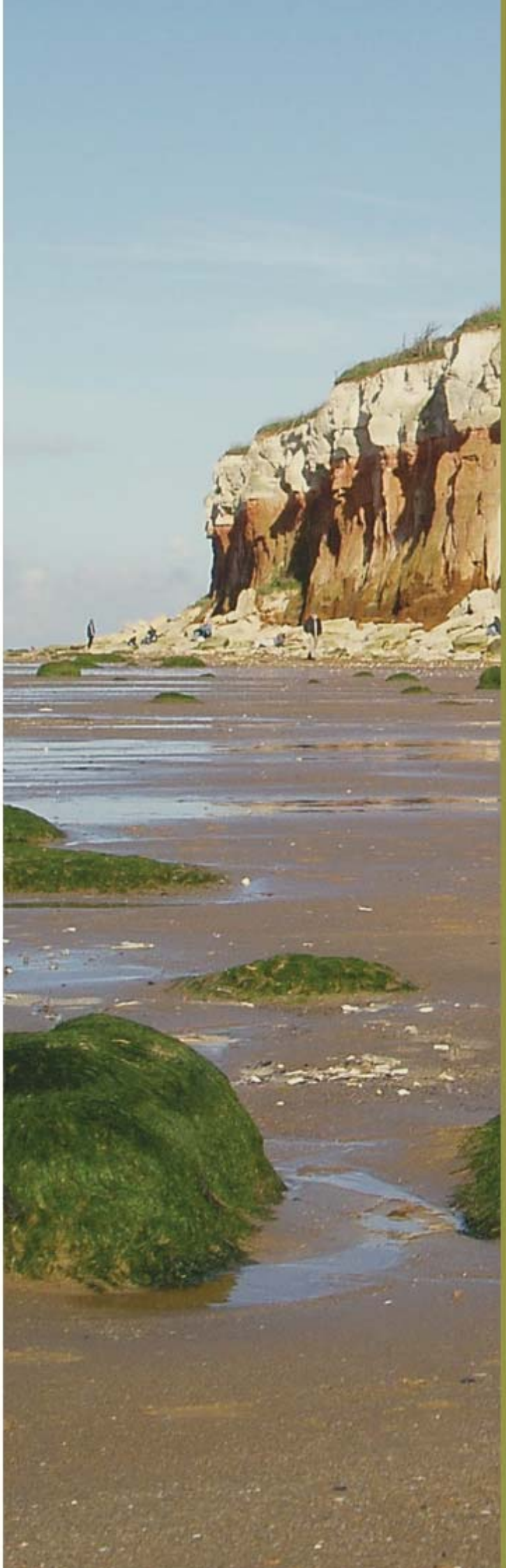
Marine Management Organisation

Strategic Scoping Report for marine planning in England

August 2013



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Executive summary

Through the Marine and Coastal Access Act 2009[1] (MCAA), the UK Government introduced a number of measures to deliver its vision of "clean, healthy, safe, productive and biologically diverse oceans and seas", including the introduction of a marine planning system. The aim of marine planning is to help ensure a sustainable future for our coastal and offshore waters through managing the many activities, resources and assets in our marine area. Marine plans will create a seamless management system covering the whole of England's marine area (11 plan areas in total). Starting with the East Inshore and East Offshore marine plans and followed by the South Inshore and South Offshore marine plans, the completed set of plans will be generated on a rolling programme expected to be completed by 2021.

Before planning begins in the South, it is important that we consider how activities, resources and ecosystems vary spatially across all 11 marine plan areas, in order to understand the specific characteristics of each. Most activities and resources are not evenly distributed and some are constrained by their particular physical requirements such as depth, water temperature, substrate type and so on. Knowing the distribution and scale of a resource within the marine plan areas and the requirements for that resource both now and in the future is critical to understanding the relative importance of that resource or activity for the marine plan.

The Strategic Scoping Exercise (SSE) first began in 2011 as a technical, evidence-gathering exercise to help bridge the gap between the overarching information provided in the Marine Policy Statement (MPS) and individual marine plans. The SSE involves an assessment of both current and future interests across all 11 marine plan areas[2] thereby ensuring a strategic approach is taken in planning activities across England's marine area and also ensuring that the needs of areas yet to be planned are identified early on.

The Strategic Scoping Report (SSR) is a non-technical summary of this exercise. The first report was published in 2011 before planning commenced in the East Inshore and East Offshore marine plan areas. The current document represents a second iteration of the SSR, a refresh undertaken prior to development of the South Inshore and South Offshore marine plans. This refresh takes account of additional information gathered by the MMO over the last two years, including a large pool of information on both current activities and future potential, gathered for plan development in the East. This has allowed the development of both the existing sections, but also a number of brand new sections including marine biomass potential and socio-economic considerations, expanding the remit of the SSR to provide greater coverage. As more evidence has been gathered on future potential activities and trends since the first iteration of this document, this has now been included within the relevant section of the report, rather than as a separate chapter.

[1] www.legislation.gov.uk/ukpga/2009/23/contents

[2] Although there are 11 plan areas, the assessment of the North West Inshore and North West Offshore areas is presented as one for the purposes of the SSR. Much of the evidence used to inform the SSR is based on strategic level assessments, which would be difficult to represent separately for the North West plan areas due to their relatively small area.

The marine plan areas

The North East marine plan areas appear to be less busy than many of the others, although they still have a wide variety of activities ranging from oil and gas in the offshore to surfing in the inshore. There are three new marine conservation zones (MCZs) recommended for designation in 2013 and the area is home to a variety of important wildlife including a major grey seal breeding colony at the Farne Islands.

The East marine plan areas have the largest and most diverse range of activities as well as the greatest potential for future change – factors that strongly influenced the decision to plan in these areas first. The area is important for current and future energy production both from oil and gas and renewables – particularly offshore wind farms. The areas also have a large proportion of marine-won aggregate, a nationally important shellfishery and many environmental designations.

The South East Inshore Marine Plan Area is a densely populated area with many activities competing for space. Shipping activity is high in this area, which is home to many important ports such as Felixstowe and Dover. The area is also important for offshore wind production with a number of Round 1 and Round 2 wind farms.

The South marine plan areas are particularly important for tourism and recreation, including specifically recreational boating. Fishing is prevalent throughout the areas particularly for vessels under 10 metres and the offshore area provides important shipping routes through to Europe and beyond.

The South West marine plan areas are important for recreational activity, particularly surfing which contributes significantly to the local economy. Both marine plan areas represent significant opportunity for the production of wave and tidal energy with several test sites already established. Fishing is also important with Plymouth and Newlyn landing particularly high volumes of fish.

The North West marine plan areas have a very dense level of activity, particularly ports and shipping and oil and gas production facilities. Offshore wind farms are active with several Round 1 and Round 2 in operation or under construction. Fishing, both for shellfish and finfish, remains an activity benefiting local employment and with economic significance.

1. Introduction

Through the Marine and Coastal Access Act 2009[3] (MCAA), the UK Government introduced a number of measures to deliver its vision of "clean, healthy, safe, productive and biologically diverse oceans and seas", including the introduction of a marine planning system. The aim of marine planning is to help ensure a sustainable future for our coastal and offshore waters through managing the many activities, resources and assets in our marine area. It follows a similar approach to terrestrial planning, setting the direction for decision making at a local level to lead to efficient and sustainable use of our marine resources.

In 2011 the Department for Environment, Food and Rural Affairs (Defra) recommended a series of marine plan areas for the English inshore and offshore marine regions to the MMO. The boundaries for these areas were identified following stakeholder and other expert input throughout the progress of the Marine Bill (now the MCAA) and were also subject to a specific consultation in 2010[4]. The completed set of plans will create a management system covering the whole English marine area, integrated with the plans (where present) of neighbouring countries at the borders. The plans are being produced on a rolling programme which is expected to be complete by 2021.

1.1 National policy context

The MPS provides the policy framework for the preparation of marine plans, establishing how decisions affecting the marine area should be made in order to enable sustainable development. It is the national component of the UK-wide marine planning system and where plans are not currently in place, provides the basis for decision making. The MPS built upon the shared UK-wide high level marine objectives[5] which set out the broad outcomes for the marine area and reflects the principles for sustainable development. These include:

- achieving a sustainable marine economy
- ensuring a strong, healthy and just society
- living within environmental limits
- promoting good governance
- using sound science responsibly

The MPS does not provide specific guidance on every activity which will take place in, or otherwise affect, UK waters. The MPS provides a framework for development of marine plans to ensure necessary consistency in policy goals, principles and considerations that must be taken into account, including in decision making. It identifies those activities to which a degree of consideration is expected to be given in marine planning, but does not state and is not intended to imply which activities should be prioritised over any others. Relative priorities will be most appropriately

[3] www.legislation.gov.uk/ukpga/2009/23/contents

[4] Defra consultation on marine plan areas within the English inshore and English offshore marine regions http://webarchive.nationalarchives.gov.uk/20101109165532/http://www.defra.gov.uk/corporate/consult/marine-plan/index.htm

[5] http://archive.defra.gov.uk/environment/marine/documents/ourseas-2009update.pdf

determined through the marine planning process, taking into account a wide range of factors alongside UK policy objectives, including the specific characteristics of the individual marine plan area.

As well as the MPS[6], marine plans must conform with other UK national policy including that in support of the Planning Act 2008[7], National Planning Policy Framework (NPPF)[8], national policy statements (NPSs) such as those for ports[9] and energy[10] and the procedures for consents of nationally significant infrastructure projects[11].

