, as well as Länder nature conservation laws. These include provisions to prevent the deterioration or disturbance of sites.

Site-specific ecological characteristics, site boundaries and associated obligations for the protection of concerned areas have been widely publicised in relevant media (local gazettes, daily newspapers, scientific journals etc.), supporting public awareness raising and anticipating visitor pressure.

Belgium

(Taken directly from the 2003 Report to the European Commission). Within the Belgian Natura 2000 programme the Federal Government is responsible for marine sites (rather than the regional governments, as is the case for terrestrial sites). The proposition of marine sites under Natura 2000 in the Belgian North Sea has been undertaken by the MUMM (Management Unit of the North Sea Mathematical Model) considering the available scientific information and some practical considerations.

The North Sea already has existing collaborative management measures in force related to management of the region as a whole and much of the management of Belgium marine SPIs appears to involve monitoring and prevention measures, which are not site specific and rely on the existing legislation. However the law of 20 January 1999 concerning the Protection of the Marine Environment under the jurisdiction of Belgium (MB 12/03/1999) (MMM law) transposes the Habitats Directive. Another Law of 22 April 1999 concerning the exclusive economical zone of Belgium in the North Sea (MB 10/07/1999) (EEZ-law) is also relevant. There are several legal instruments implementing the MMM law: the “Arrêté Royal” of 20 December 2000 establishing rules on environmental impact assessment; the “Arrêté Royal” of 20 December 2000 establishing procedures for granting permits and authorisations for some activities in the marine environment; the “Arrêté Royal” of 21 December 2001 concerning the protection of species in the marine environment; and the “Arrêté Royal” of 12 March 2000 concerning procedures for dumping certain substances and materials in the North Sea.

To facilitate understanding and monitoring of potential and proposed sites the Federal Government makes an oceanographic vessel (A962 BELGICA) available for research projects led by universities and scientific institutes. Some Belgian research projects are aimed at evaluating the health of some part of the ecosystem, in relation to certain human activities. One of the Federal research projects - Habitat - has involved part of a Natura 2000 site. The aim is to develop a programme that follows the development of the benthic habitat in order to provide the data, strategies and methods needed to manage the area. It should also provide the scientific basis for evaluating the application of the management plan. In addition the LIFE-Nature project ‘Integral Coastal Conservation Initiative’ included an element on public information. There is also a website on marine ecosystems where the Habitats Directive and the pSCI are described. Information panels have also been installed on the sea walls along several coastal cities. These provide information on the fauna and flora of the sea, as well as relevant laws to protect the Natura 2000 site.

Further afield - Non-European examples of MPA management

New Zealand

Marine biodiversity conservation in New Zealand is given effect principally through a network of 28 marine reserves, the first of which was established in 1975 (Walls 1998) as a scientific reference area. Marine Reserves are no-take areas established under purpose-built legislation (Marine Reserves Act 1971). Of the 28 reserves, all except the two located around inaccessible offshore islands are small (<25 km^2; most <10km^2), in part at least because of local opposition to fishing closures (Babcock 2003). Just 0.3% of New Zealand waters lie within reserves, compared with approximately 30% of the land area (NZ Department of Conservation 2006, Langlois & Ballantine 2005). Recent studies have highlighted the success of marine reserves as reservoirs for exploitable biomass (e.g. Kelly *et al.* 2000), and more are planned (Babcock 2003).

Philippines

Small MPAs were established in the Philippines as early as 1974, initially as fish sanctuaries to improve fishing yields in areas where coral reef destruction had impacted on fish stocks. Since that time very large numbers of small MPAs have been implemented, but the results have been mixed at best (White *et al.* 2005). Parajo (1999, cited in White *et al.* 2005) reported on 439 MPAs in the Philippines, of which only one-tenth were being fully enforced. The exact number and area of MPAs in the Philippines is not known (www.mpaglobal.org lists 202 MPAs in a range of designations), since many are set up autonomously by local communities or municipal governments in an attempt to safeguard their dwindling resources. However, without properly resourced ongoing management, they have been largely ineffective in halting the wholesale degradation of the marine environments they aim to protect. Less than 5% of coral reef is still in excellent condition; mangrove and seagrass communities have suffered similar losses (Garcia 2005). This is partly because of poor management, but also because of the intense pressure placed on resources adjacent to the successful MPAs (White *et al.*2002).

More recently, the linking of MPA planning with ICM has brought much-needed co-ordination and strategic thinking to the process. There has been a shift towards increased devolution of management powers to local authorities which has supported more effective local management. Recent studies report on some successes with fish sanctuaries and a broadening of the role of MPAs to include ecotourism (Russ and Alcala 2004).

East Africa

The experience of MPA implementation and management in the east African region has been varied, but there are common elements. Francis *et al.*(2002) report on a succession in MPA models and approaches, starting with small areas for fish species or critical habitat protection. These were followed in Tanzania and Kenya by larger multiple use MPAs designed to allow coastal development as well as biodiversity protection. More recently, NGO programs have promoted and financed the implementation of MPAs to support sustainability in newly intensified fishing operations for example octopus fishery in southwest Madagascar (Humber, in prep).

Several MPA case studies report successful outcomes in improving fish and invertebrate biomass and diversity within closed areas, and importantly exporting that biomass in the form of improved CPUE in adjacent areas (e.g. Kaunda-Arara & Rose 2004, Kamukuru *et al.* 2004, McClanahan *et al.* 1999). Not all MPAs have been so successful, with the single greatest cause of failure reported as non-compliance (McClanahan *et al.* 2005) as a result of ineffective (or absent) management (Francis *et al.* 2002).

Belize

The first MPA in Belize was established in 1982, as the first plank of an ambitious, and initially successful, program to protect the biodiversity and fisheries resources of the Belize Barrier Reef, which contribute over 30% of the country's GDP (Cho 2005). The program was modelled on the Australian GRBMP experience. By 2003 19 MPAs had been declared, representing approximately 2500 km^2 of marine area, of which more than 10% is no-take zone (source: http://www.mpaglobal.org accessed 26 August 2006).

However, as early as 1989 it was recognised that MPAs alone would not suffice to protect the country's marine resources, because significant impacts were occurring as a result of land-sourced impacts, especially increased sedimentation and nutrient loads from catchment clearing (McField 2000, cited in Cho 2005). An ICM program was set up to address these issues, with mixed success.

Key elements in the Belize model are a network of zoned MPAs, but importantly set in the context of an integrated approach. Whilst MPAs are established by amendments to the Fisheries Act, the ICM program is given effect by it's own specialist legislation (CZM Act 1998) and a statutory authority created by that Act. Ongoing planning and management is by a mixture of agencies (Fisheries and Forestry Departments, and the ICM Authority), and some conflicts in MPA planning arise, principally between the fisheries and tourism sectors. As a result of perceived failures of management through poor resourcing and co-ordination, there has been a move towards devolution of some responsibilities to co-management partners (Parsram & McConney 2004), in part also to reduce the reliance on foreign aid to fund management (Cho 2005).

