

**Highly Protected Marine Reserves –
Evidence of Benefits and Opportunities
for Marine Biodiversity in Wales**

S. Gubbay

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CRYNODEB GWEITHREDOL

Mesur hirsefydlog ar gyfer rheoli gweithgareddau dynol yn amgylchedd y môr yw Ardaloedd Morol Gwarchodedig (AMGau). Mae Llywodraeth y DU wedi ymrwymo i sefydlu AMGau er mwyn cynorthwyo i gyflawni ei nodau strategol ar gyfer amgylchedd y môr; nod arall yw gwireddu gweledigaeth y DU, sef “cefnforoedd a moroedd glân, diogel, cynhyrchiol a biolegol-amrywiol.” Mae'r Llywodraeth hefyd wedi ymrwymo i enwi a dynodi ardaloedd perthnasol moroedd y DU yn ardaloedd gwarchod y môr sy'n perthyn i “rwydwaith o safleoedd sydd wedi'u rheoli'n dda erbyn 2010”. Cytunwyd ar y weledigaeth a'r ymrwymiad hwn ledled y DU gan yr holl weinyddiaethau a ddatganolwyd ac yn eu plith mae Llywodraeth Cynulliad Cymru (LICC).

Gall amcanion AMGau amrywio'n fawr iawn ac mae cwmpas eang i faes rheoli'r gweithgareddau mewn AMGau, o ymyrryd cyn lleied ag y bo modd hyd at waharddiad cyfan gwbl. Yn yr ail achos mae'r AMGau canlyniadol yn cael eu galw'n “Warchodfeydd Morol Tra Gwarchodedig” (GMTGau) yn aml. Yn yr adroddiad hwn caiff y term Gwarchodfa Forol Tra Gwarchodedig (GMTG) ei ddiffinio fel a ganlyn;

“Unrhyw lecyn o dirwedd rynglanwol neu islanwol, ynghyd â'i ddyfroedd gorchuddiol a'i fflora a ffawna cysylltiedig, lle mae cloddio am ac/neu osod i lawr fywyd morol, sylweddau, gwrthrychau ac ynni yn cael ei wahardd gan y gyfraith. Mae'r llecyn hwn hefyd yn cael ei warchod rhag defnydd dynol niweidiol arall.”

Mae Cyngor Cefn Gwlad Cymru wedi hysbysu'r Llywodraeth bod Gwarchodfeydd Morol Tra Gwarchodedig (GMTGau) yn rhan angenrheidiol o ganlyn arni â'r Dull Ecosystem o ymdrin â dyfroedd Cymru er mwyn sicrhau y bydd ecosystemau arforol Cymru yn cael eu gwarchod a'u hadfer. Cafodd yr adroddiad hwn ei gomisiynu gan Gyngor Cefn Gwlad Cymru er mwyn ein cynorthwyo i ddeall, yn fwy manwl, beth wy'r manteision terfynol i gadwraeth natur (yn cynnwys sut mae bioamrywiaeth ac ecosystemau yn gweithredu) y gallem ddisgwyl eu cael o ganlyniad i sefydlu GMTGau yn nyfroedd Cymru.

Rhwng 1990 a 2001 cyhoeddwyd mwy na 200 o astudiaethau ar effeithiau AMGau mewn deunydd darllen blaenllaw a adolygwyd gan gymheiriaid. Mae dogfennau helaeth i'w cael hefyd ar effeithiau AMGau, gan gynnwys GMTGau, mewn adroddiadau prosiect, adolygiadau cadwraeth, newyddlenni, trafodion cynadleddau a ffynonellau eraill. Mae'r adroddiad hwn yn canolbwyntio ar ddarganfyddion astudiaethau ar ecosystemau tymherus ac ar effeithiau sy'n berthnasol i gadwraeth natur. Caiff astudiaethau achos eu defnyddio i ddisgrifio effeithiau'r GMTGau ar bedwar math o gynefin tymherus; traethlinau rhynglanwol creigiog; cynefinoedd dŵr lled hallt, gwaddod meddal isarforol bas a riffiau creigiog isarforol.

Bydd union fanteision y GMTGau i'r amrywiaeth forol yn y dyfroedd o amgylch Cymru, yn dibynnu ar wahanol ffactorau fel beth sy'n bresennol yn yr ardal ddewisedig ac ym mha gyflwr y bydd pan mae'r GMTG yn cael ei sefydlu. Fodd bynnag, ar sail y dystiolaeth sy'n bodoli mae rhai egwyddorion cyffredinol yn bosibl. Dyma'r manteision y mae ecosystem forol Cymru yn debygol o'u cael dros amser:

- Dwyseddau, biomas, amrywiaeth a meintiau uwch o rywogaethau neilltuol neu grwpiau o rywogaethau
- Atal cynefinoedd y môr rhag cael eu difrodi a'u dirywio yn ffisegol

- Manteision i gymunedau ac ecosystemau fel cymhlethdod helaethach o we fwydydd a rhagor o gynhyrchiant crai ac eilaidd
- Lle ac amser i gefnogi adferiad ac adfywiad y cynefinoedd sy'n dirywio a'r rhywogaethau sy'n prinhau
- Meithrin ac ategu gwytnwch mewn ecosystemau
- Darparu mannau cyfeirio er mwyn astudio a gwella'r dealltwriaeth sydd gennym o effeithiau gweithgareddau dynol ar amgylchedd y môr a systemau natur.

Mewn unrhyw ardal yng Nghymru sy'n cael ei dynodi yn GTMG mae'n bur debyg y bydd y manteision uchod yn amlwg i'w gweld. Fodd bynnag, o gofio pa mor gymhleth yw ecosystemau'r môr, mae'n anodd rhagweld yr union effeithiau ecolegol y gellid disgwyl eu cael mewn unrhyw leoliad penodol.

Er gwaethaf yr ansicrwydd ynghylch union effeithiau'r GTMGau, mae'r dystiolaeth yn awgrymu'n gryf mai manteision cadarnhaol a fyddant. Bydd y manteision hyn yn cynyddu yn y tymor hir, yn arbennig felly o ran hybu adferiad a gwytnwch ecosystemau'r môr.

Ystyriaethau pellach

Cafodd meini prawf dewis safleoedd posibl eu trin a'u trafod yn yr adroddiad. Fodd bynnag, dim ond cymorth i'r penderfyniadau a wneir yw'r meini prawf dewis safleoedd hyn, ac nid offeryn manwl gywir ar gyfer penderfynu ble y dylai'r GTMGau fod. Nid penderfyniad hollol wyddonol a dim arall fydd y penderfyniad terfynol a wneir ynghylch ble y lleolir y GTMGau am fod proses dewis safleoedd yn gorfod bod yn un gynhwysol. Bydd cyfleoedd i sawl grŵp a diddordeb gymryd rhan ynddi er mwyn sicrhau y rhoddir ystyriaeth i fuddiannau economaidd-gymdeithasol.

Mae sefydlu GTMGau yn golygu cyfyngiadau a manteision cymdeithasol ac economaidd a chafodd y rhain eu trafod mewn gweithdy yn gysylltiedig â'r prosiect hwn (gweler Atodiad 1). Mae'n rhaid rhoi ystyriaeth benodol i'r tri mater hwn;

- pa mor dda mae'r GTMGau yn cyfannu'r trefniadau, a'r cyfleoedd rheoli – presennol ac arfaethedig;
- ymwybyddiaeth o'r costau a'r manteision;
- a hybu dealltwriaeth pobl o bob agwedd ar y GTMGau

EXECUTIVE SUMMARY

Marine Protected Areas (MPAs) are a well established measure for managing human activities in the marine environment. The UK Government is committed to establishing MPAs to help achieve its strategic goals for the marine environment and to achieve the UK vision of “clean, healthy, safe, productive and biologically diverse oceans and seas”. Government is also committed to identifying and designating relevant areas of the UK’s seas as areas of marine protection belonging to “a network of well-managed sites by 2010”. This vision and commitment has been agreed across the UK by all the devolved administrations including the Welsh Assembly Government (WAG).

The objectives of MPAs can be very varied and the management of activities within MPAs covers a broad spectrum from minimal intervention to total prohibition. In the latter case, the resulting MPAs are often referred to as ‘Highly Protected Marine Reserves’ (HPMRs). In this report the term Highly Protected Marine Reserve (HPMR) is defined as;

“Any area of intertidal or subtidal terrain, together with its overlying waters and associated flora and fauna, in which extraction and/or deposit of marine life, substances, articles and energy is prohibited by law and which is also protected from other harmful human uses”.

The Countryside Council for Wales (CCW) has advised WAG that Highly Protected Marine Reserves (HPMRs) are a necessary element of taking forward the Ecosystem Approach in Welsh waters in order to secure the protection and recovery of Welsh maritime ecosystems. This report has been commissioned by CCW to help develop a more detailed understanding of the likely nature conservation (including biodiversity and ecosystem functioning) benefits that may be expected to result from establishing HPMRs in Welsh waters.

More than 200 studies into the effects of MPAs were published in peer reviewed primary literature between 1990 and 2001. There is also extensive documentation on the effects of MPAs, including HPMRs, in project reports, conservation reviews, newsletters, conference proceedings and other sources. This report focuses on the findings of studies on temperate ecosystems and on effects relevant to nature conservation. Case studies are used to describe the effects of HPMRs on four temperate habitat types; rocky intertidal shores, brackish water habitats, shallow sublittoral soft sediment, and shallow sublittoral rocky reefs.

The precise benefits of HPMRs to marine biodiversity in the waters around Wales will depend on a variety of factors including what is present in the selected area and its condition when the HPMR is established. However, based upon the available evidence some general predictions are possible. The following benefits to the Welsh marine ecosystem are likely to accrue over time:

- Higher densities, biomass, size and diversity of certain species or groups of species.
- Prevention of physical damage and degradation of marine habitats
- Community and ecosystem benefits such as greater complexity of food webs and increased primary and secondary productivity
- Space and time to support the recovery and restoration of degraded habitats and declining species
- Building and supporting resilience in ecosystems
- Provision of reference areas for studying and improving understanding of the impacts of human activities on the marine environment and natural systems

It is likely that any area in Wales given HPMP status would display one or more of these above benefits. However, predicting the exact ecological effects that could be expected at any given location is difficult given the complexity of marine ecosystems.

Despite uncertainties over the exact effects of HPMPs, the evidence strongly suggests that they will be positive and that these benefits will accrue over the long term, particularly in enabling the recovery and resilience of marine ecosystems.

Further considerations

Potential site selection criteria have been discussed in the report. However, site selection criteria are only an aid to decision-making rather than a precise tool for deciding where HPMPs should be. The final decision on where HPMPs are located will not be a purely scientific one as site selection needs to be an inclusive process, with opportunities for the many interested parties to play a part in order to ensure that socio-economic interests are taken into account.

Social and economic constraints and benefits of establishing HPMPs were discussed in a workshop associated with this project (see Annex 1). Three issues which need particular consideration are;

- how well HPMPs compliment existing and proposed management arrangements, activities and opportunities;
- awareness of social costs and benefits of selecting particular locations;
- and promoting public understanding of all aspects of HPMPs

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1 BACKGROUND, AIMS & OBJECTIVES

Marine Protected Areas (MPAs) are a well established measure for managing human activities in the marine environment. One of the earliest, if not the first, was the Fort Jefferson National Monument in Florida which was designated in 1935 covering 18,850ha of sea and 35ha of coastal land. There are some 4,600 MPAs today, with a total area of around 2.2 million square kilometers (Wood, 2005).

Under the 1992 Convention on Biological Diversity, Contracting Parties agreed to establish a global network of MPAs by 2012. Technical advice on how to achieve this is being provided by subsidiary bodies and a marine expert group. The latter have provided guidance on how marine and coastal protected areas, including highly protected areas, should contribute to a national framework for sustainable use of marine and coastal biodiversity (UNEP/CBD, 2003) (Box 1).

BOX 1 Elements of a national framework for sustainable use of marine and coastal biological diversity identified by the *ad hoc* Technical Expert Group on Marine & Coastal Protected Areas under the auspices of the Convention on Biological Diversity.

“...a national framework for ensuring sustainable use of marine and coastal biological diversity should contain the following components, each of which is needed to achieve the desired results:

A primary network of representative highly protected areas, i.e. areas where extractive uses are excluded, and other significant human pressures are removed or minimised, to enable the integrity, structure and functioning of ecosystems to be maintained or recovered;

An ancillary network of marine and coastal protected areas to contribute to the biodiversity objectives of the representative highly protected areas, where threats are managed for the purpose of biodiversity conservation and/or sustainable use and thus where extractive uses are allowed; and

A framework of sustainable management practices over the wider marine and coastal environment.”

UNEP/CBD/SBSTTA/8/INF/7, Para 44.

The UK Government is committed to establishing MPAs to help achieve its strategic goals for the marine environment and to achieve the UK vision of “clean, healthy, safe, productive and biologically diverse oceans and seas”. Government is also committed to identifying and designating relevant areas of the UK’s seas as areas of marine protection belonging to “a network of well-managed sites by 2010” (Defra, 2002). This vision and commitment has been agreed across the UK by all the devolved administrations including the National Assembly for Wales/Welsh Assembly Government.

The majority of existing UK MPAs are European marine sites (marine “Special Areas of Conservation” or “Special Protection Areas”) that have been designated or classified to fulfill the specific requirements of the EC Habitats and Species Directive and the EC Birds Directive. As of December 2005, there were 42 European marine sites in UK waters covering 9,109 km² (European Commission, 2006). Most are adjacent to the coast and many incorporate intertidal areas.

There are 5 European marine sites in Wales. These cover about 30% of the territorial sea and 48% of the coastline (Dernie, *et al.* 2006, Brazier *et al.*, *in prep*). Two additional sites (the Dee estuary and the Severn estuary) are proposed marine SACs, and there are two terrestrial SACs in Wales which include marine features (Figures 1 & 2).

Figure 1. Marine Special Areas of Conservation in Wales

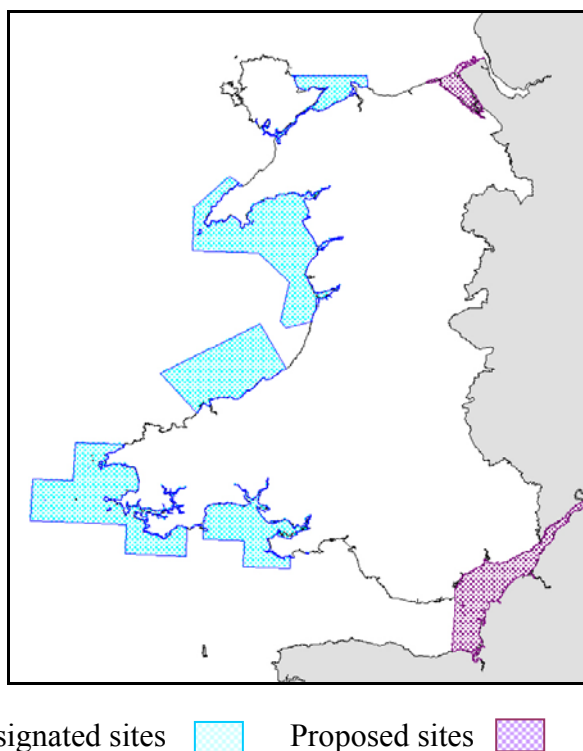


Figure 2. Tidal rapid communities in the Menai Strait marine SAC



A programme of identifying candidate European marine sites in UK offshore waters (between 12-200nm from the coast) is being undertaken by the Joint Nature Conservation Committee (JNCC). Eight locations are currently under consideration but none of these are adjacent to the territorial sea adjacent to Wales¹.

The intertidal areas of Sites of Special Scientific Interest (SSSIs) can also be considered MPAs. In Wales 127 SSSIs intersect with the intertidal and 81 of these have an intertidal species, habitats or both biological and geological qualifying features (Figure 3). The total area of intertidal habitats within SSSIs (42,233.05ha) covers 83% of the Welsh coast and 48% of these SSSIs are within the 5 European marine sites (Brazier *et al.*, *in prep*).

¹ http://www.jncc.gov.uk/protectedsites/sacselection/SAC_list.asp?Country=OF SACs in UK Offshore waters. JNCC webpage, downloaded 21/7/06



Figure 3. Part of the intertidal zone of the Kenfig Sands SSSI.

The objectives of MPAs can be very varied. They include the conservation of biodiversity, protection of cultural heritage, fisheries management and increasing scientific knowledge (IUCN, 1999). The management of activities within MPAs also covers a broad spectrum from minimal intervention to total prohibition. In the latter case, the resulting MPAs are often referred to as 'Highly Protected Marine Reserves' (HPMRs).

The possibility of establishing statutory HPMRs for biodiversity conservation in UK waters has been discussed for many years (e.g. Warren & Gubbay, 1991). The closest example to date is a 'No-take Zone' within the Lundy Island Marine Nature Reserve which came into force in early 2003 (Hoskin *et al.*, 2005). Interest in HPMRs is currently high because of the opportunity to introduce specific measures for improving nature conservation in the waters around England and Wales, and in UK offshore waters in a Marine Bill being drafted by Government (Defra 2006).

Based on available evidence, the Countryside Council for Wales (CCW) has advised the Welsh Assembly Government (WAG) that HPMRs are a necessary element of taking forward the Ecosystem Approach in Welsh waters and for securing the protection and recovery of Welsh maritime ecosystems (Dernie *et al.*, 2006).

This report has been commissioned by CCW to help develop a more detailed understanding of the nature conservation (including biodiversity and ecosystem functioning) benefits that may be expected from establishing HPMRs in Welsh waters and some background on socio-economic and legal constraints and benefits. Specific aims of the report are to inform CCW's thinking in relation to HPMRs and in particular to;

- provide an overview of the effects of HPMRs on ecosystems, habitats and species in temperate waters
- suggest potential outcomes of HPMRs in Wales and the types of species, habitats and ecosystem goods and services that might benefit most.

As part of the background research for this report a workshop was held in September 2006 to discuss the legal, social and economic constraints and benefits of establishing HPMRs in Wales. Written briefings and verbal presentations provided background material and the participants, who represented a cross-section of interests in sustainable development in the marine environment, were tasked with identifying and discussing legal, environmental, social and economic constraints and benefits. The workshop report and associated briefing papers can be found in Annex 1.

2. CURRENT UNDERSTANDING AND STATUS OF HPMRS

Marine Protected Areas (MPAs) are one of a number of management tools which are being used around the world for the conservation of biodiversity. Many of the first MPAs were small extensions of terrestrial protected areas with the marine sections being included to simplify boundary definition (Gubbay, 1995). As support for MPAs has grown, marine sites have been established in their own right. While most are still in relatively shallow waters adjacent to the coast or close inshore where there is greatest pressure on marine systems from human activities, this is changing (Kellerher *et al.*, 1995). MPAs are being established far from land as well as to protect biodiversity in the deep sea as our knowledge of offshore environments and the impacts of human activity on these environments has grown (e.g. Santos *et al.*, 2003).

Highly Protected Marine Reserves (HPMRs) have existed as a type of MPA for many years. In previous centuries they would have been *de facto* reserves – locations where access was difficult and which were therefore left largely undisturbed and unexploited. Today, with virtually all parts of the ocean accessible and with modern technology facilitating resource extraction from the seas at an unprecedented rate, HPMRs are more likely to be deliberately selected areas which have been given legal protection.

Roberts & Hawkins (2000) have estimated that the combined area of the world's MPAs cover less than half a percent of the oceans. Furthermore they estimate that perhaps only one ten thousandth of the sea is legally protected from all forms of fishing. Based on these figures, legally protected HPMRs only cover a very small percentage of the area of the oceans.

2.1. Definitions

There are numerous definitions and interpretations of what is meant by a Marine Protected Area. The World Conservation Union (IUCN) has defined MPAs as;

“Any area of intertidal or subtidal terrain, together with its overlying waters and associated flora, fauna, historical and cultural features, which has been reserved by law or other effective means to protect part of all of the enclosed environment”. (IUCN, 1988)

This is a very broad definition and it encompasses all six categories of protected area used by IUCN, where each category has a different overall objective (Table 1).

Table 1 IUCN Protected Area Categories (IUCN, 1999)

CATEGORY	OBJECTIVE
Ia Strict Nature Reserve	Protected area managed mainly for science
Ib Wilderness Area	Protected area managed mainly for wilderness protection
II National Park	Protected area managed mainly for ecosystem protection and recreation
III Natural Monument	Protected area managed mainly for conservation of specific natural features
IV Habitat/Species Management Area	Protected area managed mainly for conservation through management intervention.
V Protected Landscape/ Seascape	Protected area managed mainly for landscape/seascape conservation and recreation.
VI Managed Resource Protected Area	Protected area managed for the sustainable use of natural ecosystems.

To achieve these different objectives the management measures within MPAs range from multiple-use to virtually no use. In the latter case, sites are variously referred to as HPMRs, highly protected marine areas, fully protected marine reserves or no-take zones. These areas of strict protection may be MPAs in their own right (e.g. an IUCN Category I site) or a zone within a multiple use MPA (e.g. within an IUCN Category VI site). An additional complication is that these titles have been used to describe areas with different levels of ‘strict protection’ (Table 2).

Table 2. Different circumstances under which the term HPMR has been used

	CF	RF	CO	NL	DP	AC	Comment
Some living resource extraction prohibited							Most often fisheries management zones where some types of commercial fishing are prohibited or restricted on a permanent or seasonal basis. Also applies to areas where collection limited eg. bait, shellfish, curios
All living resource extraction prohibited							Most often some type of biodiversity conservation area but could also be established for management of commercial fisheries
All living and non-living resource extraction prohibited							Most often some type of biodiversity conservation area but could also be a safety zone around a structure
Extraction and/or deposit of marine life, substances, articles and energy prohibited							Most often some type of biodiversity conservation area.
Extraction and/or deposit of marine life, substances, articles and energy limited access except in emergency							Most often some type of biodiversity conservation area

CF Commercial Fisheries
 RF Recreational Fisheries
 CO Collecting
 NL Extraction of non-living resources
 DP Deposition
 AC Access

Permitted
 Some restrictions
 Prohibited
 HPMR definition for this report

CCW have used the term Highly Protected Marine Areas to describe ‘areas where there is a presumption against human activities, unless it can be demonstrated they will not have a negative impact on an area’ (Dernie *et al.*, 2006). In this report we use the term Highly Protected Marine Reserve (HPMR) and define it as;

“Any area of intertidal or subtidal terrain, together with its overlying waters and associated flora and fauna, in which extraction and/or deposit of marine life, substances, articles and energy is prohibited by law and which is also protected from other harmful human uses”.
 This is a working definition and is not intended to be legally robust.

The Marine Life Information Network for Britain & Ireland (MarLIN) provides an on-line synthesis of information on the sensitivity of marine habitats and species to a range of human activities. Sensitivity is defined as “intolerance of a species or habitat to damage from an external factor and the time taken for its subsequent recovery” (Tyler-Walters & Hiscock, 2005).

The synthesis is presented using a maritime and coastal activities/environmental factors matrix². Table 3 shows the likely restrictions of activities in HPMRs using the MarLIN activity categories and cross-referencing them to the definition of an HPMR provided above.

Table 3. Potential restrictions on MarLIN activity categories within HPMRs (using the working definition of HPMRs given above).

Coastal/marine activity	Sub-activity		Comment
Aquaculture	Fin-fish		These activities involve the deposition living and non-living resources and would therefore be automatically prohibited in HPMRs
	Macro-algae		
	Predator control		This activities is likely to involve the extraction of living marine resources and would therefore be automatically prohibited in HPMRs
	Shellfisheries		These activities involve the deposition living and non-living resources and would therefore be automatically prohibited in HPMRs
Climate Change	Current change		Cannot be managed at a site level but site level protection can increase resilience to climate change impacts
	Sea-level change		
	Temperature change		
	Weather pattern change		
Coastal defence	Barrage		These activities involve the deposition living and non-living resources and would therefore be automatically prohibited in HPMRs
	Beach replenishment		
	Groynes		
	Sea walls/breakwaters		
Collecting	Bait digging		These activities involve the extraction of living marine resources and would therefore be automatically prohibited in HPMRs
	Bird eggs		
	Curios		
	Higher plants		
	Kelp & wrack harvesting		
	Macro-aglae		
	Peelers (boulder turning)		
	Shellfish		
Development	Construction phase		These activities involve the deposition living and non-living resources and would therefore be automatically prohibited in HPMRs
	Artificial reefs		
	Communication cables		
	Culverting lagoons		
	Dock/port facilities		
	Land claim		
	Marinas		
	Oil & gas platforms		
Dredging	Urban		These activities involve the extraction of non-living resources and would therefore be automatically prohibited in HPMRs
	Capital dredging		
Energy generation	Maintenance dredging		These activities involve the deposition living and non-living resources and would therefore be automatically prohibited in HPMRs
	Nuclear power generation		
	Power stations		
	Renewable (tide/wave)		
Extraction	Wind farms		These activities involve the extraction of non-living resources and would therefore be automatically prohibited in HPMRs
	Maerl		
	Rock/minerals (quarry)		
	Oil & gas		
	Sand & gravel (aggregate)		
Fisheries/Shellfisheries	Water resources (abstraction)		These activities involve the extraction of living marine resources and would therefore be automatically prohibited in HPMRs
	Benthic trawls		
	Netting		
	Pelagic trawls		
	Potting/creeling		
Recreation	Suction (hydraulic) dredging		This activity involves the removal of living resources and would therefore be prohibited in HPMRs. Capture and release fisheries may be permitted with some restrictions.
	Angling		
	Boating/yachting		
	Diving		
	Public beach		
	Tourist resort		
	Water sports		The MarLIN project has identified all of these activities as having a probable effect on physical environmental factors. The need to restrict them will depend on whether they are likely to be harmful to the habitats and species within the HPMR. Intensity, type, mode of operation and location will be key considerations.

² <http://www.marlin.ac.uk/PDF/activities3.pdf>, 11/8/06

Coastal/marine activity	Sub-activity		Comment
Uses	Animal sanctuary		The MarLIN project has identified all of these activities as having a probable effect on either physical, chemical or environmental factors. The need to restrict them will depend on whether they are likely to be harmful to the habitats and species within the HPMR. Intensity, type, mode of operation and location will be key considerations.
	Archaeology		
	Coastal farming		
	Coastal forestry		
	Education/interpretation		
	Military		
	Mooring/beaching/launching		
	Research		
	Shipping		
Wastes	Fishery & agricultural wastes		The need to restrict the deposit of wastes will depend on whether they are likely to be harmful to the habitats and species within the HPMR. Quantities and precise composition are therefore important facts to be determined.
	Industrial effluent discharges		
	Industrial/urban emissions (air)		Deposit of these wastes have been categorised by marLIN as having a probable effect on either physical, chemical or biological factors. This makes it likely that such activity will be prohibited in HPMRs
	Inorganic mine and particulate wastes		
	Land/waterfront run off		
	Litter & debris		
	Nuclear effluent discharge		
	Sewage discharge		
	Shipping wastes		
	Spoil dumping		
	Thermal discharges (cooling waters)		
	Removal of substratum		This activity involve the extraction of non-living resources and would therefore be automatically prohibited in HPMRs

 Prohibited
  Assessment required before being permitted

2.2 Objectives, criteria and principles for the identification of HPMRs

The objectives of an MPA programme will influence where they should be established, how to establish them, the type of protected area which is needed, and the most appropriate management regime (e.g. HPMRs as opposed to a multiple-use areas). This process needs to be undertaken for both individual sites and networks of MPAs³ and will provide a context for decisions about the most suitable locations for HPMRs.

The IUCN have defined the goal for a global network of MPAs as providing “for the protection, restoration, wise use, understanding and enjoyment of the marine heritage of the world in perpetuity” (IUCN, 1999). International bodies (e.g. OSPAR Commission, Helsinki Commission) have also defined objectives for MPA networks as have many maritime nations. In the case of the UK, the Government and the devolved administrations are “committed to establishing networks of MPAs to maintain and restore biodiversity” (Defra, 2005) and to

“establishing networks of MPAs to contribute to the attainment of healthy, functioning and resilient ecosystems and to help to halt the decline in marine biodiversity by;

- protecting areas of threatened species and habitats to help ensure that biodiversity is not lost as a result of widespread damaging activities
- protecting areas of representative species and habitats to help ensure that they do not become threatened as a result of human activities
- providing some relatively unaffected areas of high biodiversity value to support the structure and functioning of the wider marine ecosystem” (Defra 2006)

HPMRs could assist with achieving any of the above objectives. Guidance being developed under the auspices of the Convention on Biological Diversity (which distinguishes between a primary network of representative highly protected areas and an ancillary network of marine and coastal protected areas) states that the prime objective of highly protected areas “should be to protect marine and coastal biodiversity, including the principle of full representation and with a short-term priority of attention towards rare, threatened, declining or degraded habitats or species” (CBD, 2004).

Criteria are widely used by managers to identify potential areas for the establishment of MPAs. They are developed to provide a transparent and systematic approach to site selection and to help determine priorities for action. Guidelines for the identification of MPAs published in the 1990s distinguished between a number of different types of criteria including those concerned with biological, economic, cultural and practical aspects (Kelleher, 1999). Many other programmes have used these criteria to select MPAs (Table 4).

Because the objectives of HPMRs are interlinked with those of MPAs, and because HPMRs can be used in any type of MPA, the criteria used to select them can be difficult to distinguish from criteria used to identify MPAs where other management regimes are applied. This overlap is illustrated in Table 5 where the criteria for selecting MPAs as advised by IUCN (1999) are shown alongside those recommended by Roberts *et al* (2003) for HPMRs.

³ Network has been defined as “collection of individual sites that are connected in some way by ecological or other processes” (CBD, 2003).

Table 4. Comparison of criteria for identifying MPAs (based on Gubbay, 2003).

	INTERNATIONAL				REGIONAL				EU/NATIONAL	
	IUCN	Ramsar	CBD	PSSA	Baltic	Med	SPAW	OSPAR	SAC	SSSI
INHERENT VALUE										
Representativeness	*	*	*	*	*	*	*	*	*	*
Functionally critical ^a	*	*	*	*	*	*	*	*	*	*
Rare/Unique/endemic	*	*		*	*	*		*		*
Diversity	*	*	*	*	*	*	*	*		*
Economic importance	*		*	*			*			
Social/cultural impt	*		*	*		*	*			
Scientific importance	*		*	*		*	*	*	*	*
PRACTICAL ASPECTS										
Integrity ^b	*			*		*		*	*	
Threat	*	*	*	*	*	*	*	*	*	*
Acceptability	*							*		
Accessibility	*									
Compatibility	*									
Ease of management	*					*		*		
Potential for listing	*									
Existing designation	*								*	
Public involvement						*				

^a Eg. nursery/juvenile areas, feeding, breeding and resting areas, and important for life support systems

^b Eg. areas in a large state of naturalness, and the degree to which they function as an ecosystem.

IUCN Kelleher (1999)

Ramsar Convention on the Protection of Wetlands of International Importance

CBD Convention on Biological Diversity (Annex I to decision II/10)

PSSA Particularly Sensitive Sea Areas. Sites approved by the IMO

Baltic Baltic Sea Protected Areas as approved by the Helsinki Commission

Med Protocol Concerning Specially Protected Areas and Biological Diversity in the Mediterranean

SPAW Special Protected Areas and Wildlife in the Wider Caribbean

OSPAR MPAs in the NE Atlantic (OSPAR, 2002).

SSSI Sites of Special Scientific Interest (JNCC 1996) Functionally critical refers to SSSI criterion size/extent; representative refers to SSSI criterion of naturalness; threat refers to SSSI criterion of fragility

SAC Based on Annex III of the EC Directive) The global assessment criterion for selecting SACs has been interpreted here as fulfilling the criteria on scientific importance, threat, integrity and existing designation.

Table 5. Comparison of ecological criteria listed as guidance for the selection of MPAs by IUCN (1999) and the prerequisite and modifying criteria identified by Roberts *et al* (2003) to guide selection of sites which would fall within the definition of HPMR used in this report.

IUCN (1999) MPA selection criteria	Roberts et al (2003) HPMR selection criteria
Rare biogeographic qualities or representative of biogeography type or types	Biogeography
Variety of habitats Existence of unique or unusual geological features	Habitat diversity & heterogeneity
Nursery or juvenile areas Rare or unique habitat for any species	Vulnerable habitats
Feeding, breeding or rest areas	Vulnerable life stages
Degree of genetic diversity within species Habitat for rare or endangered species	Species of special interest
	Inclusion of exploited species
Integrity	Linkages between systems
Ecological processes or life-support systems	Ecosystem services for human needs

Another critical issue relating to site selection criteria is how they are applied. Both qualitative and quantitative approaches may be used, or there may be guidance for some criteria to take precedence over others. Roberts *et al* (2003) identify prerequisite, excluding and modifying criteria while the CBD provide some guiding principles (see Box 2).

Box 2. Design principles for HPMRs [CBD, 2004]

Individual sites

Principle 1 Minimising human disturbance on all biodiversity

Principle 2 Permanence

Principle 3 Viability

Principle 4 Human Enjoyment

Networks

Principle 1 Representativeness

Principle 2 Replication

Principle 3 Viability

Principle 4 Precautionary Design

Another approach is to be opportunistic as well as proactive with site selection given that detailed information is not always available about particular locations and that the outcomes of protection cannot be determined with absolute certainty (see Section 3).

Two examples of how HPMRs have been selected are described below. In both cases a combination of expert opinion, stakeholder involvement and analytical techniques were used to develop and agree proposals. Comments on the Great Barrier Reef Marine Park re-zoning processes (Day *et al.*, 2003) suggest that clear and transparent principles are important, that the proposals should be taken as a package rather than in isolation, and that they should not be viewed as targets or ideal amounts but the minimum required, based on best available advice which can change. In the case of the Channel Islands National Marine Sanctuary, Robinson *et al.*, (2005) describe issues relating to the use of the combination of traditional knowledge and an analytical process using GIS. These stress the need for stakeholders to have the opportunity to understand the technology and the importance of combining ecological and economic considerations in the site selection process. The two examples also illustrate that some countries are well advanced in accepting and introducing HPMRs as one of a number of tools for the conservation of marine biodiversity.

2.2.1 “Green Zones” in the Great Barrier Reef Marine Park, Australia

The Great Barrier Reef Marine Park was designated in 1975. In the years that followed zoning schemes were developed to underpin management of human activities in the Park. The entire area was zoned by 1988 into General Use Zones, Marine National Park Zones, Scientific Research Zones and Preservation Zones and subsets of these. Each zone was supported by information that specified which uses were permitted and those which were restricted or prohibited. Scientific Research Zones (no-take zones) and Preservation Zones (no-go zones) provided the greatest degree of protection and covered around 4.57 % and 0.13% respectively of the area of the GBRMP (Day *et al.*, 2003).

In 2004 the Government of Australia initiated a ‘Representative Areas Programme’ (RAP) to review the zoning of the GBRMP. The first stages were to classify the area into bioregions, evaluate the adequacy of the existing network of no-take areas and then identify potential networks of no-take areas to achieve the ecological and socio-economic objectives of the programme. The next stages were to select sites from the potential networks to maximise beneficial and minimise detrimental impacts considering social, economic, cultural and management implications, prepare a draft zoning plan for consultation and agree a final zoning plan (Day *et al.*, 2003).

Within the revised zoning scheme, the areas where no activities would be permitted (HPMRs) became known as ‘green zones’. A Scientific Steering Committee provided guidance on their selection and design. The first step was to clarify objectives of these green zones. These were agreed as helping to;

- maintain biological diversity at the levels of ecosystem, habitat, species, population and genes;
- allow species to evolve and function undisturbed;
- provide an ecological safety margin against human-induced disasters;
- provide a solid ecological base from which threatened species or habitats can recover or repair themselves; and
- maintain ecological processes and systems.

The GBRMP approach was to set aside substantial areas as green zones with a view to; minimising risk, providing connectivity and resilience, opportunities for better management of some harvested species and maintenance of ecological goods and services (Day *et al.*, 2003). Eleven biophysical guiding principles alongside social, economic cultural and management feasibility considerations were used to identify potential no-take zones (Box 3).

Box 3. Principles guiding the identification of no-take zones in the re-zoning of the Great Barrier Reef Marine Park.

Biophysical principles⁴;

1. Minimum size 20km along the smallest dimension (except for coastal bioregions, refer to Principle 6)
2. Larger (versus smaller) no-take areas
3. Sufficient no-take areas to insure against negative impacts on some part of a bioregion
4. Where a reef is incorporated into no-take zones, the whole reef should be included
5. Represent a minimum amount of each reef bioregion in no-take areas
6. Represent a minimum amount of each non-reef bioregion in no-take areas
7. Represent cross-shelf and latitudinal diversity in the network of no-take areas
8. Represent a minimum amount of each community type and physical environment type in the overall network taking into account principle 7
9. Maximise use of environmental information to determine the configuration of no-take areas to form viable networks
10. Include biophysically special/unique places
11. Include consideration of sea and adjacent land uses in determining no-take areas

Social, economic cultural and management feasibility principles⁵;

1. Maximise complementarity of no-take areas with human values, activities and opportunities
2. Ensure that final selection of no-take areas recognises social costs and benefits
3. Maximise placement of no-take areas in locations which complement and include present and future management and tenure arrangements
4. Maximise public understanding and acceptance of no-take areas, and facilitate enforcement of no-take areas

Taking these principles, a combination of expert opinion, stakeholder involvement and analytical techniques (a GIS based software programme known as MarXAN) were used to identify HPMRs within the GBRMP. The end result is that more than 33% of the Park area is covered by HPMRs (Figure 4).

⁴ Biophysical Operational Principles as recommended by the Scientific Steering Committee for the Representative Areas Program
http://www.gbrmpa.gov.au/corp_site/key_issues/conservation/rep_areas/documents/tech_sheet_06.pdf Downloaded 11/8/06

⁵ Social, economic, cultural and management feasibility operational principles
http://www.gbrmpa.gov.au/corp_site/key_issues/conservation/rep_areas/documents/tech_sheet_07.pdf Downloaded 11/8/06

Figure 4. Location and extent of the Great Barrier Reef Marine Park and the location and size of the new marine no-take areas (dark grey shading) (Fernandes *et al.*, 2005)



2.2.2 Marine Reserves and Marine Conservation Areas in the Channel Islands National Marine Sanctuary, USA

The Channel Islands National Marine Sanctuary (CINMS) was designated in 1980 covering an area of around 4,292 km² off the coast of southern California. The boundary extends from mean high water to 6 nautical miles offshore and therefore encompasses both State Waters (Mean High water to 3nm) and Federal Waters (3nm outwards).

Two types of marine zones have been proposed in a Draft Environmental Impact Statement published in August 2006; 'Marine Reserves' where all extractive activities will be prohibited and 'Marine Conservation Areas' where lobster harvesting and fishing for pelagic species by hook and line will be permitted but all other extractive activities will be prohibited (NOAA, 2006).

The proposals compliment an existing network of marine zones in the Sanctuary which were agreed by the California Department of Fish & Game and NOAA. These came into force in 2003 but can be traced back to 1998 when a local recreational fishing group requested the creation of marine reserves around the northern Channel Islands as a response to declining fish populations. A Marine Reserves Working Group was set up and this group subsequently agreed on goals for marine reserves (see Box 4). At the end of their deliberations the Working Group also produced a map with two reserve network options covering between 12 -29% of the area of the Sanctuary. Following further work by State Departments, the California Fish and Game Commission approved ten Marine Reserves and two Marine Conservation Areas covering approximately 10% of the CINMS (MPA News).