1.2 Marine plans

While the purpose of the MPS is to set out the policy framework for our seas at a UK level, it is the role of marine plans to set out how the MPS will be implemented in specific areas. The plans give an area-specific expression of the MPS (and other national policy) taking into account the characteristics of each marine plan area. They will present and interpret national policies and create area-specific policy, spatially where appropriate, for the management of marine resources and activities. In doing so they will help to ensure that individual decisions within a marine plan area make the appropriate contribution to UK, national and area specific policy objectives.

Marine plans will need to be forward looking and in particular, through monitoring and review processes, ensure flexibility to anticipate and accommodate a range of future demands and scenarios. This includes new evidence, innovation and evolving technologies and techniques. The MPS and marine planning system will sit alongside and interact with existing planning regimes across England and more widely in the UK. These include land planning and the development consent order regime for nationally significant infrastructure projects (NSIPs).

Marine plans will cover the whole of England's marine area (see Figure 1 below). Plans will be produced for each of the areas shown, starting with the East Inshore and East Offshore marine plans and followed by the South Inshore and South Offshore areas. For further details on the geographic scope and area boundaries see Chapter 2 of 'A description of the marine planning system for England'[12].

[6] Marine and Coastal Access Act s.51 (6)
[7] Planning Act 2008 www.communities.gov.uk/documents/planningandbuilding/pdf/1521327.pdf
[8] www.gov.uk/government/uploads/system/uploads/attachment_data/file/6077/2116950.pdf
[9] http://assets.dft.gov.uk/publications/national-policy-statement-for-ports/111018-ports-nps-for-das.pdf
[10] www.gov.uk/government/uploads/system/uploads/attachment_data/file/47854/1938-overarching-nps-for-energy-en1.pdf
[11] Planning Act 2008 – section 14
[12] http://archive.defra.gov.uk/corporate/consult/marine-planning/110318-marine-planning-descript.pdf

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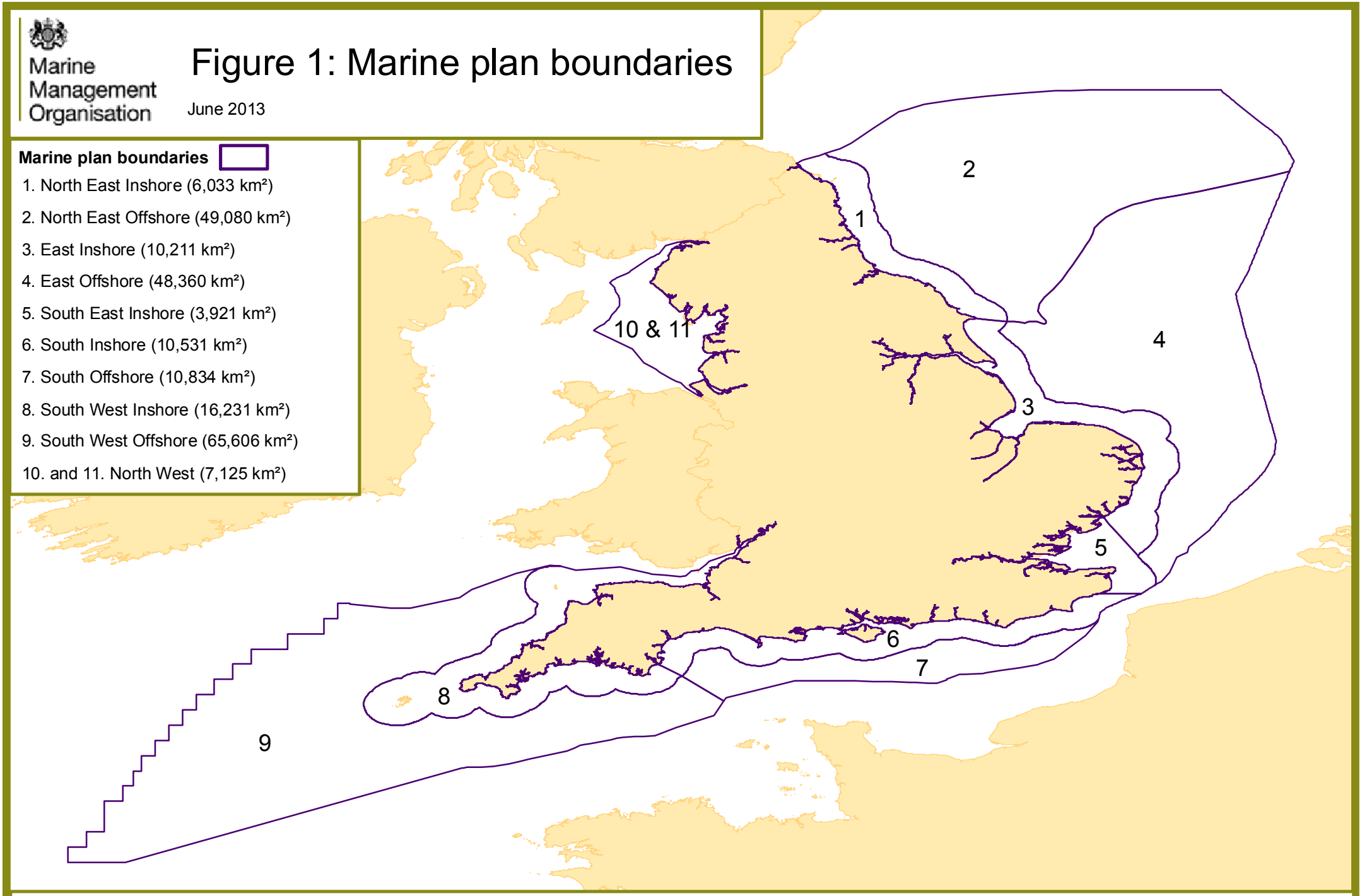
Figure 1: Marine plan boundaries

June 2013



1.3 Strategic scoping exercise and report

The Strategic Scoping Exercise (SSE) first began in 2011 before planning started in the East Inshore and East Offshore areas as a technical, evidence-gathering exercise to help bridge the gap between the overarching information provided in the MPS and individual marine plans. It constitutes an assessment of how activities, resources and ecosystems vary spatially across all 11 marine plan areas and enables the MMO to understand the specific characteristics of each. The SSE is not specified in provisions within the MCAA but has been developed by drawing on best practice and input from experts in terrestrial planning, as discussed in 'A description of the marine planning system for England'[13].

The SSE is an assessment of both current and potential future interests across all 11 marine plan areas thereby ensuring a strategic view is taken to planning activities across England's marine area. It also helps ensure that the needs of areas yet to be planned are identified early on. The intent of the exercise is not to state policy, nor set objectives. It constitutes an important tool to assist the MMO, and those engaging in the development of marine plans, in understanding how realistic objectives can be developed in each marine plan area with respect to any applicable national targets. It helps to establish for England's marine area, before marine plans are formulated, how and where marine activities and resources differ by location and the spatial constraints upon them. The outputs from the exercise will be one of many components of the evidence base for every marine plan and will help to secure consistency of approach and compatibility between individual marine plans.

The main output of the SSE is a 'Strategic Scoping Report', the first of which was published in 2011. The report displays the uneven spatial distribution of activities, resources and environmental features across all 11 marine plan areas which will help facilitate plan making in each area. The focus of the report is on the current and anticipated future use of space, rather than on providing information on the social or economic values of activities or resources. Throughout the report, information has in many cases been aggregated by adjacent inshore and offshore areas to help produce suitable summaries (such as East or South West).

1.4 Scope of the 2013 SSR refresh

This document represents the second iteration of the SSR, a refresh undertaken prior to development of the South Inshore and South Offshore marine plans and taking account of additional information gathered over the last two years.

1.4.1 Evidence

This 2013 refresh builds on the evidence collated for the first iteration of this report which includes information from national projects such as Charting Progress 2 (CP2)[14], strategic environmental assessments, and other relevant major initiatives

[13] Defra 2011: http://archive.defra.gov.uk/corporate/consult/marine-planning/110318-marine-planning-descript.pdf

[14] Charting Progress 2, published in July 2010, is the authoritative report on the state of the UK seas, gathering together a significant body of evidence from marine agencies, research institutes, universities, environmental organisations and industries around the UK. Independent peer review of all the data was conducted by national and international scientists and represents the best evidence currently available.

that have been carried out by government and other organisations and partnerships such as the UK Marine Monitoring and Assessment Strategy (UKMMAS).

Since 2011 the MMO has undertaken an extensive evidence gathering exercise to support plan development in the East. This involved scoping existing evidence from partners and stakeholders such as Defra, The Crown Estate and data collected to support the Marine Conservation Zone (MCZ) Project. This evidence was shared with stakeholders through both the Marine Planning Portal[15] and the East Inshore and East Offshore Evidence and Issues Report[16] to verify its quality, relevance and completeness. Much of this evidence has been used to support the 2013 refresh, including assisting in the production of new maps and statistics.

Where evidence gaps were identified, they have been addressed as part of the MMO Strategic Evidence Plan[17] (SEP) which sets out the MMO's four-year commitment to addressing our evidence needs. It does so by:

- identifying high level priority areas for evidence considered essential for the delivery of the MMO's business targets from 2011 to 2015
- prioritising evidence commissions to support the MMO's operational functions
- identifying immediate priorities for 2011/2012
- informing Defra's Marine Evidence Programme and other relevant bodies of the MMO's priorities to facilitate strategic engagement

A number of research reports have been commissioned by the MMO in line with the SEP's objectives, many of which have been drawn on to support the refresh of this report. In some instances, new sections have been added where evidence was not previously available, for example biomass and socio-economic considerations. Evidence used to support this document refresh has been referenced throughout to allow for easy identification and for further information to be obtained if required. It is important to note that this document represents a summary of the evidence available to the MMO, focusing primarily on sources of evidence that show a spatial distinction across the 11 marine plan areas.