South Africa

South Africa has an active MPA program which serves several objectives including: representation of examples of marine biodiversity; maintenance of biodiversity and ecological function; fisheries sustainability; protection of critical habitat and endangered species; research, monitoring and training; and interpretation (South African Network for Coastal and Oceanic Research 1997). The MPA network has come about in a series of stages since the 1970s (Atwood *et al.*1997) using both National and Provincial legal instruments. Some MPAs are extensions of coastal National Parks, whilst others are areas in which fishing gear restrictions are in force. The most recent additions to the MPA network are Marine Reserves established under purpose built legislation including several large NTZs. Mature and objective methods for evaluating planning approaches and management effectiveness have been in place for many years (e.g. Hockey and Branch 1997).

South Africa's MPA program is mature and successful in world terms. Approximately 19% of the SA coastline lies within the range of MPAs designations (Attwood 2006, http://sacoast.uwc.ac.za/education/resources/factsheets/NationalMarineProtectedAreas.htm accessed 17 September 2006). Management is based on a partnership arrangement between the

Directorate of Marine and Coastal Management (MCM) and the national and provincial natural resource management agencies. MCM provides oversight of planning processes and strategic direction, with on-the-spot management falling to the local agencies.

Australia

There is no single MPA model in use in Australia. The best known and documented is the very large multiple-use marine park model, as exemplified in the Great Barrier Reef Marine Park (Fernandes *et al.* 2005), frequently held up as a model for other ecosystem-scale marine spatial planning initiatives (GBRMPA 1994). In fact there is a range of other MPA models in active use in Australian States and Territories, from very small discrete reserves, terrestrial park extensions, reserve networks, and smaller scale multiple-use models (McNeill 1994). It is therefore difficult to make general statements, and for this reason the GBRMP model will be considered separately from other Australian MPAs.

The Great Barrier Reef Marine Park is touted as the worlds largest MPA (not strictly true; the southern ocean whale sanctuary, for instance, is bigger, but not actively managed in the same way). Its management is underpinned by its own separate legislation, which creates both the park and the statutory organisation to manage it (Great Barrier Reef Marine Park Act 1975). Much as been written about this model, so it will only be briefly summarised here. The key points of its management are as follows:

The park is an umbrella planning and management instrument, allowing consideration of each activity in its spatial context. Management prescriptions are in the form of zones ranging from little restriction to no entry (roughly corresponding to the IUCN protected area categories). The recent revisions to the zoning plan used sophisticated optimisation tools coupled with a lengthy and exhaustive consultation and public-participation process. This had its origins in a long-term strategic planning process which saw all the key stakeholders agree to a 25-year vision for the future of the Great Barrier Reef (GBRMPA 1994). This is a key element, and it is unlikely that the recent declaration of about 30% of the Reef region as no-take (Fernandes *et al.* 2005) could have succeeded without that underlying agreement. Another key point is that the Australian public in general are very strongly supportive of reef conservation and management efforts, in line with the high profile of this world heritage-listed area.

Australian States and Territories, on the other hand, take a mixed approach to MPAs. Some states have purpose-built MPA legislation supporting multiple-use and zonal systems, albeit on a smaller scale than the GBRMP. Others favour a reserve network model, whilst others extend terrestrial parks into the marine areas, or have discrete refugia under fisheries legislation. Most states and territories have more than one reserve system operating in coastal and marine areas, typically older fisheries-based legislation and more recent marine reserve or zoned marine park legislation (Zann 1995, McNeill 1994).

The diverse approaches are given context by a meso-scale biophysical classification (IMCRA Technical Group 1998) designed as a blue-print for a representative system of MPAs around the country, and being implemented to varying extents by state, territory and federal legislation.

Common features of the Australian states and territories approach are:

- Generally a genuine, in some cases legislated, commitment to consultation and public participation as an integral part of MPA planning.
- Increasingly sophisticated techniques are applied to MPA planning, with concepts of representativeness and quantativity well entrenched.
- All states and territories have enacted highly protected marine reserves (IUCN CAT I and II).
- Most states and territories have, or are developing, purpose-built MPA legislation.
- Inevitably, management by State and Territory agencies is less well resourced than that of the GBR.
- Key areas that are lacking include monitoring and evaluation to support adaptive management.

5. Key Criteria for MPA management:

The approach taken to assessing each of the MPA examples presented above is to use a multi-criteria analysis. The objective here is to place the current UK MPA practices, and other MPA models from around the world into a common comparative framework, based on criteria distilled from the published literature on best practice for MPAs (e.g. Kelleher 1999, Hocking *et al.* 2000) and the broader comparative literature. We acknowledge at the outset that there is no single 'best practice' model; best practice in a given situation depends on the cultural, legal and socio-economic contexts. However the criteria derived below represent common themes which occur in a wide range of models, across those contextual boundaries, and so serve to form a common comparative framework. Other recent studies have carried out quite complex assessments of elements of MPA management, e.g. planning processes (Leslie 2005) and management effectiveness (Pomerory *et al.* 2004, 2005), however none have attempted to encapsulate MPA management as a whole, or to place management methods in a comparative framework.

It should also be acknowledged that the literature itself presents bias in what it reports. It is logical to assume that failed MPA approaches are under-reported compared to successful ones (however measured). From that perspective all of the MPA examples given so far are success stories to varying degrees.

Derived Criteria

Twenty-one criteria are defined, falling into three groups; those concerned with the planning and technical processes of MPA management (P1 – P7), those concerned with the governance structures and process of MPA management (G1 – G10) and those concerned with assessing the effectiveness of MPA management (E1 – E4). A definition and detailed explanation of each is given below.

Planning and technical processes

P1 Statement of objectives: detail and ambitiousness in terms of specific marine biodiversity conservation, fisheries management and other objectives. Includes:-

- The need for unambiguous, detailed and measurable objectives for management, in terms of biodiversity conservation and resource management, but also management operations and user compliance;
- processes for setting priorities for levels of protection and related management provisions;
- mutual learning on respective objectives and priorities amongst stakeholders and RAs; this process should involve a 'needs assessment' whereby stakeholders and RAs outline their key objectives (conservation, economic development, recreational, etc priorities) relating to the MPA and a 'use assessment' to identify who does what, where and when;
- seeking ends-means convergences whereby stakeholder priorities can be integrated with conservation priorities, *e.g.* local users might see the MPA as a means of achieving a degree of local protectionism from incoming users (end) whilst NE might see local protectionism as a means of achieving marine biodiversity conservation objectives (end); local users might see MPA as a means of promoting more sustainable exploitation methods (end), perhaps 'incentivised' by a

value added element for more 'green' products', whilst NE might see more sustainable exploitation methods as a means of achieving marine biodiversity conservation objectives (end).

P2 The basis for setting priorities for the inclusion or higher level protection of particular areas. Some MPA models have as a basis a type of 'town planning' approach, whereby the aim is to separate non-compatible uses in space or time. Such a model may not include any particular species management or biodiversity conservation imperatives. More sophisticated models include a hierarchy of priorities for management planning, so that (for example) the protection of critical habitat for an endangered species carries a higher priority in the allocation of a limited amount of highly protected space than does representing examples of a habitat type commonly occurring in the region.