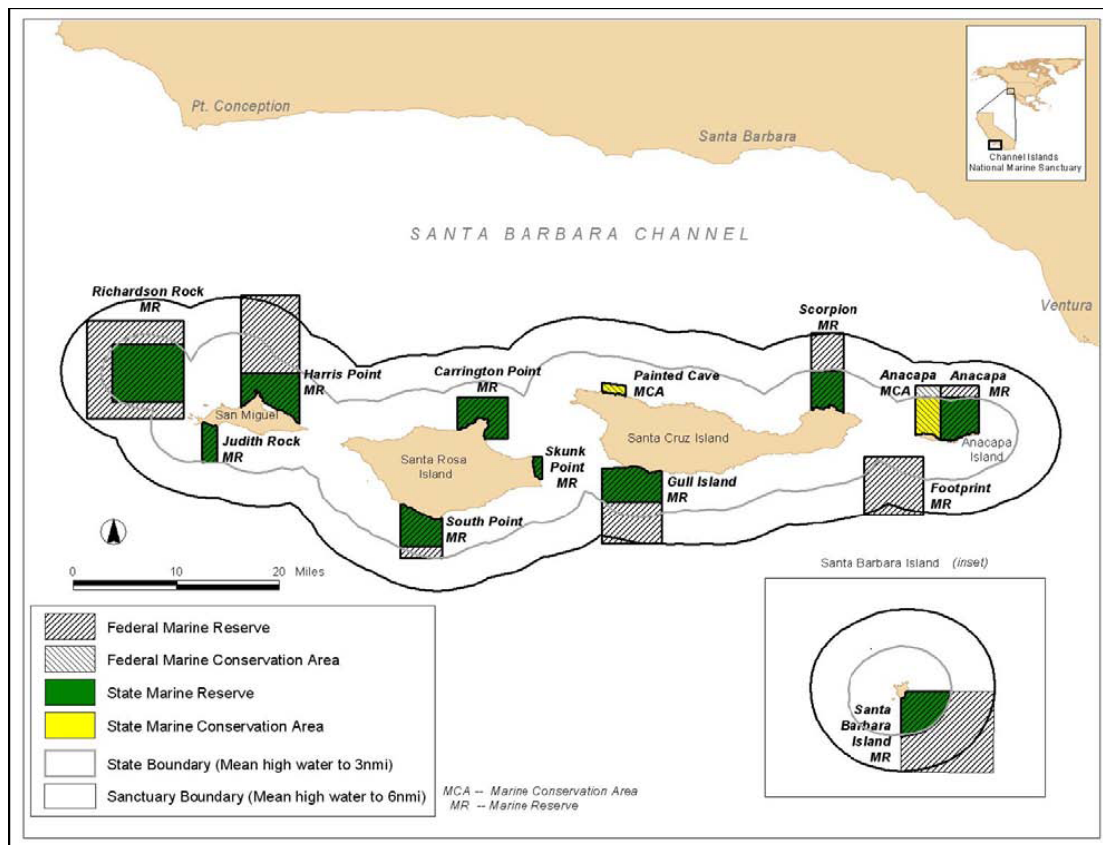
BOX 4. Goals of establishing Marine Reserves and Marine Conservation Areas in the Channel Islands National Marine Sanctuary set out by the Marine Reserves Working Group.

The objective of the proposed zones is to further the protection of Sanctuary biodiversity and, more specifically;

- To protect representative and unique marine habitats, ecological processes, and populations of interest;
- To maintain long-term socioeconomic viability while minimizing short-term Socio-economic losses to all users and dependent parties;
- To achieve sustainable fisheries by integrating marine reserves into fisheries management;
- To maintain areas for visitor, spiritual, and recreational opportunities which include cultural and ecological features and their associated values; and
- To foster stewardship of the marine environment by providing educational opportunities to increase awareness and encourage responsible use of resources.

The current consultation will complete the process by adding a tier of Federal protection to the existing State protected zones and extending some of these into Federal waters (beyond 3nm). The preferred alternative proposed by NOAA is shown in Figure 5. If approved this will add approximately 232.5 nm² (798km²) of marine reserves and 8.6 nm² (29.5 km²) of marine conservation areas.

Figure 5. One of the options being considered for the location of Marine Reserves and Marine Conservation Areas in the Channel Islands National Marine Sanctuary



The NOAA National Marine Sanctuary Programme goals for these proposals are shown in (Box 5) are set out to be consistent with their goals set out in the Marine Life Protection Act. They also identified six ecological criteria to provide the scientific framework for comparing alternatives; biogeographic representation, habitat representation, habitat replication, species of interest, size, and connectivity.

Box 5 Goals of the NOAA National Marine Sanctuary Programme for marine reserve and marine conservation area proposals.

- To ensure the long-term protection of Sanctuary resources by restoring and enhancing the abundance, density, population age structure, and diversity of the natural biological communities.
- To protect, restore, and maintain functional and intact portions of natural habitats (including deeper water habitats), populations, and ecological processes in the Sanctuary.
- To provide, for research and education, undisturbed reference areas that include the full spectrum of habitats within the CINMS where local populations exhibit a more natural abundance, density, diversity, and age structure.
- To set aside, for intrinsic and heritage value, representative habitats and natural biological communities.
- To complement the protection of CINMS resources and habitats afforded by the State of California's marine reserves and marine conservation areas.
- To create models of and incentives for ways to conserve and manage the resources of CINMS.

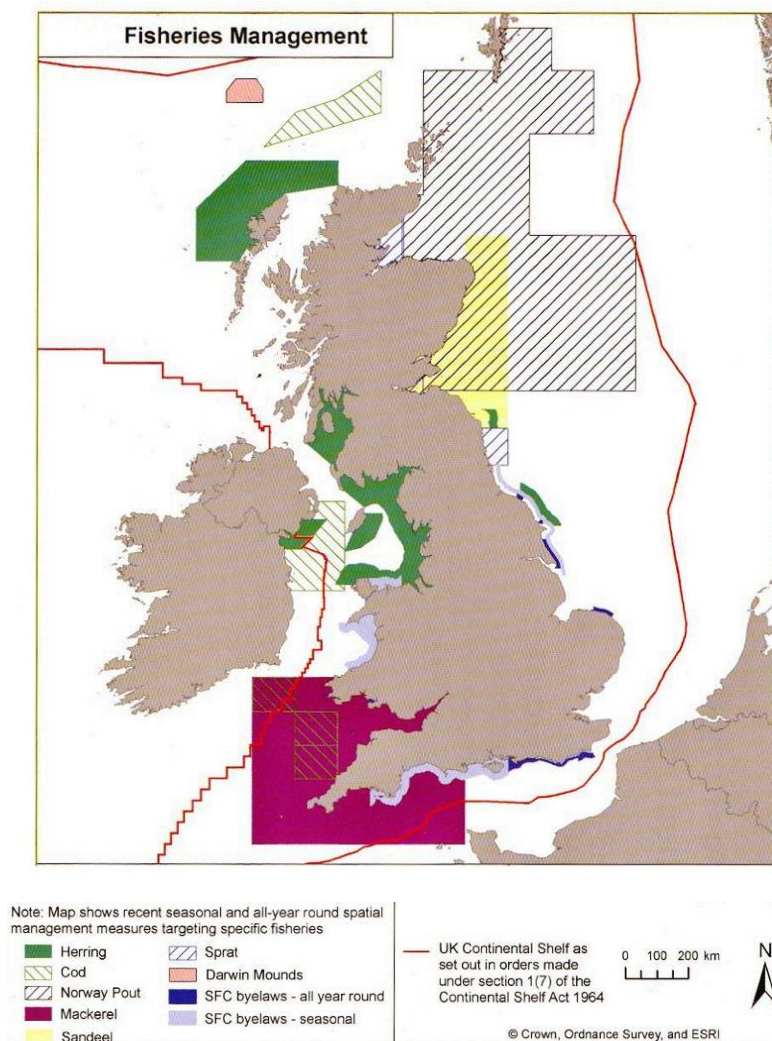
2.3 HPMRs in the North East Atlantic, Irish Sea and North Sea

This report focuses on HPMRs where the principle objective is marine nature conservation. Areas defined for fisheries management, safety reasons, cultural heritage importance and areas under private ownership have also been referred to as HPMRs but in most cases the associated restrictions are selective rather than comprehensive. Using the definition set out in this report, such sites would not qualify as HPMRs. Nevertheless, given the lack of HPMRs in UK waters, they may provide a good indication of the types of ecological effects which could be expected within HPMRs. These types of sites are described below to provide context and clarity for the discussions about HPMRs which follow.

2.3.1 Fisheries management areas

A variety of spatial measures are used to help manage commercial fisheries in the North East Atlantic, Irish Sea and North Sea. The measures include year round or seasonal closures as well as restrictions on the use of certain sized vessels or fishing gears in particular locations. Such areas are usually referred to as fisheries ‘boxes’ (see Figure 6). Given their aim, the restrictions are usually geared towards the management of particular fish stocks or species rather than to benefit marine life in general.

Figure 6. Spatial fisheries management measures on the UK Continental Shelf. (Map 3 from Defra, 2005)



In recent years there has been a move towards the introduction of fisheries restrictions to support nature conservation initiatives. On the High Seas, the North East Atlantic Fisheries Commission (NEAFC) agreed a three year ban on the use of bottom trawling and static gear around five seamounts and a section of the Reykjanes Ridge to protect vulnerable deep-water habitats. A similar approach was taken by the European Commission and subsequently, the Council of the European Union, to protect deep water corals in the UK's exclusive fishing zone, at the Darwin Mounds and by the Norwegian Government to protect the Sula and Røst deep water coral reefs.

No examples of fully protected fisheries management areas i.e. where there is a ban on all capture fisheries, were identified during this desk study for the North East Atlantic, Irish Sea and North Sea

2.3.2 Safety zones

There are many safety zones in the North East Atlantic, Irish Sea and North Sea around oil and gas platforms, subsea structures, renewable energy installations, cables and pipelines. Safety zones have also been established in navigation lanes and where hazardous materials such as munitions are present on the seabed. Regulations applying to safety zones mean that certain activities may be explicitly prohibited, or that certain activities may be excluded by virtue of general restrictions on access.

Oil and gas platforms and associated subsea structures usually have a 500m exclusion zone around them. The OSPAR Commission⁶ database, using information from OSPAR Contracting Parties in the period October – December 2004, lists 1131 offshore installations operational in the OSPAR Maritime Area which covers the North East Atlantic, Irish Sea and North Sea. Commercial fishing is usually not permitted within these areas but as discharges are permitted, and as the structures themselves have been introduced into the area, such zones would not qualify as HPMRs using the definition set out in this report.

Safety zones around seabed cables and pipelines are also widespread in the North Sea and Irish Sea. They are marked on navigational charts and the use of demersal fishing gears either explicitly prohibited in these areas or advisory. These are also generally identified as no anchoring areas. Fishermen are known to fish close to these lines (Rogers, 1998) and as the structures themselves have been introduced into the area, such zones would not qualify as HPMRs using the definition set out in this report.

Waste disposal sites of various types are also marked on navigational charts with advisory restriction on demersal fishing gears and marked as no anchoring areas. These areas may contain munitions, dredge spoil and sewage sludge. Safety zones have also been established around dangerous shipwrecks i.e. those with munitions on board. There are two examples in UK waters, the *SS Richard Montgomery* which is in the outer Medway estuary, and the *SS Castilian* on the East Platters, off the coast of Anglesey. There is an exclusion zone around each of these wrecks and diving is strictly prohibited.

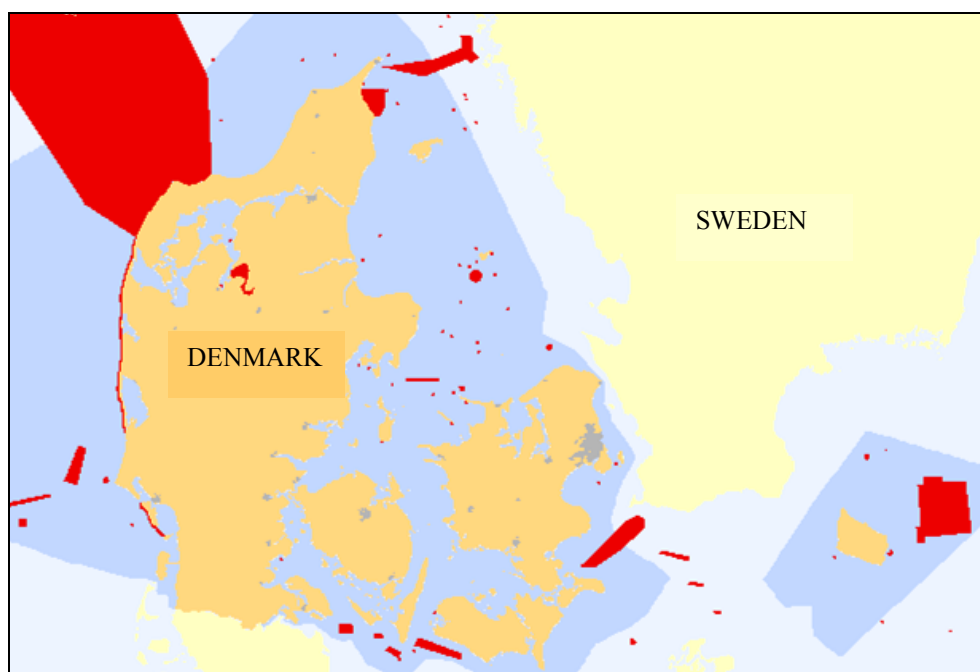
Safety is also an issue in shipping lanes and consequently certain activities may be prohibited in these areas. In the sound between Denmark and Sweden (Öresund), for example, trawling has been prohibited in an area of around 2,000km² since 1932 (ICES, *in press*).

⁶ The OSPAR Commission was established to *inter alia*, supervise the implementation of the 1992 Convention for the Protection of the Marine Environment of the North East Atlantic which merged and supplemented the 1972 Convention for the Prevention of Marine Pollution by Dumping from Ships and Aircraft and the 1974 Convention for the Prevention of Marine Pollution from Land-Based Sources.

2.3.3 *Restricted areas*

Restrictions on access and certain activities have been introduced around areas subject to military use. In some cases, such as firing ranges, these may only apply during exercises, while in others the restrictions are permanent. Figure 7 shows the location of such areas within the Danish EEZ where fishing, anchoring, diving and sand and gravel extraction is prohibited.

Figure 7. Danger areas in Danish Waters (Figure 31 from Sørensen, 2006 courtesy of DFU, GIS-Laboratoriet). Dark blue areas show the extent of the Danish EEZ and red areas are the identified danger zones.



Restrictions on access may also apply on areas of foreshore or coastal waters under private ownership. In Sweden for example, many islands are in private ownership and this ownership can extend into coastal waters.. It has not been possible to determine the location and number of areas of private land which operate as HPMRs as this information is not publicly available.

2.3.4 *Cultural Heritage*

Shipwrecks and underwater cultural landscapes may be protected by legislation which prohibits the tampering, damage or removal of artifacts. These restrictions and the presence of the structures themselves automatically preclude activities which come into contact with the seabed such as demersal fisheries. There are currently a total of 78 protected wrecks and maritime scheduled ancient monuments in UK waters. In Finland and Sweden there is automatic protection for all shipwrecks over 100yrs old.

2.3.5 *Nature conservation and research areas*

Protected areas which have been designated for their nature conservation importance can be HPMRs, although most are not. Out of the 2.2 million km² of sea covered by MPAs listed in the UNEP Global Database only 0.8% has been categorized as “no-take” (Wood, 2005). In general the associated regulations restrict or prohibit some rather than all extractive or depositional activities.

MPA Global, a database of the world's MPAs, was interrogated to try and draw up a list of HPMRs in the NE Atlantic⁷. This database is work in progress however it is still the most comprehensive global list of MPAs. It provides an inventory of MPAs and is set up to give information on designation type, location, area, intertidal/subtidal element, management, regulation and features (Wood, 2005). If known, the database assigns the listed MPAs to the appropriate IUCN protected area categories (see Table 1) and it notes whether the site includes a "no-take zone".

IUCN Category Ia and Ib sites are the most strictly protected however this does not necessarily mean that they are HPMRs. Equally sites in other categories may include HPMRs. The only reliable approach was therefore to search the database for sites which made specific mention of "no-take zones". Such areas correspond most closely to the definition of HPMR used in this report i.e. the no extraction element.

Only three potential HPMRs were identified in the area of the North East Atlantic, Irish Sea and North Sea by interrogating the MPA Global database. Further investigation of these sites and a wider search on the World Wide Web did not add greatly to this list. The five examples whose details can be confirmed are described below. One further example, Archipelago des Iles Sept is listed in MPA Global as having a no-take zone. This appears to be a hunting reserve however no further details have been found to confirm this.

Hirsholme Nature Reserve, Denmark [57° 29' N, 10° 33' E]

The Hirsholme nature reserve covers a group of small islands approximately 7k from Frederikshavn on the north east coast of Denmark. The site was designated in 1995 and all but 45ha of the 2,442ha reserve area is marine. Approximately half of the MPA is strictly protected. Anchoring is prohibited in this half and in two sub-areas which contain bubbling reefs. There is also a specific ban on fishing with bottom trawls. The reserve legislation states that it is prohibited to remove or damage the limestone structures/columns, to remove sessile animals and plants from the reefs and the surrounding areas and to extract sand, gravel, stones or other marine sediments. The legislation also allow for the regulation or prohibition of SCUBA diving at this popular dive site (Sørensen, 2006).

The Agerø and Skibsted Fjord Nature Reserve, Denmark [56° 41' N, 8° 31' E]

The Agerø and Skibsted Fjord Reserve is an MPA of 5,656ha in the internal waters of Limfjorden, which is adjacent to the north west coast of Denmark. The location, which is important for light-bellied Brent Goose, was first proposed for protection in 1987 by the Danish Forest and Nature Agency. They advocated its use as a reference area for monitoring and research because it contained habitats representative of those found in Limfjorden. A temporary ban on fishing for *Mytilus edulis* was introduced in 1988 and the area has been strictly protected since 1996 when it became a nature reserve. The extraction of marine sediments and stones, dredging, dumping, fishing with bottom trawling gear, removing or damaging bottom fauna or flora, aquaculture, construction, and establishment of windfarms are prohibited (Sørensen, 2006).

Wadden Sea zero-use/reference areas –Denmark, Germany, Netherlands

The Wadden Sea which fringes the coastlines of the Netherlands, Germany and Denmark is covered by a number of international, European Community and national designations. In 1991

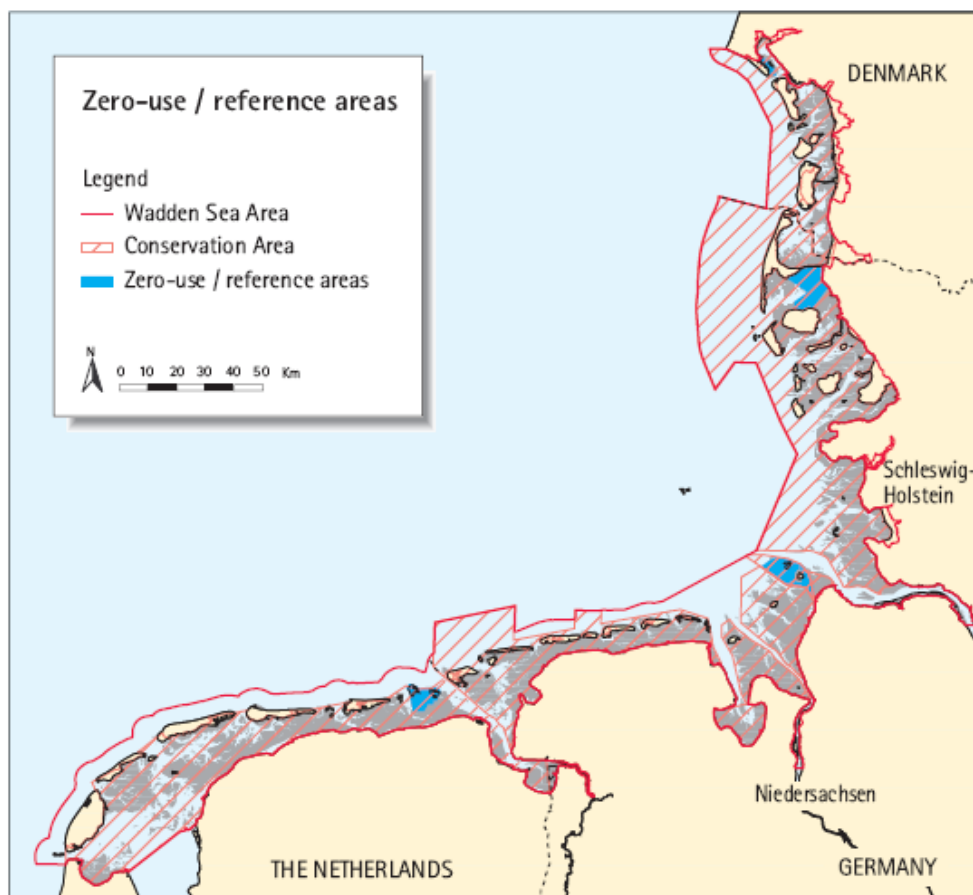
⁷ www.mpaglobal.org

the three bordering countries agreed to prepare a management plan to provide joint and consistent protection for a defined Wadden Sea Conservation Area which extends from Den Helder in the Netherlands to Esbjerg in Denmark - around 900,000ha.

A Trilateral Monitoring and Assessment Programme was initiated in 1991 and this included an agreement to designate “sufficiently large areas, spread evenly over the Wadden Sea, where all exploitation and all disturbing activities are banned and which can serve as reference areas for scientific purposes” (Esbjerg Declaration, 1999 §33.3). The 2005 Quality Status Report for the Wadden Sea identifies three such areas (one in Denmark, two in Germany). A further area under discussion is on the Dutch coastline (Figure 8) (Essink *et al.*, 2005).

The northernmost German zero-use/reference area is in the Schleswig-Holstein National Park at Hörnum Tief. It covers 12,500ha, about 3% of the National Park and was designated in 1999. The second German site is in Hamburg National Park. It includes 76% of the 10,400ha area of the Park and was established in 1990. In the latter case shrimp fishing is permitted in marked shipping lanes 100m wide. The Danish zero-use/reference area was designated around the island of Langli in 1982. It covers an intertidal area of around 800ha between Langli and the Skallingen peninsula. It is set within a wider area which is closed to the public for most of the year. The proposed reference area in the Netherlands is 6,500ha south of the islands of Rottumeroog and Rottumerplaat. It is already closed to shellfisheries and the intention is for shrimp fishing to be prohibited as well (Essink *et al.*, 2005).

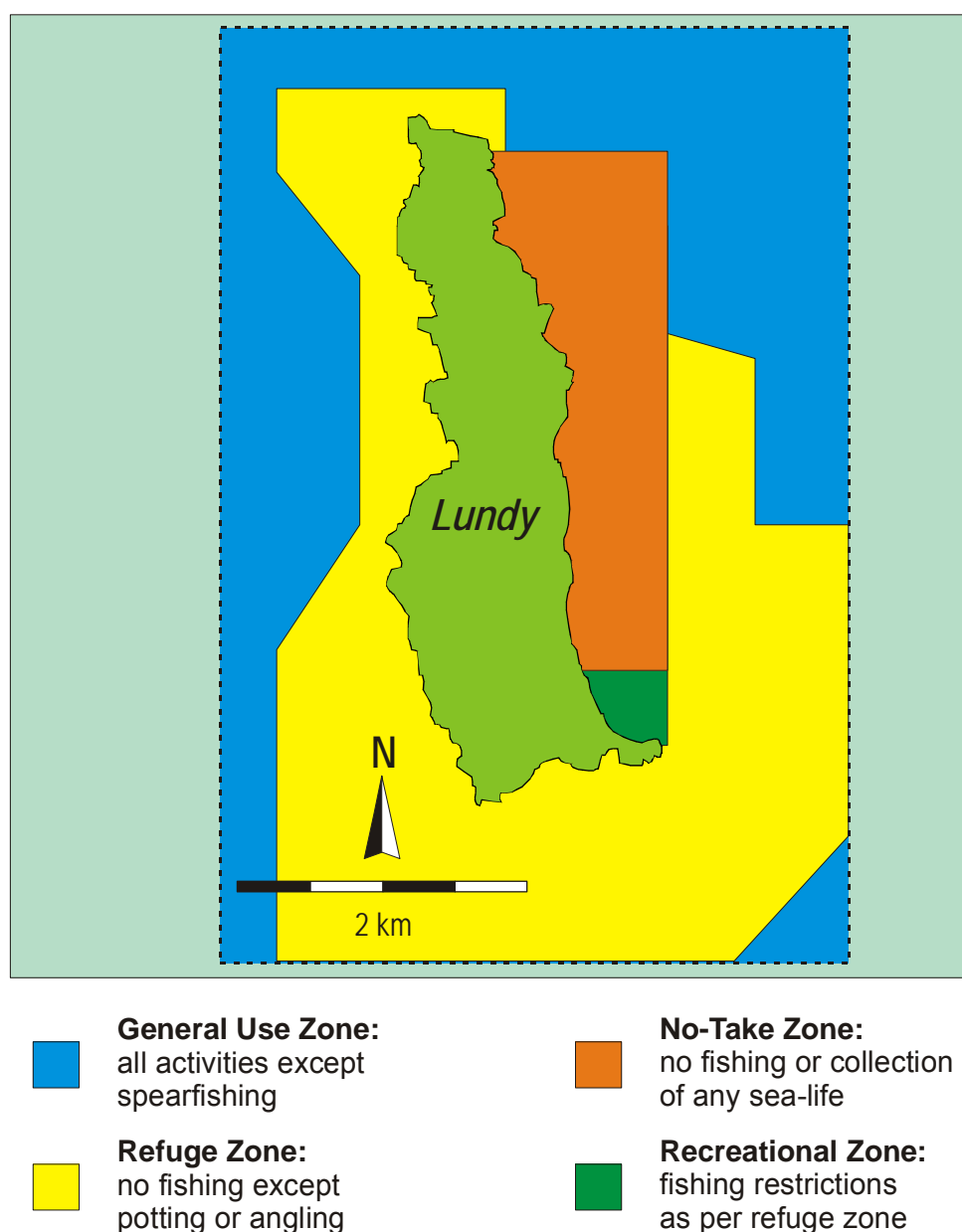
Figure 8. Map showing the locations of zero-use/reference areas in the Wadden Sea. [The designation of the site in the Netherlands is under discussion] (Figure 1.10 from Essink *et al.*, 2005). <http://www.waddensea-secretariat.org/QSR/chapters/QSR-01.3-reference-areas.pdf>



The Lundy Island “no-take zone”, United Kingdom [51° 11' N, 4° 39' E]

Lundy Island, lies at the entrance to the Bristol Channel, approximately 18km from the nearest mainland which is the coast of North Devon. Waters around the island were declared a Marine Nature Reserve (MNR) under the Wildlife & Countryside Act 1981 in 1986 and a zoning scheme was adopted for the MNR. This identified a General Use Zone, Recreational Zone, Refuge Zone, Sanctuary Zone and Archaeological Protection Zone (Laffoley, 1999). Potting was permitted but not encouraged in the refuge zone and required a license in the Sanctuary Zone. Tangle nets and fixed nets were also permitted in part of the Refuge Zone. The only areas where all extractive activities were prohibited surrounded two shipwrecks off the east coast of the island. The zoning scheme was revised in 2003 and approximately 4km² is now a “no-take zone” where fishing and the collection of any sea life is prohibited (Figure 9) (Hoskin *et al.*, 2006).

Figure 9. Zoning scheme in the Lundy Marine Nature Reserve (from Hoskin *et al.*, 2006).



Key messages

- The UK Government has signed international agreements which support the establishment of MPAs and HPMRs
- HPMRs are the most strictly protected zones within MPAs or are MPAs in their own right.
- HPMRs can be defined as; “Any area of intertidal or subtidal terrain, together with its overlying waters and associated flora and fauna, in which extraction and/or deposit of marine life, substances, articles and energy is prohibited by law and which is also protected from other harmful human uses”.
- At least some of the objectives, criteria and principles guiding the selection of HPMRs are likely to be the same as those for other types of MPAs.
- The selection of HPMRs can be quantitative, qualitative, reactive or proactive. A combination of expert opinion, stakeholder involvement and analytical techniques are generally used.
- Areas established for fisheries management, safety, and the protection of cultural heritage are not HPMRs as defined in this report. Studying such areas could however show some of the ecological effects of partial protection.

3. SCIENTIFIC INFORMATION ON ECOLOGICAL EFFECTS OF HPMRS

More than 200 studies into the effects of MPAs were published in peer reviewed primary literature between 1990 and 2001 (Willis *et al.*, 2003). There is also extensive documentation on the effects of MPAs, including HPMRs, in project reports, conservation reviews, newsletters, conference proceedings and other sources (e.g. Anon 2001; Anon 2005; Roberts & Hawkins, 2000; PROTECT, 2006).

These studies describe and try to understand the effects of MPAs in a variety of ways. Mathematical models have been used to predict effects and to design MPAs to achieve particular objectives. Many of these focus on commercially important species. Some examples are the work by Lockwood (1988) who modeled effects of area protection on western mackerel stocks off the coast of Cornwall; Guenette *et al.*, (2001) who modeled the effects of seasonal and permanently closed areas on the Newfoundland cod fishery; and McGarvey & Willison (1995) who modeled the size structure and reproductive output of scallop (*Placopecten magellanicus*) populations if HPMRs were created off the east coast of USA and Canada. Mathematical modeling has also been used for reserve design to achieve more broadly based biodiversity conservation objectives. Two examples are the work by Airame *et al.*, (2003) to identify a potential reserve network within the Channel Islands National Marine Sanctuary and by Leslie *et al.*, (2003) to identify MPA network scenarios to achieve different conservation targets within the Florida Keys National Marine Sanctuary.

Modeling studies may predict the potential effects of MPAs but data from the field provide evidence of any changes on the ground. The focus of field studies range from determining effects on individual species, to identifying any effects on communities, habitats, and ecosystems in HPMRs and other less strictly protected MPAs. In 1993, Dugan and Davis reviewed thirty studies for evidence of changes in abundance, size, reproduction, recruitment and fishery yields on a variety of fish, crustaceans, and molluscs; in 2003, Halpern evaluated 112 independent measures of the effects of marine reserves from eighty-nine studies (Dugan & Davis, 1993; Halpern, 2003). The findings of these and other studies which include effects of HPMRs are summarised below.

There has been a lot of work on MPAs in tropical waters and consequently, numerous reports of the effects MPAs on coral reef habitats and species (e.g. Chapman & Kramer, 1999; Polunin & Roberts 1993; Watson *et al.*, 1996). This report focuses on the findings of studies on temperate ecosystems and on effects relevant to nature conservation rather than the management of commercial fisheries.

3.1 Case studies

The following case studies describe the effects of HPMRs on four temperate habitat types which occur around the coastline of Wales. While the species mentioned may not be identical to those found in Welsh waters, the same assemblages are present. The four habitat types are rocky intertidal shores, brackish water habitats, shallow sublittoral soft sediment, and shallow sublittoral rocky reefs.

3.1.1 *Monterey peninsula rocky intertidal shores*

The Monterey peninsula in central California is a popular and easily accessible area of shore which lies within the Monterey Bay National Marine Sanctuary and the Pacific Grove Marine Gardens Fish Refuge. Most visitors remain above the shoreline but 30-50,000 people are estimated to visit the intertidal area every year to explore the rockpools when the tide is out. There is some natural protection for seashore life as the mid-day low tides are not as extreme during the summer which is the peak visitor season. A study was carried out to investigate the effects of visitor use on the Point Pinos rocky shoreline (TENERA, 2003).

The shoreline in this area is granite bedrock intermixed with boulders and cobbles with some small sandy beaches. The combination of a variety of substrates and cold nutrient rich upwelling offshore has resulted in a rich diversity of marine flora and fauna.

The abundance and diversity of algae and invertebrates at eight locations, subject to different degrees of human disturbance were compared in the study carried out during 2002 & 2003. The sites range from no-take areas/reference sites (the Hopkins Marine Life Reserve and the Point Lobos Ecological Reserve) to easily accessible sites where there were no restrictions on collecting other than state wide regulations (Monterey Bay Aquarium shore and Soberanes Point). More than 150 species of invertebrates, algae and intertidal fish were sampled and analysed for differences in abundance between these sites. The results include the following:

- Statistically significant difference were detected in total algal cover between the high and low use areas with high use having about 25% less total algal cover. This was mostly in the upper intertidal near public access points
- No statistically significant differences were detected in the abundance of invertebrates and fishes between the no-take zones and other sites with the exception of purple sea urchins. These were less abundant in the most accessible tide pools.
- No significant differences were detected in the mean size of black abalone and owl limpets between high and low visitor use areas. These species are often collected for consumption.
- There were lower numbers of larger size abalone at the sites that have unrestricted visitor access. This may indicate that abalone harvesting has reduced the abundance of the larger animals.

The results also revealed the large amounts of natural variability, unrelated to the intensity of human use, as well as significant differences in the abundance and size of particular species and the overall structure of the rocky shore assemblages between the open access and restricted access sites.

A small scale experiment was also carried out into the effects of trampling on wave exposed rocky headland dominated by mussel beds and sheltered shores dominated by algal beds. The experimental trampling carried out over one year caused significant reduction in algal cover on wave protected shores at medium and high-trampling intensities. In the case of the mussel beds on exposed headland, cover was significantly less even at the lowest trampling intensity and there was no trend towards recovery the following year.

This example shows a range of effects on rocky shore communities and highlights the difficulties of determining effects in an environment where there is high spatial variability and large seasonal and inter-annual variations in species abundance.

3.1.2 Licknevarpefjärden Bay brackish water habitat in the Baltic

The northern pike, *Esox lucius*, is a top predator in the coastal regions of the Baltic, living in rivers, lakes and brackish waters. It is a highly territorial species and relatively stationary although known to migrate over longer distances. The pike is fished commercially and as a game fish.

Licknevarpefjärden is a bay in the archipelago of Ostergotland in Sweden. Commercial and recreational fishing has been prohibited since the area became a reserve 30 years ago. The reserve covers an area of 6,020 ha of which 4,300 ha is sea.

The population of pike has been compared in this area with three reference areas in the same archipelago where there have been no restrictions on fishing over the same period (Edgren, 2005). Two of these, the Sankt Anna archipelago and Häxvassen, are locations where recreational fishing takes place. The third site, Aspöja, is in the outer archipelago, an area which is subject to a commercial fishery for pike. Pike populations in the four different locations were compared by sampling and a mark and recapture exercise undertaken in 2005. The main results were as follows;

- There were significant differences in abundance of pike between the no-take area, Licknevarpefjärden, when compared to Sankt Anna and Häxvassen based on angling catches. There were also significant differences with Aspöja when comparing pound net catches. Both sampling methods indicate that the pike population in Licknevarpefjärden was more abundant than in all three reference areas.
- Differences in age structure. The age structure of both male and female pike differed between areas. For both sexes there was a wider age distribution and higher frequency of older individuals in the no-take reserve when compared to those at Aspöja. The lack of difference when compared to the recreational angling sites might be explained by the fact that most of the recreational anglers practice a catch and release fishery.
- Differences in size distribution. There were no significant differences in pike length for those caught by angling. Pike caught by pound nets were significantly larger at the no-take area compared to those at Aspöja
- Pike in the no-take area had a slower growth rate than the commercially fished area but were as large as or larger than in fished areas.

This study shows clear positive effects on a top predator in the brackish water HPMR in Licknevarpefjärden.

3.1.3 Shallow sublittoral, soft sediment habitat in the southern North Sea

Safety zones around structures placed in the marine environment can act as *de facto* MPAs if the removal of living and non-living resources is prohibited within them. Oil and gas platforms fall into this category as they typically operate a 500m exclusion zone around surface and subsea installations which commercial fishing vessels are not permitted to enter or exploit.

A recent study compared the benthic communities in a no-fishing area around a southern North Sea gas production platform (L07A) with adjacent areas where no such restrictions apply. The site chosen was one where oil-based muds have never been used during drilling operations as these are known to have long-lasting effects on benthic species (Kroncke *et al.*, 1992; Daan & Mulder, 1996).

Gas production platform L07A is located in the southern North Sea in the region of the Frisian Front. This is an area of enhanced primary production as it is the convergence zone of different water masses. The seabed is a silty-sand habitat and the benthic community has a high biomass, high biodiversity and high level of activity (Cramer, 1990).

In 2004, epifauna and larger infauna were sampled within the 500m exclusion zone and four regularly trawled reference areas 1.5nm to the North, South, East and West of the fishery exclusion zone (Magda *et al.*, 2005). The results include the following;

- The fished areas had a suite (>20) of small short lived species, some in large numbers like the horseshoe worm *Phoronis*, the bivalve *Abra* spp. and various small polychaetes.
- Species more abundant within the fishery-exclusion included the bivalves *Arctica islandica*, *Thracia convexa*, *Dosinia lupines* and *Cardium echinatum*, all of which are relatively large and known to be vulnerable to beam trawling.
- Fragile but small sized bivalves such as *Abra nitida* and *Cultellus pellucidus* both had higher abundances where fishing was prohibited.
- There was a higher abundance of mud shrimps within the fishery exclusion area. This was most marked in the case of the smaller and deeper living *Callinassa subterranean* but also the case for *Upogebia deltaura*. Significant differences were only found in relation to 2 of the 4 reference areas.
- There were higher densities of the brittlestar *Amphiura filiformis*, a fragile and therefore potentially vulnerable species to beam trawling, in the non-fished areas.
- There were no significant differences in the abundance of infaunal polychaetes which dominated both regions.

This study shows clear differences between the fishery-closed area near the platform and the other regularly trawled areas.

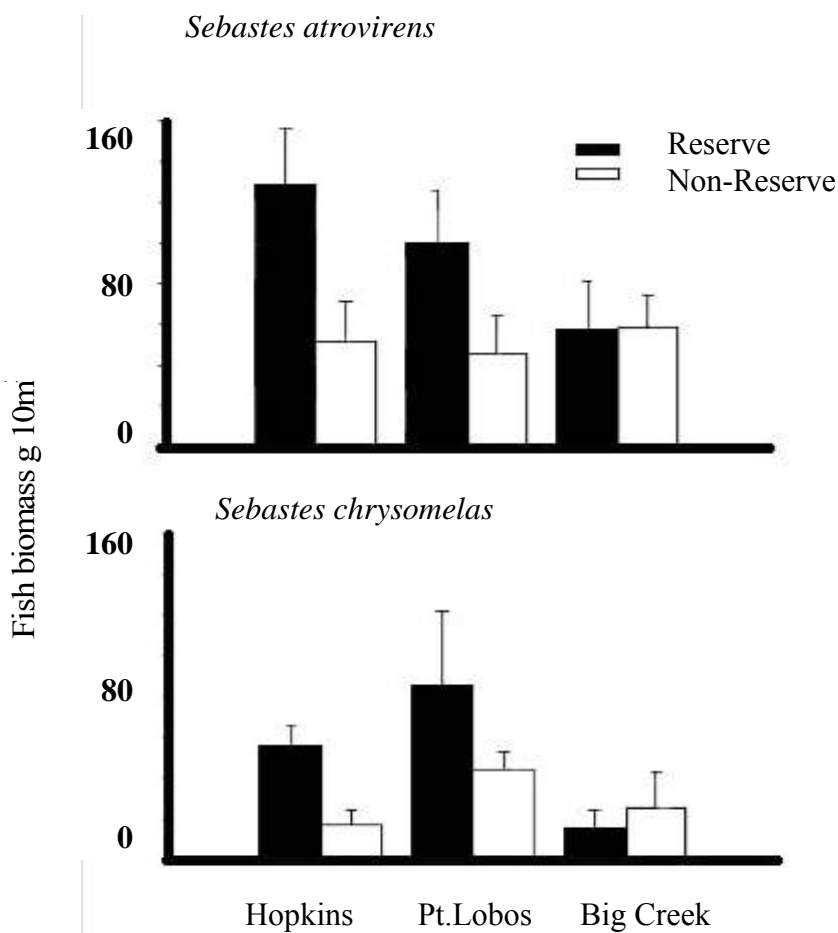
3.1.4 Shallow sublittoral, rocky seabed, kelp forest habitat.

Field research conducted from 1994-1996 compared fish populations in three marine reserves in central California with nearby areas where fishing was permitted (Estes & Paddock, 2004). The reserves are the Hopkins Marine Life Refuge where all fishing has been prohibited since 1984, Point Lobos State and Ecological Reserve where all fishing has been prohibited since 1973 and the Big Creek Marine Ecological Reserve where all fishing has been prohibited since early 1994.

