General advice on assessing potential impacts of and mitigation for human activities on MCZ features, using existing regulation and legislation.

Advice from the Joint Nature Conservation Committee and Natural England to the Regional MCZ Projects.

June 2011

In fulfilling our obligations under the Marine and Coastal Access Act 2009 to support the Regional MCZ Projects, Joint Nature Conservation Committee and Natural England have produced this package of advice providing a general assessment of potential impacts that human activities could have on habitats and species to be protected by Marine Conservation Zones, as listed in the Ecological Network Guidance, in the absence of Marine Conservation Zones but under existing regulations and legislation. Also included is advice on hypothetical plausible mitigation that may be required to avoid damage or disturbance to these habitats and species.

Whilst we have endeavoured to make these assessments as fit for purpose as possible, including seeking external review, it is generalised with the aim of supporting discussions and variations will occur on a site-to site basis. For individual Marine Conservation Zones the advice should be used alongside site specific information, local knowledge and with the support from the relevant statutory conservation adviser. Therefore, this advice does not pre-judge decisions of, nor bind Statutory Nature Conservation Bodies or regulatory authorities in any way.

Authors and review processes

More detailed information is provided within Appendix 1 in regards to version control, but to provide an overview of the authors from within Joint Nature Conservation Committee and Natural England, and those organisations who have contributed to the review, see table below.

Topic	Author(s)	Reviewed by
Aggregate extraction	Ian Reach, Simone Pfeifer and Finlay Bennet	BMAPA and The Crown Estate
Cables	James Bussell, Simone Pfeifer and Finlay Bennet	MALSF, Project Management Support Services Ltd and UK Cable Protection Committee.
Coastal Defence	Jon Curson and Tammy Smalley	Environment Agency
Electricity from renewable energy sources	Victoria Copley, Simone Pfeifer and Finlay Bennet	Centrica, DONG, Forewind, Renewable Energy Association, RPS, RWE, Scottish Power Renewables, The Crown Estate and Zero Carbon Marine
Military activities	Ollie Payne	Ministry of Defence
Navigational dredging & dredge material disposal	Nikki Hiorns	DECC
Oil, Gas and CCS	Steve Benn, Simone Pfeifer and Finlay Bennet	DECC
Recreation	Kevan Cook and Rhiannon Pipkin	RYA
Recreational sea angling & diver fishing	Helen Stevens and Audrey Jones	Cefas
Shellfish lays	Helen Stevens and Audrey Jones	Cefas
Shipping	Steve Benn and Nikki Hiorns	MCGA
Water Quality	Tammy Smalley	Environment Agency

The externally reviewed sections were then revised by the authors and submitted to a further internal review by a Senior Environmental Specialist within the Marine Evidence and Advice Team of Natural England, before being submitted to the Marine Management Organisation as a final draft version review (5-16th May 2011). The MCZ Project Board signed off the final version between 1st and 3rd June 2011.

Note: due to the multiple authors and reviews the sections differ in the way they are presented.

1. INTRODUCTION

1.1 Rationale for provision of advice

The purpose of this advice is to assist the regional Marine Conservation Zone (MCZ) projects and their stakeholder groups in identifying the potential impacts of human activities on MCZ features, whether mitigation for these impacts is currently provided in the absence of protected areas (including MCZs) and what mitigation might be appropriate for MCZs. The mitigation of impacts is suggested for MCZs is the mitigation that is needed over and above that already provided in the absence of MCZs or other protected areas.

The work done by the regional MCZ projects and their stakeholder groups in assessing the impacts of human activities and the mitigation of these will inform the impact assessment for the site recommendations. The impact assessment will inform the Minister and other stakeholders of the environmental, economic and social benefits of MCZs. The advice provided here will inform the following two components of the analysis for the impact assessments:

- Identification of the environmental benefits that will arise from the protection of habitats and species by MCZs. These benefits will be assessed compared with the condition of the habitats and species in the absence of MCZs (which will be determined by the impacts of human activities).

- Assessment of the costs of MCZs to operators and other people who directly or indirectly use the marine environment. This assessment will be based on Regional Projects and stakeholder group suggestions of the mitigation of impacts that will be needed for MCZs.

This advice supplements the conservation objective advice and the associated sensitivities and activities matrices. The matrices provide ecological pressures and sensitivities information in the context of no management of activities in the marine environment. However, there are various management tools currently implemented for licensed and unlicensed activities and this mitigation is described in the advice that is provided in this document.

This advice should also be viewed as part of a package of advice alongside the recently released advice by Joint Nature Conservation Committee (JNCC) and Natural England with regard to fisheries impacts on Marine Conservation Zone habitat features (April 2011).

1.2 Explanation of the information provided

General advice is provided on the potential impacts of eight sectors, two areas of recreational activity and two thematic areas relating to human activities in the marine environment, encompassing licensed and unlicensed activities. Advice on the potential impacts of commercial fisheries is provided in a separate document, as mentioned above. The advice considers potential impacts of these activities on features listed in the Ecological Network Guidance (ENG) for protection by MCZs (see Appendix 2). Where possible, it sets out the potential impacts that human activities could have on these features in the absence of protected areas (including MCZs) but under existing regulations and legislation that apply to the marine environment such as the Town and Country Planning regulations (EIA) 1999, Food and Environmental Protection Act 1985 (FEPA) and the Coast Protection Act 1949. The advice is general and is based on the experience of specialists in the JNCC and Natural England. The impacts of human activities are NOT site-specific and specialists in JNCC and Natural England can further advise the regional projects and their stakeholder groups of impacts in sites that differ from the general advice provided here.

Where appropriate, the advice provides suggestions of plausible mitigation that might be provided to address the impacts of human activities (to avoid damage to or disturbance of features). These suggestions of mitigation are not comprehensive and are based on existing experience. The mitigation that is required will be site-specific. As part of the MCZ process, stakeholders will be suggesting how impacts could be mitigated and specialists in JNCC and Natural England will be advising as to whether the mitigation that is proposed is likely to be sufficient.

This guidance has been written by JNCC and Natural England sector specialists based on their expert knowledge and experience working in their sectors, and has made best used of evidence available. It has been quality assessed externally, as listed in table on second page and in more detail in Appendix 1. Due to this consensus approach there is variation between the following sections in the way they are presented, where possible this has been addressed but in some case it would result in the loss of meaning. In regards to coastal defence and water quality, the related potential impacts are land based sourced (in general) that vary significantly from area to area, so an overview has been provided only and more detailed information will need to be gathered for specific sites.

1.3 Licensing and legislative change

Please note this document was first drafted in early 2011, and has been through various iterations and review processes it has taken time and therefore the following needs to be taken into account.

As of the 6th April 2011 the consents required to meet legislative conditions within the following Acts were replaced by the requirement for a Marine Licence under the Marine and Coastal Access Act 2009:

- Coast Protection Act (CPA) 1949.
- Food and Environmental Protection Act (FEPA) 1985.

2. AGGREGATE EXTRACTION

2.1 Licensing and Environmental Impact Assessment

The Crown Estate owns the mineral rights to the seabed extending to the edge of the UK continental shelf and issues consents for non-exclusive sampling and licences for commercial aggregate extraction. The planning and consenting process is the responsibility of government, who through an EIA-led consultation process determines whether an area can be used for aggregate extraction. The industry is closely regulated by the Marine Management Organisation (MMO). The MMO issues Marine Licences to dredge which are accompanied by a schedule of conditions which defines appropriate management and mitigation requirements for licensed operations. This process is to ensure that the permitted activity does not result in unacceptable impacts on the environment. The conditions will also include environmental monitoring requirements, the results of which inform the compliance with and enforcement of management and mitigation measures.

Marine aggregate extraction applications will be the subject of an Environmental Impact Assessment (EIA). The EIA process would identify nature conservation habitat features in and around the proposed area of extraction, potential impacts on these features and appropriate mitigation options if the assessment concluded the need for such measures.

The habitat features are identified as part of a licence application characterisation study which may require additional survey work if the existing evidence is not sufficient. Characterisation, baseline and on-going (licence duration) monitoring surveys are required to be of sufficient resolution to allow identification of any areas where Habitats Directive Annex I habitats occur. Similarly it is expected that habitats and species on the OSPAR List of Threatened and/or Declining Species and Habitats and the UK List of Priority Species and Habitats (UK BAP) will be identified by the seabed surveys. In the future survey data will need to be of sufficient resolution to allow identification and characterisation of features listed in the ENG.

Based on available evidence, the ENG Broad Scale Habitats listed in Appendix 3 may be found in regions where marine aggregate extraction is currently permitted or may occur in the future (Ref: 1,2,3,4,5 & 6). These are features that could be affected by either primary or secondary effects associated with marine aggregate extraction operations. Also within Appendix 3, is a list of Habitat and Species FOCI that may be found in regions of seabed where marine aggregate extraction is currently permitted or may occur in the future.

The following provide a generic summary of the main impacts arising during marine aggregate extraction on features listed in the ENG and their mitigation. For a more detailed description of impacts the reader is referred to Tillin *et al* (2011, Ref: 7) and the references therein.

2.2 Pre-application phase

Aggregate companies are required to submit an environmental characterisation of the proposed licence area and surrounding seabed. The characterisation may be derived from existing information including previous environmental baseline and monitoring data (if the application is a license renewal) augmented from other sources of evidence (Regional Environmental Characterisation studies and/or Regional Environmental Assessments). Supplementary survey work may be required to add detail in some cases where the desk-top study demonstrates knowledge-gaps in understanding the distribution of seabed features. This characterisation details the seabed environment and identifies any notable or sensitive seabed features allowing delineation of appropriate dredging zones. If a Marine Licence to permit dredging is issued then a pre-dredge baseline survey is required to establish environmental status prior to operation. This allows determination of any environmental changes that may be attributable to dredging operations to be set in context of local natural variability or change.

The site investigations prior to marine aggregate extraction normally include geotechnical investigations (vibrocores), geophysical surveys (multibeam bathymetry, sidescan sonar, etc) and ground truth surveys (seabed imagery and seabed sampling). Many of these are limited either in time or space and are unlikely to have significant effects on broadscale habitats. Certain geotechnical investigations and ground truthing surveys which involve intrusive sampling (e.g. towed bottom sampling equipment and grabs) may impact on habitats listed as MCZ FOCI. However, best practise is to mitigate effects by avoiding intrusive sampling in the first place or keep sampling to the minimum to avoid direct habitat loss and damage regardless of whether habitats listed as FOCI are protected by MCZs. Where guidelines exist for the detection and quality assessment of particular habitats (e.g. stony reef (Ref: 8); *Sabellaria spinulosa* reef (Ref: 9 & 10)) then these should be followed. Survey specifications are agreed with the regulator following advice provided by the statutory nature conservation agencies prior to any surveys being carried out.

2.3 Operation

The impacts of aggregate extraction can be separated into primary and secondary effects.

Primary effects:

Primary effects are associated with the passage of the dredger's draghead on the seabed and the associated localised removal of sediment – typically representing a 2-3 metre cut width across which 30cm depth of sediment will be removed. Additionally there will be localised physical disturbance of sediment immediately adjacent to the path of the drag head as a result of a plough effect. Over time, marine aggregate extraction removes and lowers the surface of the seabed causing localised changes to seabed bathymetry and topography. Additionally, the removal of seabed sediments directly removes animals that live on and burrow beneath the surface within the path of the drag head resulting in a reduction of species diversity, abundance of individual species and biomass of benthic communities in the dredged areas.

Secondary effects:

Secondary effects generally occur away from the direct impact at the draghead, although the impacts can overlap. They may be active or passive and can arise from: sediment plumes and dispersion, alteration of seabed sediment particle size, changes in sediment flux, changes to hydrodynamic processes, alteration or propagation of seabed bedform features and from the presence or operation of the dredging vessel itself. These are discussed in detail in the following two sub-sections.

2.3.1 Changes to hydrodynamic processes and sediment transport pathways

Changes in seabed bathymetry arising from the removal of seabed deposits have the potential to cause changes in wave propagation over the dredged areas leading to changes in wave height and direction at the coast. Seabed bathymetry changes may also lead to localised effects on tidal flows and water circulation, and alter sediment transport processes, potentially changing the availability of sediment along adjacent coasts. In all cases, these issues will be comprehensively assessed prior to dredging activity being licensed through a Coastal Impact Study which forms part of the EIA process to ensure unacceptable impacts do not occur. In areas licensed for marine aggregate extraction, changes to the wave climate, alteration of tidal currents and changes to seabed sediment processes are usually restricted within and close to the dredged area.

2.3.2 Sediment plumes

Overspill of dredged water (containing dredged materials) from the dredger and screening of dredged material (where permitted) will result in sediment plumes. The plumes are introduced into the water column and subsequently dispersed by waves and tidal currents while settling out of suspension. The plumes result in elevated suspended sediment concentrations, which will change turbidity and light penetration and may result in localised and short-term avoidance reactions of mobile species.

The sediments returned during the dredging process will eventually settle on the seabed, which may result in smothering and burial of animals living in or on the seabed. This settlement zone is typically 2-500m from the dredger, dependent upon local hydrography such as surface tidal velocities. The deposition of suspended sediments, particularly those rejected during screening, can also locally change the nature of the surface substratum and potentially alter the benthic communities where these changes fall outside of the natural seabed variability which may exist. Depending on the prevailing hydrodynamic conditions and the nature and thickness of sediment deposited, changes in surface sediment distribution may be short-term or persist for several years or decades.

Subject to prevailing conditions, sediments which settle onto the seabed may be transported away from the dredged area by tidal currents and waves, extending the potential extent of seabed/community changes and potential smothering of sessile benthic communities well beyond the dredged area. These changes to near-bed sediment loads may result in localised bedform features being created (sandwaves, streaks etc), particularly where dredged areas may be subject to limited natural bed load levels. Increases in extraction rates may increase these effects though the production of cumulatively larger sediment plumes.

Spatial and temporal changes in suspended sediment concentrations and associated bed load levels resulting from marine aggregate extraction have to be set in the context of the natural background concentrations especially those typically associated with winter storm events. Species in waters that are naturally highly turbid have evolved to exist in these conditions. Waters that contain aggregate resources that are economically viable for extraction are generally highly turbid.

2.4 Mitigation

Primary effects on the seabed will occur to all conservation features unless the feature is actively avoided by the draghead. The degree of damage caused depends on the sensitivity of the feature and frequency of draghead passage. The severity of secondary effects depends, for example, on the mode of operations (e.g. screening versus non-screening), prevailing environmental conditions, and the sensitivity of a feature to the observed changes.

Operators are expected, as part of the EIA process, to assess predicted effects in terms of their duration, frequency and extent at licence specific, local and regional scale and provide an assessment of the significance of impacts, which will inform decisions on the need for and degree of mitigation. The EIA process also requires a Coastal Impact Study for each licence application to assess possible effects of aggregate extraction on near-shore wave conditions as well as tidal flows and regional sediment transport patterns. If significant impacts are predicted it would be necessary to either revise the proposed dredging plan to reduce or avoid adverse effects before the licence application could be approved.

Currently best practice for the mitigation of environmental impacts from marine aggregate extraction is to zone out any potential sensitive nature conservation habitat or species features through the establishment of exclusion zones. Areas supporting species FOCI would also be treated in a similar manner. Similarly, seasonal restrictions may be introduced to avoid sensitive periods for species depending on specific habitat features. Exclusion Zones are an area around the defined seabed feature within which dredging is not permitted in order to prevent damage or disturbance. They typically also contain a buffer or margin around the feature to mitigate smothering effects related to the sediment plumes. Exclusion Zones are agreed with the regulator and statutory nature conservation agency prior to consent to dredge. This practice is currently employed to ensure occurrences of the habitats are protected, both inside and outside of current marine protected areas. This practice mitigates impacts on features until such time that a national coherent marine protected area network is in place.

Marine Licences to extract marine aggregate also consist of a schedule of conditions which details specific management and mitigation measures designed to reduce the environmental impacts of dredging operations. There is a standard condition that the surface sediment composition of the seabed should remain similar after dredging activities have ceased to facilitate re-colonisation and recovery of benthic communities.

The schedule of conditions also establishes any parameters for monitoring environmental effects of the operation. Monitoring conditions include the requirement to periodically survey the licence area and surrounding seabed to allow assessment of compliance with licence conditions throughout its lifetime and to inform appropriate mitigation and adaptive management as necessary. These surveys relate change to the pre-dredge baseline and a series of reference stations. The references allow a determination of any effects to be set in the context of natural variability. Relating subsequent monitoring to the baseline survey establishes any changes that have occurred to the seabed due to dredging in the actively dredged area.

For sensitive habitats zoned out from dredging operations, targeted monitoring surveys may be required to assess the condition of these features throughout the lifetime of a licence and review the boundaries of exclusion zones. Similarly should on-going environmental monitoring identify potential sensitive nature conservation habitat features not previously being detected then it is good practice to vary the licence conditions and zone these areas out of areas dredged. As with characterisation and baseline surveys, the specifications of monitoring surveys are agreed with the regulator and statutory nature conservation agency prior to being carried out.

It is likely that through sensible planning and mapping iterations, MCZs sites and most marine aggregate licenses will not be co-located. Mapping at a regional sea scale indicates that there is likely to be sufficient broadscale habitat to allow for a coherent MPA network and marine aggregate dredging to be planned. In locations where marine aggregate licenses are coincidental with MCZs then existing licence conditions may allow sufficient mitigation of impacts (as successfully demonstrated for some recently designated Special Areas of Conservation). Where licence areas are located closely to MCZ sites then consideration of secondary effects is important. Exposure to secondary effects is currently judged on the relationship of zones (halos) of proximity to operating dredgers. Smothering effects are considered to occur at distances of 0-500m and can be significant for sensitive habitats within this footprint. Within 0.5 km to 2km distance from dredger operations settlement of plume-associated sediments resulting in the creation of seabed bedforms is judged to occur. Moderate significant environmental effects can be encountered within this zone of influence where sensitive features are present. Changes in surface sediment composition and alteration of infaunal communities are considered to occur at distances up to 2km. Beyond 4km distance effects from plume associated sediments are generally not detectable. Consideration of MCZ site location and boundary delineation may wish to consider these halos of secondary effects where there is sufficient broad scale or FOCI habitat resource to allow such planning.

Any restrictions in future MCZs will also depend upon the conservation objectives and condition of specific features within each site. It is conceivable that a new dredging area could be licensed within an MCZ site if the EIA process could demonstrate that, with appropriate mitigation and monitoring, it was not going to have a significant effect on the features for which the site was (being) designated. For broadscale habitats, an important consideration will be the scale of operations in the context of the overall broad scale habitat resource. For habitat FOCI, best practice such as zoning of dredging operations to avoid particular sensitive features is likely to be carried out in a similar way to that currently applied for areas outside existing MCZs. There is potential that regulators would place greater weight on the need for mitigation measures inside a MCZ and therefore additional measures may be required (than if outside of a MCZ).

2.5 Summary of impacts on habitats and species listed for protection by MCZs that could arise in the absence of MCZs (or other protected areas)

Direct effects

- Associated with passage of drag head: direct removal of the seabed and peripheral smothering from ploughing action.
- Footprint is 2-3 metres wide and 30cm deep. Dredge lane can be kilometres long.

Indirect effects

- Altered seabed bathymetry, wave propagation, changes to tidal flows and sediment pathways have the potential to affect nearby coastlines kilometres away.
- Smothering effects are generally restricted to no more than 200 to 500 metres along tidal axis and 100m transverse to the dredge lane.
- Alteration of seabed bedforms (sandwaves, sheets etc) have been recorded at 0.5 to 2km from the dredge area.
- Indirect effects are generally undetectable beyond 2km to 4km.