P3 Organisational and spatial scale at which planning occurs. Historical approaches to resource management in marine environments often focussed on the observed trends of an individual target species at a given location. This is clearly limited in that it ignores external influences on the species at that site, or influences on the species at another site, or at different stages of it's life cycle. More complex models embrace the concept of ecosystem-scale management (e.g. Larkin 1996), which implies both a large spatial scale, and a broader organisational scale, recognising that (say) fishing has impacts not only on the target species, but on non-target species, the adjacent sea floor biotas, and potentially even further afield.

P4 Degree/extent of hierarchical spatial planning based on biophysical habitat classification: it is increasingly recognised that governance structures should be arranged in hierarchies that are consistent with biophysical structures, including intra-MPA zonation, inter-MPA linkages and the 'nesting' of MPAs with wider marine spatial planning frameworks.

P5 Assembling and integration of data and information layers: for example critical habitats, patterns of biodiversity, endangered species distributions, but also, distribution of user effort, threatening processes, modelled relative economic value, sites of cultural and historic significance, etc. Most planning processes involve a structured process to assemble and analyse these and other types of spatially-referenced information. Typically this is done using GIS techniques, but a high-tech process does not guarantee a good result. Some of the best plans have been produced on a whiteboard, chart, back of envelope, by practitioners with an intimate knowledge of the area, its resources and patterns of use. More recently, sophisticated software tools have been developed which augment reserve selection by mathematically evaluating a very large number of possible scenarios to determine the 'best' solution, expressed as maximum reservation benefit (most high value habitat encompassed) for minimum impact (least disruption to fishing activities), but subject to any necessary constraints (e.g. waters that must remain open for access to safe haven, single large versus many small protected areas).etc. (e.g. Pressey *et al.*1996), Possingham *et al.* 2000)

P6 Bringing different knowledges to planning processes. There is an increasing acknowledgment that tapping into the extensive knowledge held by users with a lifetime of experience in a particular area can have multiple benefits (Williams and Bax 2003), especially in accessing a rich source of knowledge on spatial and temporal patterns of local uses, and in thereby empowering those individuals who feel that their knowledge and experience is valued. The concept of collective learning can be particularly useful, whereby scientists, regulators and locals pool their knowledge and collaborate on research in order to minimise uncertainty. This approach also helps to generate partnership capacity (see below).

P7 Expectation management: be realistic about the likely need for some activities to be restricted and some behaviours to be modified to achieve nature conservation objectives. It is best to be honest about this from the outset and not to falsely lower expectations as to the consequences of MPA management. It should be stressed that the MPA is part of a network and that there is a strategic

statutory obligation for such a network of MPAs. Care must also be taken not to falsely raise expectations about the consequences of participation, *e.g.* not all views can be incorporated into MPA decisions as these are rarely based on total consensus; not all compatible development opportunities can be pursued, at least in the short term: such expectations must be consistent with the institutional capacity help deliver them, as few such initiatives can proceed without some sort of institutional support.

Governance structure/processes:

The concept of collaborative management, whereby stakeholders and RAs work on a partnership basis to achieve conservation objectives, is increasingly recognised as being central to the management of protected areas (e.g. Annex 1 in Kelleher 1999). However, this concept is often not discussed with reference to the need for a given protected area to fulfil strategic statutory biodiversity conservation obligations, in relation to which the power sharing arrangements for a given protected area are critical (Jones and Burgess 2005).

A concept that is central to collaborative management is that of partnership capacity, which can be considered as the potential for RAs and stakeholders to commit to working together to balance the fulfilment of both local and strategic objectives (Jones and Burgess 2005). Governance structures and processes are the means through which partnership capacity is generated and thereby the means through which such objectives are achieved. They can be considered as being comprised of several strongly inter-related elements, of which the following are particularly important in the development of partnership capacity.

G1 An appropriate level of stakeholder involvement in decision-making processes at all stages from MPA selection/design to evaluation/revision. Such involvement should, at a minimum, involve initial consultations with representatives in provisional decisions and subsequent full consolation with all stakeholders via post and workshops. It might extend to the direct involvement of stakeholder representatives in decision-making through 'flat' management structures (see G3 below), but given obligations to achieve strategic statutory marine biodiversity conservation objectives, such involvement will rarely extend to the full devolution of decisions to stakeholders. Quantitative models around this concept have been proposed by Brown *et al.*(2001) and Dalton (2005).

G2 Effective representation of the full diversity of stakeholders is a key issue in MPAs as our seas are essentially common-pool resources. This means that private property rights are rare, therefore rather than focusing negotiations on identifiable owners and occupiers along with a relatively limited number of incoming and indirect stakeholders, such negotiations must include representatives of the diverse and often broad range of stakeholders that have rights of access to and direct/indirect interests in the marine area in question.

G3 Management structure: the management structure largely dictates the power-sharing arrangements for a given MPA, recognising that where an MPA must fulfil strategic statutory marine biodiversity conservation obligations, responsibility and therefore power ultimately resides with the appropriate RAs, particularly NE and the European Court of Justice. Whatever structures are decided on must ultimately be backed up by effective legislative provisions residing with the agency charged with planning and ongoing management of MPAs (see recommendations regarding the Marine Bill).

The original DETR recommended management structure is two-tier, whereby RAs sit on a management group (executive decision making body) and stakeholders sit on an advisory group (provides information and views to management group on provisional decisions prior to full consultation); advisory groups may be supported by sectoral topic groups (fishing, recreation, tourism development, etc). This more top-down structure may be appropriate, especially in 'urban' EMSs where there is a high diversity and density of stakeholders, and for ensuring that strategic statutory marine biodiversity conservation obligations are met by avoiding the risks of parochialism whereby local priorities over-ride strategic statutory marine biodiversity conservation obligations. There remains a risk of top-down imposition, though this may be avoided by providing for stakeholder priorities and concerns to be fully aired in management group deliberations.

Efforts should made to delegate substantive tasks that support the MPAs objectives to stakeholders, as this has the combined advantage of providing for the input of their knowledge and perspectives, and of providing for stakeholder participation and 'ownership' of such initiatives. Failing to provide for such stakeholder input to tasks could alienate stakeholders, undermining the potential to develop partnership capacity.

Some EMSs have adopted flat management structures whereby the stakeholders and RAs sit on an equal basis on a single management forum, often involving an implementation group made up of RAs whose sole role is to implement jointly reached decisions, not revisit and revise such decisions. This more bottom-up structure may be appropriate in rural EMSs where there is a lower diversity and density of stakeholders, the distinction between stakeholders and RAs is more blurred and a high proportion of local people have direct or indirect interests in marine issues. However, such a structure carries the risks of parochialism.

When deciding on management structures for MPAs, it is important to assess whether existing management structures developed through previous partnership initiatives (e.g. existing estuarine management partnerships, voluntary marine conservation areas and other cross sectoral partnership initiatives) can be built on or incorporated where appropriate.