The sampling was done in giant kelp habitats (*Macrocystis pyrifera*) over rocky substrates with moderate relief. The fish species investigated were those which are common in central California kelp forests and exploited by commercial and recreational fisheries. The results include the following;

- Fish density was 12-35% greater in the reserves than adjacent non-reserves but the difference was not statistically significant.
- In the two sites which had been protected longest (Hopkins and Pt.Lobos), average lengths of the rock fish were significantly greater in reserves than non-reserves.
- The length-frequency distribution of fish was significantly different in the two sites subject to longer protection with more large fish in Hopkins and Pt.Lobos.
- Biomass estimates for densities of two species studied in detail, the kelp rockfish (*Sebastes atrovirens*) and gopher rockfish (*S.chrysomelas*) were more than two times higher at Hopkins and Pt.Lobos than non-reserve sites but with no discernable difference at Big Creek (Figure 10).
- Using the above data calculations of the reproductive output from both species was greater in the two older reserves than non-reserve sites. There was no discernable difference in the recently established third reserve at Big Creek.

Figure 10. Average biomass per unit area for *S.atrovirens* and *S chrysomelas* in reserve/non-reserve areas



3.2 Potential effects on marine biodiversity

The effects of MPAs and HPMRs on marine biodiversity are influenced by many factors. These include reserve design (e.g. size and location), the habitats and species within the reserve, the management regime (which can range from highly protected to multiple use), the effectiveness of enforcement, the starting conditions, and how activities outside the protected area are managed (Gubbay, 2006). Any effects also need to be set into the context of natural variability and global trends, such as those associated with climate change.

Determining the significance of any effects is also complex and difficult. There may be no baseline data on conditions before MPA management was introduced, no control sites, and limited opportunities for temporal and spatial replication to confirm effects.

Working within these constraints, both positive and negative effects of MPAs have been described in the literature. There are also circumstances where no discernable effects have been observed, where a variety of effects are reported within a single MPA, and where there are insufficient data to take a view. Commonly cited potential positive and negative effects of MPAs are listed in Table 6.

Table 6. Positive and negative effects attributed to MPAs
(Table 2 from Gubbay 2006; based on Anon 2001, Commonwealth of Australia 2003, Jones 2006)

Potential positive effects;	Potential negative effects
Conservation of biodiversity	Increased pressure/impact on biodiversity by attracting certain activities e.g. recreation
Protection of habitat	Increased pressure/impact on biodiversity outside the MPA due to displace of activities
Protection or enhancement of ecosystem services	Loss of opportunities for exploitation within the MPA
Recovery of depleted stocks of exploited species	Exclusion of certain activities/uses from the MPA
Export of individuals to fished areas	
Insurance against environmental or management uncertainty	
Scientific study	
Income generation	
Education, training, culture and heritage	
Inspiration	
Raising profile of an area	

Gubbay (2006) reviewed the scientific evidence for effects in relation to nature conservation and concluded that “there is overwhelming evidence of the benefits of MPAs for marine biodiversity and that these benefits are clearest and most significant in the case of HPMRs”.

Biodiversity benefits include higher densities, biomass, size and diversity of certain species or groups of species (Halpern, 2003). These types of effects have been seen when comparisons are made with the situation outside reserves (e.g. Buxton & Smale, 1989; Palsson & Pacunski, 1995; Hoskins *et al.*, 2005) and by tracking changes following the establishment of an MPA (e.g. Beukers-Stewart *et al.*, 2005; Castilla & Duran, 1985; Edgar & Barrett, 1999).

Quantitative analysis of sixty-nine different biological measures by Halpern (2003) revealed that the diversity of communities and the mean size of the organisms within the HPMRs were between 20-30% higher relative to unprotected areas (Figure 11). The density of organisms was roughly double in reserves, while the biomass of organisms was nearly triple. The species showing these sort of effects included spiny lobster in the New Zealand Leigh Reserve, lingcod in the US Shady Cove reserve and rock fish in the US Edmonds Underwater Park (Babcock, 1999; Palsson & Pacunski, 1995).

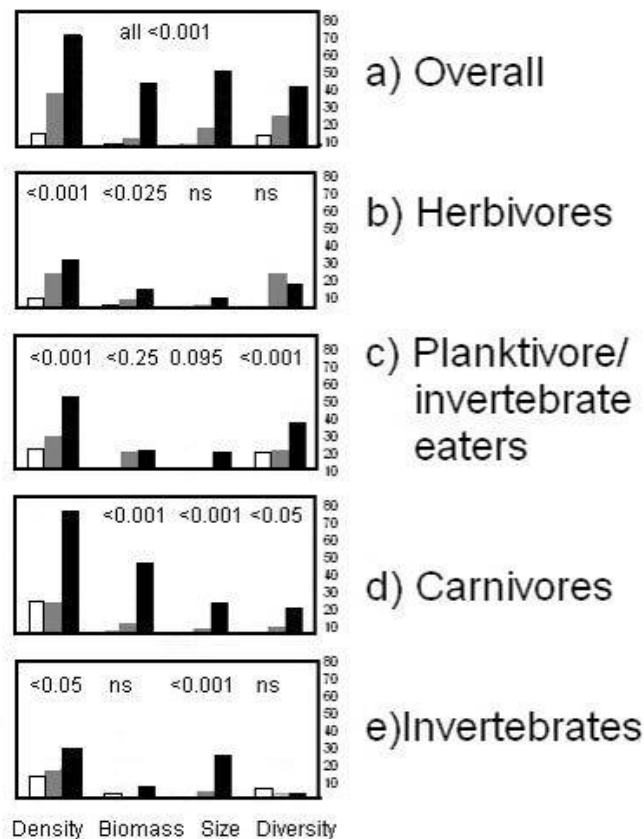


Figure 11

Differences in biological measures between inside a reserve and outside (or after vs. before) for all organisms (a) and for each functional group (b-e)

White bars - lower values inside the reserve
 Grey bars - no differences between reserve and non-reserve areas
 Black bars - higher values inside reserves

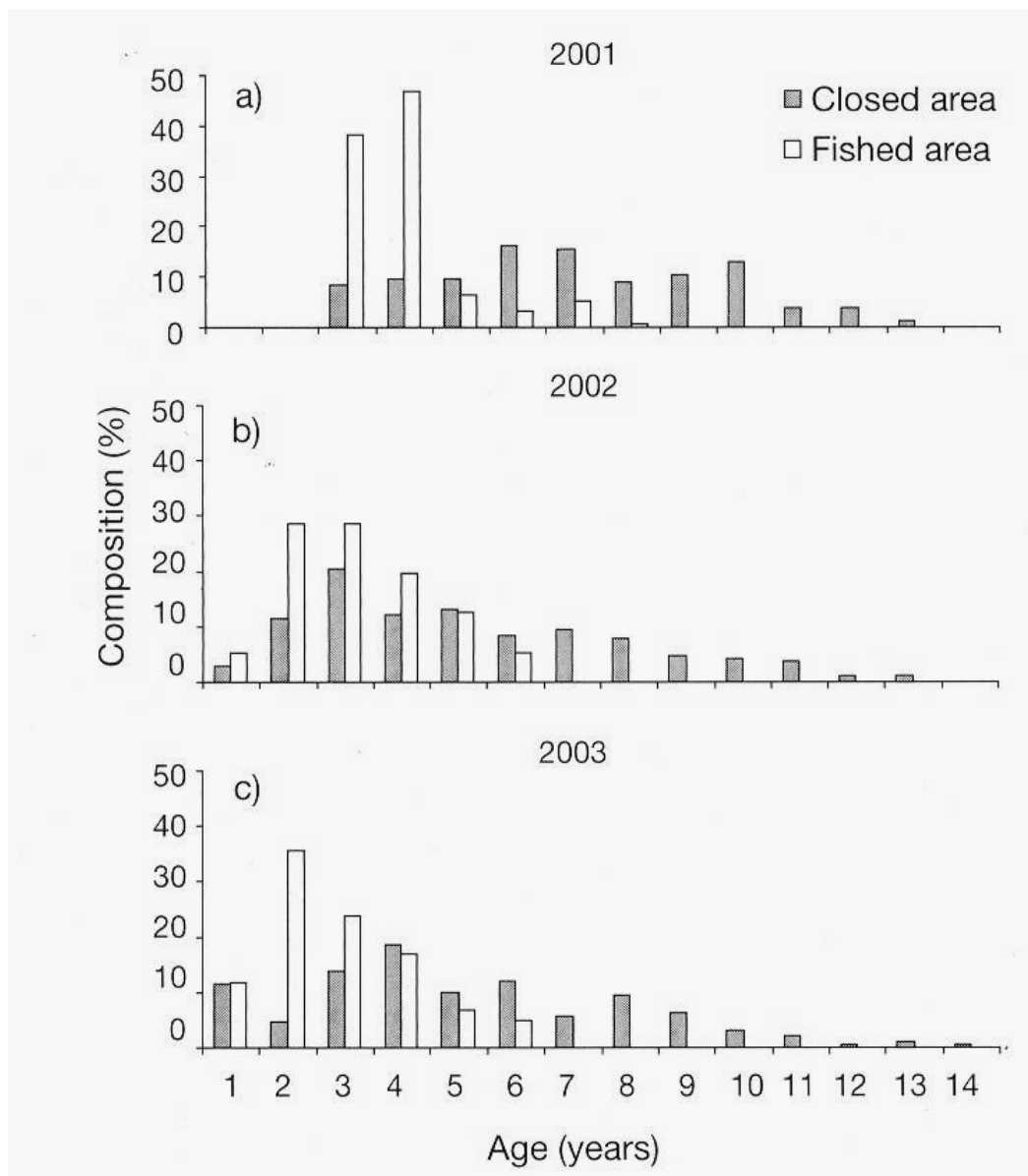
(values above bars are significance for chi-square test)

The changes resulting from the establishment of HPMRs can be categorised as; first order direct effects such as recovery of previously exploited species; indirect effects which include declines in prey or competitor populations; third order changes in habitats as a result of trophic cascades; and fourth-order changes in faunal distribution and diversity associated with habitat change (Langoise & Ballentine, 2005). Examples of each of these from temperate parts of the world are given below.

3.2.1 **Direct effects on species**

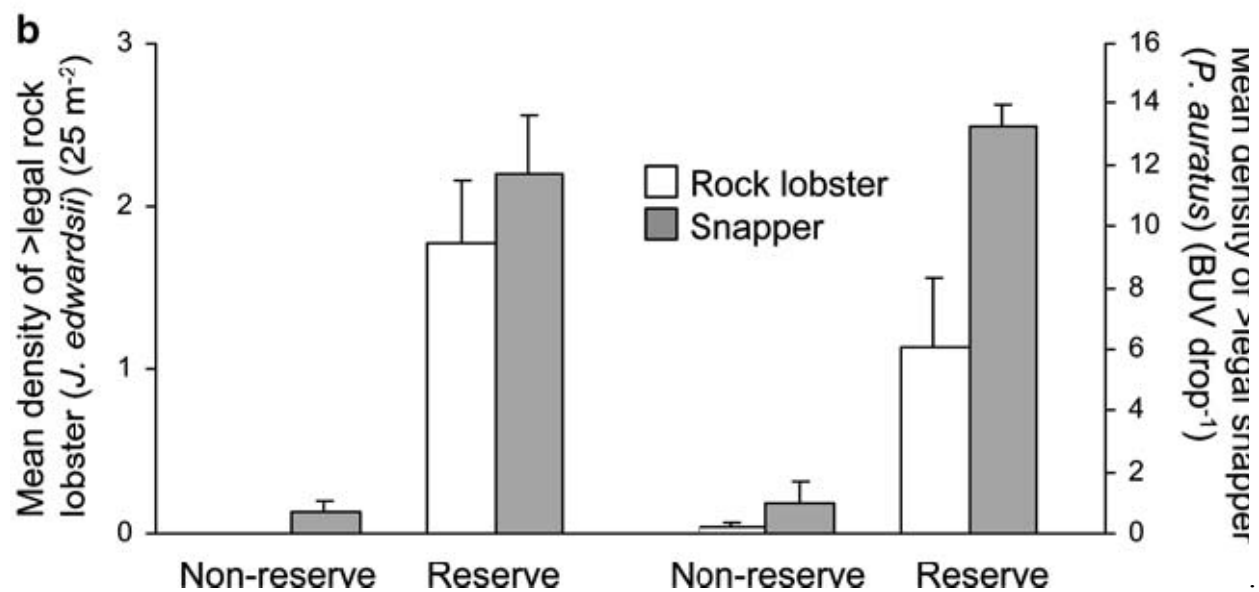
The effects of HPMRs on species are influenced by many factors including their life history characteristics and status before receiving protection. There are many examples from temperate parts of the world where the establishment of HPMRs have led to increases in the abundance and size of some of the species with them. Many, but not all of these are previously harvested species with relatively limited geographic ranges. For example, closure of an area off the Isle of Man to scallop dredging in 1989 has resulted in an increase in the density of the scallop *Pecten maximus* and a shift towards much older and larger scallops in the closed area (Figure 12). Scallop densities have also increased outside the closed area but not to the same extent as within the protected area. The overall density of scallops outside the reserve has therefore consistently remained below that of scallops within the closed area (Beukers-Stewart *et al.*, 2005).

Figure 12. *Pecten maximus* age composition within close and fished areas (Figure 3 from Beukers-Stewart *et al.*, 2005).



A similar direct effect on previously exploited species has been reported from New Zealand. Data from two HPMRs (Leigh and the Tawharanui Marine Park) show consistently higher densities and larger snapper and rock lobster in the protected areas (Langlois *et al.*, 2006) (Figure 13).

Figure 13. Average density of legal size snapper (*P.auratus*) and rock lobster (*J.edwardsii*) at reserve and non reserve sites. (from Langlois *et al.*, 2006, figure 2).



3.2.2 Indirect effects on species

The ecological interrelationships between species through processes such as predation, competition and recruitment mean that changes in the population characteristics of one species can have significant effects on other species. These types of effects have been seen in HPMRs when extractive activities are no longer permitted and have resulted in the abundance of some species increasing and of others decreasing. For example, an analysis of data on 20 coastal fish assemblages within HPMRs established for between 1- 25 years, revealed that while some species increased in abundance (those previously subject to fishing pressure) others declined in abundance (Mitcheli *et al.*, 2004). Most of the latter were previously unfished species with a low mobility such as blennies and gobies. Their decline was attributed to an increase in competition and in the abundance of their predators which were no longer subject to fishing pressure within the HPMR.

In another location, the US San Diego-La Jolla Ecological Reserve some species have increased in abundance and others have shown little change (Parnell *et al.*, 2005). This small reserve covering 2.16km² was established in 1971. All extractive activities are prohibited apart from bait fishing for squid using hand-held scoop nets. Statistical analysis revealed significant positive effects on red urchins, rock scallops, sheephead, green abalone and vermillion rock fish but no effects on kelp bass, sculpin and the purple sea urchin. The positive effects in this case were on previous harvested species and those that are sessile or have a small range.

3.2.3 Habitat effects

Changes in marine habitats are another effect which has been seen in HPMRs. In the Anacapa Island Ecological Reserve off the coast of California, protection has led to an increase in the abundance of two major sea urchin predators, the spiny lobster and the California sheephead. Outside the reserve urchin species which are not harvested (two out of three main urchin species in the Channel Islands) are much more abundant. The density of white sea urchins for example

has increased by a factor of 4 inside the reserve since it was established in 1983, compared to a factor of 15 outside the reserve. Grazing by the urchins effects the settlement success of the giant kelp. The consequence has been almost complete loss of the kelp outside the reserve and therefore loss of the structure of kelp forests along this section of coast. In contrast kelp cover has increased within the reserve (Caselle 2004)

The potential for MPAs to provide conditions for habitat ‘recovery’ has also been demonstrated. Two examples are the closure of areas to commercial scallop dredging on maerl beds off the Isle of Man which allowed the development of more heterogeneous benthic communities (Bradshaw *et al.*, 2001), and the greater benthic habitat on the northern Georges Bank after scallop dredging was banned (Collie *et al.*, 2004) (Figure 14).



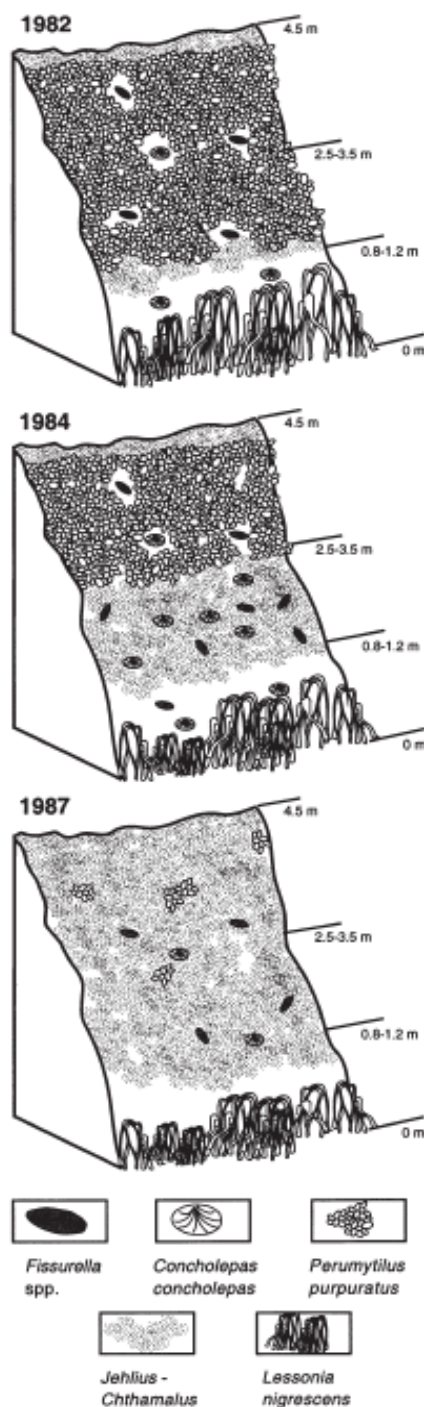
Figure 14. Photographs of the sea floor at a sampling station in an area of the Georges Bank closed to scallop dredging prior to closure (1994) and in subsequent years. 1994: prior to closure only a few burrowing anemones (ba) can be seen. 1996; many burrowing anemones and a hermit (hc) can be seen. 1997; sponges, bryozoans (br), a sea urchin (su) and small scallop (sc), a hermit crab and toad crab (tc) can be seen. 1999; sponges and a large scallop are evident. Photos by Dann Blackwood, USGS. (Figure 8 in Collie *et al.*, 2004).

3.2.4 Community effects

Research on HPMRs also provides some evidence of community benefits such as greater complexity of food webs and increased primary and secondary productivity. An analysis of data on coastal fish assemblages from thirty-one temperate and tropical locations by Micheli *et al* (2004) showed that the abundance of top predators increased gradually through time suggesting that HPMRs are an effective tool for rebuilding top trophic levels such as those depleted by fishing.

The diversity of predators is also relevant as shown in an experimental study on the effect of predator diversity on kelp biomass. The predatory species of crab *Cancer productus* and *C. magister* and the predatory sunstar (*Pycnopodia helianthoides*) caused grazers to reduce their feeding rates but no single predator reduced grazing by all both herbivores, the kelp crab *Pugettia producta* and the sea urchin *Strongylocentrotus purpuratus* (Byrne *et al.* 2006).

Community benefits have been observed in New Zealand where protection in the Leigh Marine Reserve and Tawharanui Marine Park has led to an increase in the numbers of snapper and lobster which are no longer fished alongside localised declines of their sea urchin prey. One consequence has been an increase in kelp production, higher trophic complexity and increased primary and secondary productivity (Babcock *et al.*, 1999; Shears & Babcock, 2004). Similar “trophic cascade” effects have also been reported following analysis of two decades of data from the US Channel Islands National Marine Sanctuary (Salomon *et al.*, 2005).



In Chile the creation of a no-take reserve in an area previously subject to intertidal collection, at Mehiun, led to an increase in the size and abundance of the keyhole limpets which had been harvested and an associated decline in the abundance of the algae on which these limpets feed (Duran & Castilla, 1984). At Las Cruces, also in Chile, the establishment of a HPMR led to an increase in the abundance and size of the gastropod *Concholepas concholepas* which had previously been exploited. This was followed by a reduction in the abundance of the mussels which are its main prey. This created areas of open space which became colonized by barnacles and subsequently a decline in the abundance of *C. concholepas* attributed to food shortages (Figure 15) (Thompson *et al.*, 2002). The intensity and extent of collecting was such that Paine (1994) considered that the effects have probably influenced community structure at a landscape scale.

Figure 15. Changes in community structure on an exposed rocky shore at Las Cruces, following human exclusion in 1982 (Figure 3 from Thompson *et al.*, 2002), based on review by Hawkins *et al.* 1999a, with permission from Paine 1994).

3.3 HPMR's and Ecosystem services

The Millennium Assessment (2005) defines ecosystem services as “the benefits which people obtain from ecosystems” and divides these into four categories; provisioning, regulating, cultural and supporting services. Using these headings the types of services provided by intertidal habitats have been described in an England-based case

study (EFTEC *et al.*, 2006). Beaumont & Austen (2006) have identified twelve goods and services provided by marine biodiversity under these headings, and a thirteenth which is ‘future unknown and speculative benefit’. These three outputs are summarised in Table 7.

Table 7 Millennium assessment categories of ecosystem services with details for intertidal habitats and marine biodiversity

Millennium Assessment categories of ecosystem services	Intertidal examples from England-based study (EFTEC <i>et al.</i> , 2006)	Goods & services provided by marine biodiversity (after Beaumont & Austin, 2006)
Provisioning	Food products Fibre and construction products Medicinal and cosmetic products Ornamental products Other natural coastal products Renewable energy sources	Food provision Raw materials
Regulating	Filtration of water Detoxification of water & sediments Nutrient retention Carbon fixation and sequestration Global climate regulation Local climate regulation Erosion control Flood risk mitigation Pollination	Disturbance prevention Gas and climate regulation Bio-remediation of waste
Cultural	Preservation of archaeology Education and scientific research resource Gene bank for reserve and development of products Recreation & tourism Physical health benefits and promotion of personal wellbeing Historical meaning and cultural importance	Leisure and recreation Cultural heritage and identity Cognitive values Non-use values
Supporting	Production of oxygen Nutrient cycling Habitats of conservation importance Association with species of conservation importance High rates of primary production Regenerative services	Resilience and resistance Biologically mediated habitat Nutrient cycling

Protected areas are mentioned in the Millennium Assessment as an effective way of enhancing particular ecosystem services, while “the conservation of ecosystem structure and functioning in order to maintain ecosystem services” is one of twelve guiding principles for implementation of the Ecosystem Approach to management promoted by the Convention on Biological Diversity.

Provisioning services are probably the easiest to quantify. The most obvious coastal and marine examples relate to fisheries. There is a considerable literature describing both the potential and actual effects of MPAs, including HPMRs, on commercially important species (e.g. Dugan & Davis, 1993; Gell, & Roberts, 2003). Reviews and individual studies have presented evidence of benefits as well as cases where there has been no discernable effect on fish and shellfish populations. The potential for negative effects resulting from lack of controls on any displaced pressure outside MPAs have also been described (e.g. ICES 1994a).

In an examination of the fishery effects of HPMRs Gell & Roberts (2003) conclude that the benefits for adjacent fisheries depend on the protection of spawning and vulnerable life stages and that “protection from fishing allows exploited species to live longer, grow larger and become more numerous, all of which increase reproductive output”. Surrounding fisheries can be

enhanced by the dispersal of pelagic eggs and larvae out from the reserve, as well as movement of juveniles and adults out to the fishing grounds.

Sweeting & Polunin (2005) have examined the potential of MPAs for management of temperate North Atlantic fisheries and concluded that “while not being a cure-all of fisheries management, MPAs can be valuable tools for the preservation and enhancement of certain critical habitats and management of site-attached shellfish and finfish populations”. They also note that in very specific situations MPAs may benefit mobile species of socio-economic importance.

The provisioning benefits of improving the status of fish stocks are not restricted to commercial fisheries. A study of the trends in sportfishing catches in the western English Channel in areas where towed fishing gears were restricted reported a positive influence on trophy fish species that mature early and have a limited home range (Blythe-Skyrme *et al.*, 2006). Recreational sea anglers appear to be getting some spillover benefit from the gear restriction areas.

There are a range of studies describing the regulating and supporting services of coastal and marine ecosystems such as coast protection, nutrient cycling and regulation of climate (e.g. Elliott *et al.*, 2006). Habitats in Welsh waters which provide such services include saltmarsh, mudflats, seagrass beds, kelp forests and mussel beds (Figure 16). The precise role of HPMRs in supporting and safeguarding such services is difficult to quantify, as is their relative value compared to other management measures. Nevertheless, if HPMRs can protect the structure and functioning of such ecosystems, they will continue to contribute to the provision of such services. In some situations HPMRs may also be the most practical way of providing such protection given that area based protection can be easier to enforce than general measures targeted at certain habitats and species wherever they occur. Another supporting service potentially provided by HPMRs is improving the resilience of coastal and marine habitats if they act as reservoirs for recruitment to surrounding areas. This is discussed further in section 3.3.4.

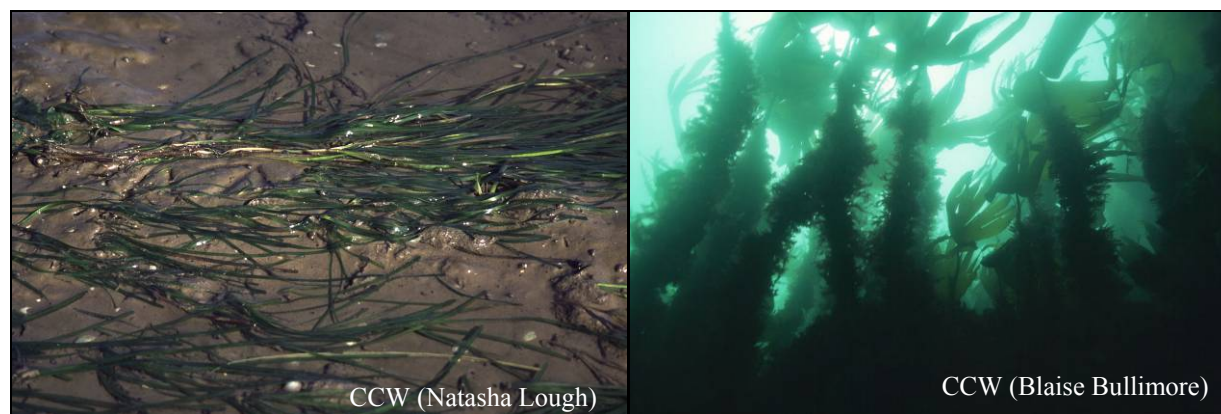


Figure 16. Seagrass beds and kelp forests are two examples of habitats found around the coast of Wales which provide ecosystem services such as coast protection and nutrient cycling

Cultural services such as education and interpretation are a key element of many MPAs, including HPMRs. These are used to raise awareness and knowledge of the coastal and marine environment as well as to encourage responsible use of such areas. There is a considerable literature showing the benefits and importance of these services to MPAs and the conservation of biodiversity (e.g. Shackell, & Willison, 1995; IUCN, 2003).

A recent analysis of the effects of change in marine biodiversity on ecosystem services using data from local experiments, long-term regional time series and global fisheries data concluded that “marine biodiversity loss is increasing impairing the ocean’s capacity to provide food, maintain water quality and recover from perturbations” (Worm *et al.*, 2006). An examination of the effects of forty-four HPMRs and four large-scale fisheries closures found an average increase in the diversity of species of 23%. When taken together with the other observed effects the authors conclude that at this point it is still possible to recover lost biodiversity, at least on local to regional scales using management measures which include the creation of marine reserves.

3.3 HPMRs as a management regime

One of the factors determining the type and scale of benefits to biodiversity from MPAs is the management regime. Designating MPAs as HPMRs is only one of several options and it is at the most restrictive end of the range. The definition used in this report makes it clear that all extractive activities would be prohibited in such areas as would the dumping of dredge spoil, munitions and other substances. The placing of structures such as oil platforms, wind turbines and tidal current generators would also be banned. This is a strict management regime so it is important to consider how the benefits for biodiversity compare with those resulting from other MPA management regimes. Four alternatives are discussed below using examples from around the British Isles; partially protected areas, seasonally protected areas, short-term HPMRs and permanent HPMRs.

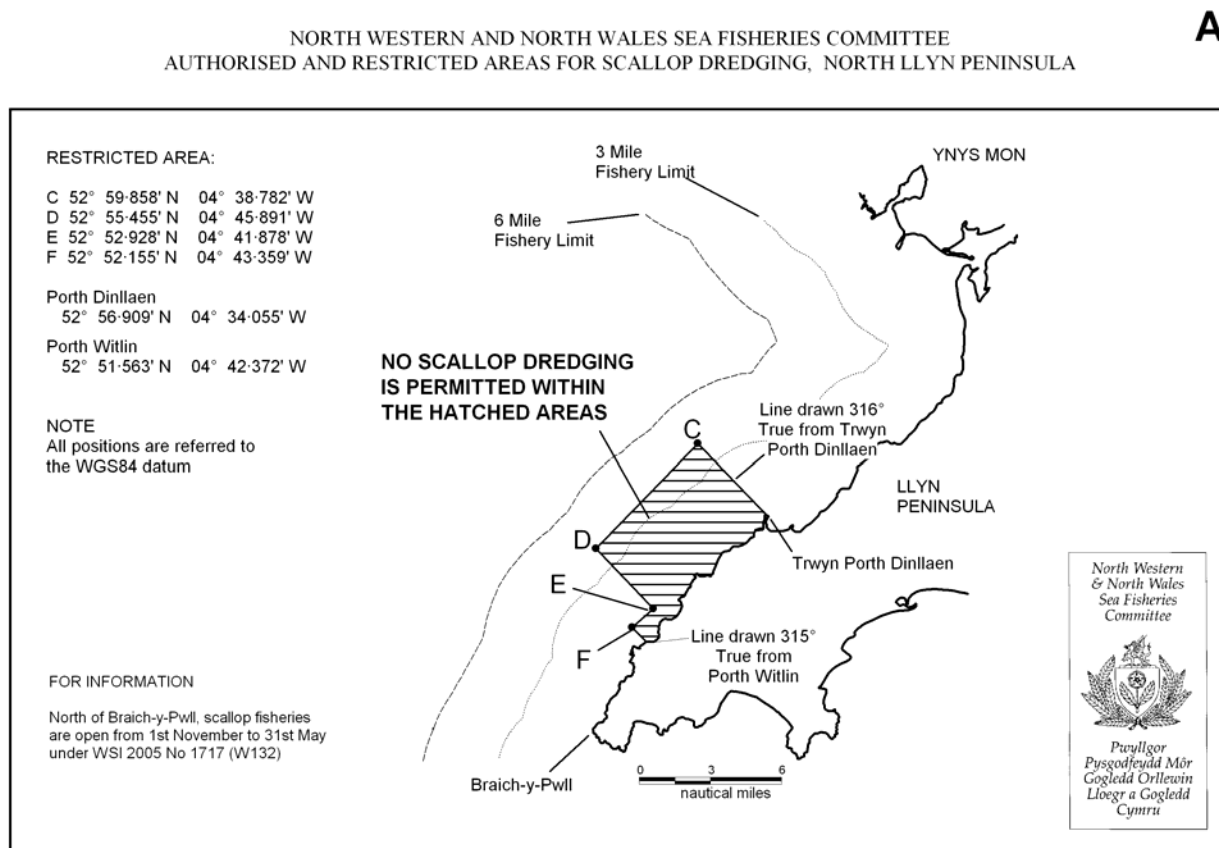
3.3.1 Partially protected areas

There are many coastal and marine examples of partially protected areas. Indeed this approach is the norm for fisheries management as well as for nature conservation. When used for fisheries management such areas are commonly referred to as fisheries ‘boxes’ and they are used alongside other fisheries management measures to support sustainable fisheries. Examples in northern Europe are the Shetland Box, Norway Pout Box, Plaice Box, Mackerel Box and Cod Box. Detailed objectives of such areas include protecting spawning stocks, avoiding capture of juvenile fish, and reducing fishing effort.

Partial protection is also the norm for nature conservation within MPAs and most commonly focused on commercial fishing although other activities may also be prohibited. Figure 17 is one example where restrictions have been introduced for nature conservation reasons rather than fisheries conservation reasons. A similar but longer running example is the dredging and beam trawling ban for nature conservation reasons at the designation of the Skomer Marine Nature Reserve in 1990. Besides unquantified benefits to benthic species, there has been a 9-fold increase in the number of *Pecten maximus* within the MNR since surveys carried out in 1984 (Luddington *et al.* 2004). The objectives of such MPAs are often very broad and all encompassing. For example, the objective set out in the EC Habitats Directive for the network of Special Areas of Conservation is to maintain or restore listed habitats at a favorable conservation status in their natural range. For bird species in Special Conservation Areas the objective is to “conserve the habitat of the species in order to ensure their survival and reproduction in their area of distribution”. Objectives for individual sites are likely to be more specific.

Other types of area which provide partial protection such as safety zones and areas of cultural heritage importance are described in Section 2.3. Incidental effects on biodiversity have been investigated at some of these sites and in other cases they have been used as control sites to study the effects of protection from fishing (e.g. see Section 3.1.3.). Two examples around the British

Isles are the ongoing investigations into the effects of protection from fishing in the BUTEC area⁸ on the Firth of Clyde and a long term study on the effects of excluding scallop dredging in an area off the south west coast of the Isle of Man (Beukers-Stewart *et al.*, 2005).



21st April 2006

Figure 17. Restrictions on scallop dredging introduced by the North Western and North Wales Sea Fishery Committee to protect horse mussel beds in the Llŷn Peninsula marine SAC.

Table 8 summarises the findings of a review of partially protected areas for fisheries management in Northern Europe. The authors of this study concluded that most of these have had little success in reaching their management objectives but that despite this there may be spin-off benefits for biodiversity. These are most apparent in areas where mobile bottom gears are prohibited where benefits may include a greater diversity of benthic fauna, more abundant erect epifauna and more heterogeneous benthic habitats (e.g. Bradshaw *et al.*, 2001; Lindholm *et al.*, 2004).

3.3.2. Seasonally protected areas

Seasonally protected areas are often a sub-group of partially protected areas. Seasonal protection is typically used as a fisheries management tool. Areas may be closed to some or all fishing activity at a time when particular fish stocks are vulnerable. Typically this will be to protect spawning stocks. Intertidal examples include seasonal closure of cockle and mussel beds on the North Wales coast to commercial collection in the area under the jurisdiction of the North

⁸ British Underwater Test and Evaluation Centre where an area of sea, tidal waters and shore in the District of Ross and Cromarty has been commandeered by the Secretary of State for defence purposes.

Western and North Wales sea fisheries committee. These fisheries are regulated through the issuing of annual permits which specify when commercial collection is permitted. There are similar arrangements regulating cockle fisheries in the area under the jurisdiction of the South Wales Fisheries Committee (Figure 18). Some of the examples relating to finfish which are given in Table 8 are also seasonal closures. As with other types of partial closures (described in Section 3.3.1) the success of this approach in achieving the objectives for which they have been set up appears to be limited.



Figure 18. Seasonal commercial collection of cockles at Three Rivers, Carmarthen Bay.

In terms of benefits for biodiversity this approach may not be particularly helpful given reports of increased fishing effort and damage once sites are re-opened for exploitation. One well reported example is the southern North Sea Plaice Box where a large increase in fishing effort was observed when the box was opened to fishing in the fourth quarter of the year in 1994 (ICES, 1994b). Seasonal closures may however temporarily prevent further deterioration and could be a useful emergency measure.

Table 8. Outcomes of the partial protection of areas in the North Sea to benefit of commercial fisheries (table prepared from text in PROTECT, 2006)

Location	Objectives	Restriction	Permanence	Estab	Outcome
North Sea Cod Box	Protect spawning cod as a part of Cod Recovery Plan	Partial – Sandeel and pelagic fishing permitted with observers on board	75 days	2001	No overall effort reduction during closure; only displacement of effort. Possible negative effect on surrounding areas not normally fished. Catches higher for 2-3 weeks after re-opening then returned to normal
Western English Channel and Bristol Channel	Reduce catch and discards of juvenile mackerel	Partial - Purse seining and pelagic trawling for mackerel prohibited.	Seasonal	1981-1989	Wintering area shifted away from box and therefore fishing effort shifted. Objective achieved but not only because of the box. Still high proportion of juveniles in box therefore this measure has been maintained and made permanent in 1989
Sprat closed Area – adjacent to Northumberland coast.	Reduce mortality of juvenile herring.	Partial	Seasonal	1998-present	Initial decrease in herring by-catch, followed by increase and more recently a decrease
Southern North Sea Plaice Box	Reduce by-catch and discard of undersize flatfish (sole & plaice) to increase recruitment, SSB and enhance fishery yields	Partial - Trawl fisheries prohibited but with certain exemptions	Seasonal	1989-1994	Small increase in abundance of under-size age groups of plaice and sole but less than predicted. Permanent closure introduced in 1995
Southern North Sea Plaice Box	Reduce by-catch and discard of undersize flatfish (sole & plaice) Increase recruitment, Spawning Stock Biomass and enhance fishery yields outside	Partial - Trawl fisheries prohibited but with certain exemptions	Permanent	1995 - present	Yield and SSB decreased, Recruitment on average decreased over time. Shelters approx 70% of juveniles, landings believed likely to fall if controls removed
Shetland Box	Protect species of special importance which are biologically sensitive by reason of their exploitation characteristics	Partial – through licensing	Permanent	1983-present	Higher concentrations of mature haddock and whiting, and young anglerfish and to a lesser extent, young haddock than outside Annual landings higher in box for light trawlers Demersal stocks declined in abundance SSB below that of 1983 for cod haddock and whiting and close to 1983 value for saithe
Norway Pout Box - North Eastern North Sea	Reduce fishing mortality on juvenile gadoids such as haddock & whiting in the Norway pout fishery to increase recruitment	Partial	Permanent	1986 - present	No data available for evaluation. Fishery closed in 2005

3.3.3. Short term HPMRs

Short term HPMRs established for perhaps 1-5 years have been advocated as a possible management measure for both biodiversity conservation and fisheries management. In the latter case the aim is usually to rebuild stocks and then open up the area so that commercial fishers can benefit. For biodiversity conservation short term HPMRs would provide a period of respite from exploitation and other damaging activities. This may allow the recovery of some impacted species and habitats but not others nor for the re-establishment of community structure and assemblages. Short term HPMRs could perhaps result in some positive effects on surrounding areas through dispersal of protected species out from the HPMR.