The level of assessment in the report is purposefully broad in terms of presenting a national picture and therefore the marine plan area summaries in chapter 3 provide only a flavour of what is important relative to other regions. These will assist with developing a vision for each plan and providing context for preparatory work in future marine plan areas. Evidence that covers only part of the marine area has not been included in this report to ensure consistency across all marine plan areas and to ensure the exercise is kept to a manageable level. The MMO will however use such data, and other relevant sub-national and local information to inform the plan-making process. All evidence used in this report has undergone the MMO's quality assurance procedure[18] to ensure it is the best available and that any limitations are made known to the MMO. This report has also undergone peer review by a number of relevant organisations to help ensure the quality of the evidence base.

[15] http://planningportal.marinemanagement.org.uk/
[16] www.marinemanagement.org.uk/marineplanning/areas/east_issues.htm
[17] www.marinemanagement.org.uk/about/publication.htm#sep
[18] www.marinemanagement.org.uk/licensing/how/data_checklist.htm

1.4.2 Future change

It is the role of marine planning to consider the activities, resources and ecosystems in each of the marine plan areas – both how they currently are but also how they may change up to 20 years into the future (based on best practice from terrestrial planning[19]). It is the aim of the SSE to consider how these assets currently vary across the different marine plan areas and how they may vary in the future. This includes consideration of how the interactions of these activities and resources may change over time.

Establishing likely future estimates of how the marine area may change over time is not an easy task. The MMO has undertaken significant work to establish both available resource and future aspirations of the users of the marine area by reviewing existing studies, talking to stakeholders about their knowledge and aspirations and commissioning new studies. A project has recently been commissioned to look at future trends in the South marine plan areas[20] to prepare for plan development here. While this report has been of limited use in assisting with the 2013 refresh (as it is localised to two marine plan areas rather that offering a national perspective), it has in some cases enabled a greater understanding of future direction.

CP2 was published in 2010 as a comprehensive report on the state of the UK seas and includes useful information on past trends and future direction of the marine environment and the activities taking place there. The information in chapter 3 (biologically diverse oceans and seas) still represents the best available evidence on the quality of the marine environment and has therefore been heavily drawn on in this report. The Marine Strategy Framework Directive (MSFD) Initial Assessment[21] reiterates much of the environmental evidence used in CP2 and has also been drawn on here. Evidence on environmental trends will continue to develop over time as a result of monitoring under MSFD, Habitats Directive and Birds Directive and may be able to feed into future iterations of this report.

In some cases the information in CP2 has been superseded by more up to date evidence, particularly on the future direction of activities with this information mostly drawn on from engagement with relevant stakeholders and recently published reports. Complementing these sources of evidence is additional futures analysis undertaken by The Crown Estate. This analysis has involved an assessment of resource areas, technical suitability and various development constraints using both expert knowledge and their Marine Resource System (MaRS) modelling tool. Such analysis has been undertaken for the following marine sectors and is set out in the relevant section of this report: wind, wave and tidal energy, cables/pipeline grid connections, marine minerals, biomass and carbon capture and storage. It should be noted that many of these maps only look at potential resource or technical suitability and do not consider development constraints resulting from existing users of the marine plan area or environmental sensitivities. More information on the methods used for the different sections of this analysis can be found in Annex 1.

[19] Defra, 2011, 'A description of a marine planning system for England' section 3.62
[20] www.marinemanagement.org.uk/evidence/index.htm
[21] www.gov.uk/government/consultations/marine-strategy-framework-directive-consultation-uk-initial-assessment-and-proposals-for-good-environmental-status

While some sectors have detailed resource maps and clear plans of how they would like to develop their activities in the future, this is not available to the same level of detail across all sectors. Information may not always be available to marine planning for commercial reasons or where a particular sector is newly emerging. As additional information becomes available it will be reflected upon in future iterations of this document.

1.4.3 Structure

The structure of the refreshed report has changed slightly since the first iteration. The most notable change being that there is no longer a separate chapter on 'future trends and opportunities'. Instead, future considerations are addressed throughout the report in their relevant section. This change reflects the growing evidence base on future trends which is now available for many more sectors since the first iteration of this report.

1.4.4 Scope for further revision and update

The SSE should be viewed as an ongoing process rather than a single report, and work on it will continue for as long as marine plans are prepared and revised. New information and data is generated all the time and the MMO will be updating its data holdings on a continuous basis.

Revisions to this Strategic Scoping Report will be published at appropriate junctures, with each new report updating and superseding the last. The MMO will continue to work in partnership with others to access datasets and map layers to add to the marine evidence base. As the marine planning evidence base develops it will continue to be drawn upon throughout the planning process, including to scope issues and develop plan policies.

2. Description of resources, uses and activities

2.1 The English marine area

The UK has a coastline of just under 20,000 miles (32,000 km). Slightly under a third of this is the English coast (including Lundy, the Isle of Wight and the Scilly Isles) at 6,261 miles (10,077 km)[22].

The total English sea area is a little less than 228,000 square km. This is defined as being the area from mean high water springs and so includes the intertidal area and extends inshore some distance up estuaries. The inshore region extends to 12 nautical miles[23] (nm) offshore and the offshore limit is the renewable energy zone (REZ) until an Exclusive Economic Zone (EEZ) is agreed by government, or the limit of the continental shelf. The sea area is divided into 11 marine plan areas, shown on Figure 1.

The largest marine plan area is the South West Offshore Marine Plan Area, at 65,606 square km, which includes 29% of the total English marine area as it extends

[22] BCS(2011) Great British data reported by the British Cartography Society at www.cartography.org.uk/default.asp?contentID=749

[23] 1 nautical mile = 1.15 miles

up to the edge of the continental shelf. The East Offshore and North East Offshore marine plan areas are also relatively large, both account for 21% each. The other areas are much smaller, the smallest being the South East inshore area at only 1.7%.

2.2 The natural environment

2.2.1 Ocean climate and acidification

Key facts

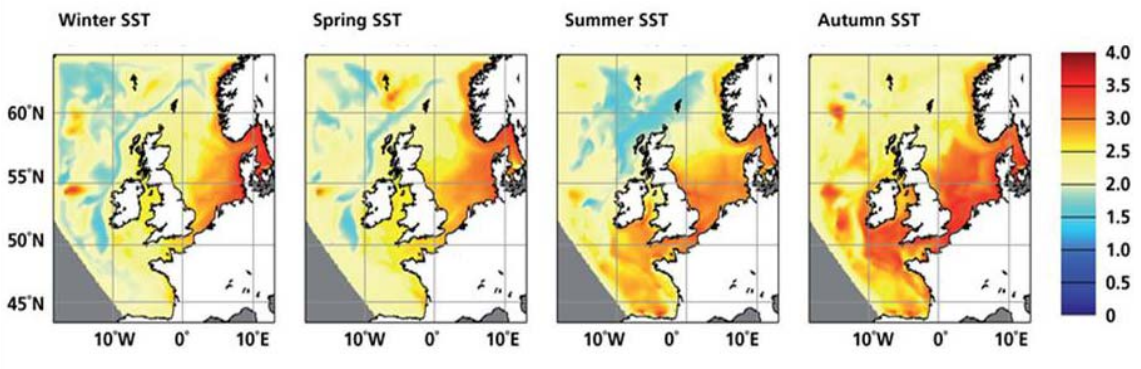
- The air temperature in central England has risen by about 1°C since the 1970s.
- Sea surface temperatures around the UK have warmed by around 0.7°C over the last three decades.
- These changes have an impact on a variety of species as, to survive, they must either adapt to the new situation or move.
- Increased atmospheric carbon dioxide and uptake in the ocean, has resulted in the ocean becoming more acidic since pre-industrial times (decreasing by 0.1 pH unit).
- Sea level around the UK has risen by about 1mm/yr in the 20th century, with this rate of increase rising since the 1990s.
- The rate of coastal erosion is likely to increase as sea levels rise.

The air temperature in central England has risen by about 1°C since the 1970s[24]. This increase is, at least in part, driven by greenhouse gas emissions from humans.

Sea surface temperatures are also increasing at a similar rate, with waters around the UK warming by around 0.7°C over the last three decades. Sea surface warming is most pronounced in the Southern North Sea (East and South East marine plan areas), with the rest of the North Sea (North East marine plan areas), north east Irish Sea (North West marine plan area), and eastern English Channel (South marine plan areas) also showing notable increases. UK Climate Projections 2009 (UKCP09)[25] are the latest set of climate projections produced to cover the UK and its shelf seas. Under the medium emissions scenario[26], the UK's shelf seas are likely to experience warming of between 1.5 and 4°C by the end of the 21st century. The strength and duration of stratification is also expected to increase across all NW European shelf seas[27].

[24] Jenkins et al, 2009. UK Climate Projections: Briefing report.
[25] Murphy, J.M., et al. 2010 UK Climate Projections Science Report: Climate change projections Version 3. Met Office Hadley Centre, Exeter, UK.
[26] UKCP09 considered the effects caused by low, medium and high CO_2 emissions scenarios, however only a medium emission scenario is available for sea surface temperature.
[27] Jenkins et al, 2009. UK Climate Projections: Briefing report.