Large sites with geographically discrete sub-areas may benefit from a federated management structure, whereby each MPA sub-area has its own management structure, be this two-tier or flat. This may be particularly appropriate where a site consists, for example, of several estuaries, when it may be better for the development of partnership capacity for each estuary to have its own management structure. Where such federated management structures are employed, it is essential that there is an overarching management structure consisting or RAs (and possibly also stakeholders if flat management structure employed) to ensure a consistent and integrated approach to the management of the overall MPA.

G4 Decision-making and conflict management arrangements: this is strongly related to the management structure and is largely dependent on the legislative basis of the MPA, particularly the executive powers granted to the nature conservation agency and how legal interventions from higher statutory levels (DEFRA to EC/ECJ) to achieve marine biodiversity conservation objectives are managed. A bewildering variety of conflict management techniques has been described in various literatures.

It is important to avoid the MPA being drawn into existing and latent conflicts, e.g. between static fishermen and dynamic fishermen. These are conflicts between different stakeholders that were present before the MPA and whilst the MPA may be instrumental in addressing such conflicts, it is important that this is done with the explicit purpose of achieving strategic statutory marine biodiversity conservation, otherwise some stakeholders may consider the MPA to have been 'captured' by other stakeholders with whom they have an existing conflict, generating objections and undermining the potential for the development of partnership capacity.

Overall, it is important to note that MPA management is rarely about seeking consensus as this can rarely be achieved at an operational level: if uses are to be restricted and user behaviour modified there will nearly always be people who maintain objections. MPA project officers will therefore encounter and have to deal with conflict; if they don't, they're probably missing something or circumnavigating issues on which conflict exists. In general, a great deal can be achieved in conflict management by good facilitation.

G5 Facilitation of discussions: it is increasingly recognised that discussions should ideally be facilitated by 'neutral brokers', but as this has considerable resource implications this may not be feasible, though it must also be recognised that up-front investment in good facilitation may well be cost-effective in the long-term by promoting the development of partnership capacity that will support subsequent MPA management processes and initiatives.

A key conflict management approach for UK MPAs with such obligations is to stress, through facilitation, the advantages of negotiating a local compromise in order to achieve them that it largely agreed by local people and the local negative impacts of which are minimised, as opposed to allowing the risks of parochialism to be realised, leading to an imposed solution that could have far wider negative impacts. The facilitator can also help guide and support negotiations to develop local compromises, in a manner that might be considered as 'tempered' facilitation, recognising that such an approach is preferable to having measures imposed.

G6 Managing uncertainty is a major challenge in MPA management as the scale, connectivity and complexity of marine ecosystems coupled with the challenges of observing and studying them means that the knowledge and understanding on which decisions must be based is limited relative to terrestrial protected areas. Such uncertainty has a number of important implications. Where a change is recorded in the quality and extent of a conservation feature, it is often difficult to robustly establish a cause-effect link between the observed change and a particular factor. It may be argued that the observed change is part of a natural dynamic therefore management interventions are not appropriate and strategic statutory marine biodiversity conservation objectives should be revised to accommodate such change ('within natural variability'). It may also be argued that the observed change is due to a wide scale factor beyond the control of MPA management, such as climate change. Appropriate reserve design (e.g. Halpern *et al.* 2006) and adaptive and responsive management (Grafton and Kompas 2005) can ameliorate the effects of unpredictable environmental changes. Both of these concepts require an understanding of the precautionary principle and its genesis.

If it is argued that the observed change is due to human influences, it may be difficult to robustly establish which particular activity or activities (if any) are having impacts that are most important in causing the observed change. Rarely will the case for a cause-effect link be readily identifiable and provable, therefore decisions to restrict user activities will generally be taken under a relatively high degree of uncertainty and may therefore be subject to challenges from potentially affected people. Uncertainty is often the basis for many conflicts in MPA management. The precautionary principle has been developed to address such uncertainty and states that:-

"*in order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.*" (Article 15 of the Rio Declaration, 1992)

The precautionary principle could be invoked to address uncertainty in MPA management, in that it could be argued that the onus should be on users of the site or their RAs to demonstrate that their activities do not damage conservation features. However, it is argued that to routinely invoke this principle in order to justify specific proposed MPA management restrictions will be

very counter-productive in gaining the cooperation of users or the support of related sectoral agencies as it will lead to 'paralysis by precaution'. To this end the original DETR guidance on managing European marine sites (1998) states that whilst a lack of full scientific certainty should not be used as a reason for postponing measures that are likely to be cost-effective in preventing damage to sites, this principle should only be acted on when damage to a site is potentially significant but the risk is uncertain. This guidance further specifies that this principle cannot be used as a licence to invent hypothetical consequences and thus eradicate all activities which it has been suggested might cause damage unless they have been proved to be harmless.

The 1992 OSPAR Convention is focused on marine environmental protection in the North-East Atlantic so its guidance on the precautionary principle is particularly relevant. In particular, this convention links prevention and precaution as it states that preventative measures should be taken when there are *'reasonable grounds for concern… even when there is no conclusive evidence of a causal relationship between the inputs and the effects'* (Article 2).

Whilst the precautionary principle is important in addressing uncertainty, it does not necessarily resolve it. Discussions over proposed use restrictions to achieve marine biodiversity conservation obligations will involve debates as to cause-effect links and the balance between the environmental impacts of not taking action and the socio-economic effects of restricting certain activities. Managing the conflicts raised by uncertainty will always be a challenge in MPA management. The following approaches are particularly important in addressing this challenge:-

- being open and honest about the important role of uncertainty in MPA management and related discussions, recognising that uncertainty will always be a factor as it can never fully be 'researched away';
- recognising that placing the burden of proof on any given single party is less than constructive: reducing uncertainty as far as is reasonably practicable is a priority for all members of the partnership and knowledge gathering/research to reduce uncertainty should be pursued on a collaborative basis;
- agreeing guidelines as to what constitutes reasonable grounds in term of the severity, likelihood and consequences of likely harm as a basis for preventative measures;
- 'learning as you go along' on the best approaches to addressing uncertainty and implementing the precautionary principle, *i.e.* adaptive management;
- stressing the importance of avoiding recourse to top-down legal interventions should discussions lead to a 'business as usual' approach through failing to adequately and appropriately address uncertainty.

G7 Promoting compliance with decisions, especially:-

- Management presence and statutory enforcement is essential to ensure that agreed closures or restrictions actually occur, and to avoid undermining confidence and trust built up between management agencies and users. It needs to be balanced against the potential to undermine partnership capacity by taking an overly punitive and authoritarian approach;
- Education and awareness raising programs can work to promote cooperation and compliance by improving the understanding of marine conservation issues. Of course, lack of understanding is not the only reason for non-compliance. However, effective programs can both reduce the potential for ignorance to be cited as a reason for non-compliance and, more positively, help in nurturing the potential for cooperation with management decisions.