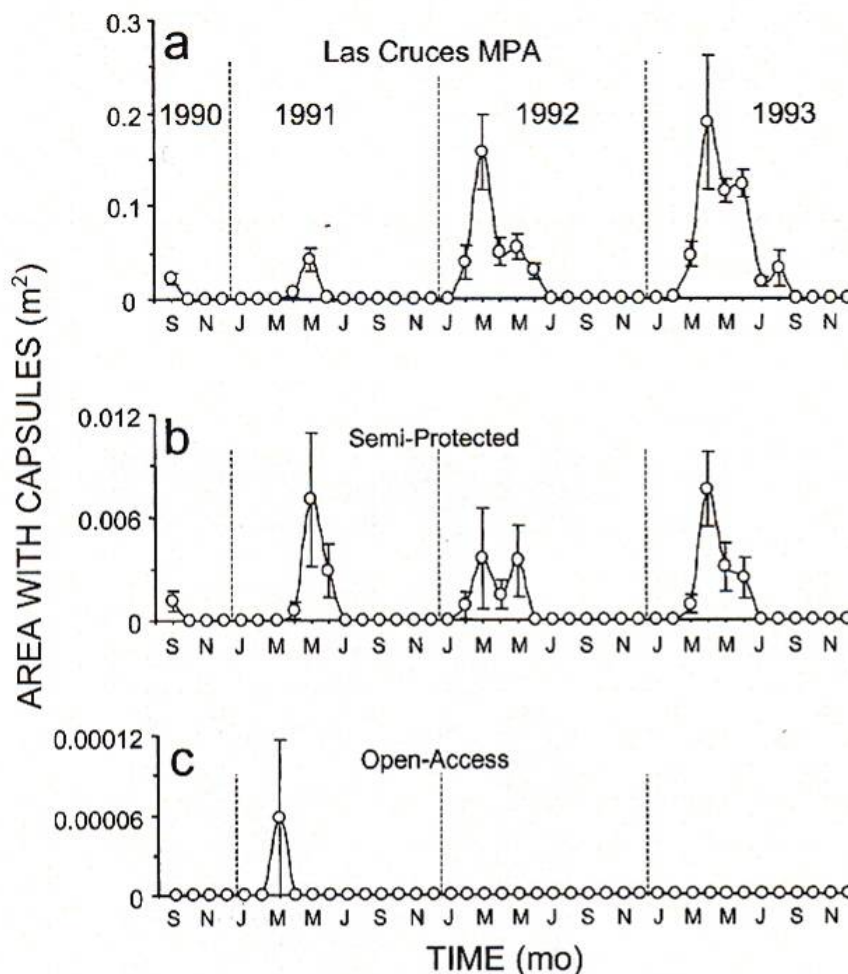
The likely effects of short term HPMRs are probably best judged by looking at areas where protection has only recently been established. Reviewing data from reserves established for different periods of time Halpern & Warner (2002) concluded that the most likely initial changes would be in relation to density, biomass, average organism size and diversity. Their analysis showed that these variables reached mean levels within 1-3 years. Previously harvested species and those with limited range are also believed to be the most likely to benefit in the early years of HPMRs.

The only example of a recently established HPMR in UK waters is around the island of Lundy where extraction is not permitted and which is not used as a disposal site. Statistical significant effects reported in the two years since the HPMR became operational are an increase in size and abundance of lobsters and in the size of scallops. A greater abundance of scallops and some sessile epifauna has also been reported but not at statistically significant levels.

3.3.4 Permanent HPMRs

Establishing HPMRs on a permanent basis is another option. The potential effects, which have been described in Section 3.1, include increases in biomass, abundance, and density of some species, protection and restoration of some benthic habitats, and recovery of trophic structure. Longer term studies show that there are continuous changes in community composition and transient states in community structure over decades (e.g. Mitcheli *et.al.*, 2004). One of the few studies in temperate waters which has compared the effects of different management regimes has been carried out in Chile (Manríquez & Castilla, 2001). The gastropod *Concholepas concholepas* lays egg capsules in rocky intertidal and shallow sublittoral areas. The size and abundance of egg capsules in harvested areas with open access, areas where the harvest was managed, and protected unharvested areas were compared over a three year period. Egg capsules were more abundant in the protected areas as well as being larger (Figure 19). The researchers conclude that the protected areas may play an important role in the natural replenishment of stocks of this species through increased larval export.

Figure 19. Area (m^2) occupied by newly cemented egg capsules of *C.concholepas* along intertidal transects (a) Las Cruces MPA; (b) semi-protected area; (c) open-access fishing ground. Data are means \pm SE (figure 5 in Manríquez & Castilla, 2001).



Permanent HPMRs have the potential to provide the greatest benefit to biodiversity conservation of all the four options described here. The comprehensiveness of protection and its permanence are likely to be especially valuable in three contexts: recovery, resilience and research.

There is an abundance of data showing changes in the coastal and marine environment as a result of human activity. Some examples from around the coasts of Wales are the disappearance of native oyster beds, the loss of mudflats and salt marsh to land claim and the decline in migratory species of fish such as lamprey and eel (Dernie *et al.*, 2006). Reversing this trend so that species and habitats are in favourable condition is one of the aims of the *Natura 2000* network of SACs and SPAs. This ideal may not always be possible given regime shifts in ecosystems and wider changes such as those associated with climate change, but HPMRs are one tool which can help, by removing localised impacts and allowing space and time for recovery. Indeed long term protection will be the only way to support the recovery of long-lived, slow growing and late maturing species.

The role of HPMRs in maintaining and building resilient ecosystems is harder to quantify but equally important. The resilience of a system is a measure of its ability to recover from

disturbance, whether natural or the result of human activity. Healthy ecosystems are likely to show greater resilience than those which are degraded and damaged, and hence the importance of HPMRs which will minimise impacts. Their effect in supporting resilience will undoubtedly depend on many factors including how extensive they are and the type of habitats they cover.

A third and equally critical role for HPMRs is for them to act as reference areas or ‘controls’ against which we can better understand and deal with the impacts of human activities on the marine environment and improve our knowledge of natural systems. These types of areas are invaluable for scientific research yet there are few in coastal and marine environments. In 1994 ICES identified regions in the North Sea that could potentially be considered as ‘refuges’ to study the effects of fishing for scientific purposes but no further action was taken. A decade has passed since calls for their establishment in the North Sea by Lindeboom (1995) with similar calls reiterated today (e.g. Langloise & Ballentine, 2005).

3.4 Predicting effects of HPMRs

Because coastal and marine habitats, communities and species are influenced by many factors, the precise effects of protection are likely to be difficult to predict. Micheli *et al.*, (2004) reviewed data on coastal fish assemblages from thirty-one temperate and tropical HPMRs which had been protected from between 1-25 years and found a variety of responses. A small but significant amount of variation in the response of a species to protection depended on its level of exploitation, trophic level and the length of protection. Species targeted by fishing or collecting increased in abundance in protected areas and these positive effects were greater the longer the area had been protected. A different type of effect has been reported from the San Juan archipelago on the Washington State coast. The invasive algae *Sargassum muticum* was significantly more abundant in reserves compared to reference sites and densities of the non-native oyster *Crassostera gigas* were significantly higher within the reserves than outside (Klinger *et al.*, 2006).

The time scale over which benefits become apparent can also be difficult to predict. In some cases changes have been observed almost immediately and in others not at all or over very long time scales. A review by Halpern & Warner (2002) suggests that the first effects are most likely to be in relation to density, biomass, average organism size and diversity. Their analysis showed that these variables reached mean levels within 1-3 years and remained consistent across reserves up to 40 years of age. Other variables continue to change over long periods. For example Mitchell *et al.*, (2004) show that the differences in the structure of fish assemblages in HPMRs compared to fished areas became greater with time, and that these changes continued over decades.

In New Zealand none of the major changes in the three oldest MPAs in New Zealand (Leigh, Hahei and Tawharanui) were predicted when the reserves were created. Trends in more recent reserves were predicted but not the time scales over which they were likely to occur and the degree of change (Langlois & Ballentine, 2005). The authors of the latter study believe that there is not enough knowledge to predict the detailed outcomes of HPMRs, and that predictions which are based on exploited systems lack the baseline information of natural states to be accurate, although an understanding of ecology will give pointer on potential outcomes.

Key messages

- There are many studies, including examples from temperate waters, showing biodiversity benefits HPMRs and other types of MPA.
- The effects of MPAs and HPMRs are influenced by many factors. They are difficult to predict and the timescales over which they take place will be variable.
- Some changes e.g. in abundance and biomass may occur within a few years but there are likely to be continuous changes in community composition and transient states in community structure over much longer periods of time. Recovery of trophic structure is likely to take decades.
- The most immediate and direct effects of HPMRs are likely to be an increase in abundance of previously exploited species and those with a small range. There will be indirect effects on other species e.g. as a result of changing pressures of predation and competition
- Changes in the structure and extent of biogenic habitats, such as increasing complexity, have been observed in HPMRs.
- HPMRs are known to have beneficial effects on marine communities such as greater complexity of food webs and increased primary and secondary productivity. They may also help support ecosystem services. Habitats in Welsh waters which provide such services include saltmarsh, mudflats, seagrass beds, kelp forests and mussel beds.
- Protected areas, including HPMRs have a role in supporting provisioning, regulating, cultural and supporting ecosystem services of the marine environment
- Partially protected areas, seasonally protected areas and short term HPMRs all have a role in marine conservation however permanent HPMRs have the greatest potential to benefit biodiversity. They are likely to be especially valuable in supporting species, community, and habitat conservation as well as ecosystem recovery, resilience and research.

4. HPMRS IN A WELSH CONTEXT

The review of scientific information on the effects of HPMRs in Section 3 provides ample evidence that HPMRs can benefit biodiversity. The benefits are varied, ranging from increasing populations of particular species, to protecting sensitive and vulnerable marine habitats. These types of benefits have been reported from temperate waters as well as from the tropics. There is also a considerable body of ongoing work which is adding to our understanding of the effects of HPMRs.

Given the scientific evidence that HPMRs can benefit biodiversity the obvious next step is to consider how they might be applied to the waters around Wales and to consider the potential criteria which may be used to guide their selection.

4.1 Marine biodiversity of the shores and waters around Wales

The varied coastline and seabed around the coast of Wales support a wealth of marine biodiversity (e.g. Barne *et al.*, 1995; CCW, 1996; CCW, 2004a; Brazier *et al.*, *in prep*).

Coastal landforms which fringe the landmass range from the limestone cliffs of south Pembrokeshire, to the boulder clay cliffs of Porth Neigwl on the Llŷn Peninsula; islands such as Flatholm and Monkstone in the relative shelter of the Severn Estuary to the exposed islands of Grassholm and The Smalls off the coast of Pembrokeshire. There are rocky shores, mixed cobble and boulder shores, and sandy beaches as well as a notable number and diversity of estuaries fringed by mudflats, sandflats and saltmarsh. The wide sandy estuary of the Mawddach and the extensive mudflats of the Severn estuary illustrate this diversity. Sediment shores make up 84% of the total area of intertidal in Wales. Brackish lagoons are a much rarer coastal habitat, both in Wales and the UK with the largest example being the Cemlyn Lagoon which lies behind a shingle spit on the north coast of Anglesey.

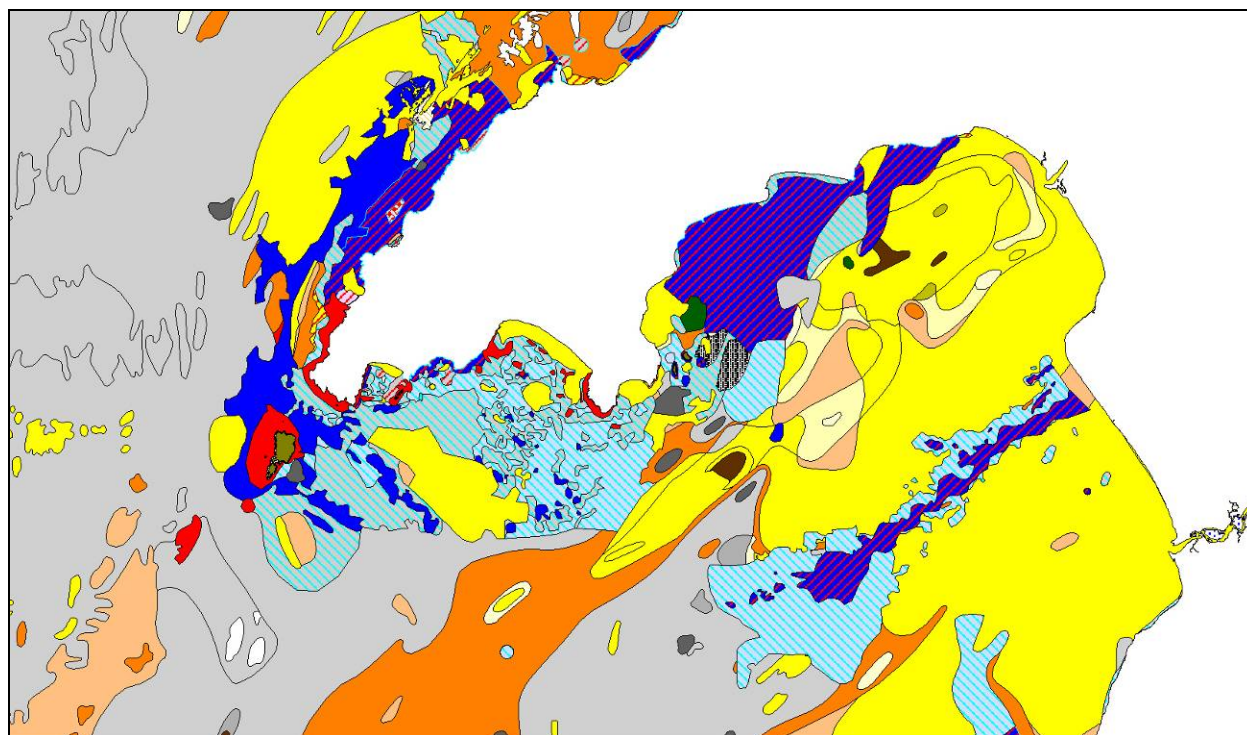
Below the low water mark exposures of bedrock form rocky reefs especially around the Pembrokeshire coast, the Llŷn Peninsula, and off Anglesey. The three Sarnau in Cardigan Bay are also reefs but these are made up of a mix of boulders, cobbles and pebbles which are the remnants of glacial moraines.

Much of the seabed off the coast of Wales is made up of soft sediments and therefore dominated by sand, gravel, mud and mixtures of these sediments. HABMAP9 is a CCW lead project that aims to produce habitat maps for the southern Irish Sea. This is being achieved by compiling existing data and collecting new data in order to build and validate a biotope prediction model. The end result will be a series of GIS-based biotope distribution maps, classified to the MNCR 04.05 biotope according to European habitat classification schemes that are based on both real and modeled data. This project will link in with MESH (Mapping European Seabed Habitats)¹⁰ that is compiling available seabed habitat mapping information across north-west Europe. Figure 16 illustrates the variety of habitats that are found within a small section of the Irish Sea.

⁹ <http://www.habmap.org>

¹⁰ MESH

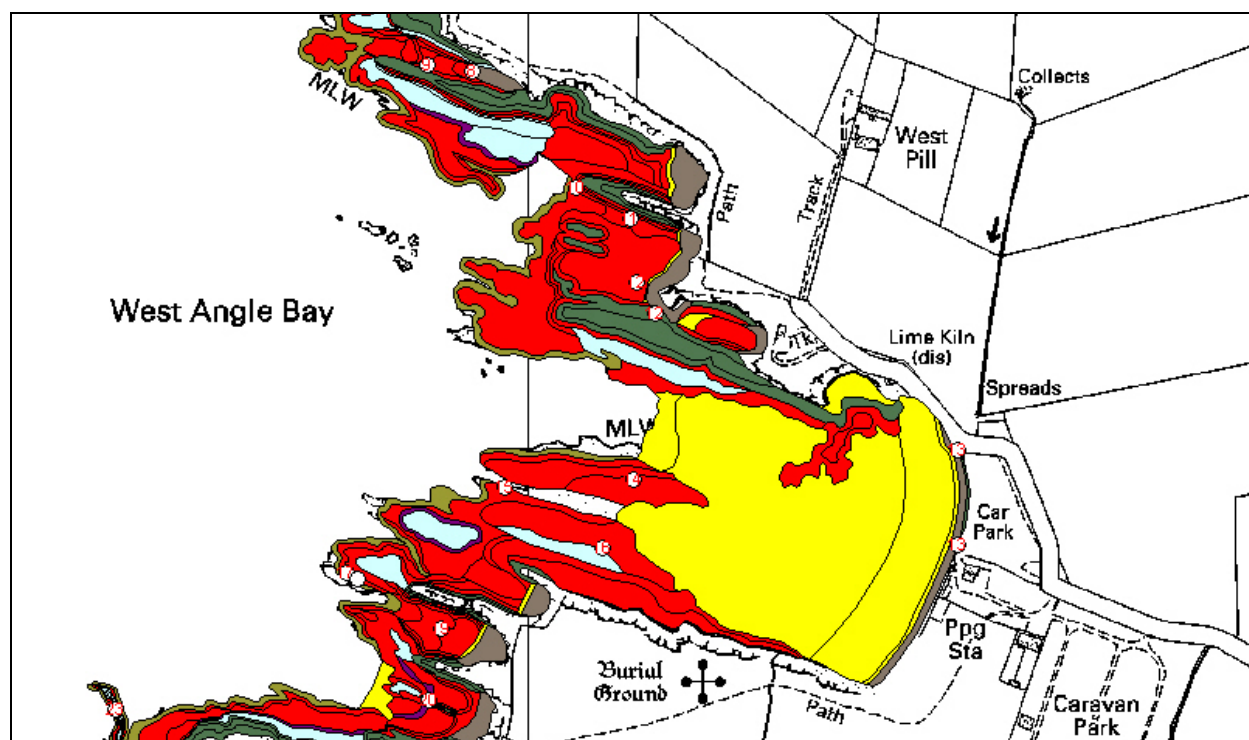
Figure 20. Sediment and rock areas as determined by HabMap (CCW, unpublished data). Each colour represents a different sediment/rock type, some colours do represent subdivided sediment types e.g. yellow is sand, muddy sand and sandy mud and grey areas are gravel sub-sediment types. Map shows the end of the Llŷn Peninsula. This is purely for illustrative purposes and does not represent suggested location for a HPMR.



Water depth, currents, and wave exposure are some of the main influences on the marine life which colonise the hard and soft substrata. In the Menai Strait, for example, it is possible to see a gradation of marine communities from those which thrive in current swept waters such as sponges, plumose anemones and soft corals, to those which can cope with extreme water flows such as keel worms and barnacles. Current swept sandy areas may appear devoid of life on the surface but they can contain large numbers of burrowing animals such as the sandmason worm. Where conditions are more sheltered eel grass beds can develop providing shelter and acting as nursery grounds for other species.

The intertidal habitats of Wales have been subject to a ten year biotope mapping survey which has mapped the whole of the Welsh intertidal zone in a consistent way (Brazier *et al.*, *in prep.*) Outputs include thematic maps, site reports and a species and habitats database (figure 17). The information collected will act as a reference for monitoring change and support nature conservation designation work, including the identification of potential HPMRs.

Figure 21. Biotope map of West Angle Bay, Pembrokeshire, produced by CCW's Phase 1 intertidal team. OS base maps reproduced with permission of the HMSO. Crown copyright reserved. CCW licence No. 100018813



The water column can also be classified into a variety of habitats whose characteristics depend on variables such as temperature, depth, degree of mixing, and proximity to land. These habitats also support a wealth of marine life, most of which is microscopic. The most conspicuous animals are the cetaceans, seals and turtles. Bottlenose dolphin, common dolphin and harbour porpoise are the most frequently recorded cetaceans from Welsh waters. Less common species include Risso's dolphin which may be seen off the coast of Pembrokeshire between September and February, killer whale, and minke whale (CCW, 2004b).

Grey seals are often seen around the exposed rocky coastlines of Wales, especially off Pembrokeshire which is used as a pupping area. They are sometimes joined by common seals but this is not typical. Three species of turtle have been recorded in Welsh waters but the majority of sightings and strandings are of the leatherback turtle which occurs seasonally, between August and October, and which is almost certainly present as a result of deliberate migratory movement.

The coastline and waters around Wales are also important for birds. Skomer, Skokholm and Grassholm support large colonies of nesting seabirds including more than 1% of the world population of Manx shearwater, gannet and lesser black-backed gull. The intertidal flats in areas such as the Severn estuary, Burry Inlet, Carmarthen Bay and the Lafan Sands act as major feeding grounds for waders and wildfowl such as oystercatcher dunlin, wigeon and shelduck.

4.2 Potential benefits for marine biodiversity in Wales

The precise benefits of HPMRs to marine biodiversity in the waters around Wales will depend on a variety of factors including what is present in the selected area and its condition when a HPMR is established. The review of effects of HPMRs in Section 3 identifies six main types of potential benefit for marine biodiversity. Table 9 lists these potential benefits and gives examples (illustrated in Figure 22) of species and habitats which occur in the waters around Wales that could show these benefits.

Table 9 Examples of species and habitats in Welsh waters which could benefit from HPMRs. N.B. This should not be considered as an exhaustive list.

Potential benefits of HPMRs	Examples of species and habitats in Welsh waters which could benefit
Higher densities, biomass, size and diversity of certain species or groups of species.	e.g. commercially exploited species such as the crayfish <i>Palinurus elephas</i> , and king scallop <i>Pecten maximus</i> , and fish species which are long-lived, slow growing or have a relatively limited range such as wrasse, blennies and gobies.
Preventing physical damage and degradation marine habitats	Calcified red seaweed (Maerl) beds, Horse mussel (<i>Modiolus Modiolus</i>) beds
Community and ecosystem benefits such as greater complexity of food webs and increased primary and secondary productivity	Kelp forests
Space and time to support the recovery and restoration of degraded habitats and declining species	Native oyster beds (<i>Ostrea edulis</i>)
Building and supporting resilience in ecosystems by reducing impacts on the health of marine ecosystems	<i>Zostera marina</i> seagrass beds
Providing reference areas for studying and improving understanding of the impacts of human activities on the marine environment and natural systems	Eg. Edge of range species such as the scarlet and gold star coral <i>Balanophyllia regia</i> , habitats known to be impacted by human activity such as sublittoral sands and gravels, and slow growing species such as the pink seafan <i>Eunicella verrucosa</i>

Figure 22. Some of the species which could benefit from the establishment of HPMRs in Wales. Clockwise from top left: the native oyster *Ostrea edulis*, the Ross Coral (*Pentapora foliacea*), the pink seafan (*Eunicella verrucosa*) and the crayfish (*Palinuris elephas*).



All of these potential benefits are important in a Welsh context given the commitments made by the Welsh Assembly Government in its Environment Strategy (WAG, 2006). This states that “the marine environment around Wales will be valued by all, understood and respected for what it contains and provides. Our seas will be clean, support vibrant economies, **and healthy and functioning ecosystems that are biologically diverse, productive and resilient**, while being sensitively used and responsibly managed” (emphasis added). HPMRs are a valuable management tool which can be used to help achieve this objective.

The WAG Environment Strategy is an important policy driver for realising the benefits of HPMRs but there are also practical drivers. These range from ensuring the sustainability of businesses which rely on a healthy marine environment such as shellfisheries and tourism, to historical changes in Welsh maritime ecosystems such as the disappearance of large beds of native oysters, loss of intertidal sand and mudflats as a result of land claim, and reductions in some fish and shellfish stocks (Dernie *et al.*, 2006).

There is no reason why any site should not benefit from HPMRs in at least one or even all of the six ways listed above although the degree and type of benefit will vary from location to location. By way of illustration, the potential benefits of HPMRs to three habitat types which occur in Wales are elaborated in Appendix 1. In each case the scope for HPMRs to eliminate threats is indicated however it is important to note that **HPMRs are not just about the elimination of threats**. Benefits such as increased resilience and scientific value cannot be viewed in these terms.

4.3 Potential criteria for identifying HPMRs in a Wales

Objectives, criteria and principles are interlinked elements which help identify potential HPMRs. Experience from around the world also reveals that decisions about where to establish HPMRs (and other types of MPA) are rarely, if ever, based on these elements alone (see Section 2.2). The final choice is ultimately a societal decision which may be reached through a combination of expert opinion, analytical techniques and the views of stakeholders. The process leading up to establishment is therefore at least as important as any guidance on how to select sites using tools such as criteria. The following discussion of criteria and guiding principles needs to be viewed in this wider context.

The review of criteria used for the selection of MPAs and HPMRs in Section 2.2 shows that a mix of ecological, social, economic and practical criteria are typically used (Table 4). The four ecological criteria which recur could be used to select HPMRs in Wales and would be certainly consistent with the existing environmental policy framework advocated by the Welsh Assembly Government, the UK Government, the European Union and international agreements such as the Convention on Biological Diversity. These criteria with some examples relevant to Wales are;

- a) Locations which are representative of particular biotopes or bioregional types e.g. *Sabellaria alveolata* reefs and sublittoral sands and gravels
- b) Locations supporting a high species and/or habitat diversity eg. Deep water mud habitats and some intertidal areas
- c) The presence of rare/unique/endemic species or habitats e.g. Muddy gravel habitat and *Modiolus* beds
- d) Functionally critical locations such as nursery areas, breeding grounds and bottlenecks on migration routes

A typical next step in the process of site selection is to decide what combination of these criteria to use and perhaps to give them some relative weighting. This is where the process becomes complex as there are almost an infinite number of options. There is also the risk of the selected criteria covering so many circumstances that virtually any location would qualify. The end result of such an approach is to make the listed criteria effectively redundant.

Any of the four criteria listed above could be used singly or in combination to identify potential HPMRs in Wales, as could a range of other criteria such as designating an agreed percentage of the sea area of Wales, or covering the entire geographic range of area of a single species such as a top predator. There are also a whole suite of practical criteria. For example, given the extent of existing conservation designations in Wales, it may be beneficial to see how HPMRs could supplement and support these designations in achieving their objectives as well as delivering wider benefits i.e. not just fulfilling the reasons for designation. They could, for example, help deliver national conservation objectives within European marine sites.

There is no analytical way of determining the ‘best’ criteria as they are not directly comparable – a case of ‘trying to compare apples with oranges’ - although quantitative methods, such as the software programme MARXAN¹¹, may help design optimal networks of protected areas by identifying locations with the least number of constraints. This is where guiding principles, including social and economic issues can be used to help refine the process.

¹¹ www.ecology.uq.edu.au/marxan.htm

A set of principles were used to provide further guidance on the identification of ‘green zones’ in the Great Barrier Reef Marine Park (see Section 2.2.1 and Box 3). Using the GBRMP as a model, key ecological principles could be developed around the following issues to guide the identification of HPMRs in the waters around Wales.

- *Size* – should there be a minimum size for HPMRs to make them viable, larger vs. smaller areas, ecologically coherent, practical etc.
- *Precaution* – How many and how extensive should HPMRs be to insure against negative impacts ?
- *Boundaries* – what ecological rules should govern boundary decisions? E.g. Inclusion of entire features, buffer zones
- *Minima* - are there a minimum areas or percentages of particular habitat types which should be managed as HPMRs?
- *Variety* – at what level of detail should habitats be classified and what range of variation in habitat types should be managed as HPMRs
- *Networks* – how could HPMRs be selected as to contribute most into networks and other types of management

Social and economic constraints and benefits of establishing HPMRs were discussed in a workshop associated with this project (see Annex 1). As these are clearly part of the decision making process there is a role for additional social and economic principles to guide the selection of HPMRs. Using the GBRMP model again, three issues which these principle could be developed around are;

- how well they compliment existing and proposed management arrangements, activities and opportunities;
- awareness of social costs and benefits of selecting particular locations;
- and promoting public understanding of all aspects of HPMRs

To move forward it is essential to recognise that site selection criteria are only an aid to decision-making rather than a precise tool for deciding where HPMRs should be. In reality the final decision on where HPMRs are located will not be a purely scientific one. On the positive side, this means that sites are more likely to have widespread support but on the negative side they are unlikely to be the “ideal” arrangement for any one interest group. Having discussed how decisions are made in relation to risk assessment, Stirling (1998) provides some guidance which can be seen as equally appropriate to making decisions about the identification of HPMRs. This would be to:

- Recognise the subjectivity in prioritising criteria
- Acknowledge uncertainty and ignorance about site selection
- Include participation as an integral part of site selection
- Ensure the selection process is transparent
- Recognise that site selection will ultimately be a social process, not an analytical act
- Focus on portfolios rather than trying and pick winners or individual options
- Use techniques which combine the discipline and transparency of quantitative methods with an openness to enable both scientific rigor as well as a range of values to be assessed systematically.

Key messages

- The benefits of HPMRs to marine biodiversity in the waters around Wales could include;
 - Higher densities, biomass, size and diversity of certain species or groups of species.
 - Preventing physical damage and degradation of marine habitats
 - Community and ecosystem benefits such as greater complexity of food webs and increased primary and secondary productivity
 - Space and time to support the recovery and restoration of degraded habitats and declining species
 - Building and supporting resilience in ecosystems
 - Providing reference areas for studying and improving understanding of the impacts of human activities on the marine environment and natural systems
- Four commonly used ecological criteria used to select HPMRs are all relevant to Wales and could be applied in Welsh waters. These are:
 - (a) Locations which are representative of particular biotopes or bioregional types
 - (b) Locations supporting a high species and/or habitat diversity
 - (c) The presence of rare/unique/endemic species or habitats
 - (d) Functionally critical locations such as nursery areas, breeding grounds and bottlenecks on migration routes

These ecological criteria could usefully be supported by a number of guiding principles which address ecological, social and economic issues relevant to HPMRs.

- Site selection criteria are only an aid decision-making rather than a precise tool for deciding where HPMRs should be. The final decision on where HPMRs are located will not be a purely scientific one. This should mean that sites are more likely to have widespread support but on the other hand they are unlikely to be the “ideal” option for any one interest group.
- Site selection needs to be an inclusive process, with opportunities for the many interested parties to play a part.

5 CONCLUSIONS

A great deal has been written about MPAs and about HPMRs in the last 30 years. This is supported by a wealth of research into ecological aspects as well as the social and economic implications of establishing such protected areas. Although much of the early work was done on tropical ecosystems this is no longer the case. There is a growing body of information on the effects of MPAs and HPMRs on temperate ecosystems including habitats such as rocky shores, sand flats, kelp forests and other coastal and marine environments comparable to those which occur around Wales. These scientific studies show a range of important potential benefits for marine biodiversity from establishing HPMRs.

The most immediate and direct effects of HPMRs are likely to be an increase in abundance of previously exploited species and those with a small range. There will be indirect effects on other species e.g. as a result of changing pressures of predation and competition. HPMRs are also known to have beneficial effects on marine communities such as increasing the complexity of food webs, as well as primary and secondary productivity. They have a role in supporting provisioning, regulating, cultural and supporting ecosystem services of the marine environment.

Some beneficial effects such as changes in abundance and biomass of particular species may occur within a few years but there are likely to be continuous changes in community composition and transient states in community structure over much longer periods of time. Recovery of trophic structure is likely to take decades.

Partially protected areas, seasonally protected areas and short term HPMRs all have a role in the conservation of biodiversity however permanent HPMRs have the greatest potential to benefit biodiversity. They are likely to be especially valuable in supporting species, community, habitat, and ecosystem recovery, resilience and research and as such will help to deliver Welsh Assembly Government aim for Wales' marine environment HPMRs offer the only effective mechanism for delivering holistic protection of habitats and species and safeguarding ecosystem function.

Four commonly used ecological criteria used to select HPMRs are all relevant to Wales and could be applied in Welsh waters. These are

- (a) Locations which are representative of particular biotopes or bioregional types
- (b) Locations supporting a high species and/or habitat diversity
- (c) The presence of rare/unique/endemic species or habitats
- (d) Functionally critical locations such as nursery areas, breeding grounds and bottlenecks on migration routes

These ecological criteria could usefully be supported by a number of guiding principles which address ecological, social and economic issues relevant to HPMRs. The final decision of where HPMRs should be located is ultimately a societal decision as there is no single or 'best' option.

This report has reviewed scientific evidence on the effects of HPMRs and reported on an associated workshop which gathered views on the legal, social, and economic constraints and benefits of such areas. The next step should be for questions surrounding HPMRs to be discussed more widely. This will need support and involvement of many parties from national to local levels, and across the wide range of stakeholders. There is much scientific evidence of the potential benefits of HPMRs for biodiversity in temperate waters. The challenge now is to have an inclusive and wide ranging process which will deliver these benefits for marine biodiversity in the waters around Wales.

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APPENDIX 1: ILLUSTRATION OF THE VARIETY AND TYPES OF BENEFITS OF HPMRS FOR THREE HABITAT TYPES

The following tables show the potential benefit of HPMRs for three different habitat types which occur in Wales. These examples were chosen to show potential effects for an intertidal habitat, a habitat which occurs in both intertidal and subtidal areas, and a subtidal habitat in Wales. In each case the scope for HPMRs to eliminate threats is indicated however it is important to note that **HPMRs are not just about the elimination of threats**. Benefits such as increased resilience and scientific value cannot be viewed in these terms.

Intertidal sheltered muddy gravels		
In Wales this habitat occurs principally in marine inlets and other areas protected from wave action and strong tidal streams. In fully marine conditions on the lower shore this habitat can be extremely species rich because of a high diversity of infauna, epifauna and epiflora. Some species of clams are characteristic of the habitat. In areas of reduced salinity there is a marked reduction in species richness.		
<u>Benefits</u>	<u>Potential ?</u>	<p>HPMRs on intertidal sheltered muddy gravels will remove direct impacts of human activity in these areas and be an incentive to deal with indirect threats. As with all HPMRs there are also likely to be unpredicted benefits which will only become apparent once sites have been established. An HPMR would also provide the first ever example of an undisturbed muddy gravel habitat in Wales to act as a reference area for studying and improving understanding of the impacts of human activities on these habitats or how they operate as undisturbed systems.</p> <p><u>Direct threats.</u> The main direct threats to muddy gravel habitat in Wales are bait digging, collecting or dredging for clams, and physical destruction or disturbance associated with coastal development. The effects of digging and clam collection include depletion of the target species, changes in species composition, alteration of the sediment characteristics. These types of effects have been reported on muddy gravel and other soft sediment habitats in Wales and elsewhere.</p> <p><u>Indirect threats</u></p> <p>The main indirect threats to this habitat in Wales is organic enrichment from sewage outfalls leading to anoxic conditions and a decrease in species diversity and domination by the non-native species <i>Crepidula fornicata</i> which can smother the sediment surface.</p> <p><u>Examples of potential benefits</u></p> <p>Removal of the identified threats could lead to changes in the species and community composition of the biotopes associated with this habitat type and possibly also the sediment characteristics. Such changes are likely to be seen as “recovery” to a more undisturbed condition. Longer term benefits such as increasing resilience cannot be predicted.</p>
Species	YES	
Habitats	YES	
Ecosystems	YES	
Recovery	YES	
Resilience	YES	
Reference	YES	
<u>Threats</u>	<u>Address threat?</u>	
Coastal development	YES	
Bait digging	YES	
Fisheries	YES	
Sewage	YES	
Non-native species	?	
References		Dernie <i>et al.</i> , 2003; Lockley, 2001; Moore, 2002; Richardson 2000; Edwards <i>et al.</i> , 1992;

Intertidal and subtidal seagrass beds		
Three species of seagrass form seagrass beds in Wales. <i>Zostera noltii</i> is found in the upper to mid shore and <i>Z.marina</i> and <i>Z.angustifolia</i> on the lower shore. The plants stabilise the substratum, are an important source of organic matter, and provide shelter and a surface for attachment by other species. Seagrass is an important source of food for wildfowl and sublittoral beds act as nursery areas for flatfish. The soft sediment infauna may include amphipods, polychaete worms, bivalves and echinoderms.		
<u>Benefits</u>	<u>Potential ?</u>	<p>HPMRs on intertidal and subtidal seagrass beds will remove direct impacts of human activity in these areas and be an incentive to deal with indirect threats. As with all HPMRs there are also likely to be unpredicted benefits which will only become apparent once sites have been established. An HPMR will also provide the first ever example of undisturbed seagrass beds in Wales to act as a reference area for studying and improving understanding of the impacts of human activities on these habitats or how they operate as undisturbed systems</p> <p><u>Direct threats.</u> The main direct threats to seagrass habitat in Wales are bait digging, shallow water trawling and dredging (e.g. for shrimp) cockling and physical destruction or disturbance associated with coastal development and boat moorings. The negative effects of these activities on seagrass beds are known to include reducing the stability of the beds, reduced sedimentation or increased removal of sediments, increased patchiness and increased turbidity which may affect re-establishment.</p> <p><u>Indirect threats</u></p> <p>The main indirect threats to this habitat in Wales is organic enrichment from sewage outfalls, competition from the non-native species cord grass and jap weed, and a wasting disease that was responsible for die-back of large areas in the 1930s. The effects of nutrient enrichment and eutrophication on seagrass beds are known to include a decrease in species diversity, decline of mature <i>Z.marina</i>, increased growth of epiphytic, blanketing or floating algae despite a potential increase in the number of grazers, reducing biomass production, the depth to which <i>Z.marina</i> can grow. The appearance of non-native species such as <i>Spartina</i> and <i>Sargassum muticum</i> have been reported to reduce <i>Zostera</i> coverage but the degree to which this happens may depend on the health of the seagrass beds.</p> <p><u>Examples of potential benefits</u></p> <p>Removal of the identified threats could affect the stability and patchiness of the seagrass beds, and also influence their ability to provide shelter for other species and to act as undisturbed nursery grounds. Longer term benefits such as increasing resilience may also become apparent. For example research has shown that <i>Zostera</i> has an increasing vulnerability to wasting disease where nutrient enrichment occurred. It has also been reported that areas of <i>Zostera</i> replaced by <i>Sargassum</i> were those which had previously been damaged by human activity.</p>
Species	YES	
Habitats	YES	
Ecosystems	YES	
Recovery	YES	
Resilience	YES	
Reference	YES	
<u>Threats</u>	<u>Address threat?</u>	
Coastal development	YES	
Bait digging	YES	
Fisheries	YES	
Sewage	YES	
Industrial discharges	YES	
Non-native Species	?	
Disease	?	
References		Moore, 2002; Davison & Hughes, 1998;

<i>Modiolus modiolus</i> beds		
In Wales this habitat occurs principally in marine inlets and other areas protected from wave action and strong tidal streams. In fully marine conditions on the lower shore this habitat can be extremely species rich because of a high diversity of infauna, epifauna and epiflora. Some species of clams are characteristic of the habitat. In areas of reduced salinity there is a marked reduction in species richness.		
<u>Benefits</u>	<u>Potential ?</u>	<p>HPMRs on <i>Modiolus</i> beds will remove direct impacts of human activity in these areas and be an incentive to deal with indirect threats. As with all HPMRs there are also likely to be unpredicted benefits which will only become apparent once sites have been established. An HPMR will also provide the first ever example of an undisturbed <i>Modiolus</i> bed habitat in Wales to act as a reference area for studying and improving understanding of the impacts of human activities on these habitats or how they operate as undisturbed systems.</p> <p><u>Direct threats.</u> The main direct threats to <i>Modiolus</i> beds in waters around Wales are physical damage from trawls and dredges, activities associated with offshore and coastal development such as trenching and cable laying, physical damage from anchors and mooring chains, and smothering from dredge spoil. The effects of these activities on <i>Modiolus</i> beds are known to include reductions in the density and extent of <i>Modiolus</i> beds flattening of emergent <i>Modiolus</i> clumps, loss of epifauna especially emergent species and damage to a variety of epibenthic organisms including many found in association with <i>Modiolus</i>.</p> <p><u>Examples of potential benefits</u> Removal of the identified threats could result in changes in the extent of <i>Modiolus</i> beds and the associated communities. There may also be better spat survival to adulthood as this is known to be best where the spat shelter amongst the mass of adults. There is limited information on the quality and natural dynamics of <i>Modiolus</i> beds and no studies on spawning and recruitment or the recovery of damaged beds. An HPMR would provide conditions under which such research could be carried out.</p>
Species	YES	
Habitats	YES	
Ecosystems	YES	
Recovery	YES	
Resilience	YES	
Reference	YES	<p><u>Examples of potential benefits</u> Removal of the identified threats could result in changes in the extent of <i>Modiolus</i> beds and the associated communities. There may also be better spat survival to adulthood as this is known to be best where the spat shelter amongst the mass of adults. There is limited information on the quality and natural dynamics of <i>Modiolus</i> beds and no studies on spawning and recruitment or the recovery of damaged beds. An HPMR would provide conditions under which such research could be carried out.</p>
<u>Threats</u>	<u>Address threat?</u>	
Fisheries	YES	
Offshore & coastal development	YES	
Anchoring	YES	
Waste dumping	YES	
References		Moore, 2002; Holt <i>et al.</i> , 1998:

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ANNEX 1: WORKSHOP REPORT

Highly Protected Marine Reserves

Report of workshop held on 21st September, 2006, Bangor

Chairman: R.Earll.