Figure 2: Seasonal increases in temperature (°C) from present to 2080s – medium emissions scenario (Lowe *et al.*, 2009)[28]



It is expected that the sea surface temperature increases would vary throughout the year as well as geographically, with the largest increases found off the south-east coast in the autumn. These changes have an impact on a variety of species as, to survive, they must either adapt to the new situation or move. Species could be affected directly, or indirectly via marine food webs (such as changes in plankton populations affect many other species as they are at the bottom of the marine food web).

Increased atmospheric carbon dioxide and uptake in the ocean, has resulted in the ocean becoming more acidic since pre-industrial times (decreasing by 0.1 pH unit)[29].

This rate of change is faster than anything experienced in the past 55 million years. It is predicted that acidification will continue as carbon dioxide emissions increase[30,31], with decreasing pH levels of around 0.1 units in the 2020s, and a decrease between 0.25 and 0.47 units by 2100[32], depending on the emission scenario used. Resulting ocean acidification could have negative consequences for ecosystem processes and species, particularly those organisms with calcareous shells including commercially important shellfish species[33]. Ocean acidification in turn reduces the ability of the oceans to absorb carbon dioxide, and therefore buffer the effect of global warming.

Climate warming may increase rates of pelagic carbon cycling, making less carbon available to the benthic systems resulting in reduced benthic biomass with potential knock on effects for marine food webs. In addition climate change may cause an increase in areas or periods of low oxygen in the oceans.

[28] Lowe, J.A., et al., 2009 UK Climate Projections science report: Marine & coastal projections. Met Office Hadley Centre, Exeter, UK.
[29] Townhill, B.L., et al, 2013, Marine Management Organisation Climate Change Adaptation Reporting - Feeder Report A report to the MMO.
[30] Defra, 2010 Charting progress 2: Chapter 6 Climate change Published by Defra on behalf of the UK Marine Monitoring and Assessment Strategy community, London.
[31] MCCIP (2010) Marine Climate Change Impacts Partnership Climate of the marine environment [Online] Available from: www.mccip.org.uk/annual-report-card/2010-2011/climate-of-the-marine-environment.aspx.
[32] Pinnegar, J., et al., 2012 Climate Change Risk Assessment for the Marine and Fisheries Sector In: UK 2012 Climate Change Risk Assessment. Defra, London.
[33] Defra, 2012, UK Climate Change Risk Assessment

Sea level around the UK has also risen by about 1millimetre (mm)/ year in the 20th century, with this rate of increase rising since the 1990s[34]. This is in response to higher temperatures resulting in thermal expansion of ocean water, and melting of land-based glaciers and ice caps. For sea level rise, waters around the UK are projected to rise by 12 to 76 centimetres (cm) by the year 2095 (depending on which emission scenario is used). Taking account of the vertical movement of land, this gives slightly larger sea level rise projections in the southern UK where land is subsiding, compared to the north. This affects intertidal habitats which balance delicately on the basis of tidal inundation and is noticeable already in the South West and North West plan areas. Coastal groundwater systems are also vulnerable and implications for coastal flooding are particularly evident in the Southern North Sea (East and South East plan areas).

The rate of coastal erosion is likely to increase as sea levels rise. This could lead to deeper water in near shore areas, which would in turn cause an increase in wave energy reaching the coast. Impacts of coastal erosion on buildings and infrastructure located along the coast are therefore likely to increase[35]. Coastal evolution will result due to combined effects of flooding, squeeze and erosion at the coast.

There is no significant evidence for future changes in storm-related extreme sea levels for the UK, due to low confidence in the simulation of extreme winds in climate models. Therefore for the most part, future changes in extreme sea level will be governed by mean sea level rise, rather than any change in the storm surge component[36].

Changes in the winter mean wave height are projected to be between –35 cm and +5 cm and changes in the annual maxima are projected to be between –1.5 metre and +1 metre. Simulations show that seasonal mean and extreme waves are generally expected to increase in the South West of the UK, experience a small change in the southern North Sea and reduce to the north of the UK, although there are uncertainties associated with these projections[37]. A potential change to wave climate and storminess may cause damage to coastal and marine infrastructure as well as disruption to shipping and transport.

The environment is intrinsically linked to UK society and the wider economy. As such, potential impacts of climate change on the marine sector will have wider consequences. Particularly clear links are identified with biodiversity, ecosystem services, health, transport and business, industry and services sectors[38].

The Climate Change Act 2008 creates a framework for the UK to adapt to climate change through producing a UK Climate Change Risk Assessment (CCRA) every five years, which includes a marine and fisheries sector report. The first CCRA was

[34] Jenkins et al, 2009. UK Climate Projections: Briefing report.
[35] Ramsbottom, et al (2012) UK Climate Change Risk Assessment for the Flood and Coastal Erosion sector.
[36] MCCIP (2010) Marine Climate Change Impacts Partnership Climate of the marine environment [Online] Available from: www.mccip.org.uk/annual-report-card/2010-2011/climate-of-the-marine-environment.aspx
[37] Jenkins et al, 2009. UK Climate Projections: Briefing report.
[38] Pinnegar, et al (2012) UK Climate Change Risk Assessment for the Marine and Fisheries Sector.

published in January 2012[39] and a National Adaptation Programme (NAP) was published on 1st July 2013, responding to the risks within the CCRA. The Climate Change Act also gives government power to request that certain organisations and, some public bodies report on the steps that they are taking to respond to climate change.

Consideration of how a changing environment could affect the marine area and activities in the future is detailed in the sections that follow.

2.2.2 Air quality

Key facts

- Industrialisation of the coast and inshore area adjacent to certain parts of the central North Sea has led to increased levels of pollutants in these areas which decrease further offshore.
- The marine plan area assessment of air quality is derived from coastal and low resolution European data, rather than a dedicated marine air quality monitoring programme.

Introduction

The principal sources of air contamination at sea are from point source oil and gas installations and ship movements[40]. Non-marine sources include coastal industry and construction[41], with additional input from major inland sources such as power stations[42].

Emissions from ships are a source of air pollutants including sulphur dioxide (SO_2) and nitrogen oxides (NOx). The main statutory instruments controlling emissions from shipping include MARPOL (International Convention for the Prevention of Pollution from Ships), that restricts sulphur oxide and nitrogen oxide emissions from ship exhausts and prohibit deliberate emissions of ozone depleting substances and European directives that generally relate to the sulphur levels in fuel sources.

The Air Quality Strategy set national objectives for local authorities. Many of the standards are derived from EU obligations (such as the Ambient Air Quality (and daughter) Directives (2008/50/EC) and the National Emission Ceilings Directive (2001/81/EC)) for the reduction or non-exceedance of a particular pollutant[43,44]. If a local authority finds any places where the objectives are not likely to be achieved, it must declare an air quality management area (AQMA) and develop a local air quality action plan. The size of the AQMA can be highly variable[45].

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[39] Pinnegar,et al (2012) UK Climate Change Risk Assessment for the Marine and Fisheries Sector.
[40] www.apis.ac.uk/overview/regulations/overview_shipping_emissions.htm
[41] www.offshore-sea.org.uk/consultations/Offshore_Energy_SEA/OES_A3e_Air_Quality.pdf
[42] www.apis.ac.uk/overview/pollutants/overview_sources.htm and www.offshore-sea.org.uk/consultations/Offshore_Energy_SEA/OES_A3e_Air_Quality.pdf
[43] www.offshore-sea.org.uk/consultations/Offshore_Energy_SEA/OES_A3e_Air_Quality.pdf
[44] www.gov.uk/government/policies/protecting-and-enhancing-our-urban-and-natural-environment-to-improve-public-health-and-wellbeing/supporting-pages/international-european-and-national-standards-for-air-quality
[45] http://aqma.defra.gov.uk/aqma/home.html

National summary

There are no regular offshore air quality monitored sites, however routine air quality monitoring is carried out by coastal local authorities within the marine plan areas. The air quality of all local authority areas is generally within national standards set by the UK government's air quality strategy[46], though several AQMAs have been declared to deal with problem areas. Industrialisation of the coast and inshore area adjacent to certain parts of the central North Sea has led to increased levels of pollutants in these areas which decrease further offshore, though oil and gas platforms provide numerous point sources of atmospheric pollution[47]. However it has not been established to what extent marine or marine related activities contribute to the reasons why relevant AQMAs are declared[48].

Distribution across the marine plan areas

There are AQMAs in the coastal districts of all marine plan areas (Table 1). The vast majority of AQMAs are in the South East – these are largely focussed in and around London. It is unlikely that the majority of the London AQMAs are in any way related to activities connected to the marine plan area. There are some areas with stronger marine links such as in the vicinity of the Port of Dover. Of the other marine plan areas, the East and South have the next highest levels of AQMAs.

Table 1: Distribution of air quality management areas (within 10 kilometres of the marine plan areas)

Plan areas	North East	East	South East	South	South West	North West	Total
AQMAs	3	6	51	7	1	3	71
Square km	Less than 1	Less than 1	16	1	Less than 1	Less than 1	18
Percentage AQMA by square km	Less than 1%	2%	93%	3%	Less than 1%	Less than 1%	
Percentage AQMA by number	4%	8%	72%	10%	1%	4%	

The greater North Sea is one of the world's busiest maritime areas with high shipping densities particularly in inshore waters. Shipping activity, namely around the Humber Estuary, the Wash and Felixstowe contribute to detectable levels of emissions of PM10, NOx CO, SO2 in the marine area. In some places, levels of SO2 and NOx are relatively higher in the marine area than in adjacent onshore areas, although from 1 July 2010, ships operating in the North Sea must use fuel not exceeding 1% sulphur[49].