- Incentives to encourage cooperation and compliance can include grants to diversify from damaging to less damaging fishing methods. In the Morro Bay MPA, California, the NGOs Nature Conservancy and Environmental Defence, working in collaboration with fishermen instituted a buy-back and re-issue program. The program achieved reduced fishing effort, three HPMRs designated and more sustainable fishing methods by using private money to 'incentivise' these initiatives, working in close partnership with fishermen.

G8 Approaches for promoting compatible economic and socio-cultural development opportunities and for maximising/internalising the local benefits of MPAs. Such approaches are a key means of providing important incentives through generating development opportunities as a result of the MPA. Stakeholders and RAs are often best able to identify such opportunities for 'adding value' through the MPA, *e.g.* green tourism, green produce labelling, etc. However, it is critically important that such ideas are followed through, involving the commitment of both the public and private sector. Failure to do so can confound positive expectations that have been instilled in stakeholders through involvement in the MPA, particularly the identification of such compatible development opportunities, and undermine the development of partnership capacity.

G9 Institutional sustainability:

- provision of long-term socio-economic and administrative support and design of MPA management arrangements that are cost-effective
- Consistent approach by NCAs to MPAs is needed across the country to provide for both a 'level playing field' and a consistent strategic approach.
- Important that the 'buy-in' to MPA related initiatives is at all levels of institutions, whether a public (RA) or private (commercial and other interest groups) institution. This is important to avoid the loss of momentum should key supporters of MPA initiatives leave, provide for institutional support for individuals involved in MPA initiatives and support the provision of adequate resources to support MPA initiatives.

G10 Purpose-built, effective legislation:

MPA programs around the world with a history of successful implementation are supported by strong and effective legislation. This may be modified from existing terrestrial legislation, but this is usually an interim measure to allow designations while more appropriate laws are enacted. The laws will generally establish the legal basis for declaration, set out a statutory process to be followed in planning, consultation and implementation. This goes hand in hand with the crucial requirement that the legislation be binding on levels of government as well as individuals - otherwise local authorities or other agencies will simply disregard the MPA as a 'paper park'. It should be clear that while the planning process should attempt to resolve conflicts, a handful of objections need not prevent the establishment of the MPA where there are other clear benefits. Finally, legislation must contain significant disincentives for non-compliance in the form of penalty provisions.

Effectiveness of management.

All of the foregoing is largely an academic argument if the ability of all of the elements of MPA management to deliver the benefits to biodiversity conservation, endangered species recovery or fishery sustainability etc. is not objectively assessed, and management strategies adjusted according to the outcomes. Whilst there is a very substantial literature reporting on processes and techniques for designing MPAs to fit a host of requirements and objectives, relatively few report on how successfully these aims were achieved. WCPA has published guidelines on assessing the management of protected areas (Hocking *et al.* 2000), but these are not specific to MPAs. More recently. Pomerory *et al.* (2004) has produced an excellent guide on assessing management effectiveness of MPAs, although some of the measures proposed are not applicable to the UK situation. The UK, and specifically Natural England are involved in a joint project for

the OSPAR Commission to develop indicators of management effectiveness for OSPAR contracting parties. Based on these sources and the wider literature the following basic set of criteria were derived. For a detailed account see especially Pomeroy *et al.* (2004).

E1 Biodiversity and resource management outcomes. Any assessment of effectiveness of these goals hinges on clear and detailed objectives having been set during the planning process (P1). Typically, focussed studies will be carried out to determine to trajectory of a species, habitat type or community of interest. The recent review by Gubbay (2006) gives detailed of many of thee types of study. It is important that these take into account information about events or trends that have occurred within or adjacent to the MPA in the intervening period. This information in turn will only be available if there has been a regular and informed management presence conducting patrols, monitoring (Gerber *et al.* 2005) and enforcement activities.

E2 What are the levels of compliance with MPA management provisions? That is, has the MPA been effective in changing the behaviour of users to address the biodiversity or resource management issues? The examples presented in the previous section highlighted the risks to MPA success associated with ineffective (or absent) on-going management. Linton *et al.* (2002) report on the ongoing degradation of coral reef environments in the Caribbean where many MPAs are effectively ‘paper parks. The largest single contributor to these failures is non-enforcement of management provisions. Therefore it is critical to measure both the frequency and type of enforcement (and other compliance incentives), and the patterns of use in the area, ideally both in the presence and absence of visible management profile. Without this information, studies carried out under E1 (above) may draw the wrong conclusions.

E3 Management structures and strategies. One key measure of management effectiveness is whether the planning process actually resulted in the intended outcomes, i.e. was an MPA actually declared? Was a management plan drawn up and agreed with stakeholders? Were the agreed management provisions given force of law by regulations or other subordinate legislation? Was the management agency able to access the resources to undertake the management required?

E4 Management adaptability. A key plank in contemporary resource management methods is the concept of adaptive management; essentially a feedback loop built into the sequence of planning and ongoing management tasks to that it becomes an cycle aimed at iterative improvement of management outcomes, especially in the face of uncertainty (Grafton and Kompas 2005, Conservation Measures Partnership 2004). It is essential, therefore, that there are processes built into the management model that allow it to adapt to changing needs or reviews of its performance. Not possessing that capability represents a failure of management effectiveness.

6. A conceptual model of MPA management approaches

The criteria listed above can be integrated to derive a conceptual model of MPA management approaches. In essence this was done by ranking each of the MPA examples presented for each criterion, then pooling the ranks for each group of criterion. The pooled scores for the first two groups of criteria (P and G) were then used as axes on a two dimensional plot (figure 1). Superimposed on this plot are the pooled ranks for criteria in the third dimension (group E) represented by the size of the dots on the plot.