Presentations and briefings by S.Gubbay, P.Jones & D.Owen

1. INTRODUCTION

There is a considerable body of information from around the world which describes the effects of Marine Protected Areas (MPAs), including Highly Protected Marine Reserves (HPMRs), on marine biodiversity and ecosystems. The findings have been reported in the scientific literature, management reports for particular sites and other documents. There have also been several decades of debate and reporting on the criteria for selection of MPAs, the potential constraints relating to their establishment and the range of management options which might be used once sites are established. The UK Government has confirmed that MPAs will play a key role in achieving its strategic goals for the marine environment, and issues such as those listed above will be key in influencing where such sites might be and what they can achieve.

In July 2006, the Countryside Council for Wales commissioned a research project to provide a synthesis of current thinking on HPMRs specifically tailored to the marine environment around Wales. This followed advice given to the Assembly by CCW earlier in the year that HPMRs are a necessary element of taking forward the Ecosystem Approach in Welsh waters, and is intended to provide more information regarding the likely benefits of having HPMRs within Wales to the Assembly.

The research project included a workshop, held in Bangor on the 21st September 2006, to gather views on the constraints and benefits of HPMRs. The findings are reported in this Appendix to the main research report.

Workshop participants were drawn from individuals whose experience covered a cross-section of interests in sustainable development of the marine environment, and not necessarily with a working knowledge of HPMRs. The list of attendees is given in Appendix A.

1.1. Workshop aims and programme

The aim of the workshop was to gather views on the potential constraints and benefits of HPMRs from a variety of perspectives. This interactive approach was favored over a desk study because it would;

- (a) Draw out different perspectives
- (b) Provide a fuller understanding of the issues surrounding potential constraints and benefits
- (c) Provide an opportunity to involve other parties and bring them up to speed with the work before a final report is published.
- (d) Provide feedback and views from CCW and others to be incorporated into the main report at an earlier stage than submission of the draft report
- (e) Enable more CCW staff to have an input to the project

The workshop was divided into four sessions:

Session 1 – Introduction to mapping the main constraints & benefits

This session introduced the aims of the day. There was also a short presentation on HPMRs setting out the definition to be used during the workshop and explaining how it was developed. Participants were then asked to prepare their first listing of potential constraints and benefits of establishing such area in Wales. A mind-mapping exercise was used to pool information from individual lists and visualise interactions under the 5 guiding principles of sustainable development: social, economic, environmental, governance/legal and science/information.

Session 2 – Perspectives on constraints and benefits

This session included presentations by the project team on constraints and benefits of HPMRs from legal, environmental and social perspectives. Economic constraints and benefits were developed in a plenary session and recorded by participants.

Session 3 – Priorities & interactions

Using the “mind map” and ideas from the briefings, participants were asked to work in small groups to elaborate constraints and benefits in more detail. These were reported to the plenary session and prioritised by participants.

Session 4 – Feedback

The final session was an opportunity for all participants to give their views on the identified constraints and benefits, their interactions and priorities. This was also an opportunity to raise other questions and express views on HPMRs in Wales.

1.2 Definition of a Highly Protected Marine Reserve.

There are numerous definitions and interpretations of what is meant by MPAs and HPMRs. The following definition was used for the workshop:

"Any area of intertidal or subtidal terrain, together with its overlying waters and associated flora and fauna, in which extraction and/or deposit of marine life, substances, articles and energy is prohibited by law and which is also protected from other harmful human uses"

This is at the more restrictive end of the spectrum of possible definitions and was considered to be suitable for the purposes of the workshop because of its relative clarity and because it was likely to elicit the strongest views about the constraints and benefits of HPMRs. **It is important to be very clear that this definition was used in its strictest sense for the purposes of the workshop only, and is not an agreed definition that CCW will be using for HPMRs. It is also important to emphasise that this definition is not intended to be legally robust.**

2. SUMMARY OF WORKSHOP BRIEFINGS

The full text of the three workshop briefings is attached in Appendix D. This section summarises the key points set out in each of these briefings.

2.1. Legal issues

Several legal issues affecting the management of HPMRs are described in the legal briefing paper at Appendix D.1. The focus in that paper is on certain legal instruments at the international, European Community (EC) and UK levels. A summary of the briefing paper's key points, drawn from its executive summary, is presented here. However, readers are advised to consult the briefing paper in its entirety. **The points made on page 1 of the briefing paper regarding copyright and in the disclaimer apply likewise to the summary that follows in this section.**

At an international level, a key treaty in the current context is the 1982 United Nations Convention on the Law of the Sea (LOSC). Subject to an important exception relating to shipping (see below), as well as the need to comply with duties regarding protection and preservation of the marine environment, the coastal State has the exclusive right to regulate, authorise and conduct activities in the water column, seabed and subsoil of its internal waters and territorial sea. This is, of course, subject to any obligations of the coastal State under any domestic legislation, other treaties or customary international law. The regulation by the coastal State may include exclusion of activities for the purposes of nature conservation, which is clearly of relevance to the management of HPMRs.

The exception relating to shipping mentioned above is that the LOSC provides for ships of all States to have the right of innocent passage through the territorial sea. (In very limited circumstances, the LOSC also provides for a right of innocent passage through internal waters.) However, the LOSC also allows the coastal State to regulate innocent passage for, *inter alia*, the purposes of environmental protection. Such regulation is subject to important duties, including a duty to avoid denying or impairing the right of innocent passage.

Under the Environment title of the Treaty Establishing the European Community (the EC Treaty), the power to make rules regarding environmental protection is shared between the EC and the Member States. Article 176 of the EC Treaty makes it clear that Member States may maintain or introduce more stringent protective measures than those imposed by EC environmental protection legislation. Thus, in principle, Article 176 entitles a Member State to go further than the requirements of, say, the Habitats Directive.

The Agriculture title of the EC Treaty includes fisheries. Under the Common Fisheries Policy (CFP), the EC has exclusive legislative jurisdiction in the area of fisheries conservation, though some rule-making powers have been delegated back to the Member States. Under those powers, Member States may, in certain circumstances, establish measures to restrict the activities of fishing vessels within 12 nautical miles of their baselines. However, measures liable to affect the vessels of another Member State must first be submitted to the European Commission for approval, and that approval will not necessarily be given.

Regarding domestic law, it is necessary to consider the devolution settlement. The legal framework for Welsh devolution is complex. The principal Acts of Parliament are the Government of Wales Acts 1998 and 2006. Most of the provisions of the Government of Wales Act 2006 are still to come into force, and there are significant changes afoot. However, there is also a layer of secondary legislation by which functions have been, and continue to be, transferred to the devolved administration. Other Acts of Parliament may also transfer functions to the devolved administration, and the Marine Bill may have a role in that regard in due course.

The scope for regulation of commercial capture fisheries, dumping of substances and articles, and construction and operation of windfarms in marine internal waters and the territorial sea adjacent to Wales has been described in the legal briefing paper.

Regarding commercial capture fisheries, the principal legal constraint for their regulation at the UK level, let alone in Wales, is the limited scope of the powers for fisheries conservation that have been delegated by the EC to the Member States. Within the UK, one of the principal Acts of Parliament with potential for exercising those delegated powers is the Sea Fish (Conservation) Act 1967. Many functions under that Act have been transferred to the National Assembly for Wales (NAW), and those functions have in turn been used. The Act clearly provides a means for the NAW to exclude commercial capture fisheries from HPMRs, subject to the UK's delegated powers.

Regarding dumping of substances and articles, the principal Acts of Parliament for its regulation are Part II of the Food and Environment Protection Act 1985 (FEPA) and Part II of the Coast Protection Act 1949 (CPA). As a result of devolution, the NAW has the exclusive power to issue, or decline to issue, a licence under section 5 of the FEPA for the deposit of substances or articles in the marine internal waters and territorial sea adjacent to Wales. That power is clearly relevant to the management of HPMRs. In contrast, functions under Part II of the CPA have not been devolved to the NAW. However, for many activities where a consent under Part II of the CPA is required, a licence under section 5 of the FEPA will also be required.

Regarding construction and operation of offshore wind farms, the principal Acts of Parliament for regulation of those activities are now the Electricity Act 1989 and Part II of the FEPA. The consenting function under section 36 of the Electricity Act has not been transferred to the NAW. However, for any operation where a section 36 consent is required, it is highly probable that a licence under section 5 of the FEPA will also be required.

Overall, the analysis set out in the legal briefing paper indicates that, as things currently stand, the devolved administration in Wales certainly would not have *carte blanche* to restrict human activities in the way envisaged by the working definition of HPMR set out in section 1.2 above. That situation arises in particular because of the nature of the devolution settlement and constraints imposed on the UK by EC law.

However, it is also clear from the briefing paper that the NAW does have several important functions relevant to the management of HPMRs. For example, the paper identifies significant powers for the NAW under the Sea Fish (Conservation) Act

1967 (albeit subject to the limits of the powers delegated to Member States under the CFP) and under the FEPA.

Where it reached the limits of its powers, or where it did not have powers, it would be necessary for the devolved administration in Wales to seek cooperation from the UK government in order to manage HPMRs in the marine internal waters and territorial sea adjacent to Wales. The UK government may in turn need to seek cooperation further afield. It should be added that the nature of the devolution settlement is changing, with the prospect of more powers for the devolved administration in Wales.

2.2. Ecological constraints and benefits

Ecological constraints and benefits of HPMRs are discussed in detail in the main report and a summary of this was prepared as the workshop briefing (see Appendix D.2). The starting point was to note that 200 studies into the effects of MPAs were published in peer reviewed primary literature between 1990 and 2001 and that there is also extensive documentation on the effects of MPAs in project reports, conservation reviews, newsletters, conference proceedings and other sources.

The briefing focused on ecological constraints and benefits of HPMRs on temperate ecosystems, and on benefits relevant to nature conservation rather than the management of commercial fisheries.

The principle ecological constraints identified and described in the briefing were

- Difficulties with predicting precise effects of establishing HPMRs
- The complexity of effects
- The variable time scales over which effects become apparent
- The scope for recovery and restoration of habitats and species within HPMRs
- The need for HPMRs to be set into a wider management context

There is overwhelming evidence of the benefits of MPAs for marine biodiversity and these benefits are clearest and most significant in the case of HPMRs. The briefing identified and described the following main benefits:

- Species benefits which include higher densities, biomass, size and diversity of certain species or groups of species
- Habitat benefits
- Community and ecosystem benefits
- Recovery and restoration with HPMRs being one tool which can help halt and reverse this trend by removing localised impacts and allowing space and time for recovery
- Building and supporting resilience in ecosystems
- Providing reference areas for studying and improving understanding of the impacts of human activities on the marine environment and of natural systems.

2.3. Social challenges and opportunities

HPMRs raise several strongly inter-related social challenges and opportunities. These are described in the briefing attached as Appendix D.3 and summarised here.

The variability of the natural environment and potential uncertainty over the changes which might take place once an HPMR have been established and can make it difficult to justify a given HPMR if certain outcomes are needed. Invoking the precautionary principle will not resolve critical questions such as the scale, magnitude and likelihood of impacts that are sufficient to justify restrictions balanced against the socio-economic impacts of taking such action. HPMRs justified on the basis of the precautionary principle may thus be challenged on ‘paralysis through precaution’ grounds and related social justice issues.

Alienation and perceptual hurdles are another challenge. To the majority of observers of coastal seas most of the adverse effects of disturbance are not apparent and therefore generally ‘out of sight, out of mind’. Even if people are aware, a lack of familiarity and empathy with most marine life may result in indifference. When taken together with resource focused views of the seas these issues represent a challenge to gaining public and user support for HPMRs.

Marine ecosystems are generally ‘natural’ in management terms in that they are rarely the result of positive intervention. The non-intervention approach, particularly in HPMRs can form the basis for resistance based on the view that marine conservation is essentially a ‘humans out’ approach. A related issue is the need for a relatively large number and variety of users to be convinced of the need for HPMRs given that our seas are essentially still a common-pool resource. The multiple use nature of our seas also raises stakeholder representation and participation challenges and if these are not addressed they can lead to challenges to the legitimacy of HPMR decisions.

The economic, safety and logistical challenges of enforcing HPMRs need to be overcome. They may be challenged on the basis that excluding relatively benign users (eg. potters, long-liners) reduce the capacity for peer exclusion, enforcement and report whereas partially protected MPAs can harness the enforcement capacity of users whose activities are compatible with the conservation objectives of the site. On the other hand there could be further nature conservation benefits from control of activities currently seen as relatively benign for example by setting limits according to carrying capacity.

Set against these challenges are a variety of social opportunities associated with HPMRs. Many people are interested in marine life because it is unusual, mysterious and unpredictable. HPMRs are an opportunity to positively affect human perception of the seas, generate an interest and nurture this fascination. HPMRs can also be promoted as an opportunity to address uncertainty through collective learning amongst scientific and users based on studies and observations that only HPMRs can provide.

Recent and growing calls for HPMRs around the world reflect the extension of preservationist and ethical concerns to our seas amongst a constituency of scientific experts. This extension of concerns is itself beginning to be extended amongst the public and users of the sea, challenging the resource focused views of our seas. This is similar to the concerns that formed the basis for terrestrial conservation initiatives that challenged the production maximisation view which dominated land management during and after the 2nd World War. HPMR initiatives represent both evidence of this

extension of concerns to our seas and a means of promoting such extension, challenging resource focused views of our seas.

HPMRs can represent an important opportunity to raise support for conserving our seas simply for the benefit and enjoyment of future generations. This stewardship principle is not only a reflection of the extension of ethical concern to our seas discussed above, but is also simple to understand and potentially both taps into and encourages the extension of ethical concerns for the health and naturalness of our seas.

The relative naturalness of marine ecosystems also represents an opportunity for HPMRs as they can be promoted and supported as a means of restoring our ‘last wilderness’.

Enforcement issues were identified as a constraint but they may also be seen as an opportunity. The high level of restrictions may make HPMRs easier to enforce and also avoid objections based on discrimination if all users are excluded.

Overall, it is important to consider that HPMRs raise social challenges and opportunities. Such issues are likely to play a key role in the success or otherwise of HPMR initiatives. The proactive assessment of such issues can provide for challenges to be addressed and opportunities to be promoted. Social issues can therefore have a critical role in HPMR initiatives, though they are often neglected by both scientists and practitioners.

3. DISCUSSION & FINDINGS

3.1 Economic implications

Potential economic constraints and benefits of HPMRs were identified by workshop participants during a plenary session and recorded in a standard format (see Appendix B for raw data). A wide range of factors including location, size, existing activities, and the ecological characteristics of the areas selected for protection influence the likely economic effects of HPMRs. However some general themes emerged from the discussions.

The main potential economic benefits of HPMRs identified during the workshop were income generation, resource enhancement, and increased knowledge and understanding of marine ecosystems.

The most likely sources of income generation were thought to be through tourism and recreation revenues. HPMRs could be a “selling point” attracting visitors to the area and benefiting the local economy through increased use of support services such as accommodation and food. One respondent reported that in New Zealand income generation from SCUBA diving in the HPMR was now greater than that from the previous fishing income. HPMRs might also support income generation through new economic opportunities. Examples given included wildlife tourism, charter boat operation to visit the HPMR, survey/monitoring work. Attracting visitors to the area might also present a opportunity for sustainable financing through user fees or eco-taxes for access to the reserve for permitted activities.

There was also the potential economic benefit of resource enhancement for surrounding areas by increasing the productivity of certain fisheries outside the HPMR. The catch from such fisheries could attain a higher market value through branding as coming from sustainable resources.

Reduced regulatory costs associated with the assessing and granting/monitoring of development proposals within the HPMRs was another potential economic benefit. There was also a benefit arising from the protection of future sources of revenue by safeguarding the diversity of species.

Increased knowledge and understanding of ecosystem function is another potential benefit of HPMRs which can be of economic benefit. This may arise by providing opportunities to study 'natural' ecosystems as part of the training of future generations of marine scientists or more specifically through enabling more effective management of fisheries. HPMRs would also provide essential reference points for monitoring and baselines for environmental impact assessments. They could also be used as a low cost method of evaluating the effectiveness of sustainable development initiatives.

Prohibiting access to resources previously exploited within HPMRs is likely to result in the most direct economic consequences. These might be apparent as a loss of revenue, a decrease in profitability, or impacts on associated businesses. Such effects might be seen in fisheries that can no longer take place within HPMRs, whose profitability may fall if vessels need to travel further to make their catches elsewhere, and whose potentially reduced landings will affect the income of associated businesses such as processing facilities. Some of these losses may be offset by resource enhancement benefits of HPMRs but such benefits are unlikely to be spread across all fisheries and may not become apparent on a timescale which sustains the industry.

Prohibiting certain activities within an HPMR may also affect the operation of businesses outside the protected area. Halting the dredging of shipping channels within an HPMR which maintain access to ports outside the HPMR and displacing fishing effort are examples. Some businesses may be able to move, a cost in itself, but even then conflicts may arise when displaced activities try to operate in new areas.

The economic viability of existing businesses is another potential issue to be considered. The marine aggregate industry operates from many small ports and has a tight turnaround in the offloading of materials. If shipping is affected by HPMRs, for example, by requiring vessel traffic to take alternative routes, it may no longer be viable to use these ports or operate the industry in these areas.

Some businesses may be able to relocate but the mobility of others will be limited. Two examples discussed during the workshop were the extraction of marine aggregates and the location of offshore wind turbines. Both can only operate where the necessary resources exist in economically and technically viable locations. If these overlap with HPMRs, these strategic resources would no longer be available.

Significant new costs were also identified during the workshop as potential constraints. These were considered most likely to be associated with the need for enforcement and compliance monitoring but there could also be costs associated with effective stakeholder consultation and administering permitted activities, for example by setting carrying capacity limits. There may also be significant costs if compensation is to be paid for loss of access to resources within HPMRs.

3.2 Key interactions and priority issues

Interactions between HPMRs and key activities/topics were discussed by participants in small break-out groups. There were also two submissions from people who were unable to attend the workshop. This information was captured using the standard format provided as Form 3. The raw data can be found in Appendix C. Twenty-two different topics were identified (some by more than one group) and in each case both constraints and benefits were described (see Box)

Topics discussed in workshop break-out groups

- Access
- Communication
- Compensation
- Diving
- Dredging (maintenance)
- Education
- Enforcement
- Environment
- Effluent disposal
- Health & well being
- Marine Spatial Planning
- Oil and gas
- Planning blight
- Potting
- Profile raising for conservation
- Recreational angling
- Research
- Scallop dredging
- Shellfisheries
- Stakeholder expectations
- Site management
- Tidal stream energy

In the case of specific activities such commercial fisheries and recreational angling the main constraints were exclusion from the resource. From the fishing industry perspective a more targeted approach, through partial closures which exclude only identified damaging activities, were considered easier to justify and may also actively encourage fisheries that do not damage the conservation features of the site. The total exclusion approach of HPMRs, as defined for the workshop, was seen as removing available productive fishing ground and being “unreasonably protectionist”. This sector were of the view that they were probably best justified in very special areas of particularly high biodiversity or hot spots where rare species are found.

There were similar concerns from the aggregate and offshore renewable sectors. In the case of fisheries loss of access might be offset by a potential increase in resources available outside the HPMR, but that would not be the case for these other users. These industries did however mention a potential benefit to the conservation sector by contributing to the monitoring and managing of HPMRs if these were near their operational sites.

Consultation, selection and management of sites were another theme. All of these can be expensive and time consuming but in the longer term there were expected to be benefits. These may be directly related to the conservation of biodiversity or indirectly for example through education, research and opportunities to study undisturbed systems and from this improve management of activities taking place outside HPMRs.

As a next step workshop participants were given an opportunity to identify those constraints and benefits of HPMRs which they believed should be addressed as a priority in any future HPMR programme in Wales.

Delivering the nature conservation benefit of HPMRs was identified as the greatest priority but there was also considerable support for working on the positive profile raising opportunities of HPMRs for marine conservation. A critical element of this communication task was not to over-exaggerate the potential benefits in order to 'sell' the idea or to complicate what is a straightforward concept. There was also a need to overcome a reluctance or unwillingness to try something new even when clearly likely to have benefits and to overcome a misleading description of conservation as a use or sectoral interest. The importance of HPMRs for research was also recognised as a priority issue and therefore one which should be explored in more detail and promoted. Other useful areas of work to be taken forward were on the benefits of HPMRs for education, for recreational users, and as part of a system of marine spatial planning.

The difficulties of enforcing HPMRs were identified as a major constraint and one that needed to be addressed as a priority. This encompasses issues as diverse as having the financial resources and capacity to carry out enforcement to addressing to encouraging peer pressure to support enforcement. Weaknesses and deficiencies in the available legislation and the policies supporting them are a related constraint which was raised in a written submission. This included the ambiguous nature of the relevant legislation and caveats which limit the action which can be taken to further conservation action.

Clarifying questions about access to HPMRs was also considered to be an important area for future work. This would require decisions on the level and types of access which will be compatible with an HPMR. Stemming from this, there was support for giving some priority to effectively communicating the management provisions for HPMRs both generally as well as for specific activities. A related issue is that of stakeholder expectations of HPMRs. These could be either constraint or benefit to the establishment of HPMRs and an important area for future work on HPMRs.

3. CONCLUDING COMMENTS

The final session of the workshop provided an opportunity for participants to raise any additional issues or reinforce points already made.

The importance and need for HPMRs was recognised by workshop participants. However the definition was obviously a critical issue and many points were raised about this in the final session. The definition used for the workshop was considered to be too strict by some participants, particularly on the question of restricted access. For example views were expressed that excluding all public access might be a step too far and an opportunity lost as the public could be great advocates of such areas. Exclusion should also be balanced against the loss of a resource. Others felt that a partial approach to protection had not worked in the past and therefore a high degree of prohibition was needed. Whatever the final outcome participants agreed that the definition needs to be as clear as possible and the selection of potential sites should be based on the best available information.

The size and number of HPMRs in Wales was another aspect which participants believed needed to be considered with great care as was the question of whether boundaries should be permanent. Decisions on these matters would affect their role and ability to respond to climate change. An open process of site selection, an in-built review process and clear objectives were other important considerations.

Conservation was seen as one sector within a whole range of other competing and overlapping sectors by some participants who went on to stress the importance of setting HPMRs within the context of a system of marine spatial planning. Others considered that conservation, including HPMRs, was fundamental underpinning of an ecosystem approach to management and that a sufficient proportion of the marine environment and representative areas should be effectively safeguarded to achieve meaningful conservation (and even fisheries) benefits. A related issue was the need for more work to be done on the socio-economic issues surrounding HPMRs as demonstrated by the wide range of potential costs and benefits identified during the workshop. At a site level, day-to-day management and especially enforcement could be a very significant cost, but also the potential economic benefits of bringing new business opportunities into an area.

The stakeholder community was recognised as being key to establishing HPMRs and perhaps a much wider group than traditionally involved in such programmes. From this viewpoint it was suggested that consultations and involvement could valuably be extended to those with indirect as well as direct interest in HPMRs. The most essential aspect was to promote an inclusive process.

There was overwhelming support for CCW to continue its work on HPMRs and a recognition that there were both political and environmental drivers supporting such a position. HPMRs were referred to as an “exciting opportunity” and although not a new idea it was clear that there was a huge communication challenge not only in explaining the concept but also in establishing sites at particular locations. Tackling these issues and addressing the many questions raised at the workshop will be important for the development of any HPMR programme in Wales.

APPENDIX A – LIST OF WORKSHOP PARTICIPANTS

First name	surname	organisation
Annabelle	Aish	JNCC
Jim	Andrews	6 Trym Road North Wales & North West Sea Fisheries Committee
Steven	Atkins*	United Marine Dredging
Andrew	Bellamy	English Nature
Simon	Brockington	Deep Green Seas
Blaise	Bullimore*	North Wales & North West Sea Fisheries Committee
Bill	Cook	Pembrokeshire Coastal Forum
Robin	Crump	CCW
Kirsty	Dernie	CMS
Bob	Earll	University of Wales
Gareth	Edwards Jones	CCW
Clare	Eno	Cardigan Bay Fishermen's Association
Ben	Fothergill	Seafish
Mark	Gray	Consultant
Susan	Gubbay	CCW
John	Hamer	Environment Agency Wales
Bryan	Jones	University College London
Peter	Jones	CCW
Lucy	Kay	Milford Haven Port Authority
Dave	Levell	REA / Focus Offshore Ltd
Stephanie L	Merry	CCW
Phil	Newman	Barrister
Daniel	Owen	Welsh Assembly Government
Victoria	Paris	CCW
Kirsten	Ramsay	CCW
Rowland	Sharp	CCW
Gabrielle	Wyn	CCW
Gretta	Hughes	NW&NWSFC
Liam	Fisher	English Nature

* written submission

APPENDIX B - ECONOMIC IMPLICATIONS

Topic

Ecotourism

- Benefit: If access is allowed have tourism opportunities
Ecotourism revenue
- Constraint: Loss of revenue from other sectors
Already have areas where ecotourism is profitable in Wales – might increase in HPMRs

Fishing

- Benefit: Possibility of increased catches outside HPMR – not only due to increased reinvestment inside HPMR but also due to increased productivity outside HPMR
- Constraint: Depending on position of HPMR inshore boats may have to travel further to fishing grounds, increasing fuel costs and therefore decreasing profitability

Fisheries

- Benefit: Increased knowledge about how ecosystems function
Enable more effective management of fisheries and enable greater/consistent catches. Use as part of selling package for sustainable/green seafood produce – e.g from the environment.
Well managed waters of Penllyn
- Constraint: Selling value of HPMRs in marketing fisheries produce
May result in more restrictions in certain fisheries sectors due to new knowledge. Only likely to benefit a limited number of fisheries? May also require effort limitations as part of overall management

Recreation

- Benefit: Selling point to attract visitors to area of access allowed
Increased economy potential to local area as get more visitors and knock on benefits of support services e.g. b&b/food/visitor services
Diversification of compatible attributes based round the HPMR
- Constraint: May need to limit overall volume of this, therefore may be seen as only favoring a few – therefore may generate conflict. Pressure to increase access. Access may not be allowed in a HPMR, therefore wouldn't realize potential benefits.

Biodiversity

- Benefit: Increase and protection of biodiversity
Protect potential sources of future revenue through protection of diversity of species.

ourism

- Benefit: Wildlife Marine Safaris
Fishermen converting to tourist operators (cf. farming and tourism land). Major draw to Marine Reserve, seals, seabirds etc
- Constraint: Restricted access due to disturbance, seals, seabirds etc

Diving / Snorkeling

- Benefit: Now much bigger in New Zealand than previous fishing income from within NZ HPMRs
Important category of visitors using accommodation, boats, air, traveling

Education (Intertidal)

- Benefit: Fieldwork courses for schools and universities and adults 5-85 age group. Students can study 'natural' ecosystems
- Constraint: Exclusion because of trampling effects

Navigation

Access to Ports and Harbors

- Constraint: Maintenance dredging
Dredge spoil deposition
No anchorages

Coastal Development

HPMRs are only one sectoral interest area in coastal/marine management. The emerging concept of MSP has to be acknowledged as a potential overarching “Governance” framework into which extent and location of HPMRs and other conservation designations should fit. Political will add effective lobby pressure from the conservation sector will determine if and where HPMRs are established

Existing Licenses

Constraint: Would HPMR designation in an area to which an existing extractive license applied lead to the operator being compensated for loss?

High Profile Industry

Constraint: Will some industries, or their government promoters, regard themselves as too important to be affected by HPMR designation? (e.g. oil and gas)

Intertidal shellfishery

Benefit: If dealing with an unmanaged or poorly managed fishery then may be increased larval production – stabilize population in fished areas nearby? Difficult to quantify
Bird numbers, wildlife tourism impact if dealing with a well managed fishery – no likely effect on cockle productivity, therefore as fishery benefit
No effect on bird numbers, therefore no wildlife amenity impact

Constraint: Direct loss of products to the industry
Indirect loss to local economy e.g. food, accommodation, fuel etc
Indirect loss to merchants / processors
Indirect loss to country – tax, export value
Effort displacement – increases risk of overexploitation elsewhere – economic loss

Economic development

Benefit: HPMRs basis for sustainable economic development
Focused more on indirect uses and increased margin on development activities

Constraint: Why do we have to sell HPMRs on the basis of their economic potential?
Not the case with terrestrial Protected areas
Challenge to resources – focused view of the seas

Bottom – Mobile fishing

Mobile fishing (dredging/trawling) of seabed tends to be quite disturbing to seabed habitats and species. While economic effects on mobile fishermen may be quantifiable, the knock on effects on other fisheries (static) whose beds may be damaged – also recreational fishermen – fewer fish, divers who visit attractive seabed areas and even tourists drawn by richer marine life. Wider effects of maintaining stock – ‘spill over’.

Recreational angling

Restriction of recreational angling may be considered to have a considerable effect on the local economy – but does it? The effect they have on the wildlife resource for other users is generally unquantified (they don’t want it to be for fear of being restricted). Divers would have a better time and other recreational users too. Walkers. Recreational anglers targets areas where commercial fishermen can’t access if they were not restricted in HMPR then no time ‘sanctuaries’ would exist

Wind farms

This is a misleading area. There are huge concessions being given to build offshore wind turbines etc. While it may be seen to be ‘greener’ the wider ecological effects are still not very well tested. The economic benefits of not putting windfarms in HPMRs could accrue from better planning where they could go.

Enforcement of HMPRs

Constraint: Cost

Marine Renewable Energy (Wave and Tidal)

- Benefit: Same as for dredging as outlined by Andrew regarding EIAs / data collection and monitoring
- Constraint: Site designation – wave and tidal currents are site specific
UK is the acknowledged (ref EPRI report) world leaders in marine renewable energy.
If domestic sites (for demonstration or commercial purposes) are excluded, the technology will migrate to other countries (eg Pelamis already going to Portugal) to the detriment of UK economy

Marine Recreation (boating, diving, swimming etc)

- Constraint: Exclusion of access for such activities (I have deliberately not mentioned fishing because it's a subject in it's own right involving extraction) will have detrimental consequences for local communities who provide the infrastructure for related tourism

Dredging

- Constraint: I don't like it, but the economic constraints of no dredging are pretty clear

Cockle picking

- Constraint: 2.4 million pounds worth of cockles on Traeth Lafan in 2006 – if this was an HPMR then these cockles would not be collected and local pickers and processors would lose out.

Bait collecting

- Benefit: If bait collecting was stopped in say the Menai Strait then the shores would be richer in interesting in habitats and species (e.g. under boulders) which would attract more tourists via interpretation, guide and walks (like NNR's on land) – this would require a raised level of interest/understanding in marine habitats and species to become a benefit

Coastal defence / set back

- Constraint: If an HPMR were set up on a stretch of coast this might constrain the ability of LA's to carry out coastal protection measures – this might result in damage to land and property due to sea level rise (increased storminess)

Bioprospecting with HPMRs

- Benefit :Sustainable financing. Tropical examples where cancer research institutes have 5-10 yr contract to take samples of various biological compounds
- Constraint: Some disturbance? Will economic benefit be ploughed back into nature conservation management of site i.e. Not just benefit pharmaceutical industry.

Tourism

- Benefit: Sustainable financing for divers and snorkellers through appropriate user fees or eco-tax/optional supplementary fee collected through tourism operators.
Public education/raising awareness amongst electorate.
- Constraints: Above certain diver densities, damage to ecosystem. Research on Red Sea dive sites (Ras Mohammed) can be managed through diver carrying capacity and education/better practice.

Commercial fishing

- No fishing activity – however the industry may be compensated through survey/monitoring work, tourist activities (observing wildlife) enforcement

Local economic welfare (generally)

- Constraints: Loss of direct industries (extraction based) + including supporting these (ancillary)
- Benefits: New less invasive industries e.g wildlife watching. Economic benefits of having a local HPMR/ identification, labeling associated merchandise.

Recreation

- Benefit: Recreational access to HPMRs (if allowed) e.g Skomer MNR
c 2-3000 divers vs c 700-1000 anglers – spend difference plus x 100 pleasure craft including commercial have extractive access. Increased charter activity local business – far outweighs extractive in financial terms

Scallop fishery

Benefit: Closure of MNR c 15 years x 10 scallops population in large numbers of large scallops – anecdotal evidence of increased beds St Brides/Milford Haven. Spat export?
Sustainable fishery by diving? – higher market value outside MNR.

Governance – consultation

Benefit: Stakeholder “buy-ins”
Constraint: Very very expensive
Can’t please everyone
Political “dilution” of proposals

Management

Reduced regulatory cost associated with assessing and granting / realizing development proposals etc
Potentially high cost associated with monitoring effect of measures, monitoring compliance and enforcement

Coastal economy

Commercial fishing of limited value in Wales compared to tourism
Potential overall gain (economic) for Wales through increased visitor numbers etc
Loss of income from fishing activities having a high impact upon coastal communities
Angling is very important (and valuable) in Wales – potential loss of income from angling (and associated tourism related activities)

Tourism – Water based

Increase in ‘eco tourism’ would possibly be offset by decrease in activity tourism such as RSA.
Too great an increase in ‘eco tourism’ could have a negative effect on conservation of HPMR, unless managed correctly HPMR could have negative social and economic effect on area

RSA

Overspill of larger fish from HPMR
Benefit to RSA tourism through increase of size of area positive and negative for economic and conservation, environment, activity and anglers visiting area

Public Health

Constraint: Restricting access may have negative effects on the population – increasing sedentary lifestyles effects on the working community

Cost of consultation

Constraint: Stake holder consultation will have massive cost implications / tax payer

Tourism in surrounding areas

Benefit: Tourism may increase in areas surrounding the HPMRs – indirect tourist attractions

Coastal Economy

Benefit: Greater sustainable use?
Constraint: HPMRs will change coastal economy like ecosystems 1 and 2 degree effects, tropical cascade

Displacement

Benefit: To the HPMR
Constraint: HPMRs will shift activity from one place to others (e.g Waddensea – Traith Lafan)
Capacity of receiving ecosystems to cope with impact

Aggregate Dredging

- Benefit: Industry can contribute data and expertise to the process of investigating HPMRs – acquired from prospecting and monitoring surveys over many square kilometers of inner continental shelf
It is fundamental that HPMR site selection is based on good data and interpretation of that data – as part of the process of involving appropriate stakeholders
- Constraint: We can only extract aggregates where they naturally occur and where they exist in economically and technically viable locations. Marine aggregates will continue to be an essential ‘mineral’ needed by society and so it is important to avoid sterilizing these strategic resources
HPMR’s could involve exclusion of vessel navigation which will interfere time/tide dependent shipping movements between dredging areas and ports of landing. Operations could be rendered commercially unviable

All extractions

- Benefit: Enhanced ecosystem functioning
- Constraint: The ‘value’ of a fishery is not a real indicator of its importance to the Welsh economy – this can only be calculated from input-output models – see Richardson (2006) for the only such model for Welsh fisheries

Tourism

Tourism can bring value, e.g. dolphin watching in Cardigan but who actually captures the ‘value’? Are the jobs seasonal or permanent? Do not assume a tourism industry of gross revenue £x has the same impact on local economy as a fishery of value £x.
Tourism is not possible in all places.

Ecosystem Services

- Benefit: Ecosystems offer goods and services which can be valued (see recent PML work for Defra) but the value of these services depends on size and location of the reserve
- Constraint: Extractive/disturbing activities.

Electricity Generation

- Constraint: If developments are prohibited it would have huge knock-on effects on electricity generation and service. Developments would have to be sited elsewhere – perhaps somewhere less ideal for generation
Mitigation aspects to climate change – also governments commitments re energy generation

Coastal Defence

- Constraint: If coastal defenses are prohibited this could have huge impacts on loss of land and amenities

Diving

- Benefit: Huge growing interest in our marine resource and this has a big impact on changing the public views – links to education

Visitors

- Benefit: HPMRs are a focus of public interest, and people will spend money with local communities to allow access. Illustration at Lundy with marked increase in dive charters

Benchmarking sustainable development

- Benefit: There is considerable economic investment in initiatives or marine sustainable development
How do we know if all this investment is having a beneficial effect?
HPMRs are a low cost method of establishing the effectiveness of our SD initiatives

Contribution to MSP

Benefit: Marine planning has an economic benefit in that it provides industry certainty for development. MPAs and HPMRs are a key part of a comprehensive MSP

Regulation

Benefit: e.g aggregates improve certainty
Constraint: Additional cost for government/tax payer
, Polluter pays principle – who is liable for costs?

Eco tourism

Benefit: Driver for 'green' tourism / non harmful tourism

Scientific Study

Benefit: Focus for scientific study / science community / university visits / field courses
/field studies centers

Tourism

Benefit: Attract eco tourists
Constraint: Would they be allowed to enter site?
Constraint on numbers, method of entry et own vessels, chartered vessels

Research

Benefit: Demonstrate what an area would look like if there was no human intervention
Constraint: Area subject to climatic change, cyclical change anyway
Species dominance as on land? E.g brambles and bracken taking over from gorse

Fisheries

Benefit: Take away destructive factor
Constraint: Only small operators would be affected – large operators would move to adjacent area
doubling impact on this site

Lobster fisheries

Benefit: Resource protected increasing (spill over) to adjacent areas

Tourism

Benefit: Visitors to an HPMR area land and sea e.g Farne Islands visit and dive with seals. 4 or 5
boats daily trip x 2 x 3 x 4 / days
Economic benefit to local community b & b
Tourism spin off

APPENDIX C – INTERACTIONS, CONSTRAINTS & BENEFITS

Topic - Activity	Constraints	Benefits	Other points of note[neutral]/interactions with other topics (re HPMRs)/ references etc
Aggregates	Sterilisation of resources. No flexibility - follow the resource. Distribution	Opportunities in areas next to valuable aggregate resource that have shallower deposits 'veneers' that could be of good conservation value. Industry will be able to say where these less valuable areas are - from their perspective. Industry could help contribute to monitoring & managing areas when next to HPMR	Don't make the same mistake of wind farms eg aggregate areas - shipping lanes
Site Selection	Costs of collating data & long drawn-out process	Opportunity to be flexible & 'go for it' when opportunities arise	
Management of site	may be decide to move/change sites	conservation benefits expected to accrue over <u>long</u> time	
Public enjoyment/ Access	Still needs some level of control/ education	Opportunity to inspire people & communicate value of HPMRs. Lessons from the tropics - diver 'carrying capacity guidelines'	
Restricting access		Opportunity to use tourism to 'pay' user fee/site entrance fee to benefit site & local community - & not just tourism operators benefiting	
	Public don't appreciate or value Welsh marine environment whereas they care about the rainforest If you want community buy-in then need to be near shore	Need to go for the 'spectacular' or involve mass media. Maybe HPMRs would result in better, more interesting areas to the public. People are interested	
No/limited access	more complicated enforcement	If public access huge buy-in and support for project	state extremes but expect to manage serial infringements to achieve conservation objectives. Establish exactly what is a non-damaging activity →management
How HPMRs will come about	Need to satisfy concerns of disadvantaged persons (tools & solutions) There must be critical mass buy-in for it to work	Might satisfy objectives	Inordinate weight given to certain vested interests (needs to be addressed)
Consultation	Expensive & time consuming. Rarely delivers conservation (agencies) objectives		

Topic - Activity	Constraints	Benefits	Other points of note[neutral]/interactions with other topics (re HPMRs)/ references etc
Regulation/MSP (planning)	Planning needs to be flexible. Over-riding public interest (does this apply in HPMRs). Enforcement/ costs. Who has final say (WAG)	HPMRs as part of MIP suite give conservation benefits	How permanent are proposals. Many activities have no 'areas' carved out, so how not to miss out
Fishing gear - most damaging, <u>mobile</u>	Displacement. Compensation?→Enforceability? / Cost (need to introduce VMS for all vessels in HPMRs). Don't know where increased productivity goes so fishermen may not get support	More benefits from disallowing more damaging fishing activities, including to other activities Increased productivity	If public right to fish then entire public should be compensated and therefore <u>no</u> compensation. Should be specific activities identified where can occur. Space to carry out lawful activities
Recreational angling	Perception that activity is benign and inordinate importance is ascribed to it. Resistance to report. Lot of people interested in it	Potential for good data and benefits to fish. Less litter/tackle in area. Benefits to other users eg. Divers/snorkellers	
Management of perceived wisdom/public perceptions	False perspectives persist & destroy proposals.	By managing these and providing correct information, dispel misperspectives.	Perceived wisdom eg. "sea angling is benign" not always timely
Research: SCIENTIFIC	A: Other stuff gets ignored? All effort focused on <u>HPMRs</u> . Legal issues - if definition so strict, how to allow scientific research to go on?	→Naturally functioning ecosystems etc, etc	<u>How big?</u> Fishing industry needs to propose areas eg in NZ (but of population of NZ & UK!)
B: FISHERIES RESEARCH		Need control area(s) of no fishing so we can rigorously assess the effect of fishing, & ability of stocks to recover.	20% of UK coastal waters (that's what RLAP said..) Q: So does fishing industry foot the bill? Needs to be done on European basis

Topic - Activity	Constraints	Benefits	Other points of note[neutral]/interactions with other topics (re HPMRs)/ references etc
REGULATION OF FISHERIES - CFP	Depending on exact situation, may have to go through commission, who may not agree (eg. pair trawling). Legal constraints relating to conservation vs. other needs (eg fisheries control) of legislation	Case studies could be used to inform future initiatives? → learning.. (eg. the pair trawling issue). Darwin Mounds	Community makes decisions, beyond 6nm Co-operation is possible with the commission Lots of prior consultation before this suggestion...groundwork done
LEGAL - offshore marine habs/birds			Process of consultation different in new regs?
Stakeholder expectation	Once a few HPMRs in place, all OK →therefore need to manage expectations		Need to talk about HPMRs within the wider context...
DUMPING AREAS FOR SEDIMENTS	Couldn't do it →may restrict industry. Legal implications at national level, need FEPA & CPA consent. Powers for FEPA devolved to WAG, but CPA still SOS, therefore could be difference of opinions	Help industry to get evidence base for their activities. -industry could argue dumping is more sustainable. could spur alternatives - re-use rather than dumping? NB putting sediment back into system may be beneficial	
DIVING	No diving in HPMRs. Don't annoy divers by excluding them. Why treat them differently than fisheries - trust. Economic loss for community.	Lots of interest for divers. Divers are stakeholders. Support base are divers. Encourage divers → education. Exclusion - other stakeholder buy in.	Diving restrictions apply in MNR-Skomer
INTERTIDAL EDUCATION	Impact of visits - trampling. DTS successful. Deeper water limited education.	Teaching in a natural habitat. Good selling point. Economic - FSC NIGN turn over	Zoning of education.