[46] Defra (2010) Charting Progress 2 Feeder Report: Ocean processes, pp282
[47] www.offshore-sea.org.uk/consultations/Offshore_Energy_SEA/OES_A3e_Air_Quality.pdf
[48] UK Marine Policy Statement: The Appraisal of Sustainability report, pp174
[49] www.marinemanagement.org.uk/marineplanning/areas/documents/east_evidence_issues_chapter6.pdf

A recent study looking at land based air pollution in the UK, showed higher levels of SO2 around some of the UK's main ports – for example Southampton, Merseyside, Humberside and Pembroke. Shipping is known to be a significant source of SO2. However, two major ports (Dover and Harwich) have large amounts of shipping but show no SO2 "hot-spot". This may indicate that it is not necessarily shipping itself that accounts for these high SO2 concentrations, but nearby industry associated with the ports. There has however been a year on year decrease in levels since 1990. NO_x concentrations are highest in urban areas due to road traffic and are therefore high in some coastal locations including Southampton and Hull[50].

Future trends

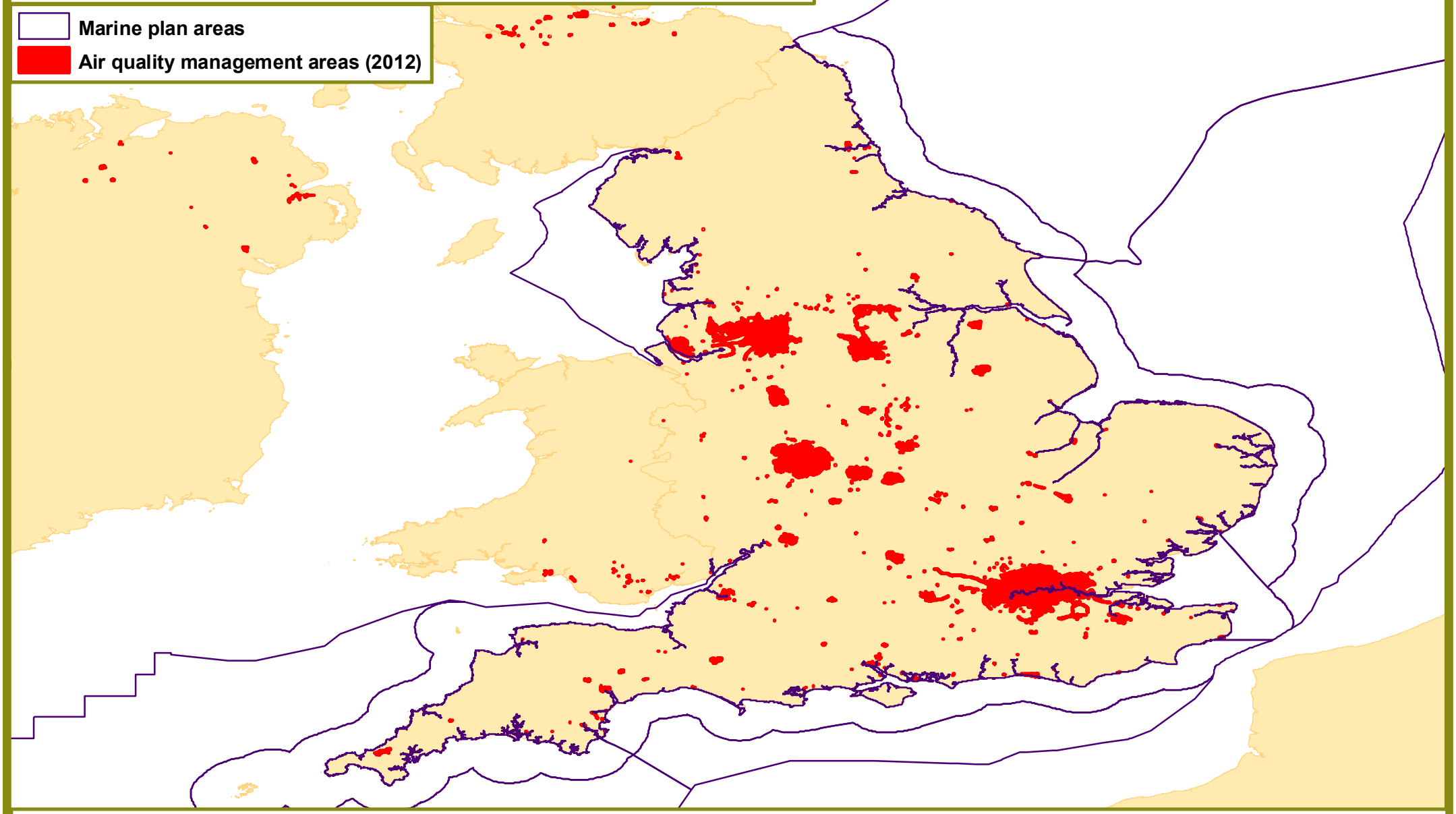
Assuming business as usual in oil and gas with existing trends in shipping and marine construction, air quality pressure is likely to increase or remain an issue in those areas highlighted by the sections 2.10 Ports and shipping and 2.6 Oil and gas.

[50] Defra (2011) Air Pollution in the UK

Marine Management Organisation

Figure 3: Air quality management areas (2012)

June 2013



2.2.3 Sediment and water quality

Key facts

- The North East Inshore Marine Plan Area has predominantly good ecological water quality, with all other inshore marine plan areas having mostly moderate ecological water quality with some pockets of good.
- The highest inputs of nutrients from land-based agricultural diffuse pollution, occur in the East, South and North West inshore areas.
- In 2007 96% of bathing waters met the imperative standard of the EC Bathing Waters Directive[51].
- Also in 2007, 40% of sampled shellfish waters met the guideline value which is a significantly more stringent requirement than for bathing waters[52].

Introduction

The Water Framework Directive (WFD) aims to protect and improve the chemical and ecological status of water bodies including estuarine and coastal waters (out to one nautical mile) across Europe. The Environment Agency monitor progress against WFD objectives, through river basin management plans (RBMP), and the current results and future predictions of water quality in English waters are discussed below and can be seen in figures 4 and 5.

MSFD has comparable objectives with the WFD and aims to achieve good environmental status (GES) in the marine environment by 2020. There is an overlap with the WFD in coastal waters with regards to chemical quality, the effects of nutrient enrichment (eutrophication) and some aspects of ecological quality and hydromorphological quality[53].

The MSFD has a number of descriptors which will determine GES. A number of these relate to water quality – eutrophication, contaminants and marine litter and these are all covered within this section.

The UK is currently developing a monitoring programme to be in place by July 2014 alongside a programme of measures (by 2015) that will need to be delivered to achieve or maintain GES. Marine planning will play a role in contributing to the delivery of the MSFD to ensure the requirements are met.

There are a number of additional directives that also aim to protect waters for various activities and purposes and these are:

- The Urban Waste Water Treatment Directive
- The Bathing Waters Directive
- The Shellfish Waters Directive

[51] http://chartingprogress.defra.gov.uk/assessment-summary-cleansafe
[52] UK Marine Monitoring and Assessment Strategy Community (UKMMAS) (2010). Charting Progress 2 Feeder report: Clean and Safe Seas. (Eds. Law, R. and Maes, T.). Published by DEFRA on behalf of UKMMAS. 366pp. http://chartingprogress.defra.gov.uk/clean-and-safe-seas-feeder-report
[53] HM Government, 2012, Marine Strategy Part One: UK Initial Assessment and Good Environmental Status

The directives mentioned above illustrate the importance of water quality for the overall health of our marine area and to ensure the sustainable use of the marine area for the many activities we rely on it for. These directives have helped deliver improvements in water quality which include 96% of bathing waters meeting the imperative standard of the EC Bathing Waters Directive[54] and 40% of sampled shellfish waters reaching the guideline value which is a significantly more stringent requirement than for bathing waters[55].

National summary

Environmental concentrations of monitored hazardous substances in the sea have generally fallen, but are still above levels where there is a risk of pollution effects in many coastal areas, especially where there have been historical discharges, emissions and losses from high population densities or heavy industry. Levels of persistent organic pollutants found in marine species have declined following the regulation of the substances concerned, but additional manmade chemicals are still being found in marine samples, and there is a need to keep gathering data to assess their potential impacts and the need for further controls[56].

Marine litter not only reduces the visual appeal of beaches but can be harmful to both people and wildlife. It can have a knock on effect to local tourism and recreational activities and to fishermen and seafarers through damaged gear and propellers. So whether it is found at sea or on land, marine litter has a wide-reaching impact that affects local coastal economies. Plastic is the most common type of litter found on beaches and offshore and can take hundreds of years to break down[57].

Marine litter is an international and trans-boundary environmental issue and is one of eight contaminant categories of the Global Programme of Action for the Protection of the Marine Environment from Land-Based Activities (GPA) of UNEP. Levels of marine litter are considered problematic in all areas where there are systematic surveys of beached litter density. There has only been limited surveying of litter on the seabed and in the water column, which has demonstrated that litter tends to accumulate in certain areas as a result of wind and currents[58].