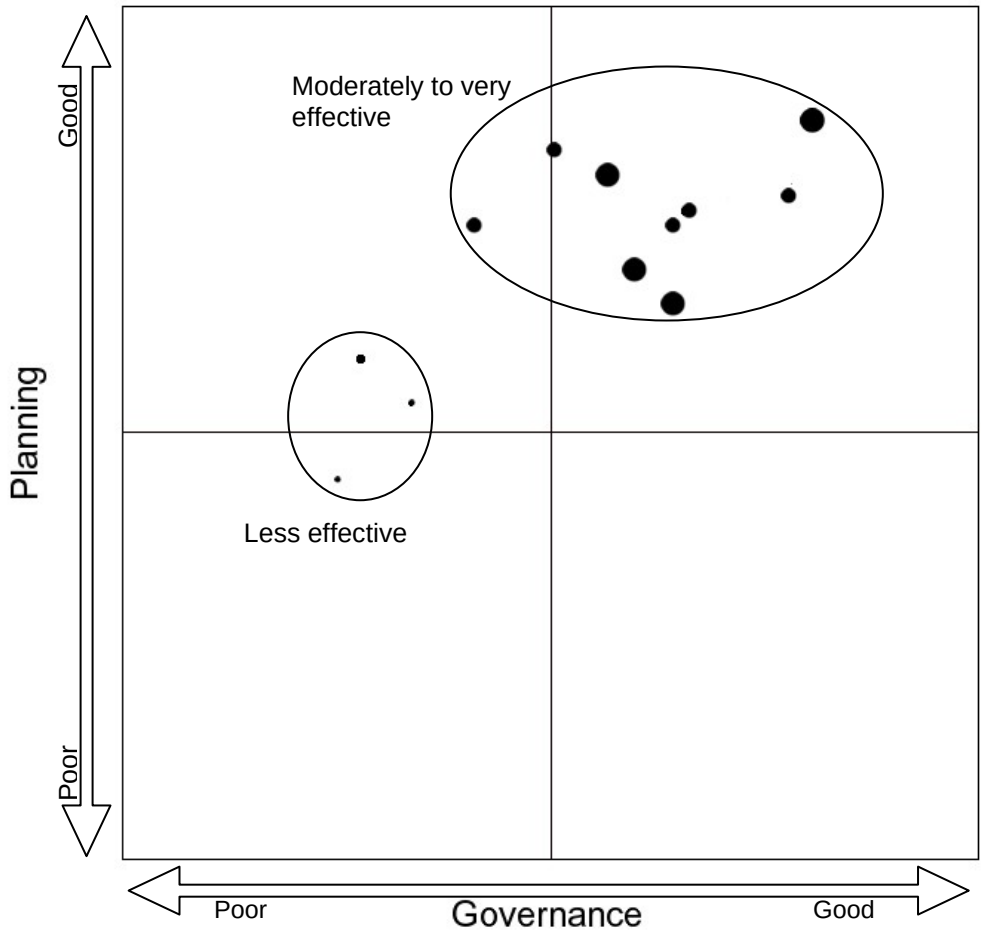

Figure 1: Conceptual model of MPA planning approaches.

The most obvious feature of this plot is that while most MPA models worldwide do a relatively good job of the technical and planning tasks associated with management, they perform less well in the ongoing administrative and governance tasks once the MPA is in place. The examples falling within the area labelled “less effective” include locations such as the Philippines and East Africa, where the commitment to an ongoing management presence has not been able to be sustained. In contrast, those examples that scored well include

locations such as South Africa, Australia, and European states, where technical expertise in the planning phase has been backed up by a formalised commitment to meaningful stakeholder involvement, strong and effective reserve legislation, and ongoing management and review.

This probably reflects the effort that has gone into developing, testing and implementing quantitative tools for MPA design in recent years, and the rise of GIS technologies as planning tools generally. These lend themselves to accurate step-by-step descriptions and quantitative testing and evaluation. In comparison, less material is published on the often more qualitative processes of consultation, integration and partnership building that are key to on-going good governance. It also reflects a bias in the selection of personnel to undertake MPA management. Overwhelmingly, staff within planning and regulatory agencies are drawn from a pool of university graduates with a strong emphasis on marine ecology and quantitative survey techniques, but much less emphasis on socio-economic research, management, communication and consultation skills.

Important trends

We have presented a variety of MPA management approaches around the world, which vary principally in:

- Design approaches
- Reserve philosophies
- Resourcing
- Commitment to on-going governance
- Legislative basis for reserve declaration

Whilst it is difficult to generalise about MPA approaches in Europe, there are some common threads.

The examples presented from France, Spain, and Italy all employ a combination of zones with differing levels of protection, typically a highly protected core surrounded by buffer areas. This is consistent with approaches taken in many other parts of the world. It is especially effective in mitigating edge effects of highly protected reserves, where the benefits in terms of enhanced biomass can be negated by over-exploitation at the margins (see Gubbay 2006 for a more complete discussion). Most European approaches also feature formal consultative processes or bodies. This has been taken a step further in the Italian Miramare Marine Nature Reserve with a co-management arrangement between the Italian WWF on behalf of the Italian Government.

The combination of zoned, multiple-objective MPAs which incorporate multiple layers of information in the planning process, and involve significant stakeholder input, is a global trend (Kelleher 1999). Equally important are the basic steps of clearly defining goals and objectives, and regular monitoring and evaluating the extent to which management of the MPA has achieved these (Lundquist and Greek 2005, Stem *et al.* 2005), so that it can be modified as necessary.

The most effective MPA models are those which use structured and quantitative approaches to design, have a purpose-built and effective legislative base, but even more importantly, have significant, well resourced and visible on-going management presence. This is especially true in developing nations, where foreign aid funds and assistance have been provided to plan and set up MPA systems (e.g. Belize, Madagascar, Philippines). In some

cases these nations have subsequently been unable to provide the long-term commitment to management, resulting in poor compliance and the failure of the MPA, although there is evidence that this is being rectified (Francis *et al.* 2002). There is no such excuse available to affluent 1st world nations. While certain characteristics of MPA design are more likely to fail as a result of non-compliance (Kritzer 2004), the reasons for non-compliance often stem from failure to effectively involve stakeholders, rather than from failures in technical design.

Australia's Great Barrier Reef Marine Park is at times held up as a potential model for UK MPA management. Whilst aspects of the GBRMP model are without question desirable in MPA management, the model is probably unsuitable to transplanting into the UK situation. There are important cultural and practical differences, such as: The GBR, prior to the declaration of the MPA and subsequently, had a very high profile nationally and internationally; the entire region is now world heritage listed. Export earnings to the country from tourism in the region significantly outweigh fisheries income, so there is an active incentive to maintain and enhance its "unspoilt" appeal as a tourist destination. At the time of its declaration in 1975 (Great Barrier Reef Marine Park Act 1975) and even today, the levels of use when considered over the entire resource are very low compared with most other coral reef areas, or coastal zones in (e.g.) the Mediterranean, the Americas, the UK or southeast Asia. The planners do not have to deal with trans-national issues or edicts imposed by administrative bodies such as the EU. Lastly, and very importantly, there is very strong and widespread public support for robust conservation efforts.

The examples presented previously and the analyses described above can be encapsulated in a set of principles of effective MPA management that are common to other areas and important for the UK, especially:

- Strong and purpose built planning and governance legislation,
- a statutory and genuine commitment to stakeholder involvement in management,
- planning at the ecosystem scale incorporating considerations of critical habitat preservation, representative, comprehensive and adequate habitat capture,
- provision of highly protected core zones augmented by buffers within a managed framework,
- adaptive management processes characterised by quantitative assessments against agreed objectives,
- and a well-resourced visible, positive management presence.

7. Recommendations:

Recommendations arising from this study are presented at two levels: **Strategic recommendations** are directed at legislators and policy makers, to give direction to the institutional arrangements that should underpin sound MPA management. Without this legislative and policy foundation, the **Practical recommendations**, which are aimed at planners, interested parties and local organisations involved in the day-to-day tasks of planning and operation in a MPA, are likely to fail.

Strategic Recommendations

Some of these recommendations match those provided in various forms as part of the consultation process for the development of the Marine Bill (see especially Mee 2006). They are presented here in summary form to aid readability.

In broad policy terms, these recommendations follow on from, and provide additional detail to, key recommendations raised by the Review of Marine Nature Conservation report (DEFRA 2004).