Regulators and their advisors will likely place greater weight on the need for mitigation measures inside a MCZ and therefore additional measures may be required (than if outside of a MCZ).

- The EIA process will determine significance of environmental effects.
- Existing licence conditions (in some cases) may provide sufficient mitigation of effects.
- Some existing licenses may require the application of additional licence conditions proven to mitigate environmental effects.
- Many environmental effects may be mitigated by adoption of proven industry best practice e.g. temporal and/or spatial exclusion zones around features.

- Secondary effects will have the largest spatial and temporal environmental footprint (usually no more than 2km from operation but up to 4km in some regions) and location of MCZ sites can sometimes be planned to avoid co-location.

Broadscale habitats

- An important consideration will be the scale of operations in the context of the overall broad scale habitat resource i.e. careful planning may mitigate interaction of MCZ site location with effect footprints from operations.
- Where marine aggregate licenses are located within a MCZ site then it may be difficult to mitigate direct impacts as the operation may target some of the broadscale habitat types (e.g. subtidal coarse sediment).

Habitat FOCI

- Best practice demonstrates that effects can be mitigated to meet conservation objectives.
- Most effective tool is likely to use of exclusion zones around discrete features.
- Secondary effects will have to be considered.

Species FOCI:

- Mitigation measures in-line with those implemented for Habitat FOCI are likely to be effective.

3. CABLES

This advice applies generally to all cables that are placed on the seabed but, in particular to cables that are used for transfer of electricity and communications between countries and continents. Therefore, cables can occur in a variety of locations and habitats depending upon the links between continents and countries and the importance to security and infrastructure within those regions. All MCZ features have the potential to be impacted.

3.1 Survey and licensing requirements

Laying cables on or under the seabed will normally require consent under at least one of:

- Coast Protection Act (CPA) 1949.
- Telecommunications Act (TA) 1984.
- Food and Environmental Protection Act (FEPA) 1985.

Some cables are exempt from licence control under FEPA, though associated works such as cable protection or preparation of the seabed by ploughing or trenching may not. From April 2010 power cables are no longer exempt from licensing provisions.
Where a cable is an integral component of a larger scheme, such as the construction of an offshore energy generation project, any FEPA licence issued for the project will need to include the laying of the cable. These projects will also usually fall under Annex I or Annex II of the EIA Directive. A survey of the cable corridor is normally required to inform an Environmental Statement, or license conditions for these consents. Interconnector cables and cables not associated with larger schemes are not listed on Annex I or Annex II of the EIA directive. From 6th April 2010, Part 4 of the Marine and Coastal Access Act 2009 will consolidate and modernise FEPA and CPA licenses into a single marine license. This will simplify the marine licensing system and remove complexity and overlap between the two existing acts that has developed over the years. Further information on licenses and consents for sub-sea cables can be found on the Marine Management Organisation website at:
http://www.marinemanagement.org.uk/works/index.htm

For all Telecommunication Cables outside of the 12nm limit the United Nations Convention for Law of the Sea (UNCLOS) applies:

- Article 87c states the Freedom to lay cables as one of the 5 basic freedoms of the high seas.
- Article 79 states that nations are to have due regard to pipelines and cables already in position, the repair of which should not be prejudiced.

Outside of 12nm telecommunications cables are free to be installed as required and maintained. Inside of 12nm, as well as the consents required, cable owners are also granted a licence from the Crown Estate. Terms within the licence grant the licensee the right to lay, inspect, repair, maintain, remove, alter and renew cables out to 12nm. A geophysical survey of the seabed would normally be required for the whole of the cable route. A corridor 500m either side of the proposed installation would allow sufficient characterisation of most habitats and allow developers to make informed decisions about cable location in respect of sensitive habitats or species. Acoustic survey work will include bathymetry and side scan sonar (SSS) surveys. Ground truthing of acoustic survey work should employ techniques like: drop down video; remotely operated vehicles; still image capture and diver surveys as appropriate. Non-destructive techniques should be used wherever possible and specific surveys may be required to identify species FOCI within an MCZ. In intertidal areas, a Phase 1 survey should be completed outside of designated sites but a more detailed survey (Phase 2) would be expected in a designated site. Where guidelines exist for the detection of particular habitats (Ref: 12 & 13) then these should be followed. Overall the pre-construction survey must be detailed enough to identify any nature conservation features and to allow identification of final cable route that avoids unacceptable damage and disturbance to conservation features.

If cable operations are carried out in a marine Special Area of Conservation (SAC) then screening will take place to determine whether the operation is likely to have a significant effect on the designated features of that site.

Overall, most of the survey requirements would be the same if the cable route was either inside or outside an MCZ. Additional survey might be needed within an MCZ to more accurately map FOCI and undertake appropriate mitigation and management.

3.2 Cable laying, burial and protection impacts

The preferred option for all cables is to bury them beneath the sea-bed. This is done to protect the cable from environmental and anthropogenic damage, and to protect shipping in particular benthic trawlers and dredgers. Where the conditions allow the preferred method of cable installation is nearly always with a plough and a very small footprint of seabed is disturbed. Other methods for burying cables include, but are not limited to, pre lay dredging, post lay ploughing, trenching and jetting.

These techniques will disturb the immediate area of the sea bed and in some cases remove sediment from the system. Small, and temporary, plumes of suspended sediment may also be produced.

The recovery of, for example, intertidal sediments dominated by aquatic angiosperms, subtidal macrophyte dominated sediment and intertidal and subtidal biogenic reefs form these impacts will be slower than for sand or mixed sediments (Ref: 14 & 15).

Evidence from the marine aggregates sector suggests that sediment plumes, which can be created during cable installation, may also have an effect, positive and negative, on habitats and species across a larger area (Ref: 16). However, sediment plumes from cable laying operations are likely to be of a smaller magnitude than those associated with aggregates activities and more transient in nature. Direct impacts to sediments and benthic fauna caused by laying cables in predominantly sandy areas are likely to be short lived with rapid recovery. Muddy and mixed sediment habitat have slower rates of recovery (Ref: 17 & 18) but in both instance the overall footprint on the sea bed is likely to be small. However, as cables cover a large longitudinal area they are likely to encounter a variety of habitats at different depths.

Where poor, or no burial is achievable, such as on hard substrates or in highly mobile sediments, it is much more likely that cables will be protected with either:

- Rock armour, (increased steel armour protection inherent in the construction of the cable. The weight of this type of cables prevents it from moving and therefore prevents causing abrasion).
- Protective external ducting, such as "uraduct" or similar.
- Rock dumping.
- Concrete mattressing or grout bags.

In very highly mobile sediment use of rock dumping, or mattressing is minimised as it is costly and likely to be destabilised and moved after a short time. Moreover, mattressing is not resistant to activities of fishing and therefore presents a risk to this industry. In highly mobile sediments the best course of action is, where possible, to bury the cable below the mobile layer.

In some areas, such as where the cable comes ashore, cables tend to be laid in trenches through the sand. Horizontal directional drilling techniques can also be used but are usually restricted to areas where there is poor access and a difference in beach levels.

Where rock dumping, mattressing or grout bags are used, this would cover areas of the sea bed around the cable and lead to direct loss of habitat. Impacts on rocky habitats and species are unlikely to be avoided, unless the cable route avoids these features. Concrete mattressing, or other stabilisation material, currently requires a FEPA license issued by the MMO and, where relevant, impact on the marine environment should be assessed as part of the consents process or EIA.

Current assessments for cable projects generally adequately cover most nature conservation features. Historically, BAP and OSPAR listed species that are now listed in the ENG may not have been covered as thoroughly as those in other legislation (e.g. those listed on Annex I and II of the Habitats Directive or those on Schedule 5 of the Wildlife and Countryside Act). Survey data currently collected will allow identification of FOCI but more detailed analysis and interpretation may be required to more accurately map FOCI and undertake appropriate mitigation and management if required.

We advise against placing hard substrates, such as rock dumping, onto areas of soft sediment if possible. Hard substrates attract a different fauna to soft substrates (Ref: 19) and can facilitate the movement of species around the coast such as non-natives (Ref: 20). Cable protection may also impact near sea bed processes such as sediment transportation, similar to groynes on beaches.

Vessels used in cable laying may need to be anchored, causing abrasion. Infrastructure associated with the burying of cables in soft sediment such as anchors and ploughs will also cause abrasion of the sea bed. These can usually be sited to avoid any impacts on sensitive features.

Cables that are surface laid and unfixed or unprotected can move, causing abrasion on the sea bed which can impact on nearby seabed habitats and species. Generally, cables are only installed like this in deep water away from risks such as benthic trawling. Given the relatively small diameter of cables, the loss of habitat and impact on biological communities in the 'footprint' of the cable can be localised and the effect is usually short term though the impact is greater on sensitive habitats and fragile communities (Ref: 14 and 15). Impacts can be reduced through diverting the route of cables away from sensitive interest features or micro-routeing around them.

3.2.1 Mitigation of cable laying, burial and protection impacts

In the majority of cases installation of cables should not pose a significant risk to marine features of conservation interest.

Wherever possible cables should be buried to the appropriate depth using the most appropriate technique that also minimises environmental impacts. If cables directly interact with a feature then, for some sensitive habitats, adjustment of the cable route to avoid the feature might be advised. It is possible that in a few cases the indirect effects such as sediment plumes, may interact with features and adjustment of the cable route may be advised. For other features, where sensitivity is low and recoverability high, the cable burial would normally be sufficient.

In line with industry preferences, use of cable protection, such as rock dumping, should be restricted to areas where it is absolutely necessary. In areas of soft sediment, should cable protection be necessary then the use of frond mattressing or removable concrete mattressing could be considered if appropriate. On hard substrates, if cable protection is not required, cables should be installed to avoid abrasion using techniques such as rock armouring.

For all projects it is sensible to seek the advice of the statutory nature conservation body at the earliest possible stage.

3.3 Operation and Maintenance Impacts

Power cables produce electromagnetic fields (EMF) that may impact on electromagnetically-sensitive organisms such as skates and rays (Ref: 21). There is, however, uncertainty about the overall effect this may cause.

Cables may get damaged or develop faults and need to be repaired or replaced. Cable operators usually have the right to repair and maintain their relevant cables due to their importance to the UK. Maintenance can occur at short notice and without consultation. The cable may be brought up to the surface for repair using various methods, including the use of remotely operated vehicles and grappling hooks. This is likely to disturb the seabed within the vicinity of the cable with the impact depending on the substrate and recovery method used. Sections of the cable may need to be replaced or repaired; new cable may need to be laid and further cable protection provided. Some areas of a cable route are likely to be under more stress, and at higher risk, than others. It is challenging, however, for developers to predict exactly where these will be. This can affect ability to maintain cables during operation and the techniques that are available at the time maintenance is required.

3.3.1 Mitigation of operation and maintenance impacts

FOCI species associated with rocky and reef areas are currently thought to have a low sensitivity to EMF and therefore no mitigation of impacts is likely to be required (Ref: 21 & 22).

In areas where there are high numbers of skate and rays, and high numbers of cables, such as in wind farm arrays, cables should be buried to the maximum sustainable depth to increase separation between the cable and the feature. Engineering solutions to reduce the EMF should be explored and if areas are considered particularly sensitive then routing the cable to avoid impacts on sensitive features should be considered.

Developers should however predict as accurately as possible likely areas of expected maintenance, such as the need for additional cable protection and allow for this in cable routes that could impact on sensitive habitats.

3.4 Decommissioning Impacts

In many cases cables that are no longer used will remain on the seabed. Depending on the age of the cable and the amount and type of cable protection used, this would most likely result in the lowest impact on features. This is because cables are likely to be operational for many years and as such the habitat around them will have adapted and grown over the infrastructure. In some cases, such as where removable cable protection has been used in a soft sediment environment, cables and cable protection may be removed in order to return the environment to its original state. This condition is more likely within a protected site than outside a protected site. Vessels and equipment used to do this can abrade the sea bed and removal of the structures will remove any species and habitats that have become associated with them. Old cables are also removed to make room for new cables or other infrastructure such as pipelines.

3.4.1 Mitigation of decommissioning impacts

In some cases it may be preferable to leave cables and associated infrastructure on the sea bed. However, in others, removal of any cable protection and restoration of the original habitat and species may be preferred. In areas where frond mattressing was used to cover the cable the sea bed should resemble the adjacent habitat to mimic natural processes and should remain in place. Our default position is to advise regulators and operators that existing habitats should be left in as natural a state as possible. Therefore, it advises that where possible the environment is to be re-habilitated to its former status. Decisions are taken on a case by case basis.

3.5 Summary of the impacts on habitats and species listed for protection by MCZs that could arise in the absence of MCZs (or other protected areas)

In general cables should be compatible with most MCZ features. In some instances micro-routing of the cable may be necessary to avoid the most sensitive features. This advice is currently applied to cable projects, both within existing MPAs and outside MPAs, through the consenting and licensing process.

4. COASTAL DEFENCE

4.1 Potential impacts of coastal flood/erosion risk management on interest features

Works to manage risks to socio-economic interests at the coast could potentially result in various intertidal MCZ features being impacted, positively or negatively. In the latter case, an area of particular concern would be from 'coastal squeeze', where intertidal habitats are prevented from 'migrating' inland (as a response to sea level rise) by a man-made coastal defence structure that manages flood and/or erosion risk. An intertidal feature would in this case be lost and/or transform into a sub-tidal type. In some cases, proactive planning that incorporates mitigation can result in positive impacts, such as creation of new habitat through managed realignment.

It should be noted the land-sea boundary is dynamic and where an intertidal feature changes due to a natural landform causing 'squeeze', then this is deemed as a natural process.

Other impacts of such works could potentially cause coastal processes such as the amounts of material and/or water channelling to change, resulting in changes to inter- and sub-tidal features as sediment loads and/or sediment composition changes. Impacts could be smothering and/or removal of material that maintains a habitat, such as mud/sand sediments.

However, the legislative mechanisms that new coastal risk management structures are subject to should ensure minimal impact on and/or mitigation of features. For existing structures and coastal squeeze, measures will have to be considered based on evidence collated in baseline setting and ongoing monitoring. The Environment Agency also has a specific duty for their flood risk management bylaws to be in keeping with the objectives of MCZs.

4.2 Summary statement of potential environmental impacts if a site is not designated

Coastal risk management structures could potentially lead to changes in coastal waters and regimes, in turn impacting on the resident biology. However, Planning Policy Statement 25 (Development and Coastal Change) sets out clearly to planning authorities the need to consider social, economic and environmental interests in equal measures, and relevant legislative drivers will trigger Environmental Impact Assessments where necessary. Furthermore, the Water Framework and Marine Strategy Framework Directives will address coastal and marine water quality issues that may be caused by coastal defences (see section 13).

5. ELECTRICITY FROM RENEWABLE ENERGY SOURCES

5.1 Tidal reach & stream: introduction and licensing requirements

For an overview of features to be protected by MCZs that the following advice on tidal reach and tidal stream generation applies to see Appendix 4 (Table A4.1).

Regulators will require most tidal licence applications to be the subject of an EIA. The EIA process would identify impacts on features of environmental importance and would identify mitigation options. Generic mitigation measures such as micro-sitting of devices and cable routes are therefore likely to be carried out in a similar way for features that are within or outwith MCZs. There is the potential that regulators would place greater weight on the need for mitigation measures in an MCZ if the generic measures are not adequate to mitigate the impact. The Statutory Nature Conservation Advisers do not have any examples to indicate that this possibility would actually happen in practice.

Some of the ecological impacts of generating energy from tidal stream turbines are reasonably well understood (Ref: 23) as a result of experience from other sectors which involve similar activities. That understanding generated from these sectors has been incorporated into this advice where possible. Other aspects such as creation of a barrier to movement and the reduction of energy downstream are less well understood. There is currently a variety in the type of devices being developed and they will vary in how they operate and their potential impacts. These differences will need to be taken into account when advising on possible impacts on features listed for protection by MCZs, on a case by case basis. In some cases it may be appropriate to consider adaptive management whereby the impacts of a project are closely monitored and mitigation measures put in place should the impact become significantly adverse. This in itself is a complicated process which needs to incorporate consideration of risk and it is not appropriate to discuss in detail in this document.

A range of technologies to generate electricity from tidal stream energy are being trialled in Strangford Lough, Orkney and other sites in Scotland, the Humber, and there are proposals for testing some tidal stream devices off the Welsh coast. These should create a better information base on which to assess possible impacts, refine the technologies and develop mitigation solutions.

Whilst most projects would be subject to an Environmental Impact Assessment, because this is an emerging industry, best practice has not been developed although this could be transferred from other industries involving similar activities. It should be noted that in some cases, the developer may not be resourced sufficiently to trial and adopt innovative solutions that minimise the environmental impact.

5.2 Tidal reach & stream: during construction

Placement of devices and associated cables may result in a small direct loss of habitat. This is unlikely to result in significant loss for those broad scale habitats that are spatially extensive. If best practice is followed, in most cases such structures should be sited so that they avoid sensitive features listed as MCZ FOCI, regardless of whether they are protected by an MCZ because they are recognised as being of national importance.

Installation of the devices may require seabed levelling for the construction jack-up rig and anchoring or foundation components so that a level surface for installing foundations is created. This would result in direct loss of habitat and some disturbance e.g. through smothering as a result of suspended sediments. Disposal of construction material close by may cause additional habitat loss or smothering despite best practice being followed.

Cables that are surface laid, rather than buried, may abrade the seabed. Where it is not possible to bury cables using ploughing or jetting techniques, which would create a small scale and short term loss of or disturbance to habitats, it may be necessary to leave cables on the seabed. In high energy environments where tidal stream devices are likely to be deployed, it should be noted that it is quite likely that there may not be much seabed sediment present, and therefore surface laying may be the only option. Cables on the seabed may need to be protected from damage through deposition of rock or concrete mattresses. Or it may be possible to bolt articulate pipe protection direct to the seabed in hard rock areas which would cause little seabed damage (*pers com* RWE, 2011). Despite adoption of best practice such as minimising the amount of protection needed and using the most sympathetic type of protection such as frond mattressing in sediment dominated environments, this can result in additional loss of habitat and local change from a sediment dominated to a rock dominated habitat. See section on cables for more detailed information.

The devices themselves are currently usually fixed to the seabed using piles but may in future be fixed using gravity bases. This will depend on the engineering design of the device, the nature of the seabed and other factors. Impacts might be mitigated by locating devices away from sensitive habitats, including those broadscale habitats and FOCI features which are small in area.

5.3 Tidal reach & stream: operation and maintenance

The operation of tidal turbines generally involves movement of blades that generate power at the turbine. The blades may impact on habitat features through hydrodynamic effects as they tend to re-distribute tidal flow locally and may reduce energy both upstream and downstream of the device. Although little information exists, this is probably unlikely to be biologically significant (Ref: 24) as has been shown with the monitoring of Seagen in Strangford Lough.

Large arrays could impact on habitats listed as MCZ FOCI because they are more spatially limited. These impacts would need to be assessed for FOCI habitats whether protected by MCZs or not although there may be little evidence to contribute to this assessment until more projects have been deployed in the water. They may also present a navigational hazard for fish in narrow high energy sites.

Power cables produce EMF that may impact on electromagnetically-sensitive organisms such as skates and rays. FOCI species associated with rocky and reef areas are currently thought to have a low sensitivity to EMF and therefore no mitigation of impacts is likely to be required.

In areas where there are high numbers of skate and rays, or their nursery areas, cables should be buried to the maximum sustainable depth or if burial is not possible, protection using rock or mattresses should be considered. It is likely that this would be required regardless of MCZ status. If available information indicates that areas are considered particularly sensitive, especially if listed as a FOCI feature within an MCZ or as a nursery area, then routing the cable to avoid impacts on sensitive features should be considered.