CP2 used the eutrophication assessment methodology developed by OSPAR to assess the eutrophication levels of eight UK marine regions and this showed there were few or no problems with respect to eutrophication. The assessment identified 17 small estuaries and harbours as problem areas and five as potential problem areas. The key pressures on these areas are inputs from sewage treatment works and/or inputs from agriculture. These small water bodies have been designated as either Nitrate Vulnerable Zones under the EU Nitrates Directive, or Sensitive Areas

[54] http://chartingprogress.defra.gov.uk/assessment-summary-cleansafe
[55] UK Marine Monitoring and Assessment Strategy Community (UKMMAS) (2010). Charting Progress 2 Feeder report: Clean and Safe Seas. (Eds. Law, R. and Maes, T.). Published by DEFRA on behalf of UKMMAS. 366pp. http://chartingprogress.defra.gov.uk/clean-and-safe-seas-feeder-report
[56] HM Government, Marine Strategy Part One: UK Initial Assessment and Good Environmental Status (2012).
[57] Defra (2011) Charting Progress 2, Chapter 4, clean and safe seas: litter
[58] Marine litter in the North East Atlantic Region (2009).

under the Urban Waste Water Treatment Directive, as such appropriate measures to reduce nutrient inputs to the associated waters have been put in place[59].

The water quality in estuaries has improved considerably in the last two decades, due to increased treatment of point source sewage discharges and better regulation of potentially polluting dockside and other industrial activities.

Distribution across the marine plan areas

Figure 4 shows water quality as assessed under WFD. It indicates the North East Inshore Marine Plan Area has predominantly good ecological water quality, with all other inshore marine plan areas having mostly moderate ecological water quality with some pockets of good. The North West has the most inshore waters categorised as poor ecological water quality.

The highest inputs of nutrients from land-based agricultural diffuse pollution, occur in the East, South and North West inshore areas. Those areas identified as a problem or non-problems with respect to eutrophication status have measures in place to reduce the input of nutrients, but as large amounts of nutrients are locked in the sediments and tackling diffuse pollution is complex, recovery is likely to be slow, if indeed possible[60].

WFD chemical status assessments (2009) reported that 69% of transitional waters and 91% of coastal waters assessed were at good chemical status. Less than good chemical status was, in the majority of cases, related to tributyl tin contamination.

Sediments in the Tyne and Tees in the North East Inshore Marine Plan Area, Thames in the South East, Severn in the South West and the Mersey in the North West all have levels of the most commonly monitored metals that are above level where there is a risk of pollution effects in biota. Sediments in the North East estuaries also contain high levels of hydrocarbons. The failure of some estuaries to meet chemical water quality can be attributed to a combination of the historical use of estuaries for industrial activity (leading to sediment contamination) and the current ongoing activities. Furthermore, removal of these contaminated sediments would be disproportionately costly and so existing measures will not address them[61].

The report on marine litter in the North East Atlantic Region identified, on average, that significantly more items of litter were found in the northern regions (North East and South West plan areas) than the southern North Sea (East and South East plan areas). The UK Marine Strategy Part One document for MSFD outlines the targets to reduce marine litter so the levels do not pose a significant risk to the coastal or marine environment. This includes an overall reduction in the number of visible litter items on coastlines as well as a number of surveillance indicators to monitor the quantities of litter found on the sea floor and the amount of plastic in the contents of fulmars stomachs[62]. These targets are trend-based as opposed to quantitative

[59] HM Government, 2012, Marine Strategy Part One: UK Initial Assessment and Good Environmental Status

[60] Strategic scoping report for marine planning in England (2011). MMO.

[61] http://qsr2010.ospar.org/en/ch05_04.html

[62] HM Government, Marine Strategy Part One: UK Initial Assessment and Good Environmental Status (2012).

targets because there is still limited understanding of the current levels, properties and impact of marine litter.

Future trends

The water quality of the marine area is dependent on many factors: climate change, population dynamics, future growth of industry and the resilience of the marine environment. Although there is little evidence available on the potential future trends of water quality, socio-economic factors will heavily impact on water quality due to effluent discharges being a by-product of growth in industry, housing and infrastructure.

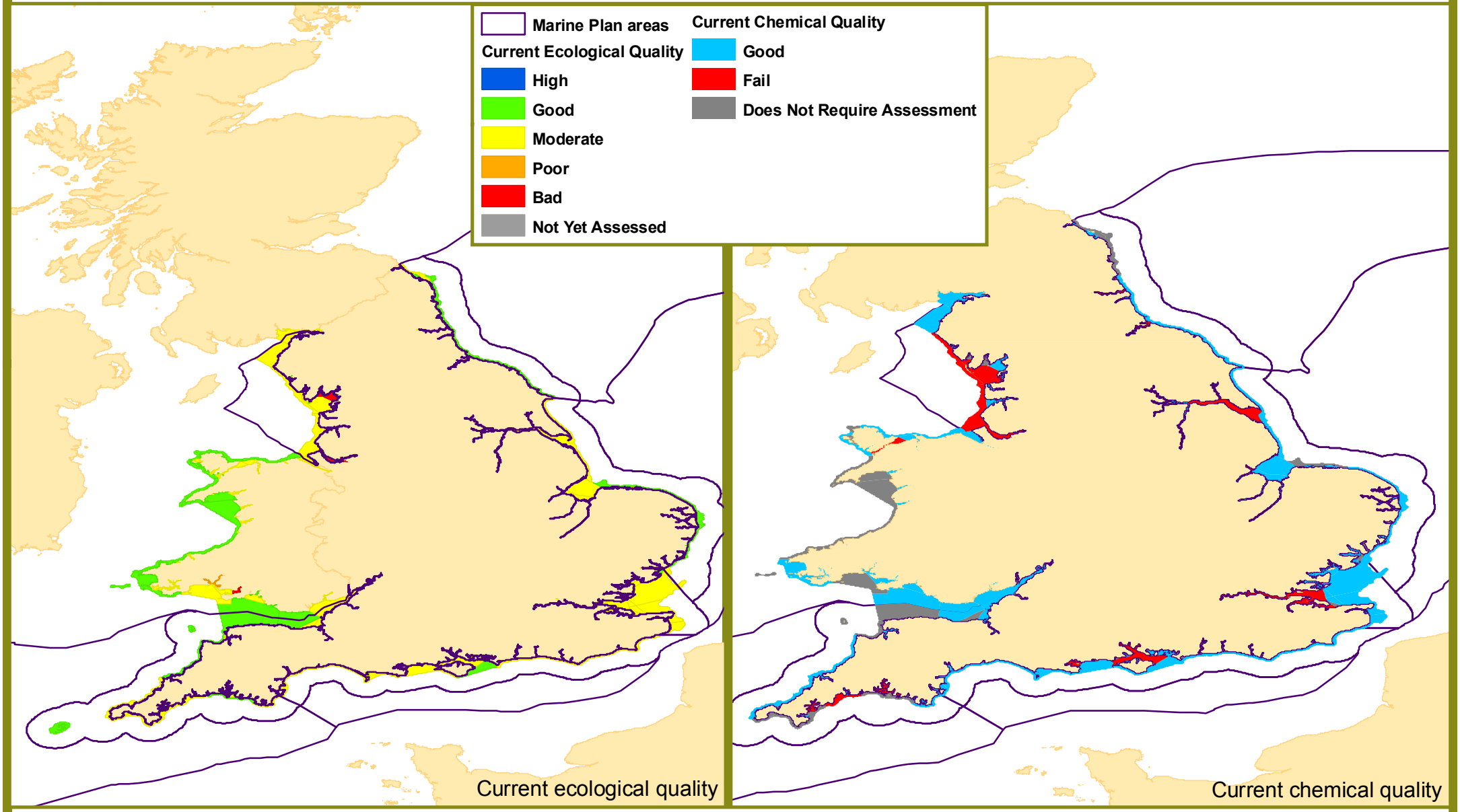
Furthermore, climate change is likely to impact on water quality with increasing evidence that it may alter pathways of hazardous substances to the North East Atlantic and make marine ecosystems more vulnerable to chemical pollution[63]. Also, as outlined in the tourism and recreation section, warmer sea surface temperatures coupled with high periods of recreational activity could lead to increased incidents of Vibrio type infections[64]. Climate change may also increase the risk of general eutrophication even with current levels of anthropogenic nutrient inputs[65]. See section 2.2.1 for information on the effects of climate change on ecology.