Statement of overall objectives for a system of MPAs in the UK.
There is a need for a clear articulation, at an all-of-government level, of the national objectives for Marine Protected Areas in the UK. It could contain the following elements, and be echoed in the intent of the legislation:

- Protection of threatened or endangered habitats and species
- Maintenance of overall ecological viability (resilience) of the system in the face of global change and human pressure
- Enhancement and sustainability of exploitable fish stocks and the livelihoods of fishing communities
- Representation of the whole range of habitats / biotopes according to the JNCC classification
- Provision for the recovery of degraded sites, so that they may eventually return to providing ecosystem or economic services .
- Maintenance of the recreational value and potential of the seas and coasts

Recognising Marine Nature Conservation as a valid competing use for space and resources in UK coastal and marine areas.
The Marine Bill represents a unique opportunity to introduce a rational policy for creating and managing marine protected areas. This must consider the requirement for marine nature conservation as an essential use of marine environments, in parallel with the legitimate needs of other uses including fishing, recreation, energy supply and mineral extraction. Globally, fishing is increasingly recognised as the largest source of pressure on marine biodiversity and we need to address complex issues such as sovereignty if we are to keep this pressure under control and achieve sustainable use of our marine resources.

Adoption of the concept of Marine Spatial Planning as a means of identifying and resolving conflicting uses in coastal and marine areas.

Marine spatial planning (MSP) will be an important tool for helping to meet as many of the stakeholder needs as possible, consistent with contemporary calls for an ecosystem approach to marine resource management (eg. Laffoley *et al*. 2004). In order to do this effectively it should operate at the ecosystem scale, and cover UK waters from MHWS to the limit of the EEZ. In common with many modern regimes such as the CBD, NSMD, and European Marine Strategy, we envisage adaptive management (see Lafolley *et al*. 2005) as an overarching strategy for marine resource management.

As a central plank of MSP, revise and simplify the range of MPA designations in use in the UK, whilst providing effective legislative support (see below).

Currently, there is a plethora of designations for marine and coastal protected areas that is confusing to stakeholders and difficult to manage in an effective manner. Examples include SACs (Natura 2000 sites), SPAs, SSSIs, MEHRAs (soon to be established), MNRs (a failed concept), World Heritage Sites, Ramsar sites, AONBs, VMCAs, Important Bird Areas, pilot NTZs. The current system is not only confusing and unwieldy to manage but scientifically flawed, as it does not allow for changing conditions caused by global warming or, in some cases, natural coastal dynamics. Many of these designations have failed to achieve their objectives (where expressed) because a lack of legislative power and/or management commitment. Many nations around the world have mature and successful MPA networks, which recognize and allow for multiple use whilst protecting critical elements. There is no logical reason for these tried and tested concepts not to be adopted in the UK.

The basic architecture of a revised system should include statutory NTZs, Buffers, and managed areas, similar to the approaches used successfully in many parts of the world. It is crucial that those designations, once agreed, are binding on users and all levels of government.

We suggest that there should be an aspirational target of 20% of all UK's coasts and waters as MPAs (NTZ or otherwise) by 2020 and an operational target of 10% by 2012. This would comply with the spirit of the agreements of the WSSD.

Simplify and strengthen management structures for MPAs and marine resource management.

These should be structured around a centralised lead agency for MSP and MPA planning and strategic direction, with devolution of both powers and sufficient resources for an ongoing effective management presence. The management structures should include a formalised MoU for complementarity, rather than competing reserve systems, between MPA and fisheries managers.

We favour direct management control with local supervision. It should provide for clear common objectives and regional-sea ecosystem objectives, a Marine Management Organisation to balance the environmental, social and economic considerations and ensure compliance, and independent Nature Conservation agencies backed by commissioned research. There is a need to ensure that the process is devolved as much as possible in order that stakeholders do not have the feeling of remote control of the process. Each MPA will have its own day-to-day locally based administration, appropriately scaled according to circumstances. Coordination of enforcement agencies is critically important and enabling them to act on one another's behalf for a wide range of issues. This will require capacity building as well as a careful evaluation of powers and intensity of deployment.

Purpose-built and strong legislation for MSP and MPA declarations, which establishes an independent management organisation, enshrines the status of MSP and MPAs in law, and underpins MPA designations, once negotiated and approved, as binding to all.
The development of a comprehensive system of MPAs which can fulfil the objectives outlined above will not be successful without new legislation (through the Marine Bill process). Similar pieces of legislation in other parts of the world typically create the head of power for MPA designations of various types, including establishing the authority of the designations in relation to other laws and agencies. The legislation should stipulate a cyclical statutory process for MPA investigation, consultation, approval, implementation and periodic review. The review should encompass contemporary adaptive management practises. Meaningful stakeholder involvement should be a key statutory provision.

Practical Recommendations

These are aimed at planners, local managers and stakeholders as a set of practical suggestions for good MPA management practise, based on the literature covered in the course of the project, but also on the experiences of the project team. They are included in the report at the request of NCAs looking for practical advice to help them manage their areas more effectively.

Planning and Technical Issues

The need for clear objectives, driven by stakeholders as well as managers.
Management, and especially planning, starts from an agreed set of objectives. These include biodiversity conservation or species recovery objectives driven by the management agency, but also stakeholder objectives for the area. This set of objectives should be developed, understood and agreed by managers, users, and the wider public at the outset. The agreed objectives should be supported by detailed, measurable goals. These include operational (e.g. management presence at least once per month) as well as conservation (e.g. maintenance of seagrass bed area) goals.

Use spatially integrated planning processes to generate options:
A typical planning process would involve:

- Document state of the resource, patterns of use (who is doing what where, both now and possible future use), drivers for change (e.g. climate change scenarios).
- Assemble this information from "traditional sources" i.e. structure resource surveys, habitat mapping, aerial photo interpretation, but also from stakeholders themselves – historical uses of the area, economic significance to local economy, social and cultural significance of important sites.
- Overlay these layers of information to identify latent or current conflicts.
- Use available quantitative tools to generate options consistent with the agreed set of objectives, with relative "costs" attached. Once the options have been generated, use stakeholders to evaluate and agree on preferred option.

BUT don't get too hung up on the technology. It's important for stakeholders to understand the process – a "black box" approach to generating a "solution" will disenfranchise users who feel they have no control.

Iterative public participation
The planning process includes iterative public participation phases. You may have to do this several times to resolve outstanding issues. This is normal, as long as you are making progress.

Good Governance Issues

Commitment to meaningful stakeholder participation.

What does this mean? It can be helpful to ask yourself these questions:

- Is everyone represented?
- Are there opportunities for input to: objectives, process, MPA design, ongoing management arrangements, review and evaluation, changing management practises in response (all the items in the generalised process)?
- Am I using the whole toolkit of public participation ideas? E.g. Local consultative committee; Databases of registered interested parties; targeted mail outs (e.g. management options, structured questionnaires to help resolve particular issues); regular feedback (newsletters, annual reports) of information that is useful and interesting to stakeholders.

One useful model is strategic planning for long-term goals. To start, it is easier to get agreement on a (say) 25 year vision. With this agreed, then work backwards in steps: To get there in 25 years, where do we need to be in 5? So what do we have to do next year? However, such a process involves considerable commitment in terms of time and resources, and may require professional facilitation skills.