Through the EIA process, developers should predict as accurately as possible likely areas of expected maintenance, such as the need for additional cable protection and allow for this in cable routes that could impact on sensitive habitats regardless of MCZ status, although especially for FOCI features. Impacts of maintenance of cables can be reduced through diverting the original route of cables away from sensitive communities such as *Sabellaria spinulosa* reef (biogenic reef) or micro-routing around them.

5.4 Tidal reach & stream: decommissioning

Little is understood about the impacts of decommissioning tidal stream energy generating devices although parallels should be drawn from decommissioning experiences in the oil and gas sector. The foundations and anchors would almost certainly be removed and some cables may be removed although it is more likely that they will remain *in situ* if they are protected and stable.

5.5 Wave: introduction and licensing requirements

For an overview of features to be protected by MCZs that the following advice on wave generation applies to see Appendix 4 (Table A4.2).

Regulators will require most wave licence applications to be the subject of an EIA. The EIA process would identify impacts on features of environmental importance and would identify mitigation options. Generic mitigation measures such as micro-siting of devices and cable routes are therefore likely to be carried out in a similar way for features that are within or outwith MCZs. There is the potential that regulators would place greater weight on the need for mitigation measures in an MCZ if the generic measures are not adequate to mitigate the impact. The Statutory Nature Conservation Advisers do not have any examples to indicate that this possibility would actually happen in practice.

Some of the ecological impacts of devices for generating electricity from waves are reasonably well understood (Ref: 23) as a result of experience from other sectors which involve similar activities. The understanding generated from these sectors has been incorporated into this advice where possible. There is currently a great variety in the type of devices being developed and they will vary in how they operate and their potential impacts. These differences will need to be taken into account when advising on possible impacts on features to be protected by MCZs, on a case by case basis.

Wave devices will be trialled at Wave Hub off the North Cornwall coast from 2011 and in the European Marine Energy Centre (EMEC) at Stromness in Scotland which should create a better information base on which to assess possible impacts and to refine the technologies. The sections below provide advice on the general, anticipated impacts from devices to generate electricity from wave energy. Whilst most projects would be subject to an EIA because this is an emerging industry, best practice has not been developed although this could be transferred from other industries involving similar activities. It should be noted that in some cases, the developer may not be resourced sufficiently to trial and adopt innovative solutions which minimise the environmental impact.

5.6 Wave: during construction

Placement of devices (or their anchors) and associated cables may result in a small direct loss of habitat. This is unlikely to result in significant loss for extensive broad scale habitats. If best practice is followed, in most cases such structures should be sited so that they avoid sensitive features listed as MCZ FOCI whether they are protected by MCZs or not.

Impacts of any seabed levelling required for installation of the devices, disposal of construction material and impacts of cables are as described for tidal stream devices, although it should be noted that offshore wave devices will tend to float with anchors fixed to the seabed whereas tidal stream technologies will tend to be fixed direct to the seabed.

5.7 Wave: operation and maintenance

Uncertainty remains over the potential for wave energy arrays to significantly affect the local energy regime, which in theory could in turn impact on the seabed features by affecting flow patterns, sedimentation rates and transport of larvae (and food) amongst other factors. Some modelling has been carried out at Wave Hub but further research and real data are needed. Effects on the local energy regime are unlikely to be a problem for extensive broad scale habitats, but large arrays could impact on features listed as MCZ FOCI. These impacts would need to be assessed on a case by case basis although it is generally agreed by the statutory nature conservation advisers that wave energy schemes are less likely to have environmental impact than tidal schemes (Ref: 25). The most significant impacts are likely to occur from mooring / tethers on the seabed.

The potential impacts of EMF are discussed in the section on tidal stream (section 5.3) and advice for cabling (section 3.3).

5.8 Wave: decommissioning

The impacts of decommissioning are as discussed under Tidal Reach and Stream in section 5.4.

5.9 Wind: introduction, licensing requirements and pre-construction

For an overview of features to be protected by MCZs that the following advice on wind generation applies to see Appendix 4 (Table A4.3).

Generally in English waters Round 1 and Round 2 offshore wind farms are located in waters less than 50m deep on sediment dominated seabeds. However, the technology is advancing and future wind farms may utilise different foundation structures that enable them to be located in areas of harder substrate and/or deeper water. Cables to shore may cross a variety of different habitat types from rocky through to fine sediment both subtidally and intertidally.

Regulators will require wind farm licence applications to be the subject of an EIA. The EIA process would identify impacts on features of environmental importance and would identify mitigation options. Generic mitigation measures such as micro-siting of turbines and cable routes are therefore likely to be carried out in a similar way for features that are within or outwith MCZs. There is the potential that regulators would place greater weight on the need for mitigation measures in an MCZ if the generic measures are not adequate to mitigate the impact. The Statutory Nature Conservation Advisers do not have any examples to indicate that this possibility would actually happen in practice.

As part of the EIA, usually developers produce a hierarchy of important habitats and species present, which includes habitats and species protected under national legislation and European Directives and those features that are rare or threatened such as those listed in Biodiversity Action Plans and on the OSPAR List of Threatened and/or Declining Species. This is to aid analysis of impacts and determine mitigation. A range of monitoring and mitigation requirements are also contained in consent and FEPA (Marine Licence) conditions to ensure that the environmental impacts of a project are as expected and not significant and/or to ensure that impact significance is reduced to an acceptable level. The offshore wind farm industry now has significant experience in assessing and mitigating for environmental impacts and has developed considerable best practice from which other sectors can learn.

Several wind farms have been consented within or near areas that have been recommended for designation as Special Areas of Conservation for sandbank habitat and biogenic (*Sabellaria*) reefs suggesting that wind farms and protection of these habitats can co-exist[1]. Post-construction monitoring information only exists for some projects but the body of evidence is growing.

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[1] The London Array wind farm was consented within an area that has since been recommended as an SAC for sandbanks and Kentish Flats and Scroby Sands are near areas recommended as SACs for sandbanks. The Lynn and Inner Dowsing wind farm and the export cable route for Lincs were consented within an area recommended as an SAC for *Sabellaria spinulosa* reef and the Lincs Array was consented near an area recommended as an SAC for *Sabellaria spinulosa* reef. Thanet wind farm was consented within area of with *Sabellaria spinulosa* reef but that is not proposed as an SAC.

There are 4 main phases in a windfarm development, each phase involving a variety of activities, which may have a range of potential impacts on features to be protected by MCZs. These are discussed below.

5.9.1 Pre-construction

The site investigations and baseline characterisations undertaken prior to a wind farm construction can include benthic habitat surveys, geophysical surveys (seabed surface and near surface features) geotechnical investigations (boreholes, vibrocores etc), installation of meteorologicalmast ('met mast') foundations and fisheries surveys. Many of these are limited either in time or space and are unlikely to have significant effect on broadscale habitats. Geotechnical surveys and met mast installation may impact on habitats and species listed as MCZ FOCI. However, through best practice, effects are mitigated by micrositing metmasts and boreholes to avoid direct habitat loss and damage to sensitive habitats regardless of whether the habitats are protected by MCZs. Certain fisheries surveys which involve intrusive sampling could impact on some FOCI habitats listed for protection by MCZs (e.g. trawl surveys over fragile reef systems) but the impacts are either considered to be insignificant or can be mitigated by using benthic habitat information to avoid surveying in areas sensitive to the impacts of fisheries surveys or by adapting the survey method (by e.g. using drop down cameras). The potential for benthic habitat surveys to have impacts can be mitigated by avoiding intrusive sampling or keeping intrusive sampling to the necessary minimum to allow characterisation of the feature and allow a decision to be made concerning the impact of the proposed activities. This practise has successfully been applied in the past for potential biogenic reef features (*Sabellaria spinulosa* reef) overlapping with proposed marine aggregate extraction and windfarm areas.

5.10 Wind: during construction

Transit of construction and maintenance vessels in shallow water, installation of scour protection and cable laying could potentially cause increased turbidity as a result of the creation of sediment plumes. However, evidence and modelling shows that suspended sediment concentrations are likely to remain within natural winter background levels. Evidence from North Hoyle Offshore windfarm suggested that levels are within the range of the diurnal cycle and not seasonal winter levels. However, a summer storm can also present high concentrations of natural suspended sediment. Good practice has been deployed at many projects to ensure that turbidity remains within the natural range where there are sensitive features nearby, for example by installing cables when the tide is running at more than 90 degrees to a feature of interest.

Anchoring of vessels could potentially impact on features listed for protection by MCZs, as described under shipping.

5.10.1 Foundations

EIAs demonstrate that the footprint of turbines may be small relative to the area of a wind farm, but placement of the turbine foundations does result in direct loss of habitat and there is potential for some further damage to habitat through scour around the base of each foundation depending on the seabed substrate. Piles, cables and other wind farm infrastructure are unlikely to result in significant loss or damage to extensive broadscale habitats because the impact is likely to be negligible in scale. However, they may impact on habitat and species FOCI. Under existing best practice, these impacts can be mitigated by micro-siting structures and micro-routing cables away from sensitive FOCI. This would occur regardless of whether the FOCI are protected by MCZs but due to technical challenges and cost, it would only occur if the impacts would otherwise be significant.

The foundations of wind turbines are generally driven or drilled to the sea bed by piling. Piling disturbs the sea bed and re-suspends sediment into the water column. EIAs have demonstrated that the effect of this is localised and temporary and unlikely to be significant for features listed for protection by MCZs.

Installing piles using drill driving techniques produces arisings from the pile location, which are typically disposed of on location. This could impact on habitats listed as MCZ FOCI as discussed under Tidal Stream but the EIA process will identify impacts and mitigation options.

Installation of turbine foundations may also require grouted connections. Grout is used to seal the foundation and transition piece. Grout spillage is always minimised by the use of grout skirts or seals to prevent loss of grout into the water column. EIAs have demonstrated that spillage of grout is unlikely to impact significantly on features listed for protection by MCZs.

Gravity based foundations may be used as an alternative to piled foundations. These are large caisson or flask shaped structures that are lowered to a prepared seabed and filled with dense aggregate to create a relatively immobile platform. Gravity base foundations do not require piling operations but require seabed preparation which disturbs the sea bed and re-suspends sediment into the water column. They have a larger footprint of directly lost and damaged habitat than piled foundations. If regulators were concerned about this greater benthic impact then they may require developers to provide further information to adequately define the potential impact and seek to agree whether management and mitigation could be applied to manage the level of impact. It should be noted that a number of offshore wind farm EIAs have assessed the potential impact associated with gravity bases as they are often identified as the ‘Realistic Worst Case Scenario’ for potential impacts on benthic communities and physical processes. In those examples, the EIAs conclude that the impact of a monopile will always be less than a gravity base. Real experience with gravity bases has yet to be gained in the UK.

For future offshore wind farm developments, including Round 3, a variety of other technologies are likely to be utilised for turbine bases. Whilst existing information on the levels of impacts of these is not necessarily available, the impacts will be assessed as part of the EIA process. Where a significant impact is considered possible from the installation of these turbines, suitable mitigation will be discussed with the Statutory Nature Conservation Advisers and best practice followed wherever this exists. However, this does not necessarily mean that it will be possible to consider other foundation options. In most instances the foundation choice will be primarily based on what is physically possible from an engineering perspective. Therefore, whilst in some instances it may be possible to mitigate for some potential impacts on MCZ and other conserved features by using specific foundation types, in the majority of cases these will largely be dictated by the seabed conditions in the area and therefore other mitigation would need to be discussed with the SNCBs.

In larger wind farm developments, one or more offshore substations may collect power from strings of turbines. These substations involve similar foundations and associated impacts to those described above for the turbines although they will be few in number and smaller in scale.

5.10.2 Scour protection

Once installed, turbine and substation foundations interrupt the natural flow of water near the seabed. This may result in localised erosion of the seabed immediately around the foundation and could compromise the stability of the structure. To prevent this developers install scour protection such as rock armouring or mattresses. Rock armour is often hard rock or sediment in bags that is not easily eroded. Alternatively, concrete mattresses may be used (especially for cables) or frond mattresses, which attempt to mimic the local environment by trapping sediments. Scour protection can introduce artificial hard substrates in sediment dominated environments, resulting in direct loss of habitat. The scour protection may be colonised. The type and amount of scour protection required depends on the type of substrate and needs to be carefully considered. Best practice includes consideration of the requirement for and impact of scour protection under the EIA in tandem with assessments of the impact of foundations. The aim is to minimise the volume of protection material required and to use the most sympathetic type of material for the local environment. Ease of recoverability on decommissioning should also be considered although there is uncertainty whether or not recovery will be achieved or desired.

Similarly use of rock dumping or mattressing to protect cables that are not buried and require protection can impact on features listed for protection by MCZs. For further details see the separate section on cables.

5.10.3 Jack up barges

A jack-up barge is a ship with supporting legs. The legs are lifted out of the water during transit, and lowered on to the sea floor when the ship is in position, raising the ship’s hull out of the water. This provides a stable platform for a crane to lift components into place.

Developers may use jack-up barges, anchor spreads and dynamic positioning vessels in the construction of wind farms. The legs of jack-up barges and anchor spreads may leave depression or drag marks on the sea floor which can persist for one or more years as found at North Hoyle wind farm. Best practice which is applied to all proposals (within and outwith protected sites) includes consideration of micro-siting jack up barges and foundations to ensure that the location of the legs avoid sensitive features. This may require anchor plans to manage siting issues.

5.10.4 Cable laying

Wind farms require array cables, which connect individual wind turbines in rows or strings to an offshore substation, and a power export cable that transmits the power to land from the offshore substation (which steps up the power). For the size of wind farms that are being developed under Round 3, multiple power export cables may run from each of the farm's offshore substations or from a converter station to the landfall. Cables may be AC (alternating current) or HVDC (high voltage direct current) cables depending on the distance from the wind farm to shore. They may run along a wide corridor through which installation may be carried out over several years. In all cases as part of the EIA process, careful consideration of the location of the cable routes and their installation is adopted to minimise overlap with sensitive habitats. Where potential impacts are considered to be significant it may be possible to micro-route around sensitive features as part of the planning of the wind farm project. Cables can be buried, either by ploughing, jetting or trenching[2] depending on the substrate:

- Ploughing - The cable is simultaneously laid and buried. The cable plough creates a furrow in the seabed and lays the cable into the void that it creates. The seabed sediment then returns to its original position as the plough passes over the cable and continues along its path. This has been the most common form of installation for export cables but has proven to be less effective in areas of very hard ground.
- Jetting - The cable is first laid on the seafloor. A remotely operated vehicle (ROV) equipped with high pressure water jets then proceeds along the cable route, fluidising the seabed around the cable, allowing the cable to fall via gravity into the trench created. The sediment resettles under its own weight to provide burial. Evidence from the United States shows that 90% of sediment falls out of suspension within 1 metre of the jetted trench (Ref: 26). Jetting is less effective in areas of harder ground.
- Trenching - An ROV fitted with a cutting attachment is used to cut a trench into the seabed as the cable is simultaneously laid. This option may be required where stiff clay or rock is present.
- Cutting - This is a variation on the cable plough technique, and may be required where stiff clay or rock is present.

EIAs demonstrate that the impacts of each of these techniques are likely to be similar in nature, short lived and limited to the width of the cable corridor. Where it is difficult to bury a cable (due to ground conditions, or mechanical failure), the cable is laid on the sea bed and a secondary postlay burial solution is required. This may be using one of the above techniques or may result in the surface laid cable being covered with mattressing or rock placement dependent upon the cable burial plan agreed with the regulator.

[2] Atlantic Array November 2010

5.11 Wind: operation and maintenance

Transit of vessels transport of personnel to and from the wind farm has little effect on features listed for protection by MCZs. Anchoring of vessels could potentially impact on features as described under shipping.

Power cables produce a small electro-magnetic field (EMF) that certain species, including elasmobranchs (sharks and rays) can detect (Ref: 27). This has been researched by COWRIE for AC cables and concluded that effects are negligible in comparison to background levels. However similar research has not yet been done for HVDC cables which are likely to be used for a number of the Round 3 wind farms. There is uncertainty about the overall impact the EMF output from export power cables (AC or HVDC) may have but no significant effects on sharks, rays and fish have been established to date. The effects of all cables will need to be considered in the EIA process and if impacts are considered to arise then suitable mitigation should be investigated, depending on the sensitivity of the receptor (in or outside and MCZ) and significance of possible impact. Potential long term impacts on invertebrates are likely to be local and small (IUCN Review – Ref: 28). There is greater uncertainty about the potential impacts of high voltage power cables (such as power export cables).

The species listed as MCZ FOCI associated with rocky and reef areas are currently thought to have a low sensitivity to EMF and therefore no mitigation of impacts is likely to be required. In areas where there are high numbers of skate and rays developers should investigate whether further mitigation might be required to mitigate impacts on elasmobranchs. Engineering solutions to reduce the EMF should be explored and if areas are considered particularly sensitive by any EIA then routing the cable to avoid impacts on sensitive features would be considered.

Cables may get damaged or develop faults and need to be repaired or replaced. The cable may be brought up to the surface for repair using a cable jointing methodology, including the use of remotely operated vehicles and grappling hooks. This is likely to disturb the seabed within the vicinity of the cable with the impact depending on the substrate and recovery method used. Sections of the cable may need to be replaced or repaired, new cable may need to be laid and further cable protection provided. Some areas of a cable route are likely to be under more stress, and at higher risk, than others but it is challenging for developers to predict exactly where these will be. Some species and habitats may colonise areas of cable and cable protection during operation, which can affect ability to maintain cables during operation or the techniques used. As part of the EIA process, developers adopt best practice and predict as accurately as possible likely areas of expected maintenance (eg jointed cables and cable crossing points) and allow for this in cable routes that could impact on sensitive habitats regardless of MCZ status.

Wind turbines will have a life span of 20-25 years and after this will require repowering. It is unknown at present what form repowering will take; it could be replacement of just the nacelle, or wind turbine above the transition piece or the whole structure. The impacts would be subject to separate EIA and consent application and may be similar to those of the construction phase.

5.12 Wind: decommissioning

Every wind turbine installed offshore has a decommissioning plan associated with it either as a consenting requirement or Crown Estate leasing requirement with the aim of returning the seabed to initial conditions. There are various options for decommissioning. Current recommendations are to leave cables *in situ*, where possible. However, it is possible that the scrap value may warrant sale and subsequent recovery. To date there is no experience of decommissioning offshore wind farms and this is not considered further in this document.

5.13 Summary of impacts on habitats and species listed for protection by MCZs that could arise in the absence of MCZs (or other protected areas)

Regulators will require most tidal and wave licence applications to be the subject of an Environmental Impact Assessment (EIA) and all wind farm licence applications are subject to an EIA. The EIA process would identify impacts on features of environmental importance and would identify mitigation options. Generic mitigation measures such as micro-siting of devices and cable routes are therefore likely to be carried out in a similar way for features that are within or outwith MCZs. There is the potential that regulators would place greater weight on the need for mitigation measures in an MCZ if the generic measures are not adequate to mitigate the impact. The Statutory Nature Conservation Agencies do not have any examples to indicate that this possibility would actually happen in practice.

6. MILITARY ACTIVITIES

This advice applies generally to all military activities which take place in UK waters. The majority of these activities can take place anywhere in the marine environment at any time and some have the potential to impact features of Marine Conservation Zones (MCZs).

6.1 Survey and Licensing Requirements

Military activities are exempt from the EIA Directive, although the Secretary of State for Defence's Safety, Health, Environmental Protection and Sustainable Development in Defence Policy Statement[3], directs the Ministry of Defence (MOD) to introduce standards and management arrangements that produce outcomes, that are, so far as reasonably practicable, at least as good as those required by legislation from which they are exempt.