[63] http://qsr2010.ospar.org/en/ch05_04.html
[64] MCCIP 2010-2011 Annual Report Card, Climate Change: Impacts of our vision for clean safe seas. Available at www.mccip.org.uk/annual-report-card/2010-2011/clean-and-safe.aspx
[65] Extract from Pinnegar et al (2012) UK Climate Change Risk Assessment for the Marine and Fisheries Sector

Marine Management Organisation

Figure 4: Current water quality

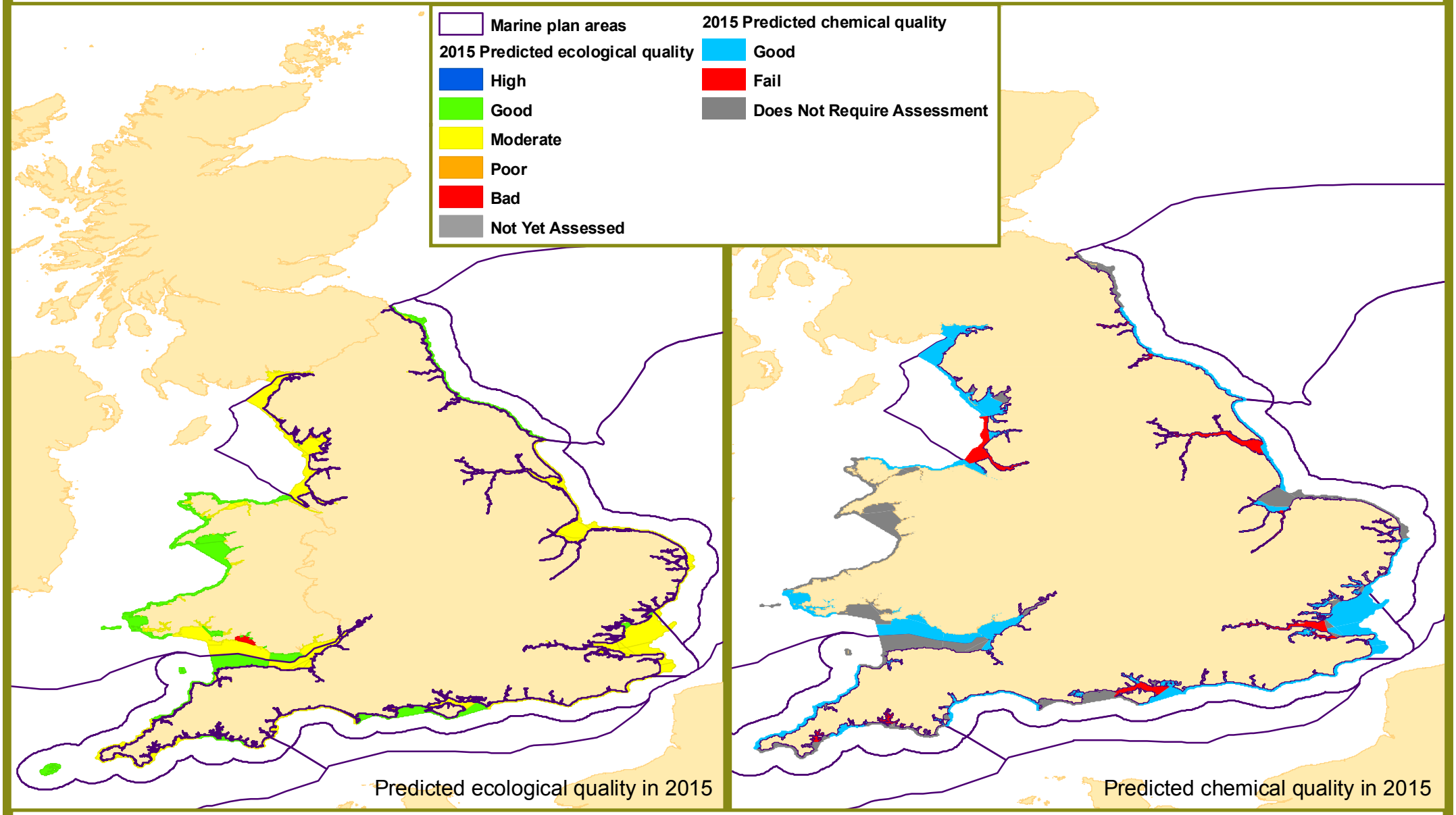
June 2013



Marine Management Organisation

Figure 5: Predicted water quality in 2015

June 2013



2.2.4 Underwater noise

Key facts

- There is not enough information to provide a quantitative assessment of the overall status and trend of underwater noise in UK seas[66].
- Ambient noise levels are likely to increase if the volume of shipping increases and as renewable energy infrastructure expands in UK waters.
- Underwater noise from seismic survey will continue to be the main source of impulsive underwater noise up to 2020. The relative contribution from the construction phase of renewable energy infrastructure will increase up to 2020 and possibly beyond.

Introduction

Anthropogenic noise sources that contribute to both ambient and impulsive noise in the sea include offshore construction, sand and gravel extraction, drilling, ship movements, use of sonar, underwater explosions, seismic surveys, and acoustic deterrent devices (ADDs). Most of the intensities of anthropogenic sounds exceed by several order of magnitude the ambient sounds in the marine environment that occur naturally, such as sounds that are induced by rain, wind and waves[67].

Increased levels of underwater noise can affect many marine organisms, it can disrupt their availability to navigate over long distances as well as local orientation needed to avoid predators and hazards, and search for prey and mates. Marine mammals are the best known group associated with underwater noise issues, but many fish species and even some invertebrates are affected. Elevated noise levels can cause behavioural reactions, physiological effects, injuries and mortality, the occurrence of these impacts depend on the proximity and sensitivity of an organism and the nature of the sound source[68, 69]. At current levels of knowledge, it is considered unlikely that there would be a significant adverse effect on marine animal populations, provided measures continue to be taken to manage the impacts of individual noisy activities[70].

National summary

There is currently insufficient evidence to support a quantitative assessment of underwater noise in UK waters. The current major source of impulsive underwater noise is from seismic surveys, and will continue to be the case up to 2020 as hydrocarbon fields are fully exploited. Beyond 2020, other activities such as the construction of offshore renewables may possibly become major sources in the future[71] (particularly in the East marine plan areas).

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[66] OSPAR, 2009, Assessment of the environmental impact of underwater noise

[67] OSPAR, 2009, Assessment of the environmental impact of underwater noise

[68] OSPAR, 2009, Assessment of the environmental impact of underwater noise and DECC, 2009, UK Offshore Energy Strategic Environmental Assessment (OESEA): Environmental Report

[69] http://chartingprogress.defra.gov.uk/clean-seas-noise

[70] HM Government, 2012, Marine Strategy Part One: UK Initial Assessment and Good Environmental Status

[71] HM Government, 2012, Marine Strategy Part One: UK Initial Assessment and Good Environmental Status

The operation of offshore energy production installations, initially wind farms then tidal and wave systems as the technology is developed, is likely to raise local ambient noise levels both in the short and long term. The management of subsurface noise emitted from shipping is currently the subject of international debate within the International Maritime Organization and further guidance is expected on this issue in the future[72].

Given the density of shipping, current hydrocarbon exploration, and future renewable energy development, underwater noise is most likely to affect the East, South East, North West and South. Underwater noise in North East and South West is more likely to remain at current levels[73].

Future trends

Characteristics of GES for the MSFD descriptor 11 (underwater noise) describe requirements for both impulsive and ambient sound in relation to significant adverse effect to marine ecosystems and risk to species. The targets for descriptor 11 require the establishment of a noise registry to monitor the distribution and timing of anthropogenic sound sources, and ambient noise levels.

2.2.5 Marine ecology and biodiversity

Key facts

- The importance of marine ecology and biodiversity in marine planning is re-enforced through obligations in the MCAA and Marine Policy Statement (MPS).
- Marine ecology is supported at a European and international level by the Habitats Directive, Birds Directive, MSFD, OSPAR convention, and Convention on Biological Diversity (CBD).
- Grey seal populations are seeing general improvements.
- Marine biodiversity in general is not currently in line with proposed good environmental status (GES) criteria with significant variation in habitats and species.
- Habitats face pressures from a range of sources, with a number listed for protection under a variety of national and international obligations
- Marine habitats and species provide a range of ecosystem services and benefits of significant value to the UK society.

Introduction

England has a rich marine environment, home to a variety of habitats and species. The seas provide us with a range of goods and services, the full extent of which is currently not fully understood. Increasing pressures on the marine environment must be effectively managed in order to maintain a healthy marine ecosystem while enabling sustainable development to continue.

CP2 was published in July 2010, provides an assessment of productivity in our seas and the extent to which human activities are putting pressure on the marine environment. CP2 assessed changes since the first Charting Progress report (2005),

[72] http://chartingprogress.defra.gov.uk/clean-seas-noise
[73] HM Government, 2012, Marine Strategy Part One: UK Initial Assessment and Good Environmental Status

and provides summary trends across a range of parameters including ocean processes, habitats and species. The UK Government has accepted the findings of the assessments, and remains committed to achieving the vision of clean, healthy, safe, productive and biologically diverse oceans and seas, which underpins the UK MPS.

Key drivers in achieving this vision include the Marine and Coastal Access Act 2009 and MSFD, which aims to protect the marine resources upon which economic and social activities depend, and to establish a framework within which EU member states take measures to achieve GES for the marine environment by 2020. The characteristics of GES[74] have been defined by the UK by reference to 11 descriptors[75] and a set of indicators and targets for guiding progress towards GES[76]. Descriptor 1 (biodiversity), descriptor 4 (food webs) and descriptor 6 (sea-floor integrity) are particularly relevant to the health of the marine environment, protection of biodiversity, sustainability and productivity of marine ecosystems and the goods and services they provide.

The MSFD initial assessment[77] builds on CP2 in providing an assessment of the state of the marine environment and the pressures and impacts it faces. The characteristics of GES provide a description of what the marine environment will look like when GES is achieved, with targets and indicators developed for each descriptor to provide a framework for assessment. Existing measures such as the Water Framework Directive, Habitats Directive, Birds Directives, marine protected area (MPA) network, and the Common Fisheries Policy are already contributing to improving the state of the marine environment. The government will review before 2015 whether any additional measures might be required to achieve GES.

The UK's MSFD initial assessment draws primarily on evidence from CP2 (and associated feeder reports[78]) and has been heavily drawn on throughout the following sections of this report. It should be noted that while CP2 is used to inform this report, its assessments are based on regional sea units, which do not exactly align with English marine plan areas (Table 2). In addition, the UK falls within the MSFD North East Atlantic Ocean Region, with waters to the west of the UK comprising part of the Celtic Seas sub-region, and waters to the east of the UK including the Channel forming part of the Greater North Sea sub-region. The assessments for a number of ecological themes are provided below.