The need for both planners and stakeholder to have realistic expectations.

You will encounter uncertainty and changed circumstances. Expect to not know everything, and make sure stakeholders understand this as well. You will encounter conflict – if you don't you're missing something! By agreeing on the objectives in the first place, the planning process can be robust enough to find the trade-off to make it work.

Monitoring must be inclusive as well as scientifically robust.

Monitoring should include system state, but also processes / pressures. It should include control sites so that when change occurs you have a chance of identifying the cause with some confidence. Monitoring also includes user activities; this can be done by the management agency or by users themselves). Monitoring also includes management activities, by the management agency concerned. Be aware that if the agency has given a commitment to certain management actions, then the users will also be monitoring you.

Commitment to long-term management presence at the local level.

A large part of good governance is achieved by simply being there. A relatively low-key local presence that is interested and involved in the community and its members is more effective than a PR blitz followed by 5 years of silence.

MPAs are a long-term strategy, not a quick-fix.

Remember that management is adaptive and long-term. It is important, especially in areas where the concept is new, to allow time for the MPA concept and the management presence to become "part of the furniture", rather than trying to address all the outstanding issues at once. An apparent solution for one MPA may not be the best for the whole system
Heavy handed top-down solutions (whilst a useful "incentive") are often bad in the long run – destroy carefully nurtured confidence of stakeholders in the planning process.

Effectiveness issues

Plan for adaptive management based on reviews by both managers and stakeholders

Plan at the outset for periodic review and evaluation of MPA effectiveness. Stakeholders should understand this process also, and have input into the evaluation, as in the original planning process.

Know what you are evaluating, and how.

Management effectiveness will be evaluated against the agreed objectives (e.g. Biodiversity, Socio-economic, Cultural); these could be expressed as a hierarchy. It is also evaluated against operational objectives, such as: User behaviour (compliance) and consequences (prosecutions); Management behaviour – have operational goals been met? Like monitoring, studies on management effectiveness should be robustly designed (e.g. incorporating BACI principles) to give confidence in the outcomes.

What do you do if…? Anticipate the management response.

Assessment of effectiveness is pointless without a mechanism to respond to the results. This need a clear adaptive management cycle, understood by stakeholders. It should include scenario triggers for change. E.g. what if biodiversity objectives are met, although User behaviour targets are not? What if biodiversity objectives are not met, but user behaviour targets are?

The bottom line

There is no single prescriptive "best" solution for MPA management, much hinges on social and cultural context. However, the underlying principles are virtually universal:

- Clear goals and objectives.
- Involve stakeholders throughout.
- Sound, objective information base.
- Strong, workable legal basis for designations
- Commitment to ongoing active management.
- Assessment of effectiveness.
- Adapt management in response.

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APPENDIX A

Policy drivers for MPAs in the UK

This section contains excerpts from a number of international and national policies that require the creation of a network of MPAs or facilitate the participatory mechanisms that enable their development. Emerging UK policy (such as the Marine Bill) will have to be developed in the context of these commitments).

Global level agreements:

(i) Convention on Biological Diversity (the Convention was signed in 1992)
agreed to establish… 'by 2012 in the marine area a **global network of comprehensive, representative, effectively managed national and regional protected area systems**'.

(ii) World Summit on Sustainable Development (2002)
agreed … 'to establish **marine protected areas consistent with international law and based on scientific information, including representative networks, by 2012** and time/area closures for the protection of nursery grounds and periods, proper coastal land use, and watershed planning, and the integration of marine and coastal areas management into key sectors'. This very strong commitment facilitates the development of protected areas with multiple functions as part of an integrated planning process.

Regional level agreements

(i) EC Habitats and Birds Directives
The Habitats Directive requires Member States to designate special areas of conservation in order to create a **coherent European ecological network**. In 1999 the UK Courts ruled that the Habitats Directive applies to Member States' EEZ or equivalent.

(ii) OSPAR Convention (applies to all UK marine areas)
Recommendation to establish by 2010 '**an ecologically coherent network of well managed marine protected areas**'. Contracting Parties would identify the first set of such areas by 2006, establish what gaps then remain and complete by 2010 a joint network of well-managed marine protected areas that, together with the Natura 2000 network (from the EC Habitats and Birds Directives), is ecologically coherent.

(iii) 2002 Ministerial Declaration of the Fifth International Conference on the Protection of the North Sea (applies to the North Sea and part of the English Channel)
promotes … 'the establishment of **a network of marine protected areas to ensure the sustainable use, conservation and protection of marine biological diversity and its ecosystems**'.

Emerging EU Policy

(i) Towards a strategy to protect and conserve the marine environment (Brussels, 02.10.2002 COM(2002) 539 final)

‘Some **problems** have been already noticed when dealing with the **management of marine protected areas**. They mainly concern the competence to adopt measures in these a reason the grounds of nature conservation needs and which are aimed at regulating, *inter alia*, activities like fishing, transport or dredging. Commission services are considering how to integrate these different policies, and the outcomes of some research and LIFE projects will undoubtedly contribute to that.’

(ii) Promoting more environmentally-friendly fishing methods: the role of technical conservation measures (Brussels, 21.6.2004 COM(2004) 438 final)
‘To **protect sensitive habitats** it may be necessary to **close the area to some type of fisheries**. A recent example of such a measure is the Commission Regulation to protect deep-water coral reefs off North-West Scotland. The Commission intends to be proactive in taking more measures of this nature in well-identified cases.’

(iii) Promoting more environmentally-friendly fishing methods: the role of technical conservation measures (Brussels, 21.6.2004 COM(2004) 438 final)
Achieving the cooperation and consent of the fishing industry **requires greater stakeholder involvement** in devising, testing, and implementing technical measures. The fishing industry’s participation in assessing the value of existing measures and formulating new ones should also help to ensure that the rules are more clearly expressed and understandable and that any potential difficulty in implementation has already been tackled.

UK Government Policy Documents (note that the UK has subscribed to or adopted all the international policies listed in previous sections, current statutory requirements are described in section qq)

(i) Net Benefits: A sustainable and profitable future for UK fishing (PM’s Strategy Unit, March 2004)
“The UK Government and devolved administrations should develop an **experimental programme of Marine Protected Areas – focussing initially on areas which provide benefits to multiple users** (commercial fishing, tourism, environment, recreational fishermen, etc).”

(ii) Review of Marine Nature Conservation RMNC Working Group, July 2004)
“An **ecologically coherent and representative network of marine protected areas should be identified and established**, and appropriate and proportionate measures applied to ensure their conservation needs are met.”

(iii) Turning The Tide: Addressing the Impact of Fisheries on the Marine Environment Royal Commission on Environmental Pollution, December 2004)
“the UK Government should develop selection criteria for establishing a **network of marine protected areas** so that, **within the next five years, a large-scale, ecologically coherent network of marine protected areas** is implemented within the UK. This should lead to 30% of the UK’s exclusive economic zone being established as no-take reserves closed to commercial fishing.”