Military activities are not exempt from the Birds and Habitats Directives, or from the provisions of the Marine & Coastal Access Act, with the exception of certain elements of licensing. As a competent authority, MOD must determine whether their plans and projects will have a likely significant effect on any Natura 2000 site and must further, or least hinder, the conservation objectives of MCZs.

To enhance its consideration of the impact of military activity on the marine environment, the MOD has been working with the Statutory Nature Conservation Bodies (SNCBs) to develop a Maritime Environmental Sustainability Appraisal Tool (MESAT). Part of this tool will be a suite of operational guidance associated with Marine Protected Areas (MPAs). By following this guidance, it is expected that military activities can be undertaken without having a significant impact on an MPA or a European Protected Species (EPS). This will be achieved by following standard operational procedures and further moderating them in the vicinity of an MPA when activity could cause a negative impact on designated features. If it is necessary for MOD to operate contrary to this UK wide guidance then a fuller environmental assessment will be undertaken. MESAT and its supporting information are still being developed and will take account of MCZs once they are designated.

A large proportion of MODs live weapons firing in UK waters takes place within designated military practise ranges found in various coastal locations. Where a likely significant effect on a protected site cannot be excluded, the activities taking place within these ranges are subject to appropriate assessment under the Habitats/Birds Directives. If an appropriate assessment is required, it is reviewed by local area officers within the SNCBs to determine whether the activities will have an adverse effect on site integrity. As a competent authority MOD determines likely significant

[3]http://www.mod.uk/NR/rdonlyres/C7C22714-98F6-4777-871D-B6F49233D99C/0/SofSPolicyStatementRevisedSept2010.pdf

effect of its activities on European sites often with local SNCB collaboration and in a similar way will make considerations for MCZs.

6.2 Military Activities impacts

The MOD undertakes a wide variety of activities which may interact with the marine environment and may cause an impact on an MCZ. A summary of the main possible impacts on MCZs has been highlighted below.

6.2.1 Noise – Sonar

The potential impact of MOD active sonar use is managed through a tool (S2117[4] or Environmental Risk Management Capability) which provides a robust, repeatable and transparent method of assessing the environmental risk to, and impact on, marine life and provides advice on mitigation measures both during planning and operations. The system incorporates a database of hydrographic, climatological, legislative and biological data. The Joint Nature Conservation Committee (JNCC) are involved in regular science and legislation review of S2117 to ensure that it is up to date and the most appropriate tool to ensure that there is a reduced likelihood of there being an impact on species sensitive to sonar as a result of MODs sonar use. The use of sonar is unlikely to have any impact on any Features of Conservation Importance (FOCI) within MCZs.

6.2.2 Noise - Explosions

Certain military activities may involve explosions which could impact FOCI although these explosives largely take place above the water surface or at the top of water column. These activities are also infrequent due to the cost of undertaking them and that frequency is likely to further reduce. The majority of military activities which include explosions take place within already designated military practise ranges and therefore any impacts on MCZs should be identified by the ranges' environmental considerations and reflected in operational procedures. Outside of military ranges, there is potential for explosions to impact FOCI. As part of the future development of the MESAT, MOD will aim to avoid, within MCZs, the use of explosives which may impact FOCI.

6.2.3 Litter

Many of MOD's activities will cause litter to be dropped into the marine environment. This is largely spent ammunition and other larger pieces of military weapons (e.g. rockets). There is the potential for these to impact MCZ FOCI. However, this is unlikely to result in significant impacts to any FOCI due to the small scale of such activities. Furthermore, the majority of these activities take place within designated military practise ranges where impacts on the marine environment are considered within the ranges' environmental assessments. Advances in technology mean that certain military weapons (e.g. torpedoes) will float to the surface after being used – this allows MOD to collect such items for future use with minimal impact on the marine environment.

[4] S2117 is a computer decision aid whose purpose is to provide command guidance on the minimisation of the environmental impacts from use of sonar.

Significant increases in firing activity which cause additional litter to be placed on the seabed will need further consideration of the impacts on the conservation objectives of any MCZ likely to be affected.

6.2.4 Low Flying

The majority of the UK is subject to the possibility of low flying aircraft for military training purposes. Certain areas are protected from low flying within the UK Military Low Flying System – these include major conurbations and certain environmentally sensitive areas. It is not expected that any low flying activity will impact any MCZ FOCI.

6.3 Summary of the impacts on habitats and species listed for protection by MCZs that could arise in the absence of MCZs (or other protected areas)

In general, most military activities should be compatible with vast majority of MCZ features given the safeguards included within MOD standard operating procedures. MCZs will all be included within MODs MESAT and appropriate guidance given to operators where additional caution is required.

7. NAVIGATIONAL DREDGING AND DREDGE MATERIAL DISPOSAL

Navigation dredging is a statutory obligation for harbour authorities to ensure safe navigation of commercial vessels into port. The majority of dredging around the country is routine and a vital part of port maintenance. Port and navigation authorities work closely with conservation bodies and regulators to ensure the environmental impacts are minimised and there is a significant wealth of experience. Navigation dredging is ongoing within and close to existing Marine Protected Areas around the country and in general the activity co-exists well.

See Appendix 5 where interest features listed for protection by MCZs that could be impacted by the activities of this sector.

7.1 Process for assessing and mitigating impacts on features outside protected areas

The statutory control of dredging operations is complex and fall under a number of regulatory authorities. Many port and harbour authorities operate under local acts which empower them to undertake dredging works within the limits of their jurisdiction.

7.1.1 Marine Licence – Dredging

Dredging will be licensable under the new Marine and Coastal Access Act 2009 (MCAA) through the introduction of a new marine licensing system which will consolidate the consent process into a single Marine Licence from the 6th April 2011. Although, it should be noted that there is an allowable transitional period for dredging within the Act (Schedule 9, Part 4). The new licensing system will capture all forms of dredging including those which do not involve deposits e.g. plough dredging, water injection dredging.

7.1.2 Marine Licence - Disposal

The disposal of dredged material to sea is currently licensed under the Food and Environment Protection Act 1985. Under the MCAA all disposal at sea of dredged material by harbour authorities or anyone else will need a marine licence. The only exception to this will be for harbour authorities that are depositing dredged material for the purposes of land reclamation, managing waters and waterways, preventing floods and droughts within surface waters provided the activity is authorised by a local Act or Harbour Order and they have demonstrated to the MMO's satisfaction that the sediments are non-hazardous.

At present as part of the procedure in applying for a disposal to sea licence applicants must submit to the MMO details of material to be dredged and deposited at sea. In the future a marine licence will cover both the dredging and disposal of material, as discussed earlier. In determining an application, the MMO must have regard to protect the environment and human health and also prevent interference with legitimate uses of the sea. Therefore the suitability of dredged material for disposal to sea needs to be assessed and this is undertaken in line with the OSPAR Guidelines for the Management of Dredged Material (Ref: 29). Cefas currently undertakes a physical and chemical characterisation of the dredged material on behalf of the MMO and provides advice to them on the potential impacts and risks from the dredging and disposal of the material.

7.1.3 Beneficial Use of Dredged Material

Beneficial use is the re-use of dredged material including:

- recycling and retention of dredged material within an estuarine or coastal sediment system.
- transport and re-use of dredged material to other geographical areas for habitat creation.
- re-use of dredged material as infill for reclamation or coast defence.
- removal and re-use of contaminated dredged material for construction and infill.

The MMO has a duty to consider what practical alternative disposal options are available, including the beneficial use of dredged materials, prior to granting a licence to dispose of dredged material at sea. Licences will not normally be issued for the disposal of dredgings for which a practicable commercial or beneficial use is available.

A number of 'environmental' beneficial use options have developed and dredged material has been used to recharge or recreate intertidal habitats (Ref: 30).

Capital dredged material, which is generally more consolidated and coarse, compared to maintenance dredgings, is more suited to direct placement schemes as its behaviour once deposited is more predictable. This is the physical placement of material in intertidal or shallow subtidal areas. In contrast, the finer maintenance dredging material is less likely to remain in one place, but has value and can be used to trickle feed sediment**,** where periodic release of material in the water column increases the supply of fine sediment to intertidal areas via tidal currents.

The benefits of such schemes need to be considered against the potential impacts to existing habitat and species interest's discussed in sections 7.4 & 17.5. The majority of beneficial use schemes are currently in areas where habitats and species are naturally tolerant of high sediment loads and periodic smothering.

7.1.4 Marine Licence - Exemption

Dredging carried out on behalf of a Harbour Authority in accordance with a Harbour Order or Local Act will still remain exempt from licensing under Section 75 of the Marine and Coastal Access Act.

In effect, only plough dredging, water injection dredging and dredging where the material will not be deposited at sea, done on behalf of the Harbour Authority will be exempt from a marine licence. As all dredging done on behalf of the Harbour

Authority where the material is deposited at sea will still require a marine licence for disposal.

7.1.5 Marine Works – Environmental Impact Assessment

Dredge proposals and disposal can be subject to EIA, currently under the Marine Work (EIA) Regulations 2007. These regulations are due to be replaced in April 2011 by the Marine Works (Environmental Impact Assessment) (Amendment) Regulations 2011, so that the regulations will refer to and apply to marine licences under the Marine and Coastal Access Act. The MMO will advise whether the project requires an Environmental Statement for the purposes of an EIA, although in general this will only apply if associated with an infrastructure project.

7.1.6 Water Framework Directive

Marine licences are also required to be compliant with the Water Framework Directive (WFD), which applies in estuaries and in coastal waters out to one nautical mile from low water. If it is demonstrated that the dredging or disposal activity will not affect status at water body level, or where a potential effect on status can be successfully mitigated, the activity is WFD-compliant and the licensing or consenting process can continue. The Environment Agency, in England and Wales, are the competent authority for WFD and acts as a statutory consultee for Marine Licensing.

7.2 Process for assessing and mitigating impacts on features within existing protected areas

The information detailed in Section 7.1 also applied to existing Marine Protected Areas.

Capital and maintenance dredging and disposal operations are carried out/on-going within and in close proximity to a number of existing MPAs around the country. In general, the activities co-exist well with certain levels of mitigation, monitoring, and in exceptional cases compensation required for specific sites.

It should be acknowledged that the majority of dredging (maintenance) around the country is routine and a vital part of port maintenance and as such is an essential and statutory aspect of port activity. For many years' port and navigation authorities have working closely with conservation bodies and regulators to ensure the environmental impacts are minimised and there is significant experience showing that this can be done.

Natural England is a statutory consultee for marine licences and is consulted by the MMO. To date Natural England's focus has been on activities affecting existing MPAs and their interest features, and therefore has not provided regular detailed comments on activities away from these sites or on interest features not currently designated.

Natural England currently provides advice where dredging may affect marine and coastal interests of existing MPAs (SSSIs, SACs, SPAs, Ramsar sites). Mitigation of impacts similar to that used for existing MPAs could be applied to FOCI protected by MCZs.
Mitigation is generally provided through dredging methodology with necessary monitoring where required and is commonly done to the satisfaction of all parties. Compensation is rare and is generally associated with major capital dredges where significant impacts are predicted, case studies have been produced for where this has occurred (Ref: 30).

7.2.1 Maintenance Dredging Protocol

For existing Natura 2000 sites potentially affected by maintenance dredging, Defra's *Maintenance Dredging & The Habitats Regulations 1994 – A Conservation Assessment Protocol* (Defra 2007 – Ref: 31) is currently being rolled out. The protocol is intended to offer a streamlined method for robust but proportionate consideration of the implications of on-going maintenance dredging operations, by providing a framework for assessing dredging activity for a given estuary.

It involves the development of a baseline document that describes all current maintenance dredging and establishes a baseline against which new applications can be judged, in the context of the Habitats Directive. The document also provides the opportunity to determine whether there is a link between the current level of dredging and the condition within an estuary.

It may be appropriate that the Protocol is expanded to new MPAs to streamline the regulatory approach and ensure speedy resolution to environmental issues; Defra will provide guidance on this.

7.3 Description of dredging

Dredging can be undertaken for a number of different purposes (Ref: 32), including:

- Navigation: To maintain or improve/extend navigable channels.
- Flood control: To improve drainage or sea defence. (Navigation dredgings may be used beneficially for this purpose)
- Construction and reclamation: For coastal development, foundations for civil engineering work e.g. barrages, piers & pipelines. (Navigation dredgings may be used beneficially for this purpose)
- Mining and aggregate extraction: Impacts of aggregate extraction are considered in a separate section and impacts of mining are not considered in this advice.
- Beach nourishment: To reinstate or improve beaches for sea defence or amenity. (Navigation dredgings may be used beneficially for this purpose)
- Environmental: To improve or clean up, generally for removal of contaminated sediments.

In regards to navigation dredging, Port Authorities have a statutory responsibility to maintain navigation, keeping navigational channels open, maintaining specific depths and to advertise these to shipping. There are two types of navigation dredging, which are:

- Capital dredging: the process of deepening for the first time or after a prolonged period (over 10 years).

- Maintenance dredging: the periodic removal of re-deposited material to maintain dredged depth. Frequency depends on rate of deposition. In sediment rich systems it can be monthly, but no longer than 10 years.

It should be noted that the period of 10 years is defined by the licensing process rather science, there is little difference environmentally between a maintenance dredge undertaken after 9.5 years and a capital dredge after 10.5 years.

7.4 Direct impacts of dredging and disposal

The potential environmental effects of dredging are as a result of:

- The dredging process itself.
- The disposal of the dredged material.

During the dredging process effects may arise due to the excavation of sediments at the bed, loss of material during transport to the surface, overflow from the dredger whilst loading, loss of material from the dredger and/or pipelines during transport, and deposition of material at the disposal site. Depending on where these activities take place, habitats listed for protection by MCZs habitat features may be affected by either dredging or disposal.

Dredging and disposal can also have environmental benefits including:

- Removal of contaminated sediments via dredging.
- Possible improvement of water quality as a result of the restoration of water depth and flow.
- Use of uncontaminated dredge material to enhance mudflat and saltmarsh habitats, and to mitigate losses of intertidal land through sea level rise and capital dredging operations.

The extent to which dredging and/or disposal might affect marine features is varied and site specific, depending upon a number of factors shown below:

- Magnitude and frequency of dredging activity.

- Method of dredging and disposal.
- The characteristics of the material to be dredged and disposed e.g. size, density, quality.
- Intertidal area.
- Background levels of water and sediment quality, suspended sediment and turbidity.
- Hydromorphology including tidal range, current direction and speed, channel size and depth.
- Rate of mixing.
- Seasonal variability and meteorological conditions, affecting wave conditions and freshwater discharges.
- Proximity of the marine feature to the dredging or disposal activity.
- Presence and sensitivity of fauna and flora communities.

Prediction of the potential effects that might be caused by dredging and/or disposal can only be made if these parameters are known on a site-by-site basis.

Generally, the potential direct impacts of dredging and disposal can be summarised as:

- Removal of habitat - Physical removal and/or burial of habitats are mostly likely direct effects of dredging projects. Resulting in the removal of benthic species and communities and the alteration of benthic habitat.

- Burial of habitat - Where the deposited material descends rapidly to the seabed this will smother benthic organisms in the disposal site and potentially the surrounding area. This can change community structure and disrupt ecological processes. The deposition of fine grained sediment on coarser grained natural sediment can also affect the makeup of benthic communities and lead to a reduced complexity and changes in community structure. Settlement of suspended sediments through the dredging or disposal activities can also smother or blanket subtidal communities and/or adjacent intertidal communities. The scale of impact is dependent upon the type of habitat/species present, dredging often occurs where habitats and species are naturally tolerant of high sediment loads and periodic smothering. Increases in suspended sediment can also be beneficial, increasing sediment supply to intertidal habitats, helping to maintain areas of mudflat and saltmarsh. The re-supply of material to estuarine intertidal habitats occurs in several locations around the country via beneficial-use schemes that put dredged material back into the water column to maintain sediment budgets.

- Turbidity - Short-term increases in the level of suspended sediment can give rise to changes in water quality affecting turbidity, reducing dissolved oxygen concentrations and light-penetration into the water column. For example, filter feeding organisms can be harmed by increased levels of turbidity clogging and damaging feeding and breathing equipment. These effects only occur when turbidity generated is significantly greater than the natural variation of turbidity levels and sedimentation rates in an area.

- Disposal impacts - The impacts of disposal also depend on the nature of the material (inorganic, organically enriched, or contaminated) and the characteristics of the disposal area, which may be accumulative or dispersive. Where accumulative disposal sites are sites where material builds up over time, which can lead to localised changes to seabed substrate/habitat, and dispersive disposal site are sites where material does not generally build up and material is redistributed to the wider sea area through tidal currents.

- Dredging activity - The activity of dredging itself can also cause disturbance to marine life through noise and vibration.

The evaluation of the environmental effects of dredging and disposal must take account of both the short-term and long-term effects that may occur both at the site of dredging or disposal (near field) and the surrounding area (far field).

IADC and CEDA (Ref: 33) provide a usefully illustrate the temporal and spatial scales in which various environmental effects of dredging might be realised (as seen in matrix below). Near field effects are defined as less than approximately 1 km and far field effects as greater than approximately 1 km from the activity. Note that other sources suggest caution when adopting an arbitrary distance to distinguish between near and far field effects, due to the site-specific nature of the potential effects that arise from dredging.

Time–space matrix of potential effects associated with dredging and dredged material placement Source: Bray (2008. Ref: 33).

	Near-field environmental effects (<1km)	Far-field environmental effects (>1km)
Short-term environmental effects (<1 week)	Dredging site: Turbidity. Smothering/removal of organisms. Reduced water quality.	Dredging site: None generally expected.
	Disposal site: Smothering of organisms.	Disposal site: Offsite movements of chemicals by physical

	Turbidity. Reduced water quality. Acute chemical toxicity.	transport.
Long-term environmental effects (>1 week)	Dredging site: Disturbance by shipping traffic. Removal of contaminated sediment.	Dredging site: None generally expected.
	Disposal site: Altered substrate type. Altered community structure. Chronic chemical toxicity. Bioaccumulation.	Disposal site: Offsite movements of chemicals by physical transport and/or biota migration.

7.5 Indirect impacts of dredging

In addition to the direct impacts of dredging discussed above (generated by the physical activity of dredging and disposal of the material), the indirect impacts of the activities should also be considered. Indirect impacts are associated with how a system functions.

It should be stressed that significant indirect impacts are generally only associated with large capital and maintenance dredges and would be fully assessed through EIA.

7.5.1 Changes to hydrography and morphology

Dredging alters the bathymetry (shape) of an area which in turn can alter the hydrography (wave and tide characteristics) and the impact upon habitats through local erosion and accretion and also lead to changes in sediment transport and budget. This is collectively known as the hydromorphology of a system.

These impacts are generally more pronounced in semi-enclosed bodies of water e.g. estuaries, harbours and bays. The magnitude of the effect will depend on the size of the dredge compared to the size of the cross-section of the estuary as a whole. The initial impact is as a result of capital dredging and is maintained by maintenance dredging.

Deepening can change the tidal propagation (ebb and flow) and speed of tidal currents, and result in shifts to the high and low water levels. This can be important as changes can lead to a reduction in exposure of intertidal habitat. These changes in water levels can be small, a few millimetres vertically, but when an estuary foreshore is tens of kilometres long, it can result in a reduction in several hectares of intertidal habitat (Ref: 30).

Dredging can also have an impact on the wave climate (type, scale and direction of waves) of an area as deeper water reduces the height of waves. A change to the angle and/or slope of the shore (shallow subtidal and intertidal) alters the direction, size, and shape of the waves. This in turn can alter the amount of energy experienced on the foreshore and the erosion rate of intertidal habitats.