Topic - Activity	Constraints	Benefits	Other points of note[neutral]/interactions with other topics (re HPMRs)/ references etc
Tidal stream energy extraction	If we don't do it then we are blocking one of the potential routes to climate change mitigation.	no disturbance during construction & de-commissioning.	A lot of other potential impacts such as electromagnetic fields, damage to mammals are not proven.
Crustacean pot fisheries - lobsters, crabs, prawns	Can't do any of these if have HPMR. Negative impact on local economy, heritage, social health & fleet structure.	Standard reserve edge effects. Enhancement of stock outside the HPMR. Boats that are redundant could be used for wildlife trips.	Not proven benefits to blood stock dispersal to areas outside HPMR.
Access: Boat trips to see birds, crustaceans & other mammals, & video	only non-intrusive behavior allowed, some sort of carrying capacity limits will be set.	See more wildlife, more tourists therefore more money for local economy. Good marketing potential.	Education.
Access: Bait collecting specifically digging for bait.	No bait for local people & local shops, therefore reduced economic potential of rod & line fisheries & enjoyment.	Recovery of degraded mud/muddy gravels. Improved nursery areas for fish due to more & varied food, therefore ecosystem benefits.	Edge effect. Pushing the activity to other sites.
Renewables: marine renewable energy generation.	If no generation in HPMR then lose associated benefits to economy eg. Maintenance etc, but might also lose benefits in local distribution & generation of electricity.	Reduced impacts on the environment (see example 1). Wave energy - reduced visual impacts & navigation impacts.	UK is the world leader in marine renewables. Any blockage of that is v.damaging to UK economy.
Local perceptions & ownership of HPMR	For local community an HPMR has negative impacts in short term, will be very unpopular. Social exclusion of rural coastal community would be high.	Shift local economy. Tourism bringing in people from outside & creating wealth & opportunities.	There is opportunity there but need to win hearts & minds before start. It's a long game.

Topic - Activity	Constraints	Benefits	Other points of note[neutral]/interactions with other topics (re HPMPs)/ references etc
Access: Diving	Limits on numbers, limits on activities, might need training costs to divers	Raise awareness, economic benefits, demonstrate best practice in dive safety, codes of conduct.	This might only work in areas where there is something to see.
Non-native species	Wouldn't be able to go in & try & control non native invaders.	Less introductions - risk should be reduced. Scientific study of the actual impacts of non-natives.	Might need some sort of permit to control non-natives in the reserve if they become a problem.
Access: Recreational boating -sailing & power boats	Impacts on local economy of no access for boating/cruising, therefore wouldn't come to local harbour & spend.	Reduced disturbance & pollution, no damage from anchoring.	Sailing is a low impact activity, anchoring & disturbance the only impacts.
Enforcement costs	Very expensive to enforce - government resistance to putting resources into enforcement.	Local staff get paid to warden site - brings money in to local economy. Good jobs in rural areas.	Enforcement is one of the major constraints to successful deployment of HPMPs.
'Potting'	Detrimental effect on a sustainable form of fishing - detrimental to individuals' 'displacement'. Knock on effect to local economy, community, marginal section of community. Publish fishing rights.	Spill over' effect for adjacent fisherman. Marketing tool + 'quality mark' green water + repletion of stock. 'Food miles' - locally sourced food. →possible social inclusion benefits.	Dependent on EU law compliance. Clear communication with stakeholders is needed.
Recreational scuba diving	Could create conflict between user groups. Effect on local businesses. Discrimination. Access to sites of interest.	Knock on increase in biodiversity to areas surrounding sites. Gives area a USP.	Finding resolution to multi user issues.
Industrial effluent disposal.	Major industrial and consumer cost + legal challenge + relocation of industry + cost of monitoring + loss of employment + knowledge gained from research/monitoring	Possibly cleaner waters. New employment in other areas?	

Topic - Activity	Constraints	Benefits	Other points of note[neutral]/interactions with other topics (re HPMRs)/ references etc
Access to the intertidal?	Destruction of inshore fisheries, effects on health and well-being + effects on tourism. Contradicts national policy on access.	Wildlife watching opportunities in adjacent areas. Coastal regeneration. Increase in species.	
Scientific research	Restrictions on the amount & type of research.	'Pulse' sites - to look at the impacts of climate change etc.	
MSP	Provides context for HMPR (N) and constructive framework for decision making. Where they fit into the MSP Critical to look at social-economics		Time critical in terms of political effectiveness.
Maintenance dredging	Incompatible with HPMR Don't want to do AA		
Science	Knowledge base and science (essential) base reviewed routinely - flexibility (N) Constraint - cost of science Scientific basis for the selection essential - Iterative process - models ie. socio		
Scallop dredging	No fishing Loss of revenue	+ve Scallop spawning limited spill-over +ve biodiversity benefit + no infraction costs in SACs eg. Strayford Lough + first settlement	Local IoM examples Close one

Topic - Activity	Constraints	Benefits	Other points of note[neutral]/interactions with other topics (re HPMRs)/ references etc
Bait collection Lugworth	None Recreation backlash Displacement	- Bird food - community structure - no physical disturbance to restore	Byelaw issues
Bait collection Peeler Crab	Ditto	Rock turning - collective structure of community - weed Protection of females	Byelaw
Leisure Access Public	Economic import Limiting will cause issues - Reduce public participation, put the public off Public right	No noise	eg. MNR Menai Strait
Issue on information dissemination		Remove misunderstandings. Additional public support. Buy in.	
Economic welfare of Coastal Communities	Extraction type industry. Reducing in support Industries for extraction.	Development of non-extraction type industries. Eco-tourism. Support industry of eco-tourism.	
Marketing of HPMRs		More public support	
Fishing, Sailing, boating	Restriction of near coast, safety aspect of small boats moving off shore.		
Lobster potting.	No fishing	Limited spill over, potentially.	Evidence base?

APPENDIX D - HPMR BRIEFINGS

D.1 LEGAL BRIEFING

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ABBREVIATIONS

Abbreviation	Full term
Birds Directive	Council Directive 79/409/EEC of 2 April 1979 on the conservation of wild birds (OJ L 103, 25.4.1979, p. 1), as amended
CFP	EC's Common Fisheries Policy
Commission	European Commission
Court	European Court of Justice
CPA	Coast Protection Act 1949
EC	European Community
EC Treaty	Treaty Establishing the European Community
ECA	European Communities Act 1972
EIA Directive	Council Directive 85/337/EEC of 27 June 1985 on the assessment of the effects of certain public and private projects on the environment (OJ L 175, 5.7.1985, p.40), as amended
FEPA	Food and Environment Protection Act 1985
GoWA 1998	Government of Wales Act 1998
GoWA 2006	Government of Wales Act 2006
Habitats Directive	Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (OJ L 206, 22.7.1992, p.7), as amended
HPMR	highly protected marine reserve
IMO	International Maritime Organization
LOSC	1982 United Nations Convention on the Law of the Sea
NAW	National Assembly for Wales
nm	nautical miles
SAC	Special Area of Conservation (under the Habitats Directive)
SEA Directive	Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment (OJ L 197, 21.7.2001, p.30)
SI	Statutory Instrument
SOLAS	1974 International Convention for the Safety of Life at Sea, as amended
SPA	Special Protection Area (under the Birds Directive)
TWA	Transport and Works Act 1992
UK	United Kingdom of Great Britain and Northern Ireland

EXECUTIVE SUMMARY

Introduction

(1). This section sets out the scope of the briefing paper. The paper addresses legal issues affecting the management of HPMRs. For that purpose, it addresses law at the international, EC and UK levels. The paper is not solely about legal constraints. Instead, it seeks to look at the law from the point of view of both constraints and opportunities. In terms of geographical scope, it focuses on marine internal waters and the territorial sea. Where appropriate, it focuses in particular on the marine internal waters and territorial sea of the UK that are part of “Wales”, as defined by the GoWA 1998 (and the GoWA 2006) and SI 1999/672.

International law

(2). This section addresses those rights and duties of States under the LOSC, within internal waters and the territorial sea, that are relevant to the working definition of HPMRs. In its territorial sea, and hence in its internal waters, the coastal State has territorial sovereignty. As a result, subject to an important exception relating to shipping and subject to the need to comply with Part XII of the LOSC on protection and preservation of the marine environment, the coastal State has the exclusive right to regulate, authorise and conduct activities in the water column, seabed and subsoil of those zones (subject to any obligations of the coastal State under any domestic legislation, other treaties or customary international law). That regulation by the coastal State may include exclusion of activities for the purposes of nature conservation, which is clearly of relevance to the management of HPMRs.

(3). Regarding the exception relating to shipping, the LOSC provides for ships of all States to have the right of innocent passage through the territorial sea. However, it also allows the coastal State to regulate innocent passage for, *inter alia*, the purposes of environmental protection. Such regulation is subject to important duties, including a duty to avoid denying or impairing the right of innocent passage. Options available to the coastal State include the establishment of routing measures, including areas to be avoided. Unless a strait used for international navigation is involved, there is no requirement for the coastal State to obtain the approval of the IMO for the establishment of areas to be avoided in its territorial sea. However, a coastal State may, for a variety of reasons, nonetheless chose to seek IMO approval. A right of innocent passage does not exist in internal waters, with one limited exception.

EC law

(4). This section addresses the Environment and Agriculture titles of the EC Treaty. Under the Environment title, the power to make rules regarding environmental protection is shared between the EC and the Member States. Article 176 of the EC Treaty makes it clear that Member States may maintain or introduce more stringent protective measures than those imposed by EC environmental protection legislation. Thus, in principle, Article 176 entitles a Member State to go further than the requirements of, say, the Habitats Directive.

(5). The UK has generally transposed EC Directives on environmental protection, including the Habitats Directive, by means of section 2(2) of the ECA. In at least one case it has also used the ECA as a legal basis for adopting measures that go further than the express requirements of the Habitats Directive. However, questions arise regarding the extent to which the section 2(2) of the ECA could validly be used as a legal basis for adopting measures that go significantly beyond the Habitats Directive’s requirements, even if such measures were compatible with EC law.

(6). The Agriculture title includes fisheries. Under the CFP, the EC has exclusive legislative jurisdiction in the area of fisheries conservation, though some limited rule-making powers have been delegated back to the Member States. Article 6 of the EC Treaty requires the EC to integrate environmental protection requirements into the CFP, but questions arise as to the “reach” of that duty and whether, for example, it enables the EC to have exclusive jurisdiction to impose restrictions on fishing vessels for the sole or primary purpose of nature conservation.

(7). Under the CFP, the powers that have been delegated back to the Member States are set out in Articles 10, 9 and 8 of the Basic Regulation and in Articles 46 and 45 of Regulation 850/98. This section analyses the nature of those delegated powers and illustrates their limited scope, including the potential difficulties for the coastal Member States in applying rules to vessels flagged to other Member States. A section on the access restriction under Article 17(2) of the Basic Regulation emphasises that the restriction does not provide a new source of legislative jurisdiction to Member States in respect of fisheries conservation, though it may lead to a situation where the only vessels operating in a given zone are those flagged to the coastal Member State in question.

Domestic law

(8). This section addresses the legal framework for Welsh devolution and then looks at the scope for regulation of the following activities in marine internal waters and the territorial sea adjacent to Wales: (a) commercial capture fisheries; (b) dumping of substances and articles; and (c) construction and operation of offshore wind farms.

(9). The legal framework for Welsh devolution is complex. The principal Acts of Parliament are the GoWA 1998 and the GoWA 2006. Most of the provisions of the GoWA 2006 are still to come into force, and there are significant changes afoot. However, there is also a layer of secondary legislation by which functions have been, and continue to be, transferred to the devolved administration. Other Acts of Parliament may also transfer functions to the devolved administration, and the Marine Bill may have a role in that regard in due course.

(10). Regarding commercial capture fisheries, the principal legal constraint for their regulation at the UK level, let alone in Wales, is the limited scope of the powers for fisheries conservation that have been delegated by the EC to the Member States. Within the UK, one of the principal Acts of Parliament with potential for exercising those delegated powers is the Sea Fish (Conservation) Act 1967. Many functions under that Act have been transferred to the NAW, and those functions have in turn been used. The Act clearly provides a means for the NAW to exclude commercial capture fisheries from HPMRs, subject to the UK’s delegated powers.

(11). Regarding dumping of substances and articles, the principal Acts of Parliament for its regulation are Part II of the FEPA and Part II of the CPA. As a result of devolution, the NAW has the exclusive power to issue, or decline to issue, a licence under section 5 of the FEPA for the deposit of substances or articles in the marine internal waters and territorial sea adjacent to Wales. That power is clearly relevant to the management of HPMRs. In contrast, functions under Part II of the CPA have not been devolved to the NAW. However, for many activities where a consent under Part II of the CPA is required, a licence under section 5 of the FEPA will also be required.

(12). Regarding construction and operation of offshore wind farms, the principal Acts of Parliament for regulation of those activities are now the Electricity Act 1989 and Part II of the FEPA. The consenting function under section 36 of the Electricity Act has not been transferred to the NAW. However, for any operation where a section 36 consent is required, it is highly probable that a licence under section 5 of the FEPA will also be required.

1. INTRODUCTION

1. The working definition of the term “highly protected marine reserve” that has been adopted for the purpose of this project is: “Any area of intertidal or subtidal terrain, together with its overlying waters and associated flora and fauna, in which extraction and/or deposit of marine life, substances, articles and energy is prohibited by law and which is also protected from other harmful human uses”.

2. It must be emphasised that the above definition is not intended to be legally robust. Instead, as a working definition, it is merely intended to convey, in broad terms, the type of protection envisaged for HPMRs by this project. It can be seen that there are two elements to that protection: (a) a prohibition (by law) on extraction or deposit of marine life, substances, articles or energy; and (b) protection from other harmful uses. The second element is broad and vague but it implies that a site may need to be protected from activities other than just extraction and deposition.

3. Two stages are implied in the protection of HPMRs: (a) identification and designation; and (b) management of human activities. This briefing paper will address the latter. For that purpose, it will address law at the international, EC and UK levels. At the international level, the focus will be on the LOSC. At the EC level, the paper will address the Environment and Agriculture titles of the EC Treaty. At the UK level, the paper will focus on the extent to which commercial capture fisheries, dumping of substances or articles and construction and operation of offshore wind farms can be controlled by the devolved administration in Wales.

4. This paper is not solely about legal constraints. It is also about the opportunities provided by the law. One fundamental point is that the law has the potential to provide for certainty. That potential may be reduced if, for example, the law is badly drafted or fails to state its relationship with other relevant laws. Nevertheless, the potential is there. Furthermore, rights in law have limits. For example, the rights of flag State [x] may represent a constraint to coastal State [y]. But beyond the limits of the rights of State [x], the rights of State [y] may begin. This paper seeks to look at the law from the point of view of both constraints and opportunities.

5. Though the geographical scope of the project relates to the intertidal zone, marine internal waters and the territorial sea, this paper will focus on the last two of those zones. The terms “internal waters” and “territorial sea” are defined by reference to the so-called “baseline”. The baseline is a line from which the breadth of various zones of coastal State jurisdiction are measured. The LOSC states that the normal baseline is “the low-water line along the coast as marked on large-scale charts officially recognized by the coastal State”.¹² However, there are also special rules for establishing baselines in particular circumstances (e.g. across mouths of rivers).¹³

6. Internal waters are the waters landwards of the baseline.¹⁴ In principle, such waters may be marine or freshwater. This paper will focus on marine internal waters. Two examples of such waters in Wales include some parts of the Bristol Channel and the waters south-east of the Llyn Peninsula. The waters of ports usually fall within internal waters. The territorial sea is a belt of sea extending seawards from the baseline and may extend up to 12 nm from the baseline.¹⁵ A map, for illustrative purposes, showing the territorial sea and internal waters adjacent to the UK (including Wales) is available on the website of the UK Hydrographic Office.¹⁶

¹² LOSC, Article 5.

¹³ LOSC, Articles 6, 7 and 9-14.

¹⁴ LOSC, Article 8(1).

¹⁵ LOSC, Article 3.

¹⁶ <www.ukho.gov.uk/cons/pdf/UK%20TS%20Limit%201%20January%202006.pdf>.

7. The GoWA 1998 and GoWA 2006 both define the term “Wales” as including “the sea adjacent to Wales out as far as the seaward boundary of the territorial sea”.¹⁷ In terms of marine waters, the term “Wales” thus includes: (a) marine internal waters adjacent to Wales; and (b) the territorial sea adjacent to Wales. To address the question of where “the sea adjacent to Wales” meets the sea adjacent to England, the GoWA 1998 and GoWA 2006 both allow the Secretary of State to determine, by order, “any boundary between ... the parts of the sea which are to be treated as adjacent to Wales ... and ... those which are not”.¹⁸

8. Such a determination was made in SI 1999/672,¹⁹ such that: “For the purposes of the definition of ‘Wales’ in the [GoWA 1998] the boundary between those parts of the sea within the Severn and Dee Estuaries which are to be treated as adjacent to Wales and those which are not shall be, in each case, a line drawn between the co-ordinates set out in Schedule 3 to this Order”.²⁰ The result is that the marine waters lying landward of the seaward limits of the territorial sea, and within the boundaries provided for in SI 1999/672, are part of “Wales” for the purposes of the GoWA 1998.

9. Such waters are sometimes referred to as “Welsh waters”. For example, that term is used in statutory instruments made by the NAW.²¹ However, that term is potentially misleading in that the use of the possessive adjective “Welsh” could be regarded as implying that the devolved administration in Wales has exclusive powers in relation to the management of activities in those waters, subject to international law and EC law. The nature of the devolution settlement means that is not the case, as is illustrated in section 4 below.

10. The GoWA 1998 and the GoWA 2006 both also anticipate that the devolved administration in Wales may be provided with some functions beyond the seaward limit of the territorial sea.²² However, such functions, including their implementation, will not be considered further in this briefing paper because areas beyond the territorial sea are outside the scope of the project.

Summary of section 1: This section sets out the scope of the briefing paper. The paper addresses legal issues affecting the management of HPMRs. For that purpose, it addresses law at the international, EC and UK levels. The paper is not solely about legal constraints. Instead, it seeks to look at the law from the point of view of both constraints and opportunities. In terms of geographical scope, it focuses on marine internal waters and the territorial sea. Where appropriate, it focuses in particular on the marine internal waters and territorial sea of the UK that are part of “Wales”, as defined by the GoWA 1998 (and the GoWA 2006) and SI 1999/672.

¹⁷ GoWA 1998, section 155(1); GoWA 2006, section 158(1).

¹⁸ GoWA 1998, section 155(2); GoWA 2006, section 158(3).

¹⁹ The National Assembly for Wales (Transfer of Functions) Order 1999, SI 1999/672, as amended.

²⁰ *Ibid.*, Article 6.

²¹ See, for example: **(a)** The Scallop Fishing (Wales) Order 2005, SI 2005/1717 (W.132), Articles 1, 3, 4, 5, 6 and 8; and **(b)** The Prohibition of Fishing with Multiple Trawls (Wales) Order 2003, SI 2003/1855 (W.205), Article 1, 3 and 4.

²² GoWA 1998, Schedule 3, paragraph 4; GoWA 2006, Schedule 3, paragraph 4.

2. INTERNATIONAL LAW

2.1 Introduction

11. This section focuses on the LOSC. The LOSC was adopted on 10 December 1982 and entered into force on 16 November 1994. The UK became a party on 25 July 1997. As at 10 August 2006, the Convention had 149 parties.²³ For reasons of space, the section does seek to address the UK specifically, including any domestic laws and policies adopted in response to the LOSC.

12. The LOSC establishes the rights and duties of States, including coastal States, within particular maritime zones and in general. This section will consider those rights and duties of States within internal waters and the territorial sea that are relevant to the working definition of HPMRs set out in section 1 above. (The LOSC's regime for straits used for international navigation will not be considered for reasons of space.)

13. In its territorial sea, and hence in its internal waters, the coastal State has territorial sovereignty.²⁴ As a result, subject to an important exception relating to shipping and subject to the need to comply with Part XII of the LOSC on protection and preservation of the marine environment, the coastal State has the exclusive right to regulate, authorise and conduct activities in the water column, seabed and subsoil of those zones (subject to any obligations of the coastal State under any domestic legislation, other treaties or customary international law).

14. The regulation by the coastal State referred to in the preceding paragraph may include exclusion of activities for the purposes of nature conservation. That is clearly of relevance to the management of HPMRs. The important exception relating to shipping, and the rights of the coastal State in that regard, are discussed in sections 2.2 and 2.3 below.

2.2 Navigation and the territorial sea

15. In the territorial sea, the territorial sovereignty of the coastal State is subject to ships of all States having the right of innocent passage through the territorial sea.²⁵ The regime of innocent passage in the territorial sea is set out in Part II (section 3) of the LOSC.

16. The term “passage” is defined as navigation through the territorial sea for the purpose of: (a) “traversing that sea without entering internal waters or calling at a roadstead or port facility outside internal waters”; or (b) “proceeding to or from internal waters or a call at such roadstead or port facility”.²⁶ Passage is to be continuous and expeditious, but may include anchoring and stopping if this is: (a) incidental to ordinary navigation; (b) rendered necessary by *force majeure* or distress; or (c) for the purpose of rendering assistance “to persons, ships or aircraft in danger or distress”.²⁷

17. Passage is “innocent” so long as it is “not prejudicial to the peace, good order or security of the coastal State”.²⁸ Innocent passage must take place in conformity with the LOSC and other rules of international law.²⁹ The LOSC lists activities that will render the passage of a vessel non-innocent.³⁰ That list includes, *inter alia*, “any act of wilful and serious pollution contrary to this

²³ <www.un.org/Depts/los/reference_files/status2006.pdf>.

²⁴ LOSC, Article 2(1).

²⁵ LOSC, Article 17.

²⁶ LOSC, Article 18(1).

²⁷ LOSC, Article 18(2).

²⁸ LOSC, Article 19(1).

²⁹ LOSC, Article 19(1).

³⁰ LOSC, Article 19(2)(a)-(l).

Convention [i.e. the LOSC]”, “any fishing activities”, “the carrying out of research or survey activities” and “any other activity not having a direct bearing on passage”.

18. The coastal State enjoys several rights in respect of vessels in its territorial sea, including: (a) the right to regulate innocent passage;³¹ (b) the right to prevent passage that is not innocent;³² (c) the right to temporarily suspend innocent passage;³³ and (d) the right to exercise its criminal jurisdiction and civil jurisdiction.³⁴ All of those rights are qualified by the LOSC in certain ways, and space does not permit a systematic treatment of each right in this briefing paper. Instead, this paper will focus on the right to regulate innocent passage.

19. It is possible to envisage a number of threats to a HPMR arising from innocent passage. For example, the ship may present a risk of accidental pollution (either from its cargo or from its fuel oil). The ship may deposit energy, in the form of noise, into the marine environment (e.g. as a result of engine vibrations or propeller noise). The ship may, from its physical presence or from the noise it creates, disturb wildlife in some circumstances. For any of those reasons, or because of other threats arising from innocent passage, the coastal State may wish to regulate such passage.

20. Article 21(1) of the LOSC sets out a list of matters in respect of which “[t]he coastal State may adopt laws and regulations, in conformity with the provisions of this Convention and other rules of international law ...”.³⁵ That list reads as follows:

- (a) the safety of navigation and the regulation of maritime traffic;
- (b) the protection of navigational aids and facilities and other facilities or installations;
- (c) the protection of cables and pipelines;
- (d) the conservation of the living resources of the sea;
- (e) the prevention of infringement of the fisheries laws and regulations of the coastal State;
- (f) the preservation of the environment of the coastal State and the prevention, reduction and control of pollution thereof;
- (g) marine scientific research and hydrographic surveys;
- (h) the prevention of infringement of the customs, fiscal, immigration or sanitary laws and regulations of the coastal State.

21. Later in the LOSC, consistent with item “(f)” above, the coastal State is stated to have rights, in respect of its territorial sea, to “adopt laws and regulations for the prevention, reduction and control of marine pollution from foreign vessels, including vessels exercising the right of innocent passage”.³⁶ The LOSC also expressly provides for the coastal State, “where necessary having regard to the safety of navigation”, to require foreign ships exercising the right of innocent passage to use sea lanes and traffic separation schemes that it designates or prescribes.³⁷

22. It can be seen that the coastal State may regulate innocent passage for the purpose of, *inter alia*, the preservation of its environment, the safety of navigation and the conservation of the sea’s living resources. Even if it is accepted that the last of those purposes is intended to address fishing vessels and fishing-associated vessels rather than vessels more generally, the first and second purposes provide scope for regulating vessels more generally for the purposes of environmental protection.

23. There are some corresponding duties on the coastal State when regulating innocent passage. Space permits only a summary of those duties. Of primary importance, the coastal

³¹ LOSC, Article 21.

³² LOSC, Article 25(1).

³³ LOSC, Article 25(3).

³⁴ LOSC, Articles 27 and 28.

³⁵ LOSC, Article 21(1).

³⁶ LOSC, Article 211(4).

³⁷ LOSC, Article 22(1).

State “shall not ... impose requirements on foreign ships which have the practical effect of denying or impairing the right of innocent passage”.³⁸ This raises the question of whether coastal State regulations may legitimately exclude vessels from certain areas of the territorial sea. That will be addressed in paragraphs 26-34 below, but it may be noted here that coastal States are not necessarily precluded from doing so.

24. Furthermore, the coastal State: (a) must not “discriminate in form or in fact against the ships of any State or against ships carrying cargoes to, from or on behalf of any State”;³⁹ (b) must not adopt laws or regulations applying “to the design, construction, manning or equipment of foreign ships unless they are giving effect to generally accepted international rules or standards”;⁴⁰ (c) must give due publicity to all its laws and regulations;⁴¹ and (d) must not levy a charge upon foreign ships “by reason only of their passage through the territorial sea”.⁴² There are also some specific duties on coastal States in relation to sea lanes and traffic separation schemes.⁴³

25. Once a coastal State has validly regulated the innocent passage of foreign ships through its territorial sea, such ships “shall comply with all such laws and regulations”. The ships must also comply with “all generally accepted international regulations relating to the prevention of collisions at sea”.⁴⁴

26. As noted in paragraph 23 above, it is relevant to ask whether regulation of innocent passage by a coastal State may legitimately exclude vessels from certain areas of the territorial sea. In nautical terminology, such an exclusion would in principle be achieved by what is known as a “routeing system”. Routeing systems that exclude ships from defined areas for a particular purpose are generically known as “areas to be avoided” (“**ATBAs**”). (Other types of routeing system include traffic separation schemes, two-way routes, recommended tracks, no anchoring areas, inshore traffic zones, roundabouts, precautionary areas and deep-water routes.)

27. The term “ATBA” is not used in the LOSC, but is used in the IMO’s *General Provisions on Ships’ Routeing* (“**the General Provisions**”).⁴⁵ The term is defined there as: “A routeing measure comprising an area within defined limits in which either navigation is particularly hazardous or it is exceptionally important to avoid casualties and which should be avoided by all ships, or certain classes of ship”.⁴⁶ However, that is rather a restrictive definition in that it refers only to: (a) particularly hazardous navigation; and (b) the exceptional importance of avoiding casualties.

28. Both of those factors are clearly relevant to “the preservation of the environment of the coastal State”, as referred to in Article 21(1) of the LOSC (see paragraph 20 above), but they do not exhaust that purpose. Other options for achieving that purpose could include, *inter alia*, excluding vessels where it is exceptionally important to avoid disturbance to wildlife or to avoid deliberate discharges of pollutants from ships. Thus the definition of the term “ATBA” in the General Provisions should not be taken as defining the only circumstances in which an exclusion area may be established by a coastal State in its territorial sea.

29. Instead, in principle, an exclusion area could be established whenever it is justified by any of the purposes set out in Article 21(1) of the LOSC and so long as the coastal State duties summarised in paragraphs 23 and 24 above are met. A broad interpretation of the scope for using exclusion areas is also indicated by Regulation V/10 of SOLAS, which states that: “Ships’

³⁸ LOSC, Articles 24(1)(a) and 211(4).

³⁹ LOSC, Article 24(1)(b).

⁴⁰ LOSC, Article 21(2).

⁴¹ LOSC, Article 21(3).

⁴² LOSC, Article 26(1).

⁴³ LOSC, Article 22(3) and (4).

⁴⁴ LOSC, Article 21(4).

⁴⁵ Available in Part A of *Ships’ Routeing*, 8th edition, 2002 (as amended), IMO, London.

⁴⁶ General Provisions, paragraph 2.1.13.

routing systems contribute to safety of life at sea, safety and efficiency of navigation and/or protection of the marine environment”.⁴⁷ (SOLAS states the same reasons to justify the use of ship reporting systems and vessel traffic services.⁴⁸)

30. In practice, however, it is the fulfillment of one of the coastal State duties in particular, i.e. the duty not to deny or impair the right of innocent passage, that may present problems. Whilst State practice shows that States do indeed establish ATBAs in their territorial seas for, *inter alia*, environmental protection purposes, the acceptability of those ATBAs to flag States, in terms of their impact on the right of innocent passage, may depend on their number, size and location.

31. For example, the UK has established five ATBAs in its territorial sea in respect of own-flag and foreign shipping for the purpose of environmental protection, i.e. in the region of the Orkney Islands (1), in the region of Fair Isle (1), in the region of the Shetland Islands (2) and between the Smalls lighthouse and Grassholme Island (1) (the last being in the territorial sea adjacent to Wales).⁴⁹ It remains to be seen how many more ATBAs for environmental protection the UK could establish before it was deemed by other States to be denying or impairing the right of innocent passage. In principle, a few more ATBAs to protect those HPMRs that are particularly sensitive to shipping may be more acceptable than a plethora of ATBAs to protect each and every HPMR (see also paragraph 34 below).

32. In international law, there is no requirement for the coastal State to obtain the approval of the IMO for the establishment of ATBAs in its territorial sea (except where a strait used for international navigation is involved).⁵⁰ Nevertheless, Regulation V/10 of SOLAS states that: “a Government or Governments implementing ships’ routing systems not intended to be submitted to the [IMO] for adoption or which have not been adopted by the [IMO] are encouraged to take into account, wherever possible, the guidelines and criteria developed by the [IMO]”.⁵¹

33. That is a reference to the General Provisions, which in turn requests the coastal State to design its territorial sea routing systems, including ATBAs, in accordance with IMO guidelines and criteria and to submit them to the IMO for adoption.⁵² Furthermore, in practice, a coastal State may prefer to obtain IMO approval in order to, *inter alia*: (a) improve the efficacy of the measure; (b) encourage other States to likewise act via the IMO; and (c) be reassured that the right of innocent passage is not deemed by other States (notably flag States) to have been denied or impaired.

34. In the event that a coastal State were to opt to seek IMO approval for a ATBA in its territorial sea, the General Provisions note that: “In deciding whether or not to adopt or amend a routing system which is intended to protect the marine environment, IMO will consider whether [*inter alia*] given the overall size of the area to be protected, or the aggregate number of environmentally sensitive areas established or identified in the geographical region concerned, the use of routing systems – particularly areas to be avoided – could have the effect of unreasonably limiting the sea area available for navigation”.⁵³

⁴⁷ SOLAS, Regulation V/10, paragraph 1.

⁴⁸ SOLAS, Regulation V/11, paragraph 1 and Regulation V/12, paragraph 1.

⁴⁹ See: **(a)** *Safer Ships, Cleaner Seas*: Report of Lord Donaldson’s Inquiry into the prevention of pollution from merchant shipping, Cm 2560, 1994, HMSO, London. Paragraph 14.17(a); and **(b)** Part D, section I of *Ships’ Routing*, 8th edition, 2002 (as amended), IMO, London.

⁵⁰ See, for example, General Provisions, paragraphs 3.11 and 3.14.

⁵¹ SOLAS, Regulation V/10, paragraph 4.

⁵² General Provisions, paragraphs 3.14-3.16.

⁵³ General Provisions, paragraph 3.6.2.

2.3 Navigation and internal waters

35. In internal waters, the coastal State has territorial sovereignty. Foreign ships have no right of innocent passage, with one exception. That exception arises “[w]here the establishment of a straight baseline ... has the effect of enclosing as internal waters areas which had not previously been considered as such ...”.⁵⁴

36. In that specific case, “a right of innocent passage as provided in this Convention [i.e. the LOSC] shall exist in those waters”. The rights of flag States and coastal States under the regime of innocent passage are discussed in the section on the territorial sea above. Those rights can be taken as applying to innocent passage in internal waters as well.

37. Subject to that exception (and subject to any obligations of the coastal State under any domestic legislation, other treaties or customary international law), a coastal State may, *inter alia*, exclude ships from areas of internal waters for the purposes of nature conservation. That is clearly of relevance to the management of HPMRs.

Summary of section 2: This section addresses those rights and duties of States under the LOSC, within internal waters and the territorial sea, that are relevant to the working definition of HPMRs. In its territorial sea, and hence in its internal waters, the coastal State has territorial sovereignty. As a result, subject to an important exception relating to shipping and subject to the need to comply with Part XII of the LOSC on protection and preservation of the marine environment, the coastal State has the exclusive right to regulate, authorise and conduct activities in the water column, seabed and subsoil of those zones (subject to any obligations of the coastal State under any domestic legislation, other treaties or customary international law). That regulation by the coastal State may include exclusion of activities for the purposes of nature conservation, which is clearly of relevance to the management of HPMRs.

Regarding the exception relating to shipping, the LOSC provides for ships of all States to have the right of innocent passage through the territorial sea. However, it also allows the coastal State to regulate innocent passage for, *inter alia*, the purposes of environmental protection. Such regulation is subject to important duties, including a duty to avoid denying or impairing the right of innocent passage. Options available to the coastal State include the establishment of routing measures, including areas to be avoided. Unless a strait used for international navigation is involved, there is no requirement for the coastal State to obtain the approval of the IMO for the establishment of areas to be avoided in its territorial sea. However, a coastal State may, for a variety of reasons, nonetheless chose to seek IMO approval. A right of innocent passage does not exist in internal waters, with one limited exception.

⁵⁴ LOSC, Article 8(2).

3. EC LAW

3.1 Introduction

38. This section will focus on the Environment title and Agriculture title of the EC Treaty. It is possible that constraints may also arise from other fields of EC law, such as the law relating to the internal market; however, reasons of space prohibit their consideration.

3.2 Environment title of the EC Treaty

39. The power to make rules regarding environmental protection is shared between the EC and the Member States. The Environment title of the EC Treaty sets out EC policy on the environment and provides, in Article 175, a power for the EC to adopt secondary legislation to implement that policy. Two examples of such legislation are the Habitats Directive and the Birds Directive.

40. The Environment title, in Article 176, states that: “The protective measures adopted pursuant to Article 175 shall not prevent any Member State from maintaining or introducing more stringent protective measures. Such measures must be compatible with this Treaty. They shall be notified to the Commission”. In principle, Article 176 entitles a Member State to go further than the requirements of, say, the Habitats Directive.

41. In practice, in view of the requirement for the measures to be compatible with the EC Treaty, and hence with other provisions of the EC Treaty, with EC secondary legislation and with general principles of EC law, it would be prudent to assess the lawfulness of any measure proposed in the light of Article 176 on a case-by-case basis. However, such an assessment, for example in respect of a measure seeking to establish HPMPs within marine SACs in order to better protect the features for which the SACs have been designated, is beyond the scope of this paper.

42. In the UK, EC Directives are generally implemented by means of powers provided by section 2(2) of the ECA which, subject to Schedule 2 to the ECA, enables the use by “any designated Minister or department” of regulations, rather than Acts of Parliament, for the purpose, *inter alia*, “of implementing any Community obligation of the United Kingdom, or enabling any such obligation to be implemented, or of enabling any rights enjoyed or to be enjoyed by the United Kingdom under or by virtue of [the EC Treaty] to be exercised”.

43. The Habitats Directive and Birds Directive are relevant examples. The Birds Directive (in part) and the Habitats Directive are implemented in the marine internal waters and territorial sea of the UK adjacent to Great Britain by SI 1994/2716.⁵⁵ That SI, which in its original form predated devolution, was made by “[t]he Secretary of State for the Environment, as respects England, the Secretary of State for Wales, as respects Wales, and the Secretary of State for Scotland, as respects Scotland”,⁵⁶ all three having previously been designated for the purposes of section 2(2) of the ECA in relation to “[m]easures relating to the conservation of natural habitats and of wild fauna and flora” (i.e. measures to implement, *inter alia*, the Habitats and Birds Directives).⁵⁷

44. Under an order made pursuant to section 22 of the GoWA 1998,⁵⁸ functions under SI 1994/2716 in relation to Wales have been transferred to the NAW (except functions under regulations 71 to 78, which relate to electricity and pipelines). Furthermore, under a subsequent

⁵⁵ The Conservation (Natural Habitats, &c.) Regulations 1994, SI 1994/2716, as amended.

⁵⁶ SI 1994/2716, preamble.

⁵⁷ The European Communities (Designation) (No. 4) Order 1992, SI 1992/2870. Article 2 and Schedule.

⁵⁸ SI 1999/672, Schedule 1.

order made pursuant to section 29 of the GoWA 1998,⁵⁹ the NAW has been designated for the purposes of section 2(2) of the ECA in relation to “[t]he conservation of natural habitats and of wild fauna and flora” (i.e. implementation of, *inter alia*, the Habitats and Birds Directives), albeit with one relevant and important exception.⁶⁰

45. That exception is “measures which, in the interests of conservation, concern the assessment of, and authorisation of, projects or plans likely to have a significant effect on natural habitats and habitats of species, unless a function relating to the authorisation of the project or plan, in the interests of any other matter, is exercisable by the [NAW] at the date of the making of this Order”.⁶¹ In other words, the NAW may only implement the assessment and authorisation provisions of the Habitats Directive (notably those in Article 6(3) and (4)) to the extent that it already has “a function relating to the authorisation of the project or plan, in the interests of any other matter”.