7.5.2 Changes to Sediment Budgets

Dredging and deepening a system can move it away from its natural balance. Dredging can increase the tendency for material to be deposited in the deepened areas and can reduce the supply of material elsewhere in the system and deprive inter-tidal habitats (mudflats, saltmarshes, sandflats) of the sediment. The scale and consequences of these impacts are dependent on the sediment budget of the system, the scale, frequency, and location of the dredging.

The initial impact to the sediment budget is caused by capital dredging, but maintaining the dredged area can lead to the on-going decline in condition of habitats, by the continuing removal and disposal of material at sea (which maintains the reduction in supply in particular to intertidal habitats). This on-going impact can often be mitigated by the beneficial use of dredgings, recycling and retaining material within the system.

It should be noted that not all dredging will cause a negative effect to the sediment budget; it is very dependent on the dynamics of system and the volume and location of dredging. Generally where significant concerns are identified these are fully assessed through EIA.

7.5.3 Release of chemical contaminants

If the dredged material contains elevated levels of contaminants, such as heavy metals or PAHs, organic matter or nutrients then contaminant-related effects may occur from the dredging or disposal of sediment.

7.6 Potential mitigation of impacts

It is important to note that many of the mitigation measures described in this section are associated with very large capital and maintenance dredges where significant science and impact assessment has been carried out. These should not necessarily be applied to the smaller localised maintenance dredging happening on a daily basis around the country. Beneficial use of dredged material is discussed in Section 7.1.3.

7.6.1 Contaminated Sediments and Water Quality

The disposal of dredged material is licensed by the MMO. As discussed in Section 7.1, Cefas advises the MMO on the potential impacts for contamination, and risks from dredging and disposal of the material. Cefas uses a 'weight of evidence' approach to assess dredged material and its suitability for disposal to sea. This includes chemical analyses that pertain to whether an area is affected or characterised by contaminated marine sediments such as TBT or metals. Where such contaminants are found in concentrations above certain levels (Cefas Action Levels) their disposal at sea cannot be permitted.

Defra are currently developing a decision framework for assessing options for the disposal and treatment of contaminated dredged material[5]. The purpose of the Decision Framework is to provide a holistic approach to managing contaminated sediments in the long-term and to assist in the sustainable development of ports, harbours, and marinas. It has been designed to promote and provide a consistent approach to identifying environmentally acceptable management alternatives for contaminated dredged material when it cannot be disposed of at sea.

7.6.2 Suspended Sediment and Water Quality

Impacts of suspended sediment are dependent on the existing background conditions and habitats; in areas of high sediment load increased elevations from dredging have minimal effect on the surrounding environment.

In areas with lower sediment load, dredge plumes may be reduced by restricting the type of dredger, dredging with no overflow from the hopper, phasing dredging to occur in the winter when impacts to dissolved oxygen will be less or phasing around sensitive periods e.g. migratory fish runs.

Where there is still concern over suspended sediment loads, schemes have put in place real time monitoring of dredge plumes with conditions to stop dredging if threshold limits are reached. It should also be acknowledged that dredging is generally for a short duration as it stops when the dredger is full and sails for the disposal site e.g.in a12 hour dredge cycle dredging may only occur for a few hours as the rest may be spent sailing to and from the disposal site.

7.6.3 Sediment deposition (dredging)

As with suspended sediment, smothering impacts are dependent on the existing conditions and habitats present. Dredging can be phased to avoid sensitive periods e.g. for susceptible fish species. In locations of high risk where this is not possible, EIA for licences can identify key areas of sensitivity, allowing the dredge proposal and dredge methods to be altered to reduce suspended sediment load and hence deposition, as discussed above.

7.6.4 Sediment deposition (disposal)

[5] http://www.defra.gov.uk/environment/marine/legislation/sediment/index.htm

Disposal of waste at sea can pose a threat to marine life if not properly controlled. In England, disposal is strictly controlled through the licensing process and conditions can be placed on licences to ensure that potential impacts are acceptable and largely confined within the disposal site. This can include restricting the type and volume of material disposed at a site or restricting the timing of disposal to avoid sensitive periods.

Cefas conduct an annual programme of monitoring of disposal sites on behalf of the regulatory authority. This provide regulatory authority with data required to make licensing decisions and to re-evaluate assessments made during the licensing process and, if necessary, amend licences to protect the marine environment and human health.

7.6.5 Changes to Tidal Range/Loss of Intertidal Exposure

These changes are generally only a problem for large capital dredges and are comprehensively assessed through EIA. Where substantial loss/changes in exposure are identified these can be offset by managed realignments and intertidal habitat creation scheme (Ref: 30).

7.7 Summary of impacts on habitats and species listed for protection by MCZs that could arise in the absence of MCZs (or other protected areas)

Navigation dredging is ongoing within and close to existing Marine Protected Areas around the country and in general the activity co-exists well. In the future a marine licence will cover both the dredging and disposal of material. In determining an application, the MMO must have regard to protect the environment and human health and also prevent interference with legitimate uses of the sea. Mitigation is generally provided through dredging methodology with necessary monitoring where required and is commonly done to the satisfaction of all parties. Compensation is rare and is generally associated with major capital dredges where significant impacts are predicted. It may be appropriate that the Protocol is expanded to new MPAs to streamline the regulatory approach and ensure speedy resolution to environmental issues.

8. OIL, GAS AND CARBON CAPTURE STORAGE

Under existing environmental regulation all potential impacts of oil and gas exploration are assessed and, if necessary, mitigated. Whether mitigation is required will depend upon the severity and significance of the impacts. The remainder of the chapter describes the measures that are taken to assess potential impacts and mitigate them.

8.1 Oil and gas exploration and production: process for assessing and mitigating impacts on features

The oil and gas sector has a history of implementing best practice as demonstrated through the Strategic Environmental Assessments (SEA). The regulator (DECC) additionally ensures compliance with best practice by requiring operators to take account of impacts via EIA, either through formal submission of an Environmental Statement (where this is required, or considered appropriate) or through the Petroleum Operations Notices submitted in support of the applications for environmental approvals at various stages in projects (e.g. for seismic surveys, drilling and pipelaying).

Standard practice currently dictates that the surveys undertaken to support the EIA, or the cited reports relating to previous surveys, will identify sensitive habitats and species. This enables identification of potential impacts from operations at the planning stage, so that any necessary mitigation can be incorporated into the proposals to ensure that significant effects do not arise. The mitigation is agreed with the regulator, taking account of advice provided by the relevant statutory nature conservation agency, prior to the regulator granting consent for the proposed operations. Assessments have generally focussed on Annex 1 habitat. Currently, Species FOCI and Habitat FOCI, (such as sand and gravels) are features not currently assessed as a part of the EIA procedures. In the future more focus may be required on data gathering/analysis, presentation and interpretation to ascertain the Conservation Objectives for MCZ features and to ensure the MCZ features are not compromised. Impacts on all potential MCZ features would then be assessed and, if necessary, mitigated via the EIA process.

The default assumption is that MCZs would not entail additional or different mitigation measures to those that could be applied anyway by the regulator through existing consenting processes. However, each proposal is considered on a case by case basis and if there was evidence that supported the adoption of additional mitigation it is a possibility that the regulator would require this. The remainder of this section discusses the types of impacts currently considered by EIA and their mitigation.

8.2 Oil and gas exploration and production: potential impacts

8.2.1 Survey

Geological structures that could bear viable oil and gas reserves are identified through geophysical surveys, including seismic surveys (which use short bursts of sound energy). If promising amounts of oil and gas are indicated, more detailed appraisal (seismic surveys and drilling exploration and appraisal wells) of the prospect/discovery will be required to identify the potential size of the field and the production methods that could be used to develop the field. Seismic operations have the potential to impact or disturb a range of marine species (though disturbance impacts are not fully understood). Impacts on fish can be reduced by avoidance of sensitive spawning and nursery periods for certain species.

Best practice mitigation is also adopted to manage the risk of injury and disturbance to cetaceans such as implementing soft starts when undertaking seismic activity. Similar mitigation can also be adopted in relation to seals. Targeted surveys such as pipeline route and site surveys to delineate features (e.g. reef) may be necessary. Best practise dictates to design such surveys to allow sufficient characterisation of feature to undertake impact assessment whilst also avoiding damage to the feature, e.g. by avoiding the use of damaging sampling equipment (such as towed bottom gear in potential reef areas). See also 'Cable' and 'Aggregate' section.

8.2.2 Production and Development - Drilling

To identify viable oil and gas reserves for potential exploitation, exploration and appraisal wells are drilled into the seabed. The drilling operation, and in most cases the drilling rig legs or anchors, will directly impact on benthic features. The potential impacts of drilling (and other activities associated with oil and gas exploration and production) on conservation features considers, for example, the impacts on the structure and function of a feature, the scale of the predicted impacts in relation to the size of the feature as a whole and the potential for recovery. Existing mitigation and best practice to avoid impacts from the installation of oil and gas infrastructure are similar to those applied by the marine aggregate and renewable energy sector. This involves mapping of features and infrastructure location and pipeline routes and relocation to avoid known areas of sensitive features if there is a risk that conservation targets would not be achieved.

<u>Broadscale habitats</u> & effects of drilling: considered unlikely that drilling will have significant effects given, for example, extent of drilling footprint compared to extent of the broadscale habitats in each region.

<u>Habitat FOCI:</u> Impacts on particular sensitive features (e.g. reef) would be mitigated under best practise (i.e. re-location structures if needed). Potential smothering effects arising from the deposition of drill cuttings are considered.

The installation of oil and gas infrastructure such as platforms and manifolds will impact sediments and seabed communities. Secondary effects on benthic communities during drilling may arise from the deposition of drill cuttings and associated drilling mud on the seabed. The drill cuttings are discharged into surface, or near-surface, waters, where they are subject to dispersion and dilution in the water column. The produced cuttings will be deposited on the seabed in a pattern that reflects the nature of the cuttings' particle size distribution and the prevailing hydrodynamic conditions. The deposition of cuttings has the potential to disturb and smother benthic species. EIAs have demonstrated that the effects of these are localised and temporary. This is likely to also be the case for impacts on MCZ broadscale habitats. Drill cuttings could also impact on habitats listed as MCZ FOCI, however the EIA process will identify potential impacts and mitigation options.

If the receiving environment is significantly sensitive or of low energy the pattern of settlement could have an adverse effect, and if the drilling operation cannot be relocated, mitigation may be required such as taking the drill cuttings to land for appropriate treatment and disposal. Transporting the cuttings ashore is rarely employed, except in the case of drilling operations using oil-based muds (which cannot be discharged), because there is unlikely to be a significant adverse impact on sensitive ecosystems. However, decisions will be taken on a case by case basis and if evidence supported additional mitigation then land disposal may be considered.

The legs of jack-up drilling rigs (and the presence of other installed infrastructure, including platforms) can interrupt the natural flow of water near the seabed. This may result in erosion of the seabed immediately around the structures which could compromise its stability. This scouring normally occurs in sandy areas with a combination of high currents and shallow water depth. To prevent it, developers can apply to install scour protection, usually by depositing rock (about 5–8 cm in size), which cannot be recovered, at the base of each leg (typically about 1,000 tonnes of rock for each leg). This can change the soft surface of the sediment to a hard surface, resulting in a change in habitat. This changes the suitability of the sea floor for colonisation by organisms and so can impact on the plants and animals living on it. Scour protection is employed where there is a significant risk of erosion. Impacts of scour protection are likely to arise even if best practice is followed, for example sessile organisms can be smothered by the rock and the new habitat formed may not be suitable for their re-colonisation, but in terms of MCZ broadscale habitats the impacts are likely to be minimal, although there could be significant cumulative effects if there is extensive rock dumping in an area. Wherever possible and following good practice, the industry aims to avoid potential impacts of rock dumping on sensitive features.

8.2.3 Production and Development – Laying Pipelines

Pipelines may be trenched, or trenched and buried, for example in areas where this would minimise the impact on benthic trawling. Trenched, or trenched and buried pipelines do not cause long term impacts on hydrological flow. However, trenching and burying the pipeline disturbs the benthic habitat along the pipeline route. Trenching without burial is normally used in areas where natural burial would be expected because of the hydrodynamic regime. Following deliberate or natural burial, the seabed would be expected to be re-colonised eventually.

Alternatively, pipelines may be laid directly on the seabed, although this could interfere with some fishing operations and problems could arise from ships' anchors attaching to the pipelines (although this could also occur in the case of trenched or buried pipelines if the depth of trenching and/or burial was insufficient). The presence of surface pipelines could potentially interrupt the natural flow of water near the seabed and therefore impact the natural movement of sediment. To address any potentially significant effects, the oil/gas industry could be advised to bury the pipeline, though this would have the impacts described above. Alternatively, they could be advised to deposit concrete mattresses over the pipelines, to stabilise and protect the lines. The mattresses may introduce artificial hard substrates into environments dominated by soft sediments, resulting in direct loss of habitat, but there is potential for subsequent colonisation by sand or other sediment and colonised by the species that are normally found in the area. Concrete mattresses should only be used where an operator can fully demonstrate the necessity.

In some areas new pipelines may need to cross over existing pipelines and/or cables. In such situations, concrete mattresses can be laid between the existing pipeline and/or cable and the new pipeline, and/or on top of the new pipeline, or rock dumping can be used to create and protect the crossing.

Rock dumping is also requested to ensure pipeline stability to prevent freespans and upheaval buckling.

When laying a pipeline across areas affected by sand waves, this could prevent adequate trenching and/or burial or increase the risk of free spans. In such situations an option is pre-sweep dredging to “shave” the sand crests and “flatten” the seabed in the pipeline installation corridor. This can cause geomorphological impacts and impacts on habitats and species, depending on the scale, even if best practice is followed.

The use of anchors during pipelay operations, to control the location and advancement of the pipelay vessels, could damage sensitive features such as biogenic reefs but impacts on topographical features are assessed as part of EIA and mitigated if necessary. It is best practice to ensure that the pipelay corridor and associated impact footprint avoids sensitive features, or by micro-siting the anchor locations.

The laying of pipelines will incur impacts on benthic habitats and species, the aim is to reduce those impacts as much as possible.

8.2.4 Production and Development – emissions, discharges and waste

During operation, produced water from reservoirs may contain formation water (i.e. that occurring in and around the reservoir) together with their dissolved salts, crude oils, dissolved gases (possibly hydrogen sulphide), solids (e.g. produced sand) and various production chemicals. Under permit these wastes may be discharged to sea but under best practice this will be limited or avoided. It is unlikely that the volumes discharged will have significant impact on MCZ features, however, each proposal is considered on a case by case basis and if evidence supported adoption of additional mitigation it is a possibility that the regulator would require this.

Solid waste is managed within the operator's waste management system, which should return all solid wastes (such as scrap metal and surplus chemicals) back to shore for treatment and appropriate disposal. Under the MARPOL Convention the discharge of any solid wastes into the North East Atlantic is prohibited.

8.2.5 Production and Development – oil spill

The oil/gas industry aims to control the risk of oil pollution and ensure effective and efficient response to any oil spills. The potential impacts of oil spills are discussed further in the section on the potential impacts of shipping. Oil Pollution Emergency Plans (OPEPs), and regular training and exercises, are required by legislation, and the sector demonstrates compliance with the requirements and has a very responsible approach to oil spill response. Operators are also required to put in place control measures to minimise the risk of a spill, and this includes regular maintenance and inspection of infrastructure.

The number and volume of oil spills from offshore installations has declined over recent years as a result of the legislative requirements and the adoption of best practice, achieved through improved training and behavioural changes. There is likely to be an ongoing process of learning by the regulator, the operators and the response agencies (for example, from the recent oil spill in the Gulf of Mexico) that will be integrated into best practice. It is unlikely that additional mitigation will be required from oil spills to protect MCZ features.

8.2.6 Maintenance

Pipelines may require maintenance if they become exposed as a result of erosion of the sea bed. To combat this problem, operators may request approval to deposit additional protection material (e.g. concrete mattresses, rock). Impacts of these materials on seabed features are discussed above, and operators must demonstrate that the deposits are a necessity.

Much of the installation maintenance is undertaken above water and does not impact on benthic habitats and species, but there can also be a requirement for the deposit of protective materials on infrastructure immediately adjacent to the installation, for example to prevent damage from dropped objects.

Maintenance work and the anchoring of vessels used to maintain subsea infrastructure such as pipelines, in the vicinity of sensitive features (e.g. reefs) risks damaging the reef. Refining the maintenance schedule may help to reduce these risks.

8.2.6 Decommissioning

OSPAR Convention Decision 98/3 prohibits the dumping, or the leaving wholly or partly in place, of disused offshore installations within the maritime area, subject to a number of derogations. There are derogations for concrete installations and, in exceptional and unforeseen circumstances, installations that have suffered structural damage or deterioration that precludes partial or total removal. The Decision applies to all installations that are proud of the sea bed (manifolds, platforms, etc). Pipelines decommissioning is addressed on a case-by-case basis.

In providing advice on decommissioning, the statutory nature conservation organisations may consider the habitat prior to the activity taking place and advise that the environment is to be re-habilitated as close to its former status as possible.

8.3 Associated pipelines: process for assessing and mitigating impacts on features

Under existing environmental regulation all potential impacts of oil, gas and carbon dioxide pipelines are assessed and, if necessary, mitigated.

8.4 Associated pipelines: potential impacts

The impacts of pipelines for the transport of natural gas or CO_2 in connection with storage projects are likely to be the same as those described above for pipelines relating to oil and gas exploration and production. The best practice described for oil and gas exploration and production pipelines would be followed.

8.5 Storage & unloading of natural gas: process for assessing and mitigating impacts on features

Operators wanting to store or unload natural gas in the UK's offshore area[6] must hold a licence issued under Section 4 of the Energy Act 2008. The licensing authority would normally be the Secretary of State for Energy and Climate Change, but the Devolved Authorities may have licensing functions in territorial or controlled waters. Additionally, in order to carry on such developments the developer will also need to obtain a lease from The Crown Estate.

EIAs for such projects are required to meet the requirements of The Offshore Petroleum Production and Pipelines (Assessment of Environmental Effects) Regulations 1999 (as amended). During EIA, potential environmental impacts are assessed and, if necessary, mitigated.

8.6 Storage & unloading of natural gas: potential impacts

The impacts associated with gas storage projects are likely to be the same as those described for oil and gas exploration and production (see above), and the same best practice would be followed.

[6] This comprises both the UK territorial sea, and the area extending beyond the territorial sea that has been designated as a Gas Importation and Storage Zone ("GISZ") under section 1(5) of the Energy Act 2008.

8.7 Carbon capture and storage: process for assessing and mitigating impacts on features

Anyone who wants to store carbon dioxide in the UK's offshore area (as describe in footnote 6) must hold a licence issued under Section 18 of the Energy Act 2008. Those licences must be issued in accordance with the Directive on the Geological Storage of Carbon Dioxide (Directive 2009/31/EC). The Directive requires permanent containment of the stored carbon dioxide and remediation plans in the event that carbon dioxide migrates beyond the defined boundaries of the storage site. The store must also be monitored during its lifetime and once it is closed. The licensing authority would normally be the Secretary of State for Energy and Climate Change (DECC), but the Devolved Authorities may have licensing functions in territorial or controlled waters. Additionally, in order to carry out such developments the developer will also need to obtain a lease from The Crown Estate.

EIAs for such projects are required to meet the requirements of The Offshore Petroleum Production and Pipelines (Assessment of Environmental Effects) Regulations 1999 (as amended). During EIA, potential environmental impacts are assessed and, if necessary, mitigated.

8.8 Carbon capture and storage: potential impacts

The majority of the impacts associated with carbon dioxide storage projects are likely to be the same as those described for oil and gas exploration and production (see above), and the same best practice would be followed. The storage of CO_2 would be a totally new activity in the UK's waters and possible additional impacts are not yet known. Potential impacts of a carbon dioxide release could include (but not be limited to) ocean acidification.