46. The NAW has exercised its powers under section 2(2) of the ECA in relation to the Habitats and Birds Directives on at least two occasions.⁶² However, the NAW has not, to date, exercised its section 2(2) powers to make any regulations implementing the Habitats and Birds Directives in the marine internal waters and territorial sea adjacent to Wales. That may be partly because: (a) the NAW already has functions under SI 1994/2716; and (b) in view of the limitation on its powers under section 2(2) of the ECA (see paragraph 45 above), it is currently easier for the NAW to ask the Secretary of State to legislate on its behalf in relation in Wales (as appears to have been the case with the draft Conservation (Natural Habitats, &c.) (Amendment) (England and Wales) Regulations 2006).

47. Whether the NAW acts on its own under section 2(2) (to the limit of its powers) or whether it asks the Secretary of State to legislate on its behalf, it is relevant to consider the extent, if any, to which section 2(2) of the ECA could be used by the Secretary of State or the NAW as a valid legal basis for regulations that take the Habitats Directive or Birds Directive as a starting framework but then seek to go further than the requirements of the Directives on the basis of Article 176 of the EC Treaty (assuming the measures to be established by those regulations were compatible with EC law – see paragraphs 40 and 41 above).

48. An example of the UK government going further than the requirements of the Habitats Directive is provided by SI 2000/192.⁶³ Those regulations, by amending SI 1994/2716 in respect of England only, applied the protection offered by Article 6 of the Habitats Directive to sites from the point that they were proposed by the Secretary of State and transmitted to the Commission,⁶⁴ rather than, as required by the Directive, only applying such protection from the point of the inclusion of the sites in the draft list of sites of Community importance.⁶⁵ SI 2000/192 was made using powers under section 2(2) of the ECA.⁶⁶

49. Defra has justified SI 2000/192 as being a measure “to mitigate the risk of infraction proceedings” by the Commission, in view of the fact that by 2000 the UK had fallen well behind in the Habitat Directive’s timetable for notification of candidate sites to the Commission.⁶⁷ Defra has also justified the measure in the light of a judgment of the Court issued in January

⁵⁹ The European Communities (Designation) Order 2002, SI 2002/248.

⁶⁰ SI 2002/248. Article 3 and Schedule 2.

⁶¹ SI 2002/248. Article 3 and Schedule 2.

⁶² (a) The Environmental Impact Assessment (Uncultivated Land and Semi-natural Areas) (Wales) Regulations 2002, SI 2002/2127 (W.214); and (b) The Wildlife and Countryside Act 1981 (Amendment) (Wales) Regulations 2004, SI 2004/1733 (W.176).

⁶³ The Conservation (Natural Habitats, &c.) (Amendment) (England) Regulations 2000, SI 2000/192.

⁶⁴ SI 2000/192, Regulation 2(2).

⁶⁵ Habitats Directive, Article 4(5).

⁶⁶ SI 2000/192, preamble.

⁶⁷ <www.cabinetoffice.gov.uk/regulation/documents/davidson_review/annex_a.pdf>, page 54.

2005,⁶⁸ whereby the Court held that, in respect of “sites eligible for identification as sites of Community importance which are included in the national lists transmitted to the Commission”, Member States are “required to take protective measures that are appropriate, from the point of view of the [Habitats] Directive’s conservation objective, for the purpose of safeguarding the relevant ecological interest which those sites have at national level”.⁶⁹

50. Thus Defra has justified SI 2000/192 on the grounds that the regulations were intended to: (a) help rectify, by introducing earlier protection, a failure to adhere to the Directive’s timetable; and (b) provide for a level of protection that was anyway implied by the Directive. That may be contrasted with seeking to use section 2(2) of the ECA to provide for, say, the establishment of HPMRs within marine SACs in order to better protect the features for which the SACs have been designated (assuming such measures were compatible with EC law – see paragraphs 40 and 41 above).

51. The former is seeking to meet the requirements the Habitats Directive, express or implied. The latter, however, would be going well beyond the requirements of the Directive. It is necessary to ask whether or not it would be valid to use section 2(2) of the ECA to adopt regulations going well beyond the requirements of a EC obligation (assuming the particular measures in question have been deemed compatible with EC law – see paragraphs 40 and 41 above). It is beyond the scope of this paper to advise, even in a preliminary fashion, on the answer to that question. However, it is a question that should be addressed carefully by the NAW or by the Secretary of State if there is any intention of using section 2(2) to make regulations going well beyond the requirements of the Habitats Directive or Birds Directive.

52. Meanwhile, it is interesting to note that the government does have some concerns about over-implementation of Directives. First, guidance prepared by the Cabinet Office and published in 2005 states that: “It is government policy not to go beyond the minimum requirements of European directives, unless there are exceptional circumstances, justified by a cost-benefit analysis and extensive consultation with stakeholders”.⁷⁰

53. Secondly, a review has also been launched by the Chancellor into over-implementation of EC Directives.⁷¹ That review is due to report at the end of 2006. However, as an interim measure, the review issued a call for evidence of over-implementation of Directives. It presented that evidence, together with government responses, in July 2006.⁷² Of note, SI 2000/192 was presented to the review as an example of over-implementation;⁷³ Defra’s response is summarised in paragraph 49 above.

3.3 Agriculture title of the EC Treaty

Introduction

54. The Agriculture title of the EC Treaty is relevant to this briefing paper because it includes fisheries. The inclusion of fisheries arises because: (a) Article 32(1) of the EC Treaty states that the term “Agricultural products” means “the products of the soil, of stock farming and of fisheries and products of first-stage processing directly related to these products” (emphasis added); and (b) Article 32(3) states that “[t]he products subject to the provisions of Articles 33 to 38 are listed in Annex I to this Treaty”, Annex I in turn including products arising from fisheries.

⁶⁸ Case C-117/03, *Società Italiana Dragaggi SpA and Others*, Judgment of the Court 13 January 2005.

⁶⁹ *Ibid.*, paragraph 30.

⁷⁰ *Transposition guide: how to implement European directives effectively*, 2005, Cabinet Office (<www.cabinetoffice.gov.uk/regulation/documents/pdf/europe/tguide.pdf>). Paragraph 3.18. See also paragraphs 1.10 and 3.17-3.19.

⁷¹ <www.cabinetoffice.gov.uk/regulation/reviewing_regulation/davidson_review/index.asp>.

⁷² <www.cabinetoffice.gov.uk/regulation/reviewing_regulation/davidson_review/summary.asp>.

⁷³ <www.cabinetoffice.gov.uk/regulation/documents/davidson_review/annex_a.pdf>, page 54.

55. Those references clearly imply that the EC has a fisheries policy, as does the reference in Article 3(1)(e) of the EC Treaty to “a common policy in the sphere of agriculture and fisheries” (emphasis added). However, the specific term “common fisheries policy” is not actually mentioned anywhere in the EC Treaty. Instead, that term has arisen through practice, with the Agriculture title as its legal basis.

56. The geographical scope of the CFP is not entirely straightforward, by virtue of Article 299 of the EC Treaty. However, it can be said that the CFP applies to, *inter alia*, the marine internal waters and territorial sea adjacent to Wales. The material scope of the CFP is also not straightforward. However, in broad terms it can be said that the CFP applies to products of, and hence fisheries for, *inter alia*, finfish, molluscs and crustaceans. The CFP includes four principal areas, comprising fisheries conservation, structures, markets and external relations.

57. This briefing paper will focus on fisheries conservation. Under the CFP, the EC has exclusive legislative jurisdiction in the area of fisheries conservation. The term “legislative jurisdiction” means the power to make rules. The EC has in turn delegated some limited rule-making powers back to the Member States (see paragraphs 60-76 below). Therefore, the power of the Member States, including the UK, to make rules for fisheries conservation is restricted to those limited powers that have been delegated back to them. This briefing paper will focus on those delegated powers, though it should be remembered that the option always remains to seek to persuade the Commission to take, or initiate, action at the EC level if the delegated powers prove inadequate for the particular task in question.

58. The situation regarding legislative jurisdiction in the area of fisheries conservation is complicated by Article 6 of the EC Treaty, whereby the EC is required to integrate environmental protection requirements into the definition and implementation of, *inter alia*, the CFP. That duty has led to the adoption of several legislative provisions under the CFP that restrict the activities of fishing vessels for purposes relating to nature conservation rather than solely or primarily for fisheries conservation purposes.

59. Questions arise about the “reach” of Article 6. For example, to what extent can Article 6 justify the EC adopting Regulations under the CFP that restrict the activities of fishing vessels solely or primarily for the purposes of nature conservation? And to what extent can the Commission in turn claim that the adoption of measures of that kind is the exclusive province of the EC, except to the extent that the EC delegates powers in that regard to the Member States? Questions of that kind are addressed in report published by the IEEP in 2004.⁷⁴ However, for reasons of time, it will be assumed in this briefing paper that neither the UK government, nor the devolved administration in Wales, currently has any intention of adopting fisheries measures for nature conservation purposes other than through the UK’s delegated powers under the CFP.

60. That brings us to the powers that have been delegated to the Member States. Those powers are set out in Articles 10, 9 and 8 of Regulation 2371/2002⁷⁵ (“**the Basic Regulation**”) and in Articles 46 and 45 of Regulation 850/98.⁷⁶ This briefing paper will summarise the powers available under each of those provisions.

Article 10 of the Basic Regulation and Article 46 of Regulation 850/98

⁷⁴ D.Owen, *Interaction Between the EU Common Fisheries Policy and the Habitats and Birds Directives*, IEEP Policy Briefing, 2004, Institute for European Environmental Policy, London.

⁷⁵ Council Regulation (EC) No 2371/2002 of 20 December 2002 on the conservation and sustainable exploitation of fisheries resources under the Common Fisheries Policy (OJ L 358, 31.12.2002, p.59).

⁷⁶ Council Regulation (EC) No 850/98 of 30 March 1998 for the conservation of fishery resources through technical measures for the protection of juveniles of marine organisms (OJ L 125, 27.4.1998, p.1), as amended.

61. Under Article 10 of the Basic Regulation, Member States may take “measures for the conservation and management of stocks in waters under their sovereignty or jurisdiction” in respect of: (a) fishing vessels flying the flag of the Member State concerned and which are registered in the EC; or (b) persons established in the Member State concerned (in the case of fishing activities which are not conducted by a fishing vessel). Such measures must be compatible with the objectives set out in Article 2(1) of the Basic Regulation and must be no less stringent than existing EC legislation.

62. The reference in Article 10 to “waters under their sovereignty or jurisdiction” means that the UK can use Article 10 to adopt the measures in question for stocks in, *inter alia*, the marine internal waters and territorial sea adjacent to Wales. However, Article 10 only applies to the categories of fishing vessel or person referred to in “(a)” and “(b)” in the preceding paragraph, and hence has no application to, *inter alia*, fishing vessels flying the flag of other States, including other Member States.

63. Article 10 may be contrasted with Articles 8 and 9 of the Basic Regulation, in that Article 10 uniquely does not expressly provide for measures to be taken for the purposes of protection of the marine ecosystem. Without conducting further research, it is not possible to be clear whether that omission was an oversight on the part of those drafting the Basic Regulation or was intentional. However, in practice, the omission may not matter with regard to internal waters and the territorial sea by virtue of Article 9 of the Basic Regulation (see paragraphs 67-70 below).

64. Article 10 of the Basic Regulation may also be contrasted with Article 46 of Regulation 850/98. The latter provision was not repealed by the Basic Regulation and must therefore be regarded as still in force. Article 46(1) states that:

Member States may take measures for the conservation and management of stocks:

- (a) in the case of strictly local stocks which are of interest solely to the Member State concerned; or
 - (b) in the form of conditions or detailed arrangements designed to limit catches by technical measures:
 - (i) supplementing those laid down in the Community legislation on fisheries; or
 - (ii) going beyond the minimum requirements laid down in the said legislation;
- provided that such measures apply solely to fishing vessels flying the flag of the Member State concerned and registered in the Community or, in the case of fishing activities which are not conducted by a fishing vessel, to persons established in the Member State concerned.

65. Thus, like Article 10, Article 46(1) applies only to “measures for the conservation and management of stocks” in respect of: (a) fishing vessels flying the flag of the Member State concerned and registered in the EC; and (b) persons established in the Member State concerned (in the case of fishing activities which are not conducted by a fishing vessel). It is broader in scope than Article 10 in that there is no express requirement for the measures to be compatible with any particular objectives or for measures to apply only within certain waters. However, it is narrower in that it relates only to: (a) “strictly local stocks ...”; or (b) “conditions or detailed arrangements designed to limit catches by technical measures ...”.

66. Article 46(2) of Regulation 850/98 sets out the procedure to be followed in the event that a Member State plans “to introduce or amend national technical measures” under Article 46(1). First, the Commission is to be notified of any such plans “in time for it to present its observations”. Secondly, the Commission may request suspension of entry into force of the planned measures for a limited period pending a decision as to whether or not the conditions in Article 46(1) are met. Thirdly, in the event of non-compliance with the Article 46(1) conditions, the Commission may decide that entry into force is to be conditional on certain amendments to the planned measures being made by the Member State. Lastly, the Member State is to inform the other Member States and the Commission of the measures adopted, “having made any amendments which may be necessary”.

Article 9 of the Basic Regulation

67. Under Article 9 of the Basic Regulation, a Member State may take “measures for the conservation and management of fisheries resources and to minimise the effect of fishing on the conservation of marine eco-systems” but only: (a) “within 12 nautical miles of its baselines”; (b) if the measures are non-discriminatory; (c) if the EC “has not adopted measures addressing conservation and management specifically for this area”; (d) if the measures are compatible with the objectives set out in Article 2 of the Basic Regulation (see paragraph 60 above); and (e) if the measures are no less stringent than existing EC legislation.⁷⁷

68. The reference in Article 9 to “within 12 nautical miles of its baselines” means that the UK can use Article 9 to adopt the measures in question for fisheries resources and marine ecosystems in, *inter alia*, the marine internal waters and territorial sea adjacent to Wales.

69. Measures adopted under Article 9 may include measures “liable to affect the vessels of another Member State”.⁷⁸ However, such measures may be adopted “only after the Commission, the Member State and the Regional Advisory Councils concerned have been consulted on a draft of the measures accompanied by an explanatory memorandum”⁷⁹ and are subject to the procedure laid down in Article 8(3)-(6) of the Basic Regulation.⁸⁰ The latter reads as follows:

3. The Member States and Regional Advisory Councils concerned may submit their written comments to the Commission within five working days of the date of notification. The Commission shall confirm, cancel or amend the measure within 15 working days of the date of notification.

4. The Commission decision shall be notified to the Member States concerned. It shall be published in the *Official Journal of the European Communities*.

5. The Member States concerned may refer the Commission decision to the Council within 10 working days of notification of the decision.

6. The Council, acting by qualified majority, may take a different decision within one month of the date of receipt of the referral.

70. In January 2005, the UK sought to use Article 9 in respect of its own flag vessels and vessels flagged to other Member States in order to solve a problem arising from the impact of pelagic pair-trawling for bass on small cetaceans. Because the measure was “liable to affect the vessel of another Member State”, the UK consulted the Commission as required under Article 9. In due course, the Commission adopted a Decision rejecting the UK’s request to apply the measure in question to vessels flagged to other Member States,⁸¹ partly on the basis that the proposed measure was deemed by the Commission as being unlikely to contribute to solving the problem.⁸²

Article 8 of the Basic Regulation and Article 45 of Regulation 850/98

71. Under Article 8 of the Basic Regulation, a Member State may take “emergency measures”: (a) “[i]f there is evidence of a serious and unforeseen threat to the conservation of living aquatic

⁷⁷ Basic Regulation, Article 9(1), 1st paragraph.

⁷⁸ Basic Regulation, Article 9(1), 1st paragraph.

⁷⁹ Basic Regulation, Article 9(1), 2nd paragraph.

⁸⁰ Basic Regulation, Article 9(2).

⁸¹ Commission Decision 2005/322/EC of 26 February 2005 on the request presented by the United Kingdom pursuant to Article 9 of Council Regulation (EC) No 2371/2002 on the conservation and sustainable exploitation of fisheries resources under the Common Fisheries Policy (OJ L104, 23.4.2005, p.37).

⁸² *Ibid.*, preamble, recital (6).

resources, or to the marine ecosystem resulting from fishing activities, in waters falling under the sovereignty or jurisdiction of [that] Member State”; and (b) “where any undue delay would result in damage that would be difficult to repair”.⁸³ In principle, the measures may have a duration of up to three months.⁸⁴

72. The reference in Article 8 to “waters falling under the sovereignty or jurisdiction” of the Member State proposing to take the measure means that the UK can use Article 8 to adopt the measures in question for living aquatic resources and marine ecosystems in, *inter alia*, the marine internal waters and territorial sea adjacent to Wales.

73. Measures under Article 8 may potentially apply to own-flagged vessels or vessels of another Member State. In both cases, the same procedure must be followed. First, “Member States intending to take emergency measures shall notify their intention to the Commission, the other Member States and the Regional Advisory Councils concerned by sending a draft of those measures, together with an explanatory memorandum, before adopting them”.⁸⁵ Secondly, the procedure laid down in Article 8(3)-(6) must be followed. The requirement to notify an “intention” and the reference to “sending a draft” in Article 8(1) suggest that the measure should not be allowed by the Member State to take effect until the Commission has reached its decision.

74. Article 8 of the Basic Regulation may be contrasted with Article 45(2) & (3) of Regulation 850/98. The latter provisions were not repealed by the Basic Regulation and must therefore be regarded as still in force. Article 45(2) states that:

Where the conservation of certain species or fishing grounds is seriously threatened, and where any delay would result in damage which would be difficult to repair, a Member State may take appropriate non-discriminatory conservation measures in respect of the waters under its jurisdiction.

75. Thus, unlike Article 8, Article 45(2) does not require that there must be an “unforeseen” threat and refers to “delay” rather than “undue delay”. However, the threat must be to “the conservation of certain species or fishing grounds”. Though it is arguable that the term “certain species” should be interpreted broadly to mean more than just commercially important fish species, Article 8 is undoubtedly clearer about its application to nature conservation (see paragraph 71 above). Article 45(2) refers to waters under the Member State’s “jurisdiction”, whereas Article 8 refers to waters under the “sovereignty or jurisdiction” of the Member State. In practice, the term “jurisdiction” is likely to include all zones covered by Article 8.

76. Article 45(3) of Regulation 850/98 sets out a slightly different procedure to that established by Article 8 of the Basic Regulation. Notably, there is an obligation on the Member State to communicate “the measures” referred to in Article 45(2) to the Commission and the other Member States “as soon as they are adopted”.⁸⁶ The requirement to communicate the adopted measures, rather than draft measures, suggests that the measures may be allowed by the Member State to take effect pending the Commission’s decision. However, any such effect may be short-lived: within 10 working days of receipt of the Member State’s communication, the Commission must “confirm such measures, or require their cancellation or amendment”.⁸⁷

Relationships between articles

77. There is scope for overlap between Articles 10, 9 and 8 of the Basic Regulation. For example, which article should apply in the event of non-emergency fisheries conservation measures for own-flagged vessels operating within the 12 nm limit? Is it Article 10 or Article 9?

⁸³ Basic Regulation, Article 8(1).

⁸⁴ Basic Regulation, Article 8(1).

⁸⁵ Basic Regulation, Article 8(2).

⁸⁶ Article 45(3), 1st paragraph.

⁸⁷ Article 45(3), 2nd paragraph.

Alternatively, which provision should apply in the event of emergency measures for own-flagged vessels? Is it Article 10 or Article 8?

78. The answer to such questions is not necessarily academic. Different articles apply different thresholds, standards and procedures. Regarding the example in the preceding paragraph about emergency measures for own-flagged vessels, action under Article 8 would require, *inter alia*, “evidence of a serious and unforeseen threat” and consultation with the Commission, the other Member States and the Regional Advisory Councils concerned. In contrast, action under Article 10 would merely require the measures to be compatible with the objectives set out in Article 2(1) of the Basic Regulation and to be no less stringent than existing EC legislation.

79. It is also unclear how Member States should decide between using Article 10 of the Basic Regulation versus Article 46 of Regulation 850/98 or Article 8 of the Basic Regulation versus Article 45 of Regulation 850/98. In some cases it may be advantageous to use one in preference to the other. As noted in paragraph 113 below, the NAW appears to have used Article 46 of Regulation 850/98 as the CFP legal basis for several of its fisheries measures. However, it is not clear why the NAW prefers that basis to Article 10 of the Basic Regulation.

Access restriction under Article 17(2) of Basic Regulation

80. Article 17(2) of the Basic Regulation provides a coastal Member State with a right to restrict access to waters under its sovereignty or jurisdiction up to 12 nm from its baselines. It states that:

In the waters up to 12 nautical miles from baselines under their sovereignty or jurisdiction, Member States shall be authorised from 1 January 2003 to 31 December 2012 to restrict fishing to fishing vessels that traditionally fish in those waters from ports on the adjacent coast, without prejudice to the arrangements for Community fishing vessels flying the flag of other Member States under existing neighbourhood relations between Member States and the arrangements contained in Annex I, fixing for each Member State the geographical zones within the coastal bands of other Member States where fishing activities are pursued and the species concerned.

81. It can be seen that the right to impose the access restriction is without prejudice to two categories of arrangement, namely: (a) “the arrangements for Community fishing vessels flying the flag of other Member States under existing neighbourhood relations between Member States”; and (b) “the arrangements contained in Annex I [to the Basic Regulation] ...”.

82. It is important to emphasise that the right provided by Article 17(2) does not provide a new source of Member State legislative jurisdiction in respect of fisheries conservation. Instead, if exercised, it simply acts to limit the number of foreign-flagged vessels fishing in waters landward of the 12 nm line. The result may be that the proportion of foreign-flagged vessels fishing landward of that line is lower than the proportion fishing seaward of that line and hence that the coastal Member State may be able to apply its delegated powers regarding own-flagged vessels to a greater proportion of vessels fishing landwards of the 12 nm line.

83. In the case of the UK, Annex I to the Basic Regulation reveals no arrangements relating to the 0-6 nm zone or marine internal waters. Furthermore, in respect of the UK, it will be assumed for the purposes of this paper that there are no relevant “existing neighbourhood relations” applicable to the 0-6 nm zone or marine internal waters and that there are no foreign-flagged “vessels that traditionally fish in those waters from ports on the adjacent coast”.

84. On that basis, it will be assumed that the only vessels fishing in marine internal waters adjacent to Wales and in the 0-6 nm zone of the territorial sea adjacent to Wales are those flying the flag of the UK and registered in the EC. If that is right, the UK may apply its delegated powers regarding own-flagged vessels to all vessels fishing landwards of the 6 nm line in the seas

adjacent to Wales (on which see section 4.2 below). That situation contrasts with parts of the 6-12 nm zone of the territorial sea adjacent to Wales, in respect of which Annex I to the Basic Regulation reveals several arrangements for access (by Belgium, French and Irish vessels).

Summary of section 3: This section addresses the Environment and Agriculture titles of the EC Treaty. Under the Environment title, the power to make rules regarding environmental protection is shared between the EC and the Member States. Article 176 of the EC Treaty makes it clear that Member States may maintain or introduce more stringent protective measures than those imposed by EC environmental protection legislation. Thus, in principle, Article 176 entitles a Member State to go further than the requirements of, say, the Habitats Directive.

The UK has generally transposed EC Directives on environmental protection, including the Habitats Directive, by means of section 2(2) of the ECA. In at least one case it has also used the ECA as a legal basis for adopting measures that go further than the express requirements of the Habitats Directive. However, questions arise regarding the extent to which the section 2(2) of the ECA could validly be used as a legal basis for adopting measures that go significantly beyond the Habitats Directive's requirements, even if such measures were compatible with EC law.

The Agriculture title includes fisheries. Under the CFP, the EC has exclusive legislative jurisdiction in the area of fisheries conservation, though some limited rule-making powers have been delegated back to the Member States. Article 6 of the EC Treaty requires the EC to integrate environmental protection requirements into the CFP, but questions arise as to the "reach" of that duty and whether, for example, it enables the EC to have exclusive jurisdiction to impose restrictions on fishing vessels for the sole or primary purpose of nature conservation.

Under the CFP, the powers that have been delegated back to the Member States are set out in Articles 10, 9 and 8 of the Basic Regulation and in Articles 46 and 45 of Regulation 850/98. This section analyses the nature of those delegated powers and illustrates their limited scope, including the potential difficulties for the coastal Member States in applying rules to vessels flagged to other Member States. A section on the access restriction under Article 17(2) of the Basic Regulation emphasises that the restriction does not provide a new source of legislative jurisdiction to Member States in respect of fisheries conservation, though it may lead to a situation where the only vessels operating in a given zone are those flagged to the coastal Member State in question.

4. DOMESTIC LAW

4.1 Introduction

85. This section will address the extent to which the following three activities can be controlled by the devolved administration in Wales, with a view to understanding the extent to which those activities could be excluded from HPMRs: (a) commercial capture fisheries; (b) dumping of substances or articles; and (c) construction and operation of offshore wind farms. Clearly, those activities are only a selection of the activities that would potentially need to be prohibited in order to meet the working definition of the term “HPMR”. However, they have been chosen to illustrate a range of legal issues that arise.

86. To understand the scope for control of activities by the devolved administration in Wales, it is necessary to understand what functions in relation to those activities have been devolved and what constraints on the exercise of those functions exist. The legislative framework for Welsh devolution is complex; only a brief introduction can be provided in this briefing paper. Until July 2006, the principal Act of Parliament providing for devolution in respect of Wales was the GoWA 1998. However, on 25 July 2006 the GoWA 2006 received Royal Assent.⁸⁸ Only a few parts of the GoWA 2006 are currently in force; many important provisions will not come into force until immediately after the appointment of the First Minister after the 2007 NAW elections.⁸⁹

87. The GoWA 1998 established the NAW.⁹⁰ Functions may be transferred to, and then become exercisable by, the NAW by four principal means: (a) the GoWA 1998 itself; (b) other primary legislation; (c) orders made under section 22 of the GoWA 1998 (which identify primary or secondary legislation under which certain functions are transferred wholly or partly to the NAW); and (d) orders made under section 29 of the GoWA 1998 (which designate the NAW for the purpose of section 2(2) of the ECA – see paragraphs 42-45 above).

88. The GoWA 1998 makes it clear that a EC obligation of the UK is also an obligation of the NAW “if, and to the extent that, the obligation could be implemented (or enabled to be implemented) or complied with by the exercise by the [NAW] of any of its functions” (with one exception regarding certain quantitative obligations).⁹¹ However, the devolution Memorandum of Understanding adds that: “If the devolved administrations wish, it is open to them to ask the UK Government to extend UK legislation to cover their EU obligations”.⁹² (The NAW appears to have used that option regarding the Habitats Directive – see paragraph 46 above.) Conversely, the GoWA 1998 makes it clear that the NAW has no power to “make, confirm or approve any subordinate legislation ... or ... do any other act” that is incompatible with EC law.⁹³

89. Regarding international obligations (e.g. an obligation under the LOSC), if a Minister of the Crown considers that any action capable of being taken by the NAW is required for the purpose of giving effect to any international obligation, “he may by order direct the Assembly to take the action”.⁹⁴ Conversely, if a Minister of the Crown considers that any action proposed to be taken by the NAW would be incompatible with any international obligation, “he may by order

⁸⁸ GoWA 2006, Explanatory Notes, page 1, paragraph 1.

⁸⁹ GoWA 2006, section 161, including section 161(2) and (4)(a).

⁹⁰ GoWA 1998, section 1.

⁹¹ GoWA 1998, section 106(1).

⁹² Memorandum of Understanding and Supplementary Agreements Between the United Kingdom Government, Scottish Ministers, the Cabinet of the National Assembly for Wales and the Northern Ireland Executive Committee, 2001, Cm 5240. Page 9, paragraph 20.

⁹³ GoWA 1998, section 106(7).

⁹⁴ GoWA 1998, section 108(2).

direct that the proposed action shall not be taken”.⁹⁵ Likewise, a Minister of the Crown may, by order, revoke legislation made by NAW that is incompatible with any international obligation.⁹⁶

90. Several orders under section 22 of the GoWA 1998 have been made to date, the one transferring the most functions having been SI 1999/672. That order has already been mentioned in paragraph 8 above, and will be referred to again in the sections that follow.

91. In respect of section 22 orders, it should be added that Ministers of the Crown retain certain powers regarding implementation of EC law. Thus the GoWA 1998 states that: “Any power of a Minister of the Crown to make subordinate legislation which has been transferred by an Order in Council under section 22 shall continue to be exercisable by the Minister of the Crown (as it would be had it not been transferred) for the purpose of ... [*inter alia*] ... implementing any Community obligation of the United Kingdom ...” (emphasis added).⁹⁷ The reference to “exercisable” indicates that the UK government has retained a power to act but will not necessarily exercise that power.

92. Several orders under section 29 of the GoWA 1998 have also been made. Of relevance to HPMRs, SI 2005/2766 designated the NAW, for the purposes of section 2(2) of the ECA, in relation to “[t]he common agricultural policy of the European Community” (with some exceptions unrelated to fisheries conservation).⁹⁸ That power has been used by the NAW in relation to implementing the CFP (see paragraph 103 below). Also, SI 2002/248 designated the NAW, albeit in a qualified way, in relation to the Birds and Habitats Directives (see paragraphs 44 and 45 above). That power has also been used to some extent (see paragraph 46 above). Limitations on the use of powers under section 2(2) of the ECA are discussed in paragraphs 47-53 above.

93. Under the GoWA 1998, the NAW in practice delegated its executive powers to an entity known as the Welsh Assembly Government (“**WAG**”), comprising ministers appointed from the NAW. Under the GoWA 2006, the WAG is formally established in law as an entity separate from, but accountable to, the NAW and comprising the First Minister, the Welsh Ministers, the Counsel General to the WAG and the Deputy Welsh Ministers (as defined).⁹⁹ The term “Welsh Ministers” is used by the GoWA 2006 to refer to the First Minister and the Welsh Ministers collectively.¹⁰⁰

94. Under the GoWA 2006, the WAG becomes the direct recipient of functions of the kind previously transferred to the NAW by orders under sections 22 and 29 of the GoWA 1998 (the equivalent sections in the GoWA 2006 being sections 58 and 59). Transitional provisions in the GoWA 2006 provide for functions transferred to the NAW by, *inter alia*, orders made under sections 22 and 29 of the GoWA 1998 (e.g. those under SI 1999/672) to be exercisable by the WAG immediately after the First Minister has been appointed after the 2007 NAW elections.¹⁰¹ The GoWA 2006 includes, in respect of the Welsh Ministers, similar obligations and restrictions to those in paragraphs 88 and 89 above.¹⁰²

95. The GoWA 2006 also contains provisions on two new forms of law-making, to be exercised by the NAW in relation to Wales. In both cases, the resulting laws will be outside the NAW’s legislative competence if they are incompatible with EC law.¹⁰³

⁹⁵ GoWA 1998, section 108(1).

⁹⁶ GoWA 1998, section 108(3).

⁹⁷ GoWA 1998, Schedule 3, paragraph 5.

⁹⁸ The European Communities (Designation) (No.3) Order 2005, SI 2005 No. 2766. Article 4 and Schedule 3.

⁹⁹ GoWA 2006, section 45(1).

¹⁰⁰ GoWA 2006, section 45(2).

¹⁰¹ GoWA 2006, Schedule 11, paragraphs 30-42.

¹⁰² GoWA 2006, sections 80 and 82.

¹⁰³ GoWA 2006, sections 94(6)(c) and 108(6)(c).

96. First, there are provisions on “Assembly Measures”,¹⁰⁴ which may “make any provision that could be made by an Act of Parliament”.¹⁰⁵ However, such measures may only relate to prescribed matters within prescribed fields,¹⁰⁶ such fields currently including, *inter alia*, “... fisheries ...” (Field 1) and “environment” (Field 6) (subject to some exceptions and restrictions).¹⁰⁷ With one exception (i.e. Field 13, entitled “National Assembly for Wales”), prescribed matters within the various fields have not yet been defined.¹⁰⁸ An Order in Council, requiring prior Parliamentary approval, is needed for that purpose.¹⁰⁹ So the GoWA 2006 itself, as originally enacted, does not directly provide the NAW with legislative competence to adopt Assembly Measures regarding, say, fisheries or the environment.

97. Secondly, there are provisions on “Acts of the Assembly”,¹¹⁰ but these can only come into force if a referendum in Wales supports them.¹¹¹ They provide for the NAW to adopt primary legislation in prescribed fields “without the need for further recourse to Parliament”.¹¹² Once the Acts of Assembly provisions come into force, the provisions on Assembly Measures (see preceding paragraph) will cease to have effect.¹¹³ The fields currently include, *inter alia*, “Agriculture, fisheries, forestry and rural development” (emphasis added), “Environment” (including, *inter alia*, “Nature conservation ...”, “Protection of natural habitats, coast and marine environment ...”, “Biodiversity”), “Shipping ...” and “Navigational rights and freedoms” (subject to some exceptions and restrictions).¹¹⁴

98. This briefing paper, in addressing commercial capture fisheries, dumping of substances and articles and construction and operation of offshore wind farms, will focus on the powers of the NAW as they stand irrespective of the GoWA 2006. That is because many important provisions of the Act will not come into force until immediately after the appointment of the First Minister after the 2007 NAW elections (see paragraph 86 above). Of note, however, the provisions coming into force at that time will include, *inter alia*, the provisions on Assembly Measures.¹¹⁵ It is possible that, in the interim, orders may be adopted to include matters under the fields of “... fisheries ...” and “environment”.¹¹⁶ If that were to happen, the NAW would, at the coming into force of the Assembly Measures provisions, then be able to take steps to adopt Measures on such matters.

99. This paper, when addressing the powers of the NAW in relation to commercial capture fisheries, dumping of substances and articles and construction and operation of offshore wind farms, does not, for reasons of space, address any devolved powers under the various statutory instruments implementing the EIA or SEA Directives or the Habitats or Birds Directives. It should also be added that the Marine Bill may also provide for devolution of further powers to the devolved administration for Wales. For example, Defra’s consultation document *A Marine Bill* states that: “The Marine Bill could offer UK Government the opportunity to devolve further or new powers to the devolved administrations, if felt appropriate as the policies are developed further”.¹¹⁷

¹⁰⁴ GoWA 2006, Part 3.

¹⁰⁵ GoWA 2006, section 94(1).

¹⁰⁶ GoWA 2006, section 94(4)(a).

¹⁰⁷ GoWA 2006, Schedule 5.

¹⁰⁸ GoWA 2006, Schedule 5, Part 1.

¹⁰⁹ GoWA 2006, section 95.

¹¹⁰ GoWA 2006, Part 4.

¹¹¹ GoWA 2006, section 105.

¹¹² GoWA 2006, Explanatory Notes, page 57, paragraph 371.

¹¹³ GoWA 2006, section 106.

¹¹⁴ GoWA 2006, Schedule 7, Part 1, paragraphs 1, 6 and 10. See also Parts 2 and 3.

¹¹⁵ GoWA 2006, section 161(4)(a).

¹¹⁶ GoWA 2006, section 161(2), which brings into force, *inter alia*, section 95 and Schedule 5 on the day on which the GoWA 2006 is passed.

¹¹⁷ *A Marine Bill*, Defra, London, 2006. Page 15, paragraph 5.6.

4.2 Commercial capture fisheries

100. The principal legal constraint regarding the regulation of commercial capture fisheries is the exclusive jurisdiction of the EC in the area of fisheries conservation. That means that the Member States, including the UK, may only make rules for fisheries conservation to the extent that powers to do so have been delegated back to them by the EC. As noted in paragraph 59 above, it will also be assumed that neither the UK government, nor the NAW, currently has any intention of adopting measures restricting the activities of fishing vessels for nature conservation purposes other than through their delegated powers under the CFP.

101. On that basis, the UK government, and the NAW, may only make rules to restrict the activities of fishing vessels for fisheries conservation or nature conservation purposes by means of the powers made available to Member States under Articles 10, 9 and 8 of the Basic Regulation and Articles 46 and 45 of Regulation 850/98. The analysis of those powers in section 3.3 above illustrates that they are very limited in scope. Nevertheless, they still provide some scope for action. (As noted in paragraph 57 above, it should be remembered that the option always remains to seek to persuade the Commission to take, or initiate, action at the EC level if the delegated powers prove inadequate for the particular task in question. For reasons of space, that option is not discussed further in this paper.)

102. Within the UK, including Wales, the principal domestic legal basis for exercising the delegated powers arises from Acts of Parliament relating to fisheries and, potentially, environmental protection. The main Acts of Parliament that, directly or indirectly, enable controls to be placed on commercial capture fisheries are: (a) the Sea Fisheries Regulation Act 1966 (whereby, *inter alia*, sea fisheries committees may make byelaws); the Sea Fisheries (Shellfish) Act 1967 (whereby, *inter alia*, the Secretary of State may confer a right of regulating a fishery); and the Sea Fish (Conservation) Act 1967 (on which see below).

103. It is arguable that an alternative domestic legal basis for exercising the delegated powers arises from the ECA, in that section 2(2) of the ECA enables the use of regulations, rather than Acts of Parliament, for the purpose of, *inter alia*, “enabling any rights enjoyed or to be enjoyed by the United Kingdom under or by virtue of the Treaties to be exercised” (emphasis added; see paragraph 42 above). However, the UK does not so far seem to have chosen section 2(2) as a basis for exercising its delegated powers under the CFP.¹¹⁸ Neither does the NAW, despite having been designated under section 2(2) in relation to the CFP (see paragraph 92 above). The NAW has, however, used its powers under section 2(2) to implement various CFP obligations.¹¹⁹

104. For reasons of space, the analysis in this briefing paper will be confined to the Sea Fish (Conservation) Act 1967 (“**the 1967 Act**”). Under SI 1999/672, made under section 22 of the GoWA 1998 (see paragraph 90 above), it was directed that, with two qualifications, all functions of a Minister of the Crown under the 1967 Act are, so far as exercisable in relation to Wales, transferred to the NAW.¹²⁰ The two qualifications are: (a) that functions of the “Board of Trade” under section 8 of the 1967 Act are excepted from the transfer; and (b) that “the functions under sections 4, 4A and 15(3) [of the 1967 Act] shall be exercisable by the [NAW] concurrently with any Minister of the Crown by whom they are exercisable” (functions under sections 4 and 4A being exercisable by the NAW free from the requirement for Treasury consent).¹²¹

¹¹⁸ See, in particular, The South-west Territorial (Prohibition of Pair Trawling) Order 2004, SI 2004/3397, by which the UK exercised its powers under Article 9 of the Basic Regulation but which was based on “the powers conferred by sections 3, 5(1), 5A, and 15(3) of the Sea Fish (Conservation) Act 1967”.

¹¹⁹ See, for example: (a) The Registration of Fish Buyers and Sellers and Designation of Fish Auction Sites (Wales) Regulations 2006, SI 2006/1495 (W.145); (b) The Fisheries and Aquaculture Structures (Grants) (Wales) Regulations 2002, SI 2002/675 (W.72); and (c) The Sea Fishing (Enforcement of Community Satellite Monitoring Measures) (Wales) Order 2000 Amendment Regulations 2002, SI 2002/677 (W.74).

¹²⁰ SI 1999/672, Article 2(a) and Schedule 1.

¹²¹ SI 1999/672, Schedule 1.

105. The 1967 Act contains several provisions of importance for controlling the activities of fishing vessels. However, section 5 is of particular importance in the context of HPMRs because it creates a general power for ministers to, by order, prohibit in any specified area: (a) “all fishing for sea fish”; (b) “fishing for any description of sea fish specified in the order”; or (c) “fishing for sea fish, or for any description of sea fish specified in the order, by any method so specified”.¹²²

106. The prohibition may be for a specified period (including by reference to particular months, weeks, days or hours) or without time limitation.¹²³ An order may apply to any fishing boat within relevant British fishery limits, but must be more limited outside such limits.¹²⁴ Orders may make different provision for different types of fishing boat.¹²⁵ Section 5 includes provision on discarding of fish that are covered by a prohibition but are taken on board.¹²⁶ It also creates some offences.

107. Section 5A of the 1967 Act allows any power to make an order under section 5 to be exercised for marine environmental purposes. The term “marine environmental purposes” is defined as meaning the following purposes: (a) “conserving or enhancing the natural beauty or amenity of marine or coastal area (including their geological or physiographical features) or of any features of archaeological or historic interest in such areas”; or (b) “conserving flora or fauna which are dependent on, or associated with, a marine or coastal environment”.¹²⁷

108. Section 5A of the 1967 Act was introduced by the Environment Act 1995. It has not been used on many occasions. The few examples include: (a) The Razor Shells, Trough Shells and Carpet Shells (Specified Sea Area) (Prohibition of Fishing) Order 1998,¹²⁸ which related to the Wash; (b) The South-west Territorial Waters (Prohibition of Pair Trawling) Order 2004,¹²⁹ which aimed to reduce by-catch of small cetaceans during pelagic pair-trawling for bass; and (c) The Shellfish (Specified Sea Area) (Prohibition of Fishing Methods) (Wales) Order 2003,¹³⁰ which was adopted by the NAW and aimed to protect Common scoters in Carmarthen Bay (see further paragraph 111 below).

109. By virtue of SI 1999/672, the Minister of the Crown’s functions under sections 5 and 5A of the 1967 Act have been transferred to the NAW, so far as they are exercisable in relation to Wales (see paragraph 104 above). The term “Wales” includes the marine internal waters and territorial sea adjacent to Wales (see paragraph 7 above). Thus, subject to the important constraints placed by Articles 10, 9 and 8 of the Basic Regulation and Articles 46 and 45 of Regulation 850/98, the NAW may, for example, prohibit fishing within such waters by virtue of section 5 or 5A of the 1967 Act. Section 5A would enable the prohibition to be adopted for environmental protection reasons, for example in relation to HPMRs.

110. In practice, the NAW has already used the functions under section 5 of the 1967 Act that were transferred to it by SI 1999/672. It has done so in at least six cases (though the NAW has also adopted several other fisheries statutory instruments, of a different nature, for which section 5 of the 1967 Act is not invoked):

¹²² 1967 Act, section 5(1).

¹²³ 1967 Act, section 5(1) and (5).

¹²⁴ 1967 Act, section 5(1) and (8).

¹²⁵ 1967 Act, section 5(2).

¹²⁶ 1967 Act, section 5(6).

¹²⁷ 1967 Act, section 5A(3).

¹²⁸ SI 1998/1276.

¹²⁹ SI 2004/3397 (amended by SI 2005/49).

¹³⁰ SI 2003/607 (W.81).

Order	Domestic legal basis [stated in order's preamble]	CFP legal basis [stated in order's Explanatory Note]	Target of prohibition
The Scallop Fishing (Wales) Order 2005 SI 2005 No. 1717 (W.132)	1967 Act: ss. 1, 3, 5, 15(3) and 20(1)	[not stated]	British fishing boats “in any part of Welsh waters which lie within 3 nautical miles of the shore ...” or “in any part of Welsh waters which lie beyond 3 nautical miles of the shore ...” or “within [or “in”] Welsh waters” (depending on the prohibition in question)
The Shrimp Fishing Nets (Wales) Order 2003 SI 2003 No. 3035 (W.283)	1967 Act: ss. 5(1) and 15(3)	[implied as Reg. 850/98: Article 46]	British fishing boats in “Wales”
The Prohibition of Fishing with Multiple Trawls (Wales) Order 2003 SI 2003 No. 1855 (W.205)	1967 Act: ss. 5(1) and 15(3)	Reg. 850/98: Article 46	British fishing boats in “Welsh waters”
The Shellfish (Specified Sea Area) (Prohibition of Fishing Methods) (Wales) Order 2003 SI 2003 No. 607 (W.81)	1967 Act: ss. 5, 5A and 15(3)	[not stated]	British fishing boats, in a specified area of Carmarthen Bay
The Undersized Spider Crabs (Wales) Order 2002 SI 2002 No. 1897 (W.198)	1967 Act: ss. 1(1), 1(6) and 15(3)	Reg. 850/98: Article 46(1)	Scottish fishing boats and relevant British fishing boats in “Wales” [and landing by foreign fishing boats is expressly exempted]
The Lobsters and Crawfish (Prohibition of Fishing and Landing) (Wales) Order 2002 SI 2002 No. 676 (W.73)	1967 Act: ss. 5(1), 6(1) and 15(3)	Reg. 850/98: Article 46(1)	Scottish fishing boats and relevant British fishing boats “within the territorial sea adjacent to Wales”

111. Of the six orders listed in the table above, the only one to have additionally used section 5A of the 1967 Act part of its legal basis is SI 2003/607. As noted in paragraph 107 above, section 5A allows any power to make an order under section 5 of the 1967 Act to be exercised for marine environmental purposes. SI 2003/607 was adopted to protect Common scoters in Carmarthen Bay, hence the need for section 5A to be part of its legal basis. More specifically, it was adopted to protect the food source of the Common scoter in the area in question, that area

having “been identified as a potential Special Protection Area for the purposes of the Birds Directive”.¹³¹ It did so by prohibiting the use of “hydraulic dredging to recover bivalve molluscs” (as defined) in a specified area.¹³²

112. Though SI 2003/607 was adopted to protect the bird interest in a potential SPA, there is no reason why the NAW may not use its powers arising under section 5A for marine environmental purposes unrelated to the Birds Directive (or Habitats Directive). In other words, there is scope for the NAW to adopt orders based on sections 5 and 5A to protect sites irrespective of whether such sites merit protection under EC legislation. That makes section 5A, and orders made using it, a potentially useful tool for the protection of HPMRs. However, it is to be reiterated that any exercise by the NAW of its powers arising under section 5A is subject to the limited powers delegated under the CFP.

113. The example of the 1967 Act considered above illustrates some important points about legal constraints and opportunities for managing commercial capture fisheries in the marine internal waters and territorial sea adjacent to Wales:

(a) any functions exercisable by the NAW are constrained by the limited nature of the powers delegated to the Member States under Articles 10, 9 and 8 of the Basic Regulation and under Articles 46 and 45 of Regulation 850/98 (which, in particular, affect the extent to which the NAW may regulate foreign-flagged vessels in the 6-12 nm zone);

(b) the different articles referred to in “(a)” above provide different powers (see section 3.3 above). The NAW appears to have chosen Article 46 of Regulation 850/98 as the CFP legal basis for at least half of the six orders listed in the table above; however, its reasons for choosing Article 46 over Article 10 of the Basic Regulation are not clear;

(c) reliance by the NAW on provisions of Acts of Parliament as a legal basis for fisheries management actions will depend on the extent to which the functions under those provisions have been devolved to the NAW. For example, functions under sections 5 and 5A have been fully devolved, whereas the functions under sections 4 and 4A (regarding licensing of activities) and 15(3) (regarding enforcement) must be exercised concurrently “with any Minister of the Crown by whom they are exercisable”;

(d) functions under sections 5 and 5A of the 1967 Act provide an example of functions that have been transferred to the NAW that could be used by the NAW to exclude commercial capture fisheries from HPMRs; but transferred functions under other provisions of the 1967 Act and under provisions of other fisheries Acts of Parliament also provide options in that regard; and

(e) the discussion above has focused on just one Act of Parliament (i.e. the 1967 Act), and has been largely confined to two sections of that Act (i.e. sections 5 and 5A). To understand fully the true extent of the NAW’s powers to manage fishing vessels would require a systematic analysis of what fisheries management functions have been transferred, in full or in part, to the NAW and what such functions allow the NAW to do.

4.3 Dumping of substances and articles

Introduction

114. The principal Acts of Parliament regulating dumping of substances and articles in the sea are Part II of the FEPA and Part II of the CPA.

¹³¹ SI 2003/607, Explanatory Note, paragraphs 2 and 3.

¹³² SI 2003/607, Article 3.

FEPA

115. Under section 5 of the FEPA, with some qualifications, a licence is needed for, *inter alia*, the deposit of substances or articles within United Kingdom waters or United Kingdom controlled waters, either in the sea or under the seabed, from “a vehicle, vessel, aircraft, hovercraft or marine structure”, “a container floating in the sea” or “a structure on land constructed or adapted wholly or mainly for the purpose of depositing solids in the sea”.¹³³ (For a full list of the operations requiring a licence, see section 5 of FEPA.)

116. The term “United Kingdom waters” means “any part of the sea with-in the seaward limits of United Kingdom territorial waters”.¹³⁴ It therefore includes, *inter alia*, the marine internal waters and territorial sea adjacent to Wales. The term “sea” includes “any area submerged at mean high water springs and also includes, so far as the tide flows at mean high water springs, an estuary or arm of the sea and the waters of any channel, creek, bay or river”.¹³⁵

117. A section 5 licence is issued by a “licensing authority”,¹³⁶ which is defined as “in relation to England and Wales whichever of the Ministers is responsible for fisheries in the place where an operation to which a licence would relate would, or have been, be carried out or commenced”.¹³⁷ The licensing authority may, by order, specify operations “which are not to need a licence” or “which are not to need a licence if they satisfy conditions specified in the order”.¹³⁸ One such order has been made – SI 1985/1699.¹³⁹ Some other exemptions are specified in the FEPA itself.¹⁴⁰

118. In determining whether to issue a licence a licensing authority must have regard to the need to: (a) protect the marine environment, the living resources which it supports and human health; and (b) prevent interference with legitimate uses of the sea (and may have regard to such other matters as the authority considers relevant).¹⁴¹ The licensing authority has a power to attach certain conditions to a licence, and to vary or revoke a licence in certain circumstances.¹⁴² The licensing authority has various other functions, set out throughout Part II, including a power to carry out certain remedial action.¹⁴³

119. Under SI 1999/672, made under section 22 of the GoWA 1998 (see paragraph 90 above), it was directed that, with two exceptions and certain other qualifications, all functions of a Minister of the Crown under the FEPA are, so far as exercisable in relation to Wales, transferred to the NAW.¹⁴⁴ The two exceptions are: (a) “functions under Part II so far as exercisable in relation to matters concerning or arising from the exploration for, or production of, petroleum”; and (b) “the functions of the Minister of Agriculture, Fisheries and Food under sections 16 and 18 and paragraphs 1 to 3 of Schedule 5”.¹⁴⁵

120. Exception “(b)” above does not relate to Part II of the FEPA, and therefore is not relevant for current purposes. Exception “(a)” above does relate to Part II but is exclusively concerned with “matters concerning or arising from the exploration for, or production of,

¹³³ FEPA, section 5(a).

¹³⁴ FEPA, section 24(1).

¹³⁵ FEPA, section 24(1).

¹³⁶ FEPA, section 8.

¹³⁷ FEPA, section 24(1).

¹³⁸ FEPA, section 7(1).

¹³⁹ The Deposits in the Sea (Exemptions) Order 1985, SI 1985/1699, as amended.

¹⁴⁰ FEPA, section 7A.

¹⁴¹ FEPA, section 8(1).

¹⁴² FEPA, section 8.

¹⁴³ FEPA, section 10.

¹⁴⁴ SI 1999/672, Article 2(a) and Schedule 1.

¹⁴⁵ SI 1999/672, Article 2(a) and Schedule 1.

petroleum”. Exception “(a)” is compatible with the fact that the subject matter of the Petroleum Act 1998 has not been devolved to the NAW.

121. The other qualifications to the transfer of functions effected by SI 1999/672 are that: (a) “It is directed that the functions under sections 1(1), 3(1) and (2), 13, 14(2) and (3), 17 and paragraphs 4 to 6 of Schedule 5 shall be exercisable by the Assembly concurrently with any Minister of the Crown by whom they are exercisable”; and (b) “The Treasury consent requirements under sections 8(9), 16(2) and 18(4) shall continue in effect”.

122. Qualification “(a)” above, in respect of sections 1(1), 3(1), 3(2) and 17 and Schedule 5, does not relate to Part II of the FEPA, and therefore is not relevant for current purposes. Section 13, in Part II, relates to testing to ascertain the probable effect on the marine environment and living resources of substances for treating oil on the sea surface (e.g. dispersants). Section 14(2) and section 14(3), also in Part II, relate to public registers of information. Therefore sections 13, 14(2) and 14(3) are not directly relevant to the management of HPMRs.

123. Overall, it is clear that the NAW is now the licensing authority for the purpose of Part II of the FEPA so far as the functions of that authority are exercisable in relation to Wales (though, in some cases, applications for section 5 licences “are administered on behalf of the Assembly by Defra’s Marine Consents and Environment Unit ...”¹⁴⁶). As a result of being the licensing authority, the NAW has the exclusive power to issue, or decline to issue, a section 5 licence for the deposit of substances or articles in the marine internal waters and territorial sea adjacent to Wales. That power is clearly relevant to the management of HPMRs in such waters.

CPA

124. Part II of the CPA comprises sections 34-36A. Under section 34 of the CPA, subject to section 35, no person shall without written consent from the Secretary of State “construct, alter or improve any works on, under or over any part of the seashore lying below the level of mean high water springs”, “deposit any object or any materials on any such part of the seashore as aforesaid” or “remove any object or any materials from any part of the seashore lying below the level of mean low water springs”, if the operation “(whether while being carried out or subsequently) causes or is likely to result in obstruction or danger to navigation”.

125. Section 35 of the CPA identifies several operations that are excepted from section 34 (including offshore generating activities in certain cases – see paragraph 128 below). Section 36 of the CPA sets out enforcement provisions regarding section 34, and section 36A provides powers for the Secretary of State to impose safety requirements in cases of emergency. Sections 34-36A apply to, *inter alia*, the marine internal waters and territorial sea adjacent to Wales.¹⁴⁷

126. Under SI 1999/672, made under section 22 of the GoWA 1998 (see paragraph 90 above), it was directed that, with some important exceptions, all functions of a Minister of the Crown under the CPA are, so far as exercisable in relation to Wales, transferred to the NAW.¹⁴⁸ However, one of those exceptions is Part II of the CPA. The result is that the functions under sections 34-36A of the CPA are not devolved to the NAW. That means that the Secretary of State still has the exclusive power to issue, or decline to issue, a section 34 consent relating to operations in the marine internal waters and territorial sea adjacent to Wales. However, for many activities where a section 34 consent is required, a licence under section 5 of the FEPA will also be required (on which see paragraph 123 above).

¹⁴⁶ *A Marine Bill*, Defra, London, 2006. Page 66, paragraph 9.25a.

¹⁴⁷ CPA, section 49(2A).

¹⁴⁸ SI 1999/672, Article 2(a) and Schedule 1.

4.4 Construction and operation of offshore wind farms

127. The principal Acts of Parliament regulating construction and operation of wind farms in marine internal waters and the territorial sea are now the Electricity Act 1989 (“the 1989 Act”) and Part II of the FEPA. In the past, applications for wind farms in such waters have also been made under section 3 of the TWA,¹⁴⁹ since the TWA allows for navigational rights to be regulated. However, navigational rights are now also addressed by section 36A of the 1989 Act. For reasons of space, the TWA will not be considered further in this briefing paper.

128. Part II of the CPA has reduced in relevance because section 35 of the CPA now states that a consent under section 34 of the CPA is not required for, *inter alia*, “... any operations comprised in offshore generating activities carried out in accordance with a consent under section 36 of the Electricity Act 1989 granted after the commencement of section 99 of the Energy Act 2004”.¹⁵⁰ Section 99 of the Energy Act 2004, upon commencement, introduced sections 36A and 36B of the 1989 Act, of which the latter addresses similar issues to those addressed by section 34 of the CPA.

129. Part II of the FEPA and Part II of the CPA have already been addressed in section 4.3 above. This section will focus on the 1989 Act. Under section 36 of the 1989 Act, subject to some qualifications, a consent granted by the Secretary of State is required for, *inter alia*, the construction or operation of a generating station.¹⁵¹ That requirement applies to such operations in, *inter alia*, the marine internal waters and territorial sea adjacent to Wales.¹⁵²

130. The 1989 Act enables the Secretary of State to provide, by order, that the requirement for a consent under section 36 does not apply to “generating stations of a particular class or description”.¹⁵³ Accordingly, a 1990 order exempts any generating station which is “situated on an offshore installation ... and ... used solely for the purpose of the supply of electricity to that offshore installation, or to that and any other offshore installation”.¹⁵⁴

131. Though the 1989 Act itself establishes a threshold of greater than 50 megawatts capacity for the section 36 requirement to apply,¹⁵⁵ SI 2001/3642 reduces that threshold such that a capacity of any more than 1 megawatt triggers the section 36 requirement “[i]n the case of generating stations which are wholly or mainly driven by wind or water and are situated in waters within or adjacent to England and Wales (provided that the waters are not within an area in which development requires planning permission under the Town and Country Planning Act 1990) up to the seaward limits of the territorial sea ...”.¹⁵⁶

132. The consenting function under section 36 of the Electricity Act has not been transferred to the NAW. That means that the Secretary of State still has the exclusive power to issue, or decline to issue, a consent under section 36 of the 1989 Act relating to the marine internal waters and territorial sea adjacent to Wales. However, for any operation where a section 36 consent is required, it is highly probable that a licence under section 5 of the FEPA will also be required (on which see paragraph 123 above).

¹⁴⁹ See, for example, The Scarweather Sands Offshore Wind Farm Order 2004, SI 2004/3054 (W.263), made by the NAW under the TWA.

¹⁵⁰ CPA, section 35(1)(ga), introduced by section 99(4) of the Energy Act 2004.

¹⁵¹ 1989 Act, section 36(1).

¹⁵² 1989 Act, section 36(1) and section 4(5).

¹⁵³ 1989 Act, section 36(4).

¹⁵⁴ The Offshore Generating Stations (Exemption) Order 1990, SI 1990/443.

¹⁵⁵ 1989 Act, section 36(2).

¹⁵⁶ The Electricity Act 1989 (Requirement of Consent for Offshore Wind and Water Driven Generating Stations) (England and Wales) Order 2001, SI 2001/3642.

Summary of section 4: This section addresses the legal framework for Welsh devolution and then looks at the scope for regulation of the following activities in marine internal waters and the territorial sea adjacent to Wales: (a) commercial capture fisheries; (b) dumping of substances and articles; and (c) construction and operation of offshore wind farms.

The legal framework for Welsh devolution is complex. The principal Acts of Parliament are the GoWA 1998 and the GoWA 2006. Most of the provisions of the GoWA 2006 are still to come into force, and there are significant changes afoot. However, there is also a layer of secondary legislation by which functions have been, and continue to be, transferred to the devolved administration. Other Acts of Parliament may also transfer functions to the devolved administration, and the Marine Bill may have a role in that regard in due course.

Regarding commercial capture fisheries, the principal legal constraint for their regulation at the UK level, let alone in Wales, is the limited scope of the powers for fisheries conservation that have been delegated by the EC to the Member States. Within the UK, one of the principal Acts of Parliament with potential for exercising those delegated powers is the Sea Fish (Conservation) Act 1967. Many functions under that Act have been transferred to the NAW, and those functions have in turn been used. The Act clearly provides a means for the NAW to exclude commercial capture fisheries from HPMRs, subject to the UK's delegated powers.

Regarding dumping of substances and articles, the principal Acts of Parliament for its regulation are Part II of the FEPA and Part II of the CPA. As a result of devolution, the NAW has the exclusive power to issue, or decline to issue, a licence under section 5 of the FEPA for the deposit of substances or articles in the marine internal waters and territorial sea adjacent to Wales. That power is clearly relevant to the management of HPMRs. In contrast, functions under Part II of the CPA have not been devolved to the NAW. However, for many activities where a consent under Part II of the CPA is required, a licence under section 5 of the FEPA will also be required.

Regarding construction and operation of offshore wind farms, the principal Acts of Parliament for regulation of those activities are now the Electricity Act 1989 and Part II of the FEPA. The consenting function under section 36 of the Electricity Act has not been transferred to the NAW. However, for any operation where a section 36 consent is required, it is highly probable that a licence under section 5 of the FEPA will also be required.

D.2 ECOLOGICAL BRIEFING

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More than 200 studies into the effects of MPAs were published in peer reviewed primary literature between 1990 and 2001. There is also extensive documentation on the effects of MPAs in project reports, conservation reviews, newsletters, conference proceedings and other sources.

These studies describe and try to understand the ecological effects of MPAs in a variety of ways. Mathematical models have been used to predict effects and to design MPAs to achieve particular objectives, often for commercially important species. Empirical studies, using data from field, provide evidence of any changes on the ground. The focus of field studies range from determining effects on individual species, to identifying any effects on communities, habitats, and ecosystems.

To achieve their objectives the management measures within MPAs range from multiple-use to virtually no use. Most of the studies into effects on biodiversity of MPAs refer to the latter type of site - Highly Protected Marine Reserves (HPMRs).

There has been a lot of work on Highly Protected Marine Reserves (HPMRs) in tropical waters and consequently, many reports of the effects MPAs on coral reef habitats and species. This briefing focuses on ecological constraints and benefits of HPMRs on temperate ecosystems, and on effects relevant to nature conservation rather than the management of commercial fisheries.

ECOLOGICAL CONSTRAINTS

Predicting precise effects

The effects of HPMRs on marine biodiversity are influenced by many factors. These include reserve design (e.g. size and location), the habitats and species within the reserve, the effectiveness of enforcement, the starting conditions, and how activities outside the HPMR are managed.

Micheli *et al.*, (2004) reviewed data on coastal fish assemblages from thirty-one temperate and tropical HPMRs which had been protected from between 1-25 years and found a variety of responses. A small but significant amount of variation in the response of a species to protection depended on its level of exploitation, trophic level and the length of protection. Species targeted by fishing or collecting increased in abundance in protected areas and these positive effects were greater the longer the area had been protected.

Studies on effects on rocky shore communities such as those conducted on the Monterey peninsula, California have highlighted the difficulties of determining effects in an environment where there is high spatial variability and large seasonal and inter-annual variations in species abundance (TENERA, 2003). Statistically significant differences were detected in total algal cover between the high and low use areas but only in the abundance of one of the species studied in the rock pools. The results also revealed the large amounts of natural variability, unrelated to the intensity of human use, as well as significant differences in the abundance and size of particular species and the overall structure of the rocky shore assemblages between the open access and restricted access sites.

There will always be uncertainty when dealing with natural systems and many variables. In New Zealand none of the major changes in the three oldest MPAs in New Zealand (Leigh, Hahei and

Tawharanui) were predicted when the reserves were created. Trends in more recent reserves were predicted but not the time scales over which they were likely to occur and the degree of change (Langlois & Ballentine, 2005). The authors of the latter study believe that there is not enough knowledge to predict the detailed outcomes of HPMRS, and that predictions based on exploited systems lack the baseline information of natural states to be accurate.

Complexity of effects

While some effects of HPMRs may be relatively straightforward to detect and explain (such as an increase in abundance or size of a previously exploited species) others reveal the complex interactions in marine ecosystems. Four categories of effects may be identified; first order direct effects such as recovery of previously exploited populations, indirect effects which include declines in prey or competitor populations; third order changes in habitats as a result of trophic cascades and fourth-order changes in faunal distribution and diversity associated with habitat change (Langlois & Ballentine, 2005).

Determining the significance of any effects

An important question relating to ecological effects of HPMRs is the significance of such effects. These can be difficult to determine as there is often no baseline data describing conditions before the HPMR was introduced, no control sites to use for comparison, and limited opportunities to set up replicates to confirm effects. Without such information it is difficult to view effects within the broader context of natural variability and human induced changes such as those associated with global warming.

Time scales

The timescale over which ecological effects become apparent may be a constraint to the establishment of HPMRs if certain benefits are expected within a short time frame. In some cases changes have been observed almost immediately but in others there have been no apparent changes or changes only obvious after a long period of protection. An analysis by Halpern & Warner (2002) showed that some variables reached mean levels within 1-3 years and remained consistent across reserves up to 40 years of age. Other variables continue to change over long periods. For example Mitchell *et al.*, (2004) show that the differences in the structure of fish assemblages in HPMRs compared to fished areas became greater with time, and that these changes continued over decades.

Recovery and restoration

HPMRs are a management tool which can help halt threats and reverse declines in condition of some species and habitats. However recovery and restoration to a precise, pre-defined state may not always be possible for example if there have been regime shifts in ecosystems and wider changes such as those associated with climate change.

Wider context

HPMRs are one of a number of management tools which can be used for biodiversity conservation. For maximum effect they need to work in tandem with other conservation tools and to be linked to wider management measures. Management of human activities outside HPMRs which take no account of management within the protected areas and *vice versa* can constrain the potential benefits of HPMRs. Setting the management of HPMRs into a wider

context will also help resolve questions about suitable locations, size and the specific contribution of HPMRs to biodiversity conservation.

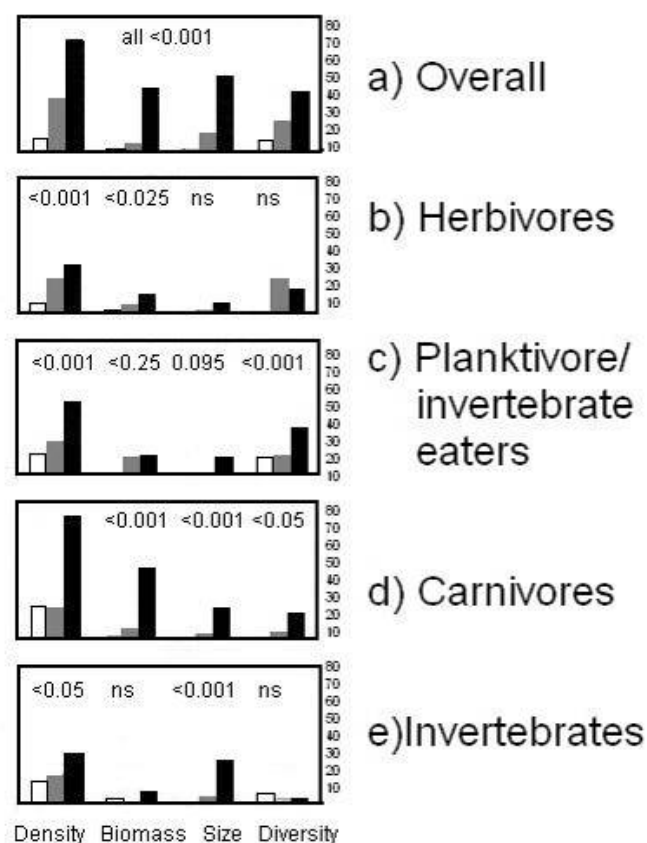
ECOLOGICAL BENEFITS

There is overwhelming evidence of the benefits of MPAs for marine biodiversity and these benefits are clearest and most significant in the case of HPMRs

Species effects

Species effects reported from HPMRs include higher densities, biomass, size and diversity of certain species or groups of species. Quantitative analysis of sixty-nine different biological measures by Halpern (2003) revealed that the diversity of communities and the mean size of the organisms within HPMRs were between 20-30% higher relative to unprotected areas. The density of organisms was roughly double in reserves, while the biomass of organisms was nearly triple.

Figure 1. Differences in biological measures between inside a reserve and outside (or after vs. before). White bars represent lower values inside the reserve, grey represent no difference and black represent higher values inside the reserve (from Halpern, 2003).



These types of effects have been seen when comparisons are made with the situation outside reserves and by tracking changes following the establishment of an HPMR. They are also likely to be some of the first effects to be observed within HPMRs.

Habitat effects

HPMRs can have a beneficial effect on coastal and marine habitats by excluding or controlling activities which damage habitats. Two examples which illustrate this are the closure of areas to commercial scallop dredging on maerl beds in the Clyde sea which allowed the development of more heterogeneous benthic communities (Bradshaw *et al.*, 2001), and the greater benthic habitat complexity due to the presence of bushy bryozoans, hydroids and the tube worm *Filograna implexa* in sites on the northern Georges Bank after scallop dredging was banned (ICES, 1996).

Community and ecosystem effects

Research on some HPMRs has provided evidence of positive community effects such as greater complexity of food webs and increased primary and secondary productivity. An analysis of data on coastal fish assemblages from thirty-one temperate and tropical locations by Micheli *et al.* (2004) showed that the abundance of top predators increased gradually through time suggesting that HPMRs are an effective tool for rebuilding top trophic levels such as those depleted by fishing.

Community effects have been observed in New Zealand where protection in the Leigh Marine Reserve and Tawharanui Marine Park has led to an increase in the numbers of snapper and lobster which are no longer fished alongside localised declines of their sea urchin prey. One consequence has been an increase in kelp production, higher trophic complexity and increased primary and secondary productivity (Babcock *et al.*, 1999; Shears & Babcock, 2004). Similar “trophic cascade” effects have also been reported from the US Channel Islands National Marine Sanctuary (e.g. Byrnes *et al.*, 2006).

Recovery and restoration

There is an abundance of data showing changes in the coastal and marine environment as a result of human activity. Some examples from around the coasts of Wales, are the disappearance of native oyster beds, the loss of mudflats and salt marsh to land claim and the decline in migratory species of fish such as lamprey and eel. HPMRs are one tool which can help halt and reverse this trend by removing localised impacts and allowing space and time for recovery (but note comments on habitat recovery under section on Constraints).

Resilience

The resilience of a system is a measure of its ability to recovery from disturbance, whether natural or the result of human activity. Healthy ecosystems are likely to show greater resilience than those which are degraded and damaged, and hence the importance of HPMRs which aim to minimise impacts. The role of HPMRs in maintaining and building resilient ecosystems depends on many factors including their extent and the habitats and species which are protected within the HPMR.

Reference areas

The high level of restriction in HPMRs make them invaluable as reference areas or ‘controls’ for studying and improving understanding of the impacts of human activities on the marine

environment and of natural systems. These types of areas are essential for robust research into such questions yet few exist in northern Europe. In 1994 ICES identified potential ‘refuges’ in the North Sea that could be used to study the effects of fishing for scientific purposes but no further action was taken. More than a decade has passed and there are similar calls today (e.g. Langloise & Ballentine, 2005).

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D.3 SOCIAL BRIEFING

Social challenges to and opportunities for HPMRs in Wales

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HPMRs potentially raise several strongly inter-related social **challenges** and **opportunities**, the key elements of which are outlined as follows.

Challenges

Uncertainty and variability

Biological communities in inshore seas tend to exhibit particular variability or discontinuities due to a combination of biotic, abiotic and anthropogenic factors, the interactions between which are increased by the connectivity of the marine environment. Inshore marine ecosystems can be particularly complex due to the interactions between a diversity of communities in a wide range of niches, which often have non-linear population dynamics. Therefore, populations may rise and fall in a relatively unpredictable and non-attributable manner due to complex interactions between the ecological dynamics of different communities. Such variations also occur in response to natural variations in the physical environment, such as changes in currents, terrestrial run-off and coastal geomorphology.

Human activities often also affect inshore communities, and the connectivity of the marine environment means that such activities may occur a considerable distance from the MPA, but can still have a significant impact on the communities in question. Ecological variations ‘outside’ the HPMR may also affect it through the connectivity of marine ecosystems. An important consequence of such linkages is that management situations are often very complex through interactions between the impacts of local and ‘outside’ human activities and the variability of relatively poorly understood systems. Such outside activities range from fishing pressures in areas to which fish populations that frequent the HPMR also migrate, to global warming and ocean acidification. It is often very difficult to distinguish between natural and anthropogenic variations in inshore marine ecosystems and to link observed variations with specific anthropogenic impacts. Such variability and connectivity can lead to challenges to ‘alleged’ cause–effect linkages and can also confound related recovery/restoration initiatives, making it difficult to justify a given HPMR, especially if wide scale changes are occurring or are predicted to occur as a result of climate change.

In a related sense, the logistical and scientific challenges of observing and studying marine ecosystem dynamics means that our understanding of what they were like before wide-scale impacts such as fishing is poor. This can lead to challenges to initiatives to restore marine ecosystems through HPMRs, *eg ‘how far back do you want the seas to go, why do you want the seas to go back there and how will you know when the seas are there?’* If such restoration is not an objective or is successfully challenged, this often leads to the replacement of HPMRs with compatible multiple-use MPAs (‘business as usual’). Marine conservation can thus fall foul of the shifting baselines tendency, whereby such challenges to restoration objectives, fuelled by our lack of knowledge of what marine ecosystems used to be like, can make it difficult to justify HPMRs.

The precautionary principle was developed to address such uncertainty and is often used as a justification for initiatives such as HPMRs. However, this principle does not resolve critical

questions such as the scale, magnitude and likelihood of impacts that are sufficient to justify precautionary restrictions such as HPMRs, balanced against the socio-economic impacts of such responses. The invocation of the precautionary principle is the beginning of the debate rather than to end. HPMRs justified on the basis of the precautionary principle may be challenged on ‘paralysis through precaution’ grounds and related social justice issues.

Alienation & perceptual hurdles

To the majority of observers of coastal seas, most of the adverse effects of disturbance are not apparent. The immediate damage caused during fishing and the consequent impacts on habitats, populations and ecosystems are, therefore, generally ‘out of sight, out of mind’. Even if people are aware of the adverse effects of certain uses, our lack of familiarity and empathy with most marine life and its general lack of intrinsic appeal, charismatic megafauna aside, means that the reaction is more likely to be one of indifference. Also, marine populations do not follow familiar seasonal patterns and the sea itself is also often seen as an adversary. It is therefore relatively difficult to gain public and user support for HPMR initiatives to protect marine wildlife due to such alienation and perceptual hurdles.

Resource focused views of the seas

It could be argued that society’s relation to the sea is largely defined in terms of the resources it provides, particularly as a place to harvest fish, dilute and disperse liquid wastes, and undertake marine navigation. Land, on the other hand, is conceived as a tangible entity in itself, the uses of which can be spatially divided, including the set-aside of areas solely for nature conservation. This represents a challenge to gaining support for initiative such as HPMRs as people are unfamiliar with applying *subjective* preservationist and ecocentric ethical motives behind such initiatives to our seas, as such initiatives are contrary to the *objective* resource management view of our seas that dominates.

Naturalness

Marine ecosystems are generally natural in conservation management terms, in that they are rarely the result of positive intervention. By contrast, some terrestrial habitats considered to be of high conservation value, e.g., moors, lowland heaths and meadows, are semi-natural in that positive intervention through the maintenance of certain human activities is required to preserve them in their plagioclimax or modified state. Marine ecosystems are, to varying extents and degrees, subject to negative interventions through anthropogenic impacts that result from a range of activities, *eg* fishing. This leads to significantly modified ecosystems and the majority of the world’s coastal seas have been affected. However, it is rarely argued that such activities should continue in certain marine areas because the impacted habitats are considered, as a result, to have developed a conservation interest. The general approach to the management of MPAs, particularly HPMRs, is therefore one of non-intervention in comparison to the active management approach to conservation which is often practised on land, especially in the UK. MPA management essentially involves the minimisation of negative interventions, through the restriction of certain activities in certain areas, in order to maintain or, more often, restore relatively natural ecosystems, particularly in HPMRs, rather than the promotion of positive interventions, through the selective continuation of certain activities, in order to maintain semi-natural habitats.

This can form the basis for resistance based on the view that marine conservation is essentially a ‘humans out’ approach, the best MPAs being HPMRS where all impacting human uses are excluded. Furthermore, the ‘humans in’ approach to the conservation of semi-natural habitats that dominates on land means that people are less familiar with and sympathetic towards what might be perceived as a ‘humans-out’ approach.

Multiple-users

Our seas are essentially still a common-pool resource, whereby different users with different priorities and undertaking different activities have access to a given marine area. This raises the challenge that a relatively large number and wider variety of users must be convinced of the need for HPMRs. If they cannot be convinced, this leads to the related challenge of enforcing HPMR restrictions on a relatively large number and wider variety of users, particularly given the remote nature of many of our seas and the economic, safety and logistical challenges of policing them.

The multiple-user nature of our seas also raises stakeholder representation and participation challenges, *ie* should only direct users with a direct stake in marine exploitation activities be involved in decisions such as whether and where to have HPMRs, in keeping with the dominant resource-focused view of the sea discussed above, or should those with an indirect stake based on more preservationist and ecocentric concerns also be involved? Such questions can lead to challenges to the legitimacy of HPMR decisions, including social justice issues for users excluded by such designations.

HPMRs more difficult to enforce

The economic, safety and logistical challenges of enforcing HPMR restrictions are a significant constraint, given the remote nature of our seas. HPMRs might therefore be challenged on the basis that excluding relatively benign users (eg potters, long-liners) reduces the capacity for peer exclusion, enforcement and reporting. It might accordingly be argued that partially protected MPAs harness the enforcement capacity of users whose activities are compatible with certain conservation objectives, particularly for benthic features, therefore HPMRs could actually worsen marine conservation prospects by losing, for example, the capacity of potters to exclude beam trawlers and other relatively damaging static gears.

Opportunities

Weird, unpredictable & wonderful

It is important to remember that variability and uncertainty factors and the related alienation and perceptual hurdles, such as those discussed above, can positively affect human perception of the seas and the benefits of HPMRs, many people having a particular interest in marine life because it is unusual, mysterious and unpredictable. For example, trophic and structural cascades of recovery in the Leigh Marine Reserve are still being observed after over 20 years, revealing fascinating and unpredicted recovery patterns that are evidence of the complex interactions in marine ecosystems. This represents an important social opportunity based on emphasising the weird and wonderful nature of marine wildlife and the unpredictable nature of marine ecosystem recovery. For instance, explaining the complex and bizarre physiology of sea urchins and their changing and various roles in marine ecosystem dynamics can be of fascination to people and generate an interest in initiatives such as HPMRs.

Collective learning

HPMRs can be promoted as an opportunity to address uncertainty through collective learning amongst scientific and user experts based on studies and observations that only HPMRs can provide, blending scientific and traditional knowledges and promoting mutual learning. It could also be proposed that scientific principles for HPMRs could be tabled by ‘experts’, then users could select sites employing them, introducing a degree of randomisation that could be important in HPMR network design.

Extension of preservationist and ecocentric concerns

Recent and growing calls for HPMRs around the world reflect the extension of preservationist and ethical concerns to our seas amongst a constituency of scientific experts. This extension of concerns is itself beginning to be extended amongst the public and users of the sea, challenging the resource focused views of our seas. This is similar to the concerns that formed the basis for terrestrial conservation initiatives that challenged the production maximisation view which dominated land management during and after the 2nd World War. HPMR initiatives represent both evidence of this extension of concerns to our seas and a means of promoting such extension, challenging resource focused views of our seas.

Simple stewardship principle

HPMR proposals can represent an important opportunity to raise support for conserving our seas simply for the benefit and enjoyment of future generations. This stewardship principle is not only a reflection of the extension of ethical concern to our seas discussed above, but is also simple to understand and potentially both taps into and encourages the extension of ethical concerns for the health and naturalness of our seas.

Last wilderness

The relative **potential** naturalness of marine ecosystems also represents an opportunity for HPMRs as they can be promoted and supported as a means of restoring our 'last wilderness', recognising that marine ecosystems are currently widely impacted by activities such as fishing. However, our relative unfamiliarity with the wilderness preservation ethic, given the dominance of semi-natural terrestrial habitat conservation with which we are familiar in the UK, can make it a challenge to realise this opportunity, though this argument could be inverted by stating that that fact that our seas are potentially our last wilderness is a great opportunity.

HPMRs simpler to enforce

The above multiple-users argument is often inverted by stating that enforcement challenges are greater for multiple-use and partially protected MPAs and that HPMRs are easier to enforce, therefore they are more appropriate for our multiple user seas. HPMRs also avoid objections based on discrimination, as all users are excluded so none are being particularly discriminated against

Overall, it is important to consider that HPMRs raise social challenges and opportunities. Such issues are likely to play a key role in the success or otherwise of HPMR initiatives. The proactive assessment of such issues can provide for challenges to be addressed and opportunities to be promoted. Social issues can therefore have a critical role in HPMR initiatives, though they are often neglected by related scientists and practitioners.