9. RECREATION

Recreational activities included are swimming, surfing, coaststeering, diving, snorkling and boating. They are presented in tabular form within Appendix 6 for ease of interpretation.

The potential impacts to MCZ features are outlined and the sensitivity to these impacts is presented based on advice from Natural England specialists. Where there is potential mitigation this has been highlighted and the management options effectiveness is discussed briefly. Where no current mitigation exists this has also been highlighted.

Please note that the three pages of Appendix 5 contain tables sized at A3 for readability and although easily viewed on a computer screen will require a printer with A3 capability for producing hard copies.

10. RECREATIONAL SEA ANGLING AND DIVER FISHING

Recreational fishing can be undertaken using several different methods including: angling (boat and shore), potting, netting, trawling and diver fishing (spear fishing and hand collection).

Only recreational sea angling and diver fishing are considered in this chapter. This advice should also be viewed as part of a package of advice alongside the recently released advice by Joint Nature Conservation Committee (JNCC) and Natural England with regard to fisheries impacts on Marine Conservation Zone habitat features (April 2011). It should also be considered alongside Section 11 on Shellfish Lays.

The habitats considered are all the intertidal and subtidal FOCI or broad scale habitats as described for the MCZ feature descriptions.

10.1 Potential impacts and management options

10.1.1 All habitats

- Impacts

If Recreational Sea Angling (RSA) is intense and spatially restricted then it can lead to localised degradation of habitats, particularly from litter of fishing line, lead sinkers, hooks and sacrificial anchors (Ref: 34).

Diver fishing will have a negligible direct impact on the habitats (Ref: 35).

- Management

Management regarding handling of litter and the discarding of anchors may be required at an individual site level.

10.1.2 Intertidal habitats

- Impacts

Trampling and disturbance to habitats and species can be caused by routes of access. Please see intertidal habitats in the commercial fisheries assessment for detailed impacts.

- Management

Please see commercial fisheries assessments for advice on potential management.

10.1.3 Subtidal habitats

- Impacts

There can be some abrasion of subtidal habitats through the placing of anchors on the seabed. This will have the same physical impacts as the placement of pots and traps, but at a lower intensity. Please see commercial fisheries assessments for pots and traps in subtidal habitats for detailed impacts.

Motorised vessels used in recreational fishing can disturb benthic habitats and aquatic vegetation, particularly in near shore areas e.g. seagrass beds and maerl (Ref: 34). Please see commercial fisheries assessment for seagrass beds and maerl for detailed impacts.

- Management

Please see commercial fisheries assessments for advice on potential management.

10.1.4 Removal of species

- Impacts

This is unlikely to have any significant direct impact on the habitats, but could have an impact on typical species. The extent of this interaction is not currently known, and will depend on the species targeted and the extent that they are taken.

RSA induced changes in trophic or community structure are rare. RSA usually targets piscivorous fish and therefore will tend not to fish down food webs, as many lower trophic feeders are not readily susceptible to capture by angling. Estuarine and inshore habitats, including nursery areas are where RSA is most likely to have an effect on the structure and functioning of ecosystems (Ref: 34).

Recreational hand diving is predominantly for shellfish and is becoming increasingly common (*Cefas, pers comm*) and if done at a large scale and not adhering to the legal minimum landing sizes can have a localised effect on shellfish populations (Diver shellfish code of conduct, Dorset Wildlife Trust).

Spear fishing is not widespread within the UK, and is predominantly carried out in the South and South West of England, it is a highly selective form of fishing that targets the largest individuals of fish, so if undertaken intensively could have an localised effect on the population structure of the target species (Ref: 36)

MCZs will be designated for vulnerable life stages such as spawning and nursery grounds, where temporal restrictions on removal by any form of fishing may be needed to ensure that the species are able to reproduce effectively.

- Management

Temporal restrictions for the protection of vulnerable life stages may be required depending on the reasons for designation of the MCZ. The option for the use of catch and release could be a potential management measure, if enough is known about the interactions between the target species and the features of interest of the MCZ.

10.2 SAP advice on vertical zoning in reference areas

- Impacts

The advice given by the SAP on vertical zoning for reference areas should be considered in relation to sea angling. Their advice was largely based on a US study by panel of experts (Ref: 37).

They found that recreational angling for pelagic species may not be compatible with benthic conservation in:
(1) high relief habitats;
(2) depths shallower than 50–100 m (depending upon the specific location);
(3) major topographic and oceanographic features, and;
(4) spawning areas.

This will need to be taken into account when considering the interactions between the mobile non-resident species and those that are resident, but currently we do not know enough about these direct connections, so it would be advisable to assume that areas that are spawning areas should be temporally restricted to ensure that the species are protected.

There are examples of impacts of RSA activities on the size structure of targeted species from South Africa, Florida, the Mediterranean and Australia (Ref: 34). There are no examples from the UK as the effects of RSA have not been widely studied.

10.3 Summary statement of potential environmental impacts if a site is not designated

Under the Sea Fish Act 1967 and Sea Fishery Committee/Inshore Fisheries Conservation Authority byelaws there are Minimum/Maximum Landing Sizes (MLS) and temporal closures for species to protect the spawning stock and age structure. Recreational fishermen have to comply with these.

There are currently no restrictions on bag limit by marine recreational fishermen and catch and release schemes are largely operated on a voluntary basis.
The only species where there is national legislation for catch and release by recreational anglers is tope.

Some Sea Fisheries Committees/Inshore Fisheries and Conservation Authorities (IFCAs) may limit the number of pots/traps a recreational boat can carry, and access to shore to fix nets will also be regulated in some instances if they are within existing designated sites.

Under the Marine and Coastal Access Act, IFCAs will be able to regulate the exploitation of sea fisheries resources in their district which will include recreational angling.

11. SHELLFISH LAYS (clams, mussels and oysters)

The following chapter follows the format of the recently released advice by Joint Nature Conservation Committee (JNCC) and Natural England with regard to fisheries impacts on Marine Conservation Zone habitat features (April 2011), and this document forms a package of advice with the commercial fisheries document.

11.1 Intertidal and sub-tidal sediments

- Impacts

Mussel lays on sediments may result in physical loss of the habitat as a consequence of smothering from the production of mussel mud, and biological disturbance through selective extraction/introduction of species, which will change the species composition of the habitat (Ref: 38 & 39). The impact of smothering is temporary and reversible, with limited influence over the lay area only, as the mussels will be harvested from the lay, and the mussel mud can also be removed from the lay area, allowing re-colonisation of the original substratum by organisms in the adjacent area (Ref: 39). Mussel lays cause declines in both number of individuals and species richness of benthic communities with edge effects extending a few metres outside the bed (Ref: 40).

- Evidence and quality

See references 38, 39 and 40.							
The evidence is from UK waters so can be regarded as directly applicable to the MCZ area.							
Directly relevant peer reviewed literature	✔	Directly relevant grey literature		Inference from peer reviewed or grey literature relating to a comparable habitat, gear or geographical area.		Expert judgement	✔

- Natural England advice

Possible management options (see introduction section 2.5 of commercial fisheries	Consequences for habitats/features	Will the option help to meet the conservation objective?	
		Maintain	Recover

assessment)			
Unrestricted access	If scale and location of lays is unrestricted then impacts on habitats could be significant, but of a temporary nature, depending on the sensitivity of the habitat. However shellfish lays are predominantly managed through several or regulating orders which means that there are very few unrestricted fisheries in existence.	This option may help to achieve the conservation objective depending on the habitat type and cultivation scale	This option may help to achieve the conservation objective
Managed access	If the size and location of the lays is restricted then the level of impact on the intertidal sediments can be reduced to levels which have minimal impacts, depending on the sensitivity of the habitats	If appropriate management is applied, this option may help to achieve the conservation objective.	If appropriate management is applied, this option may help to achieve the conservation objective.
No access	The habitat will not be subject to further modification or degradation. If there are no other unregulated pressures then recovery would be expected to take place at a natural pace.	This option will help to achieve the conservation objective.	This option will help to achieve the conservation objective.

11.2 Shellfish bag culture directly on sediments (clams & oysters principally)

Intertidal and subtidal sediments

- Impacts

Shellfish grown in nets placed on sediments can cause organic enrichment in the area covered by the nets. They can also lead to an increase in sedimentation on a temporary and localised basis. The nets also encourage the settlement of green macroalgae and can have a major influence over some infaunal species (Ref: 41). The use of netting can induce localised changes in benthic communities (Ref: 42).

- Evidence/quality

See references 41 and 42							
The evidence is from UK waters so can be regarded as directly applicable to the MCZ area.							
Directly relevant peer reviewed literature	✔	Directly relevant grey literature		Inference from peer reviewed or grey literature relating to a comparable habitat, gear or geographical area.		Expert judgement	

- Natural England advice

Possible management options (see introduction section 2.5 of commercial fisheries assessment)	Consequences for habitats/features	Will the option help to meet the conservation objective?	
		Maintain	Recover
unrestricted access	If scale and location of bag area is unrestricted then impacts on habitats could be significant, but of a temporary nature, depending on the sensitivity of the habitat. However shellfish lays are predominantly managed through several or regulating orders which means that there are very few unrestricted fisheries in existence.	This option may help to achieve the conservation objective depending on the habitat type and cultivation scale	This option may help to achieve the conservation objective.

Managed access	If the size and location of the bag area is restricted then the level of impact on the intertidal sediments can be reduced to levels which have minimal impacts, depending on the sensitivity of the habitats	If appropriate management is applied, this option may help to achieve the conservation objective.	If appropriate management is applied, this option may help to achieve the conservation objective.
no access	The habitat will not be subject to further modification or degradation. If there are no other unregulated pressures then recovery would be expected to take place at a natural pace.	This option will help to achieve the conservation objective.	This option will help to achieve the conservation objective.

11.3 Estuarine rope grown mussels and shellfish suspended bag culture (of oysters and clams)

<u>Subtidal sediments</u>

- Impacts

There can be some smothering/alteration of benthic habitats as a result of deposition from mussel mud and/or shell accumulating under the ropes (Ref: 39). The effects of smothering will be very variable depending on the degree of flushing in the system and eutrophication may occur if not enough tidal flow to disperse particulate matter (Ref: 42).

- Evidence and quality

See References 39 and 42							
The effects of rope grown mussels is not that well documented.							
Directly relevant peer reviewed literature	✔	Directly relevant grey literature		Inference from studies on comparable habitats, gears or geographical areas.		Expert judgement	✔

- JNCC and Natural England advice

Possible management options(see introduction section 2.5 of commercial fisheries assessment)	Consequences to habitat/feature	Will the option help to meet the conservation objective?	
		Maintain	Recover
unrestricted access	If operation carried out in an area with high flushing and moderate energy then the impacts of the mussel mud are likely to be minimal, this will however depend on the size of the operation, and the sensitivity of the habitat to smothering and alteration due to mussels shells	This option may help to achieve the conservation objective	This option may help to achieve the conservation objective

	being deposited on the seabed..		
Managed access	If the size of the operation is restricted to ensure that there is no damage to the underlying benthos then may not have an effect.	If appropriate management is applied, this option may help to achieve the conservation objective.	If appropriate management is applied, this option may help to achieve the conservation objective.
no access	The habitat will not be subject to further modification or degradation. If there are no other unregulated pressures then recovery would be expected to take place at a natural pace.	This option will help to achieve the conservation objective.	This option will help to achieve the conservation objective.

11.4 Offshore rope grown mussels

Any subtidal habitat

- Impacts

This is a fairly new operation, so the effects of it are not documented. Likely impacts are going to be from smothering of benthic habitats from mussel mud and abrasion from the anchors fixing the ropes.

- Evidence and quality

This is a new operation so no evidence currently available, but studies taking place in Lyme Bay where first operation is being undertaken.							
Directly relevant peer reviewed literature		Directly relevant grey literature		Inference from studies on comparable habitats, gears or geographical areas.		Expert judgement	✔

- JNCC and Natural England advice

Possible management options(see introduction section 2.5 of commercial fisheries assessment)	Consequences to habitat/feature	Will the option help to meet the conservation objective?	
		Maintain	Recover
unrestricted access	If operation carried out in an area with high flushing and moderate energy then the impacts of the mussel mud are likely to be minimal, this will however depend on the size of the operation..	This option may help to achieve the conservation objective if the size of the lay is small	This option may help to achieve the conservation objective if the size of the lay i small.
Managed access	If the size of the operation is restricted to ensure that there is no damage to the underlying benthos	If appropriate management is applied, this	If appropriate management is applied,

	then may not have an effect.	option may help to achieve the conservation objective.	this option may help to achieve the conservation objective.
no access	The habitat will not be subject to further modification or degradation. If there are no other unregulated pressures then recovery would be expected to take place at a natural pace.	This option will help to achieve the conservation objective.	This option will help to achieve the conservation objective.

11.5 Oyster trestles

Intertidal sediments

- Impacts

Trestles may impact a range of broadscale habitat types and FOCI, as a result of potential loss of habitat from construction/footprint of structure, creation of a hard substratum which may alter the intertidal community, changes in the benthos from biodeposition, and accumulation of shells which may alter the habitat structure (Ref: 43). There can be a decrease in the abundance of macrofauna and increase in meiofauna beneath oyster trestles (Ref: 42). The effects of biodeposition are often localised (Ref: 44). Trampling due to access to the trestles (Ref: 39) may also affect FOCI. The culture of invasive non-natives increases the risk of population establishment of species which may adversely affect habitat type and community composition (e.g. Pacific oyster) (Ref: 45).

- Evidence and quality

See references 39, 42, 43, 44 and 45.							
There is some evidence for the effects of structures on intertidal sediments, and the effects of pacific oysters on endemic habitats is also well documented, though subject to some debate on its severity .							
Directly relevant peer reviewed literature	✔	Directly relevant grey literature		Inference from studies on comparable habitats, gears or geographical areas.		Expert judgement	

- JNCC and Natural England advice

Possible management options(see introduction section 2.5 of commercial fisheries assessment)	Consequences to habitat/feature	Will the option help to meet the conservation objective?	
		Maintain	Recover
Unrestricted access	Impacts to habitats will vary significantly according to feature type and scale of cultivation. There is some potential for habitat modification with the presence of	This option may help to achieve the conservation objective but	The conservation objective may not be achieved

	hard structures and an alteration in the organic components of the sediments in some instances. Un regulated access to the cultivation sites may result in abrasion effects on the habitats, with saltmarsh species at higher risk. The use of diploid stock could elevate the risk of wild settlement of Pacific oyster.	with a risk of deterioration in condition.	under this option.
Managed access	If the use of trestles is managed in terms of number and location, then it is possible to mitigate the effects of this cultivation technique on some habitats, depending on the level of exposure and a recoverability. This will be heavily dependent on the specific broadscale habitat or feature and can only be judged at the level of individual sites.	If appropriate management is applied, this option may help to achieve the conservation objective.	If appropriate management is applied, this option may help to achieve the conservation objective.
no access	The habitat will not be subject to further modification or degradation. If there are no other unregulated pressures then recovery would be expected to take place at a natural pace.	This option will help to achieve the conservation objective.	This option will help to achieve the conservation objective.

12. SHIPPING

Throughout the UK there are a wide variety of shipping operations that occur in the marine environment. International (e.g. tankers such as Very Large Crude Carriers - VLCC), coastal (e.g. general cargo, ferries), recreational and naval shipping (e.g. frigates, submarines), and also ships associated with licensed activities (e.g. oil and gas exploration and production, renewables). The following section refers to all shipping types.

For activities requiring consent under the EIA Directive (such as the installation of renewable energy devices, marine aggregate extraction or activities associated with the exploration and production of oil and gas), developers would usually undertake a Marine Navigational Impact Assessment as part of the EIA process. The aim of this assessment is to identify and assess the marine navigational safety risks of the proposed operations including prediction of the risk of grounding, stranding and collision and contact with other vessels and/or subsea and subsurface infrastructure. The potential consequences of such incidents, with respect to seafarers, the environment, and coastal features need to be considered in any assessment.

12.1 Ships en-route: potential impacts

12.1.1 Shipping collisions potential impacts

Impacts could arise directly by collision of vessels with a feature or indirectly following ship to ship encounters or collision with subsurface or surface infrastructure leading to vessel damage and subsequent grounding.

Collision incidents could impact on the following broadscale habitats: Subtidal biogenic reefs, possibly high, medium and low energy circalittoral rock, intertidal rock, subtidal sand, mud, coarse sediment, mixed sediment and macrophyte-dominated sediments, and sublittoral coarse sediment, sand and sublittoral macrophyte-dominated sediment. Even where impacts do occur it is likely that the impact on sand habitats would be temporary and the habitats would soon recover to pre-impact form, replaced by normal tide, current and sediment motion. Collision with biogenic reef may cause significant impact and physically damage the reef to the extent that the reef is split into smaller fragments.

Species listed in the ENG as highly mobile species FOCI are unlikely to be impacted on directly by a shipping collision but could be affected if a vessel collided with their habitats. Sedentary species or slow moving species may be impacted on directly by collision with a ship or the ship colliding with its habitat (with the likely exceptions of *Gobius cobitis (*giant goby), *Gobius couchi* (couch's goby), *Hippocampus guttulattus (*long-snouted seahorse) and *Hippocampus hippocampus* (short-snouted seahorse)). The following habitat FOCI listed in the ENG could be impacted on by a shipping collision: the honeycomb worm, ross worm, horse mussel beds and blue mussel beds.

12.1.2 Risk of impacts

Direct impacts from ships travelling en-route through a site are unlikely. Shipping and other offshore industry sectors follow best practice and can demonstrate a history of safety strategies into their operations and as a result there has been a reduced risk of marine incidents. If best practice is followed no impacts should arise. Often changes to shipping legislation take some time to become practice with owners/operators. In most instances changes to "current" best practice takes the form of agreements (through the IMO) by a minimum number of countries and, until that number of countries agree to comply, then the best practice may not be adhered to by all operators.

The following have the potential to increase the risk of a collision:

- Current trends in shipping, particularly:
  - The UK's heavy reliance on shipping for the transport of goods[7], which is likely to be maintained.
  - The tendency for ships to be built larger to carry cargo more efficiently and with lower overall emissions[8]. They take longer to slow down and take longer to turn and consequently larger ships do not have the same ability to manoeuvre as smaller ships.

- Combined with increasing offshore development, particularly:
  - Existing wind farms and construction of new wind farms (and their associated infrastructure) which will aid achievement of the UK's commitments under the EU Renewable Energy Directive (2009).
  - Existing offshore developments, including oil and gas exploration and production.
  - Construction of developments to generate electricity using tidal stream energy and wave energy.

Possible increase in coastal storms as a result of climate change complicates the scenario. Although the risk of a shipping incident may be categorised as "low", the impacts from such a marine incident have the potential to be significant.

When looking at mitigation for shipping incidents there are two stages to distinguish - (1) first, the risk of an incident happening and what can be done to reduce this risk, and (2) the risk of adverse effects on conservation features should an incident occur. We do not anticipate additional mitigation in MCZ sites to reduce the risk of incidents above those already in place. Should an incident occur assessments would need to

[7] "About 95% of goods consumed or produced in the UK come and go by sea" Source: http://webarchive.nationalarchives.gov.uk/+/http://www.dft.gov.uk/pgr/shippingports/tenthingsyoudidnotknowabouts6181.

[8] "This trend is likely to accelerate as the drive towards low-carbon transport gains speed and governments look at managing down the contribution of the maritime sector to climate change emissions". Source: personal communication, A.K. Tatman, Maritime and Coastguard Agency, 26.2.2010. Response to consultation on a suite of marine SACs and SPAs.

be made on a case-by-case basis and decision would be based on the potential threats to different features both offshore and in the coastal area. Looking at the Napoli incident for example, the decision was made to ground to vessel on an offshore sandbank area rather than taking the risk to bring the vessel into harbour because at the time there was a high risk that the vessel may break up.

We do not anticipate additional mitigation in MCZ sites to reduce the risk of incidents above those already in place. For vessels operating under licensed activities (e.g. renewable and oil and gas), navigational risk assessments are carried out as part of the EIA. To reduce the risk of incidents, operators are required to notify the UK Hydrographic Office to permit the promulgation of maritime safety information and updating of nautical publications and operators are asked to seek data from the UK Hydrographic Office relating to underwater obstructions to ensure safe navigation. All vessels including commercial vessels need to comply with the International Regulations for Preventing Collisions at Sea, 1972 (as amended).

12.2 Oil spill and other pollution incidents: potential impacts

12.2.1 Oil pollution potential impacts

Oil pollution incidents could impact on the following features: all the broad-scale habitat types (even deep-sea habitats). The low energy habitats (such as the intertidal habitats) are likely to be more sensitive. Higher energy habitats may possibly benefit from the natural break up of oil.

There is a risk of oil pollution from ships. If an oil spill occurs there is a likelihood that in areas where wave energy is high (high energy infralittoral rock, high energy circalittoral rock) this will help to break up and disperse the oil slick. However, if the slick moves over the rock or towards the coastline there may be a call to use dispersants to stop the slick from impacting the coastline or possibly favoured fishing areas. The use of dispersants will break a large slick into smaller slicks and will also distribute the oil particles into the water column from the water surface. Before dispersants are used the relevant statutory nature conservation adviser(s) would be asked for an opinion on their use and would consider the environmental impacts of dispersants before agreeing to their use.

Oil pollution is not likely to affect the form of geomorphological features, but will impact the inhabitants (e.g. silver eels). Generally, oil spills have the greatest impacts on the plants and animals near shore and shallow environments. It is likely to significantly impact on biogenic reefs as the reef-forming species' feeding ability is likely to be affected. If the species forming the reef dies, other inhabitants of the biogenic reef that rely on the living reef-forming species for the structure may also be impacted. Also other biogenic reef components may suffer directly from the oil toxicity. The impacts on biogenic reef created by mussels would be very similar.

12.2.2 Risk of impacts

Internationally trading ships will comply with the International Safety Management (ISM) code and have a Shipboard Marine Pollution Emergency Plan (SOPEP) in

place to control the risk of pollution from an accident. Domestic vessels are covered by equivalent national arrangements including the Domestic Safety Management (DSM) regime.
MARPOL (The International Convention for the Prevention of Pollution from Ships) provides for implementation of controls to address marine pollution incidents. Oil spill response plans exist for all local authorities in adjacent areas and major national emergency plans are in place for major incidents, such as the National Contingency Plan for Marine Pollution from Shipping and Offshore Installations (NCP).

It is not anticipated that additional mitigation of impacts of oil pollution will be required specifically for features protected by MCZs.

12.2.3 Other pollution
There is also always a risk that toxic and non toxic contamination and nutrient and organic enrichment of sediment and the water column may occur due to accidental spillage of cargo or the release of sewage and rubbish by shipping, or very rarely the purposeful release of “tank washings” from vessels. MARPOL (The International Convention for the Prevention of Pollution from Ships) contains substantial quantities of internationally agreed design and operational requirements for ships which have been instrumental as a preventative instrument for reducing marine pollution. MARPOL also provides for implementation of controls to address marine pollution incidents. It is not anticipated that additional mitigation of impacts of pollution will be required specifically for features protected by MCZs.

Planned revisions of MARPOL being finalised within the International Maritime Organization for adoption in the 2012/13 biennium are expected to further limit discharges of waste to sea.

12.3 Ships at anchor: potential impacts

In general, ships at anchor can cause damage to the animals living in and near the seabed. In general, the impacts from anchoring on habitats and species listed for protection by MCZs are the same as the impacts listed for a shipping collision. The only way to reduce impacts would be not to anchor over features that could be impacted on.

For licensed activities such as pipeline installation work, it is best practice to micro-site anchors in order to avoid damage to sensitive features. Also, under best practice vessels would follow agreed shipping “routes” to and from the operational area to aid safe navigation, avoid contact with the seabed or man-made structures; therefore, impacts should not occur following best practise.

Anchoring of ships or small vessels over areas of sensitive habitats (for example biogenic reef*),* maerl beds, chalk communities, sea-pen and burrowing communities, fragile sponge and anthozoan communities on rocky subtidal communities) may cause significant damage. The potential impacts include:

- Direct damage to the feature from an anchor dropping onto the habitat.
- Abrasion from the anchor and anchor chain on the feature itself.
- A circular area of damage to the feature and its associated communities (plants and animals) due to the ship revolving around the anchor as a result of wind, waves, tide and current action.

Anchoring impacts on sand habitats are generally low so for the current level of shipping activity anchoring is not expected to significantly impact on sandbanks.

Anchor restrictions for licensed activities will be decided as part of EIA consultation - For sensitive habitat FOCI (such as biogenic reef), current best practice such as micro-siting of anchors/anchor chains to avoid particular sensitive features is likely to be carried out in a similar way to that currently applied for areas outside existing MCZs. Given the scale of potential impacts from anchoring, impacts on broadscale habitats that compromise the conservation objectives of a site/feature are unlikely, but this will be assessed in EIA.

Assuming that sites for sensitive FOCI would not be proposed over or near designated anchor places, then it is unlikely that there will be any additional restrictions for anchoring commercial cargo vessels.

Anchor restrictions for licensed activities will be decided as part of EIA consultation - For sensitive habitat FOCI (such as biogenic reef), current best practice such as micro-siting of anchors/anchor chains to avoid particular sensitive features is likely to be carried out in a similar way to that currently applied for areas outside existing MCZs. Given the scale of potential impacts from anchoring, impacts on broadscale habitats compromising the conservation objectives of a site/feature are unlikely, but this will be assessed in EIA.

If any anchoring restrictions are implemented for any ships these restrictions will not apply in emergencies.

12.4 Non-native and invasive species: potential impacts

Through ballast water discharge, shipping is considered a key vector for the introduction and dispersal of non-native invasive species[9] which could potentially cause disturbance to species living in a site. There are many non-native invasive species found along England's coastline and in the marine environment. Most, if not all features listed for protection by MCZs have the potential to be affected by invasive non-natives. The impact is likely to be a shift in the dominant species and further effects as a result of this initial change.

Once the International Maritime Organisation's Ballast Water Management Convention enters into force (which will ensure that best practice is followed) the risk

[9] Other pathways for introduction of non-native species include recreational yachting, hull fouling and aquaculture.

of non-native invasive species from shipping is likely to be reduced. Natural England and JNCC are working towards developing pathway management plans and codes of conduct that will sit alongside existing sector specific conventions and guidelines. The Marine Strategy Framework Directive will also be a strong driver for these. It is not anticipated that additional mitigation of impacts of non-native invasive species will be required specifically for features protected by MCZs.

12.5 Summary of impacts on habitats and species listed for protection by MCZs that could arise in the absence of MCZs (or other protected areas)

Navigational impacts are considered in the EIA process. Although collision could be an issue for listed MCZ features, following best practice should make the risk negligible. Changes in the shipping sector could lead to greater risks but it is anticipated that these would be mitigated through legislation and best practice. We do not anticipate additional mitigation in MCZ sites to reduce the risk of incidents above those already in place.

Oil pollution incidents could impact on all the broad-scale habitat types. However, due to the legislation in place It is not anticipated that additional mitigation of impacts of oil pollution will be required specifically for features protected by MCZs. Other types of pollution are also legislated for and mitigated through MARPOL.

In general, ships at anchor can cause damage to the animals living in and near the seabed and should be considered in recommendations for sites. The impacts and mitigation are discussed in detail above. If any anchoring restrictions are implemented for any ships these restrictions will not apply in emergencies.

Once the International Maritime Organisation's Ballast Water Management Convention enters into force (which will ensure that best practice is followed) the risk of non-native invasive species from shipping is likely to be reduced.

13. WATER QUALITY

4.1 Potential impacts of water quality on interest features

Pollution from the land (e.g. industrial discharges, agriculture and development) could potentially impact on interest features in the site through changes in physico-chemical conditions of the water column or sediment, such as effects on temperature, turbidity, salinity, nutrient and organic matter status, and the presence/concentration of toxic substances. Impacts can also be positive, if specific requirements are placed upon developers to take account of water quality standards followed up by monitoring.

The risk will depend on the dilution and hydrodynamics of particular sites, and the nature and severity of the pollution, though in many cases high levels of dilution are likely to reduce the risk of significant impact. Local impacts are possible, particularly where circulation is restricted, such as in estuaries or bays. A number of areas have been identified as at risk of eutrophication and some more persistent contaminants have widespread occurrence in marine biota.

4.2 Summary statement of potential environmental impacts if a site is not designated

Pollution from the land could potentially lead to changes in water quality at sea and in turn impact on the resident biology. The Water Framework Directive (WFD) will be addressing freshwater, transitional and coastal (out to 1nm) water quality issues where they coincide with Water Bodies (designated under WFD) through a programme of Measures identified via a risk based assessment of meeting the various parameters. The Directive also includes requirements to address sources of diffuse pollution. The timing and effectiveness of these Measures will vary between sites depending on cost-effectiveness and technical feasibility, though the overall objective of the WFD will be to attain Good Ecological Status/Good Ecological Potential by 2027.

It should be noted that a review of consents relating to the Habitats Directive for many ongoing activities that may impact water quality has been completed recently. Any changes to permitted activities would need to be re-assessed and if required compensated for using the Water Framework Directive water quality standards which are the most stringent guidelines followed.

The Marine Strategy Framework Directive requires Good Environmental Status (GES) for the marine environment to be achieved by 2020. GES is described within Article 3 (5) as, *'environmental status of marine waters where these provide ecologically diverse and dynamic oceans which are clean, healthy and productive within their intrinsic conditions...'* There are 11 high level descriptors for GES based on sustainable use, not pristine state, including one on marine litter and concentration of contaminants. Member States have to have described GES for own waters by 2012, which in part includes an initial assessment of pressures and impacts covering such topics as contamination by hazardous substances and organic/nutrient enrichment. Identifying Measures and Indicators for GES is currently underway, and as progress is made towards the 2020 deadline, broader water quality issues should be addressed to achieve GES.

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15. ACRONYMS

Acronym	Meaning
BAP	Biodiversity Action Plan
DECC	Department of Energy and Climate Change
EIA	Environmental Impact Assessment
EMEC	European Marine Energy Centre
EMF	Electromagnetic force
ENG	Ecological Network Guidance
FEPA	Food and Environmental Protection Act
FOCI	Features of Conservation Interest
IFCA	Inshore Fisheries and Conservation Authority
JNCC	Joint Nature Conservation Committee
MARPOL	The International Convention for the Prevention of Pollution from Ships
MCAA	Marine and Coastal Access Act
MCZ	Marine Conservation Zone
MMO	Marine Management Organisation
MOD	Ministry of Defence
OSPAR	Oslo and Paris Convention for the protection of the marine environment of the North Atlantic
RSA	Recreational Sea Angling
SAC	Special Area of Conservation
SEA	Strategic Environmental Assessment
SNCB	Statutory Nature Conservation Body
SSS	side scan sonar
WFD	Water Framework Directive

APPENDIX 1: Version control details for whole document and each section

Following are a series of tables that illustrate the version control practiced in regards to the development of this document. The first table relates to the overall co-ordination of the document and accumulating all the sections into one. The tables following that provide details for each section (in the order presented in this document) relating to the various sectors and topics. All version one authors and reviewers are from JNCC and Natural England, as are those in version two box where the external review comments were incorporated.

FULL DOCUMENT VERSION CONTROL Advice for Marine Conservation Zones and human activities	
Request to specialists: Rebecca Clarke, Natural England Co-ordination of specialists: Aisling Lannin and Tammy Smalley, Natural England	
Final Draft Version 1	Date prepared: 4th May 2011 Prepared by: multiple authors – see each section version control record Externally reviewed by: multiple reviewers – see each section version control record Internal final review by – Edward Mayhew, Natural England
External Quality Assessment	Date reviewed: 5-16th May 2011 Reviewed by: Andrew Beattie, Michael Coyle and Brian Hawkins, Marine Management Organisation
Final Draft Version 2 (inclusion of external comments)	Date prepared: 18th May 2011 Prepared by: Tammy Smalley
Proposed final draft (V2)	MCZ Project Board Reviewed & Approved by: James Marsden and Kathleen Cameron Date Approved: 1st to 3rd June 2011 Prepared by: Tammy Smalley & Lydia Barnes Date of final version: 6th June 2011

AGGREGATE EXTRACTION	
Version 1	Date prepared: 11th March 2011 Prepared by: Ian Reach, Simone Pfeifer, Finlay Bennet Reviewed by: Rebecca Clark
External Quality Assessment	Date reviewed: 11th March 2011 Reviewed by: - Mark Russell of BMAPA - Prof. Mike Cowling of The Crown Estate

Version 2	Date prepared: 22nd March 2011 Prepared by: Ian Reach, Simone Pfeifer, Finlay Bennet Reviewed by: Rebecca Clark, Aisling Lannin

CABLES	
Version 1	Date prepared: 11th March 2011 Prepared by: James Bussell, Simone Pfeifer and Finlay Bennet Reviewed by: Rebecca Clark
External Quality Assessment	Date reviewed: 16th March 2011 Reviewed by: - Michael Newell, Science Adviser at MALSF - Rob Struzyna, Peter Jamieson and Anthony Zymelka at UK Cable Protection Committee - Rachel McCall, Senior Environment Consultant at Project Management Support services Ltd
Version 2	Date prepared: 17th March 2011 Prepared by: James Bussell and Simone Pfeifer Reviewed by: Rebecca Clark, Aisling Lannin

COASTAL DEFENCE	
Version 1	Date prepared: 28th February 2011 Prepared by: Jon Curson Reviewed by: Tammy Smalley
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Version 2	Date prepared: 1st April 2011 Prepared by: Tammy Smalley Reviewed by: Aisling Lannin

ELECTRICITY FROM RENEWABLE ENERGY SOURCES	
Version 1	Date prepared: 11th March 2011 Prepared by: Victoria Copley, Simone Pfeifer and Finlay Bennet Reviewed by: Rebecca Clark
External Quality Assessment	Date reviewed: 17th March 2011 Reviewed by: - Maria Scarlett, Gero Vella and Kit Hawkins, Centrica - Keith Henson, DONG - Sophie Barrell, Forewind

	- Stephanie Merry, Renewable Energy Association - Andrew Prior, RPS - Jamie May, RWE - Mandy Gloyer, Scottish Power Renewables - Andrew Finlay, The Crown Estate - Michael Huntingford, Zero Carbon Marine
Version 2	Date prepared: 18th March 2011 Prepared by: Victoria Copley Reviewed by: Rebecca Clark, Aisling Lannin

MILITARY ACTIVITIES	
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External Quality Assessment	Date reviewed: 12th April 2011 Reviewed by: Rod Jones, MOD - Royal Navy
Version 2	Date prepared: 13th April 2011 Prepared by: Ollie Payne Reviewed by: Sonia Mendes

NAVIGATIONAL DREDGING AND DREDGE MATERIAL DISPOSAL	
Version 1	Date prepared: 10th March 2011 Prepared by: Nikki Hiorns and Simone Pfeifer Reviewed by: Rebecca Clark
External Quality Assessment	Date reviewed: 18th March 2011 Reviewed by: - Peter Barham, Seabed Users Group - Derek McGlashan, Forth Ports PLC - Liz English, ABP - Andy Birchenough, Cefas
Version 2	Date prepared: 21st March 2011 Prepared by: Nikki Hiorns Reviewed by: Rebecca Clark, Aisling Lannin

OIL, GAS AND CARBON CAPTURE STORAGE

Version 1	Date prepared: 10th March 2011 Prepared by: Steve Benn, Simone Pfeifer and Finlay Bennet Reviewed by: Rebecca Clark, Aisling Lannin
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RECREATION	
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External Quality Assessment	Date reviewed: 16th March 2011 Reviewed by: Neal Hill and colleagues, RYA
Version 2	Date prepared 17th March 2011 Prepared by: Aisling Lannin Reviewed by: Rebecca Clark

RECREATIONAL SEA ANGLING AND DIVER FISHING	
Version 1	Date prepared: 15th March 2011 Prepared by: Audrey Jones Reviewed by: Helen Stevens
External Quality Assessment	Date reviewed: 23rd March 2011 Reviewed by: Kevin Denham, Cefas
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SHELLFISH LAYS (clams, mussels and oysters)	
Version 1	Date prepared: 17th February 2011 Prepared by: Audrey Jones Reviewed by: Helen Stevens
External Quality Assessment	Date reviewed: 22nd March 2011 Reviewed by: Mike Gubbins and Keith Jeffrey, Cefas
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SHIPPING	
Version 1	Date prepared: 11th March 2011 Prepared by: Steve Benn, Simone Pfeifer and Finlay Bennet Reviewed by: Rebecca Clark
External Quality Assessment	Date reviewed: 31st March 2011 Reviewed by: Jonathon Simpson, Maritime & Coastguard Agency
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WATER QUALITY	
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External Quality Assessment	Date reviewed: 22nd March 2011 Reviewed by: Sarah Peaty, Lindsey Tucker and Antonia Scarr, Environment Agency
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APPENDIX 2: Interest Features (habitat & species) as listed within the Ecological Network Guidance for protection by Marine Conservation Zones

Table A2.1: Broad-scale habitats to be protected within MPAs in each regional MCZ project area where they occur.

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

Broad-scale habitat types	EUNIS Level 3 habitat code
Deep-sea bed***	A6

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

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

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

Table A2.2: Habitat FOCI to be protected within MPAs in each regional MCZ project area where they occur.*

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

Peat and clay exposures
Honeycomb worm (*Sabellaria alveolata*) reefs
Ross worm (*Sabellaria spinulosa*) reefs
Seagrass beds
Sheltered muddy gravels
Subtidal chalk
Subtidal sands and gravels
Tide-swept channels

*Habitat FOCI have been identified from the OSPAR List of Threatened and/or Declining Species and Habitats and the UK List of Priority Species and Habitats (UK BAP). Those habitats that are known to be sufficiently conserved under the EC Habitats Directive, or are not known to occur in the area covered by the regional MCZ projects are excluded from this list of habitats of conservation importance (see Annex 2 of the ENG for full details).

**Note that this habitat only covers 'natural' beds on a variety of sediment types, and excludes artificially created mussel beds, and mussel beds which occur on rock and boulders.

***Cold-water coral reefs, coral gardens, deep-sea sponge aggregations and file shell beds currently do not have distribution data which demonstrate their presence in the MCZ Project area, but expert knowledge of their broad geographic distribution suggests they may occur within the MCZ Project area and if new distribution information becomes available they should be protected.

Table A2.3: Low or limited mobility species FOCI to be protected within MPAs in each regional MCZ project area where they occur.*

Scientific name	**Common Name**	**Taxon group**
Padina pavonica	Peacock's tail	Brown alga
Cruoria cruoriaeformis	Burgundy maerl paint weed	Red alga
Grateloupia montagnei	Grateloup's little-lobed weed	Red alga
Lithothamnion corallioides	Coral maerl	Red alga
Phymatolithon calcareum	Common maerl	Red alga
Alkmaria romijni	Tentacled lagoon-worm**	Annelid (worm)

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

*Species FOCI have been identified from the OSPAR List of Threatened and/or Declining Species and Habitats, the UK List of Priority Species and Habitats (UK BAP) [10] and Schedule 5 of the Wildlife and Countryside Act. Those species that are known to be sufficiently

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

conserved under the EC Habitats Directive, or are not known to occur in the area covered by the regional MCZ projects, or are considered to be vagrant to the UK waters are excluded from this list of species of conservation importance (see Annex 2 for full details and Annex 3 of the ENG for further explanation).

**Those lagoonal species of conservation importance may be afforded sufficient protection through coastal lagoons designated as SACs under the EC Habitats Directive. However, this needs to be assessed by each of the regional MCZ projects.

Table A2.4: Highly mobile species FOCI to be protected within MPAs in each regional MCZ project area, where appropriate spawning, nursery or foraging grounds occur.*

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

*Species FOCI have been identified from the OSPAR List of Threatened and/or Declining Species and Habitats, the UK List of Priority Species and Habitats (UK BAP) [1] and Schedule 5 of the Wildlife and Countryside Act. Those species that are known to be sufficiently conserved under the EC Habitats Directive, or are not known to occur in the area covered by the regional MCZ projects, or are considered to be vagrant to the UK waters are excluded from this list of species of conservation importance (see Annex 2 of the ENG for full details and Annex 3 for further explanation).

APPENDIX 3: Interest features to be protected by MCZs that the advice applies to in consideration of aggregate extraction

These are features that could be affected by either primary or secondary effects associated with marine aggregate extraction operations.

Broad-scale habitat types	EUNIS Level 3 habitat code
High energy infralittoral rock	A3.1
Moderate energy infralittoral rock	A3.2
Low energy infralittoral rock	A3.3
High energy circalittoral rock	A4.1
Moderate energy circalittoral rock	A4.2
Low energy circalittoral rock	A4.3
Subtidal coarse sediment	A5.1
Subtidal sand	A5.2
Subtidal mud	A5.3
Subtidal mixed sediments	A5.4
Subtidal macrophyte-dominated sediment	A5.5
Subtidal biogenic reefs	A5.6

The following Habitat FOCI may be found in regions of seabed where marine aggregate extraction is currently permitted or may occur in the future:

Habitats of conservation importance (Habitat FOCI)
Blue Mussel beds (including intertidal beds on mixed and sandy sediments)
Fragile sponge & anthozoan communities on subtidal rocky habitats
Horse mussel (*Modiolus modiolus*) beds
Mud habitats in deep water
Sea-pen and burrowing megafauna communities
Native oyster (*Ostrea edulis*) beds
Ross worm (*Sabellaria spinulosa*) reefs

Seagrass beds
Sheltered muddy gravels
Subtidal chalk
Subtidal sands and gravels

The following Species FOCI may be found in regions of seabed where marine aggregate extraction is currently permitted or may occur in the future:

Scientific name	**Common Name**	**Taxon group**
Hippocampus guttulatus	Long snouted seahorse	Bony fish
Hippocampus hippocampus	Short snouted seahorse	Bony fish
Gitanopsis bispinosa	Amphipod shrimp	Crustacean
Palinurus elephas	Spiny lobster	Crustacean
Arctica islandica	Ocean quahog	Mollusc
Ostrea edulis	Native oyster	Mollusc

APPENDIX 4: Interest features to be protected by MCZs that could be impacted in consideration of the differing renewable energy sources

Table A4.1 Features to be protected by MCZs that tidal reach and tidal stream generation advice applies to.

Feature	Cables and devices	Cables only
High energy intertidal rock		Yes
Moderate energy intertidal rock		Yes
Low energy intertidal rock		Yes
Intertidal coarse sediment		Yes
Intertidal sand and muddy sand		Yes
Intertidal mud		Yes
Intertidal mixed sediments		Yes
Coastal saltmarshes and saline reedbeds		Yes
Intertidal sediments dominated by aquatic angiosperms		Yes
Intertidal biogenic reefs		Yes
High energy infralittoral rock	Yes	
Moderate energy infralittoral rock	Yes	
Low energy infralittoral rock		Yes
High energy circalittoral rock	Yes	
Moderate energy circalittoral rock	Yes	
Low energy circalittoral rock		Yes
Subtidal coarse sediment	Yes	
Subtidal sand	Yes	
Subtidal mud		Yes
Subtidal mixed sediments	Yes	

Subtidal macrophyte-dominated sediment	Yes	
Subtidal biogenic reefs	Yes	
Deep-sea bed	Yes	
Blue Mussel beds (including intertidal beds on mixed and sandy sediments)	Yes	
Estuarine rocky habitats		Yes
Fragile sponge & anthozoan communities on subtidal rocky habitats	Yes	
Intertidal underboulder communities		Yes
Littoral chalk communities		Yes
Maerl beds	Yes	
Horse mussel (*Modiolus modiolus*) beds	Yes	
Sea-pen and burrowing megafauna communities	Yes	
Native oyster (*Ostrea edulis*) beds		Yes
Peat and clay exposures	Yes	
Honeycomb worm (*Sabellaria alveolata*) reefs	Yes	
Ross worm (*Sabellaria spinulosa*) reefs	Yes	
Seagrass beds		Yes
Sheltered muddy gravels		Yes
Subtidal chalk	Yes	
Subtidal sands and gravels	Yes	
Tide-swept channels	Yes	

Table A4.2 Features to be protected by MCZs that wave generation advice applies to.

Feature	Cables and devices	Cables only
High energy intertidal rock	Yes	
Moderate energy intertidal rock	Yes	
Low energy intertidal rock		Yes
Intertidal coarse sediment		Yes
Intertidal sand and muddy sand		Yes
Intertidal mud		Yes
Intertidal mixed sediments		Yes
Coastal saltmarshes and saline reedbeds		Yes
Intertidal sediments dominated by aquatic angiosperms		Yes
Intertidal biogenic reefs		Yes
High energy infralittoral rock	Yes	
Moderate energy infralittoral rock	Yes	
Low energy infralittoral rock		Yes
High energy circalittoral rock	Yes	
Moderate energy circalittoral rock	Yes	
Low energy circalittoral rock		Yes
Subtidal coarse sediment	Yes	
Subtidal sand	Yes	
Subtidal mud		Yes
Subtidal mixed sediments	Yes	

Subtidal macrophyte-dominated sediment	Yes	
Subtidal biogenic reefs	Yes	
Blue Mussel beds (including intertidal beds on mixed and sandy sediments)	Yes	
Estuarine rocky habitats		Yes
Fragile sponge & anthozoan communities on subtidal rocky habitats	Yes	
Intertidal underboulder communities		Yes
Littoral chalk communities		Yes
Maerl beds	Yes	
Horse mussel (*Modiolus modiolus*) beds	Yes	
Mud habitats in deep water	Yes	
Sea-pen and burrowing megafauna communities	Yes	
Native oyster (*Ostrea edulis*) beds		Yes
Peat and clay exposures	Yes	
Honeycomb worm (*Sabellaria alveolata*) reefs	Yes	
Ross worm (*Sabellaria spinulosa*) reefs	Yes	
Seagrass beds		Yes
Sheltered muddy gravels		Yes
Subtidal chalk	Yes	
Subtidal sands and gravels	Yes	

Table A4.3 Features to be protected by MCZs that wind generation advice applies to.

Feature	Cables and arrays	Cables only
Moderate energy intertidal rock		Yes
Low energy intertidal rock		Yes
Intertidal coarse sediment		Yes
Intertidal sand and muddy sand		Yes
Intertidal mud		Yes
Intertidal mixed sediments		Yes
Coastal saltmarshes and saline reedbeds		Yes
Intertidal sediments dominated by aquatic angiosperms		Yes
Intertidal biogenic reefs		Yes
Moderate energy infralittoral rock		Yes
Low energy infralittoral rock		Yes
High energy circalittoral rock		Yes
Moderate energy circalittoral rock	Yes	
Low energy circalittoral rock	Yes	
Subtidal coarse sediment	Yes	
Subtidal sand	Yes	
Subtidal mud	Yes	
Subtidal mixed sediments	Yes	
Subtidal macrophyte-dominated sediment	Yes	
Subtidal biogenic reefs	Yes	
Blue Mussel beds (including intertidal beds on mixed and sandy sediments)	Yes	
Estuarine rocky habitats		Yes

Fragile sponge & anthozoan communities on subtidal rocky habitats	Yes	
Intertidal underboulder communities		Yes
Littoral chalk communities		Yes
Maerl beds	Yes	
Horse mussel (*Modiolus modiolus*) beds	Yes	
Mud habitats in deep water	Yes	
Sea-pen and burrowing megafauna communities	Yes	
Native oyster (*Ostrea edulis*) beds		Yes
Peat and clay exposures	Yes	
Honeycomb worm (*Sabellaria alveolata*) reefs	Yes	
Ross worm (*Sabellaria spinulosa*) reefs	Yes	
Seagrass beds		Yes
Sheltered muddy gravels		Yes
Subtidal chalk	Yes	
Subtidal sands and gravels		Yes

APPENDIX 5: Interest features to be protected by MCZs that could be impacted in consideration of navigational dredging and dredge material disposal

The following MCZ Broad Scale Habitats could potentially be affected by navigation dredging (capital and maintenance) and dredge material disposal. It should be noted, the list of features affected by disposal may increase depending on the location of dredge disposal sites.

Broad-scale habitat types	**EUNIS Level 3 habitat code**
Intertidal coarse sediment	A2.1
Intertidal sand and muddy sand	A2.2
Intertidal mud	A2.3
Intertidal mixed sediments	A2.4
Coastal saltmarshes and saline reedbeds	A2.5
Intertidal sediments dominated by aquatic angiosperms	A2.6
Intertidal biogenic reefs	A2.7
Subtidal coarse sediment	A5.1
Subtidal sand	A5.2
Subtidal mud	A5.3
Subtidal mixed sediments	A5.4
Subtidal macrophyte-dominated sediment	A5.5
Subtidal biogenic reefs	A5.6

Habitat FOCI which could potentially be affected by navigation dredging (capital and maintenance) and dredge material disposal associated with the above broad scale habitats include:

Habitat FOCI
Estuarine rocky habitats
Maerl beds
Horse mussel (*Modiolus modiolus*) beds
Sea-pen and burrowing megafauna communities
Native oyster (*Ostrea edulis*) beds
Peat and clay exposures

Honeycomb worm (*Sabellaria alveolata*) reefs
Ross worm (*Sabellaria spinulosa*) reefs
Seagrass beds
Sheltered muddy gravels
Subtidal chalk
Subtidal sands and gravels
Tide-swept channels

Species FOCI which could potentially be affected by navigation dredging (capital and maintenance) and dredge material disposal associated with the above broad scale habitats include:

Species FOCI		
Scientific name	**Common Name**	**Taxon group**
Cruoria cruoriaeformis	Burgundy maerl paint weed	Red alga
Grateloupia montagnei	Grateloup's little-lobed weed	Red alga
Lithothamnion corallioides	Coral maerl	Red alga
Phymatolithon calcareum	Common maerl	Red alga
Alkmaria romijni	Tentacled lagoon-worm**	Annelid (worm)
Gobius couchi	Couch's goby	Bony fish
Hippocampus guttulatus	Long snouted seahorse	Bony fish
Hippocampus hippocampus	Short snouted seahorse	Bony fish
Haliclystus auricula	Stalked jellyfish	Cnidarian
Lucernariopsis campanulata	Stalked jellyfish	Cnidarian
Arctica islandica	Ocean quahog	Mollusc
Atrina pectinata	Fan mussel	Mollusc
Ostrea edulis	Native oyster	Mollusc
Tenellia adspersa	Lagoon sea slug**	Mollusc
Osmerus eperlanus	Smelt	Bony fish
Anguilla anguilla	European eel	Bony fish

The list includes migratory fish and species associated with maerl beds, seagrass-seaweed, and muddy sites where dredging could occur. The potential impact of dredging on species which are restricted in distribution e.g. *Atrina pectinata,* is dependent on whether dredging occurs close to where the species are present.

The list does not include species restricted to lagoons (*Nematostella vectensis, Gammarus insensibilis, Tenellia adspersa),* should dredging occur within a lagoon system they should also be considered.

APPENDIX 6: Recreational activities impact assessment

Please note that the following three pages containing the table are sized at A3 for readability and although easily viewed on a computer screen will require a printer with A3 capability for producing hard copies.

<u>Key to following activity impact table</u>

Green = NKE = No known effect

Red = H = High potential impact

Orange = M = Moderate potential impact

Yellow = L = Low potential impact

Activity	Potential Impacts on Habitats	Potential Impacts on Species	Coastal saltmarshes and saline reedbeds	Other Estuarine Features	Intertidal rock	Intertidal mixed sediments	Subtidal rock	Subtidal mixed sediments	Biogenic reefs	Macrophyte-dominated habitats	Existing Controls	Effectiveness	Reference
Personal Activity													
Swimming	None	None	NKE	NKE	NKE	NKE	NKE	NKE	NKE	NKE	None Known	N/A	N/A
Surfing	None	None	NKE	NKE	NKE	NKE	NKE	NKE	NKE	NKE	None Known	N/A	N/A
Coaststeering	Physical damage through trampling, impacts, disturbance of species	Physical damage through trampling, impacts, disturbance of species	L	L	L	L	NKE	NKE	L	L	None Known other than rights of access over private land	N/A	N/A
Diving (SCUBA & Snorkelling)													
Diver Physical Impacts	None	Fin Kicks & Other Collision	NKE	NKE	NKE	NKE	L	NKE	L	NKE	None Known	N/A	N/A
Trophy Collection	None	Taking of photogenic species such as *Pentapora, Eunicella* and some sponges	L	L	L	NKE	L	NKE	NKE	L	None Known	N/A	N/A
Diver Fishing (Spear Fishing & Hand Collection)	None	Removal of species such as *Ensis, Pecten, Cancer, Homarus* & various fish species	NKE	NKE	NKE	NKE	L	L	L	NKE	None Known if for personal consumption	N/A	N/A
Boating													
Boating Infrastructure													
Construction of recreational boating infrstructure (marinas, slipways etc)	Complete loss of habitats, pollution of surrounding habitats	Complete loss of habitats, pollution of surrounding habitats	H	H	M	H	M	M	H	M	Planning Application and FEPA	Well managed with EIAs required for major developments through planning legislation	Regulation 10 of the Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999 / Food and Environmental Protection Act 1985.
Leachate from infrastructure	Pollution of surrounding habitats & species	Pollution of surrounding habitats & species	M	L	L	L	L	L	L	L	Planning Application and FEPA	Well managed with EIAs required for major developments.	As above
Shading	Loss of algal assemblege habitats	Loss of individual algal species and associated infauna	M	L	M	L	L	L	L	M	Planning Application and FEPA	Although controls are present, these rely on correct assessment of impacts and best practice mitigate of effects.	As above
Moorings	Physical damage from both installation and operational use	Particularly damaging to seagrass and maerl	M	L	L	M	L	M	M	M	Generally FEPA licence required but Harbour authorities may also have block licence and may regulate moorings within their own harbour boundaries	FEPA applications not always submitted & harbour authorities may not have detailed enough knowledge to regulate mooring placement & type well enough to prevent damage.	Food and Environmental Protection Act 1985. Andy Brigden (Maritime Manager Cornwall Council): Personal Communication.
Use of Boats													

Anchoring	Physical damage from deployment and recovery of anchors and swinging chains	Particularly damaging to seagrass and maerl	L	M	L	L	L	M	M	M	Harbour orders / local authority bye laws	At peak times, harbour authorities generally police well, however outside immediate harbour confines, control of impacts rely of voluntary best practice. These are often poorly policed and also generally unenforceable.	Example papers of Impacts (Francour et al., 1999; Montefalcone et al., 2008; Montefalcone et al., 2006) Recreational Boaters attitides (LLORET et al., 2008).
Sewage & grey water	Pollution of surrounding habitats & species	Pollution of surrounding habitats & species	M	L	L	L	L	L	L	L	None Known (for private recreational vessels)	Discharges of black & grey water from commercial vessels are controlled under MARPOL IV. However, this has not been ratified for private vessels. PPG 14, 8b states that “discharges from seas toilets are not prohibited” but “the use of toilets with storage tanks is recommended in preference. It is poorly monitored and even for smaller commercial vessels (up to 12 passengers) rarely enforced.	Marpol 73/78. General lack of research of untreated sewage from recreational boats on estuarine habitats but: Impacts on fish and shellfish (HELLIN et al., 2004) Impacts on water quality (eutrophication) (USEPA, 1996) Impacts on water quality loss of algal assemblage (ENVIRONMENT, 2002)
Litter	Pollution of surrounding habitats & species	Pollution of surrounding habitats & species	M	L	L	L	L	L	L	L	MARPOL regs	Disposal of litter into the marine environment from all vessels is controlled under MARPOL V. Although harbour authorities have to have waste receptions facilities, it is poorly monitored and even for smaller commercial vessels (up to 12 passengers) rarely enforced.	Marpol 73/78. KJC Personal Experience.
Fuel, oil and lubricants	Pollution of surrounding habitats & species	Pollution of surrounding habitats & species	H	M	M	M	L	L	L	M	MARPOL regs	Discharges of fuels and oils from all vessels are controlled under MARPOL I. Although ports and harbours have to have pollution response plans, small but chronic fuel & oil leaks continue and at times is poorly monitored.	Marpol 73/78. (GESAMP, 2007)
Antifouling	Pollution of surrounding habitats & species	Pollution of surrounding habitats & species	L	L	L	L	L	L	L	L	MARPOL regs	Use of TBTs has been banned and although the alternatives can be equally polluting.	Marpol 73/78. (BOXALL et al., 2000) (MATTHIESSEN et al., 1999)

Zinc anodes	Pollution of surrounding habitats & species	Pollution of surrounding habitats & species	L	L	L	L	L	L	L	L	None known for anode use, disposal controlled under MARPOL	As most replacement takes place within controlled areas (marinas etc), disposal is not thought to be a problem. For beach haul outs, see below	Marpol 73/78. (MATTHIESSEN et al., 1999)
Invasive species	Competition for space, resources, loss of habitats & species	Competition for space, resources, loss of habitats & species	M	M	M	M	M	M	M	M	Ballast water discharge controlled under MARPOL	MARPOL regs control discharges when moving between wide areas. However, local movement,(i.e. around the UK coast or in northern EU waters) not controlled. Hull fouling and private vessel discharges no controlled. Best practice guidance for movement of pontoons sought.	Marpol 73/78. (ARENAS et al., 2006)
Boat Launching	Physical impacts leading to loss of habitats & species	Physical impacts leading to loss of habitats & species	L	L	L	L	NKE	NKE	L	L	Land Owner / Harbour Authority Control	The majority of boat launching tales place on formal slipways. However lighter boats can be launched and recovered over intertidal habitats. This is generally poorly policed.	No source reference found.
Boat Haulouts (for hull cleaning / maintenance)	Physical impacts leading to loss of habitats & species	Physical impacts leading to loss of habitats & species	M	L	M	M	L	L	M	M	Land Owner / Harbour Authority Control	Beach haul outs are popular for hull maintenance (cleaning / anode replacement / antifouling / repairs) as they are free. However, waste materials from such operations are often left in situ as few, if any, waste disposal facilities are available close at hand. This is generally poorly policed.	Andy Brigden (Maritime Manager Cornwall Council): Personal Communication. (STEVENSON, UNDATED)
Boat disposal (abandonment)	Physical impacts leading to loss of habitats & species	Physical impacts leading to loss of habitats & species	M	L	L	L	L	L	M	L	Land Owner / Harbour Authority Control	Abandonment of unwanted vessels in estuaries difficult to police and control. Can be expensive for local authorities / land owners therefore vessels often left to degrade and pollute local habitats.	Andy Brigden (Maritime Manager Cornwall Council): Personal Communication. (STEVENSON, UNDATED)