[74] MSFD, 2008/56/EC Article 3(5) – Good environmental status means the environmental status of marine waters where these provide ecologically diverse and dynamic oceans and seas which are clean, healthy and productive within their intrinsic conditions, and the use of the marine environment is at a level that is sustainable, thus safeguarding the potential for uses and activities by current and future generations. A fuller description is set out at MSFD, 2008/56/EC Article 3(5).
[75] MSFD 2008/56/EC Annex 1.
[76] HM Government, 2012, Marine Strategy Part One: UK Initial Assessment and Good Environmental Status
[77] HM Government, 2012, Marine Strategy Part One: UK Initial Assessment and Good Environmental Status
[78] Charting Progress 2 documentation including feeder reports can be found at: http://chartingprogress.defra.gov.uk/

Due to the inclusion of new evidence sources and the changing context of the SSR (such as the MSFD initial assessment and associated consultation), the original CP2 summary tables have been removed from this first revision of the SSR to ensure consistency.

Table 2: Comparison of CP2 regional seas and English marine plan areas

CP2 regional seas	Marine plan areas	Notes
1. Northern North Sea	1-2. North East	The Northern North Sea extends much further north than the North East marine plan areas to cover the Eastern Scottish waters to the Moray Firth and East of Orkney and Shetland.
2. Southern North Sea	3-4. East	The East marine plan areas sit fully in the Southern North Sea.
	5. South East	The South East marine plan area sits almost fully in the Southern North Sea, with only a slight overlap with the Eastern Channel.
3. Eastern Channel	6-7. South	The Eastern Channel regional sea extends slightly further east than the South marine plan areas.
4. Western Channel and Celtic Sea	8-9. South West	The Western Channel and Celtic Sea includes South Wales from the Severn Estuary to St David's Head, Pembrokeshire
5. Irish Sea	10. North West	The Irish Sea extends over a far greater and more diverse area than the North West marine plan area. It includes mid and north Wales, Northern Ireland and north to the Firth of Clyde in Scottish waters.

2.2.6 Microbes and plankton

National summary

Marine microbial and planktonic organisms play a key role in cycling nutrients that are essential for other marine organisms. As plankton are at the bottom of the food web they support and therefore affect many other species, such as seabirds, and determine the carrying capacity (in this case the level of biomass and diversity) of ecosystems and the services they provide.

Through their presence and absence plankton regulate larval fish development and survival, and thus the success or failure of recruitment[79] to the adult fish stocks[80]. Though not yet quantified it is suggested that plankton may potentially be moderating climate change by production of biogenic aerosols and through the transfer of carbon to the deep sea[81].

[79] Recruitment occurs when juvenile organisms survive to be added to a population
[80] CP2 Chapter 3: Healthy and Biologically Diverse Seas p.34
[81] CP2 HSBDSEG Feeder Report: Section 3: Topic Assessments p.293 sec3.3.2.2 (Steinberg et al., 2008).

Marine microbes play a key role in cycling nutrients that are essential for other marine organisms and the ecosystem services they provide[82]. Microbial cyanobacteria are responsible for up to 50% of primary productivity in UK waters, although this varies by region and season. However, there is still lack a fundamental understanding of the complex roles they play. This means there is insufficient evidence to assign a current or future health status to microbes[83].

Distribution across the marine plan areas

Long-term observations indicate that plankton as a whole are healthy and subject to few direct anthropogenic pressures. Research has shown the major influence in the distribution of plankton to be climate. Large-scale changes have occurred linked to rising sea temperatures, which have resulted, in a large increase in phytoplankton (plant) populations around the west of the UK (South West and North West marine plan areas), while in the North Sea (North East and East marine plan areas), there is a shift to earlier blooming of surface species and an increase in abundance of meroplankton (planktonic larvae of benthic animals living on the bottom). However, the consequences of the feedback relationships with the wider ecosystem, fisheries and climate change are not clear[84].

Future trends

Trends in increasing sea surface temperature, eutrophication, ocean acidification and pollution all affect the balance of biomass and diversity within natural community structures[85],[86], for instance an increase in sea surface temperature could lead to more diversity in plankton, but less overall biomass. This in turn could lower the carrying capacity of ecosystems. Changes in plankton as a result of rising sea temperatures may impact on other species groups in the pelagic food web. Ocean acidification is expected to impact planktonic ecosystems and especially vulnerable calcareous organisms in the future[87].

New targets for achieving GES in pelagic habitats all focus on plankton, recognising their key role in the marine ecosystem. The targets require that plankton distribution, structure, condition and abundance are not significantly adversely affected by anthropogenic drivers[88].

2.2.7 Habitats

National summary

The UK has a particularly high biological diversity as a result of the variety of habitats present. Its position in a transition zone between north-eastern cold water and south-western temperate conditions also contributes to this. The following text describes the current distribution and trend for each broad habitat type – specific pressures are noted where they differ by marine plan area.

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[82] UK National Ecosystem Assessment, 2011, Chapter 12: Marine
[83] CP2 Chapter 3: Healthy and Biologically Diverse Seas p.33
[84] CP2 Chapter 3: Healthy and Biologically Diverse Seas p.34
[85] http://chartingprogress.defra.gov.uk/feeder/HBDSEG-FeederReport-sec3_2.pdf
[86] Edwards et al. 2012. Global Marine Ecological Status Report: results from the global CPR survey – www.sahfos.ac.uk/research/publications/ecological-status-report.aspx
[87] http://chartingprogress.defra.gov.uk/base-food-web
[88] HM Government, 2012, Marine Strategy Part One: UK Initial Assessment and Good Environmental Status

Intertidal rock is an abundant and widespread habitat in all marine plan areas. It is generally in good condition, though under pressure from localised harvesting of edible shellfish, the occurrence of non-native species and climate change[89]. Impacts to community composition are evident, due to warming of the sea in the South West and North West marine plan areas.

Intertidal sediments are similarly widespread, including sand and shingle beaches, mudflat and salt marsh. Mudflat and salt marsh are considered to be in poor condition and declining, due to historic and ongoing land claim, coastal defence (structures) and pollution. As described in section 2.2.3 Sediment and water quality, pollution is generally localised with impacts in estuaries which do not necessarily reflect the average regional conditions. All English regions are affected, but pressure is greatest in the East and South East marine plan areas due mostly to the greater influence of climate change and the creation of extensive hard coastal defences to manage low-lying coastal regions. Coastal habitats become squeezed between rigid structures and rising sea level or coastal erosion.

Shallow and shelf sub-tidal sediments are under pressure in all areas and condition is generally on a level trend. However the East and South East plan areas have shown some signs of improvement. Widespread fishing is the activity contributing the most pressure[90] on these habitats with pollution and non-native species also considered a concern. Aggregate extraction is a particular local, but significant pressure in the East and South East marine plan areas.

Deep sea habitats are only present in the very western tip of the South West Offshore marine plan area and are thought to be in good condition but with pressure from bottom trawling and litter such as discarded nets.

Distribution across the marine plan areas

Figure 6 below shows the distribution of benthic habitats across the marine plan areas at the European Nature Information System (EUNIS) level 2, which is a relatively coarse degree of detail that matches the aggregated nature of the CP2 assessments. EUNIS is a hierarchical system where level 1 contains very broad descriptions of physical habitats moving to level 5, which describe detailed biotopes (physical habitat with associated biological community).

The latest map used in marine planning[91] is a composite of MESH (Mapping European Seabed Habitats) survey[92] and UKSeaMap 2010[93] modelled data[94]. Survey maps are created from remote sensing and/or data collected on site. The UKSeaMap 2010 predictive modelled maps are created by overlaying different

[89] http://chartingprogress.defra.gov.uk/assessment-summary-2
[90] http://chartingprogress.defra.gov.uk/assessment-summary-2
[91] May 2013
[92] MESH – www.searchmesh.net/Default.aspx?page=1934
[93] UKSeaMap 2010: predictive mapping of seabed habitats in UK waters – http://jncc.defra.gov.uk/page-5955
[94] A bespoke model was developed for the East marine plan areas by the Joint Nature Conservation Committee and the Centre for Environment, Fisheries and Aquaculture Science using updated physical data layers, see Compilation and confidence assessment of seabed habitat data for full methodology – www.marinemanagement.org.uk/evidence/1014b.htm

physical layers – seabed substrate, depth, proportion of surface light reaching the seabed, and energy (disturbance). The combined physical layers are matched to descriptions in the EUNIS habitat classification. As the predictive model is based on physical data alone, it can only predict the broadscale physical habitats down to EUNIS habitat classification levels 3 or 4 where there are no biological components.

To ensure the best available data from each source was used in the composite map, only survey data with a confidence score of 'high' or 'very high' was used. This makes up only a small percentage of the overall map. The remainder of the map used predictive model data, which is the best available.

Future trends

GES targets for reef and rock habitats are to ensure habitats are either stable or increasing. Relevant factors relate to habitat distribution, extent and condition (as well as condition of the benthic community). Targets for pelagic habitats focus on ensuring the distribution, structure, condition and abundance of plankton are not significant affected by anthropogenic drivers. A lack of evidence on sediment habitats means that current targets are trend based with the intention of setting more specific, quantified targets in the future.

Habitat loss through sea level rise and coastal squeeze is an issue for the North East, East, South East, and South marine plan areas[95], mitigation though measure like managed realignment[96] is possible only where it is both technically feasible and where it is socially acceptable.

Additional future habitat loss and habitat change is closely linked to the ongoing and future anthropogenic activities described in following sections of this report.

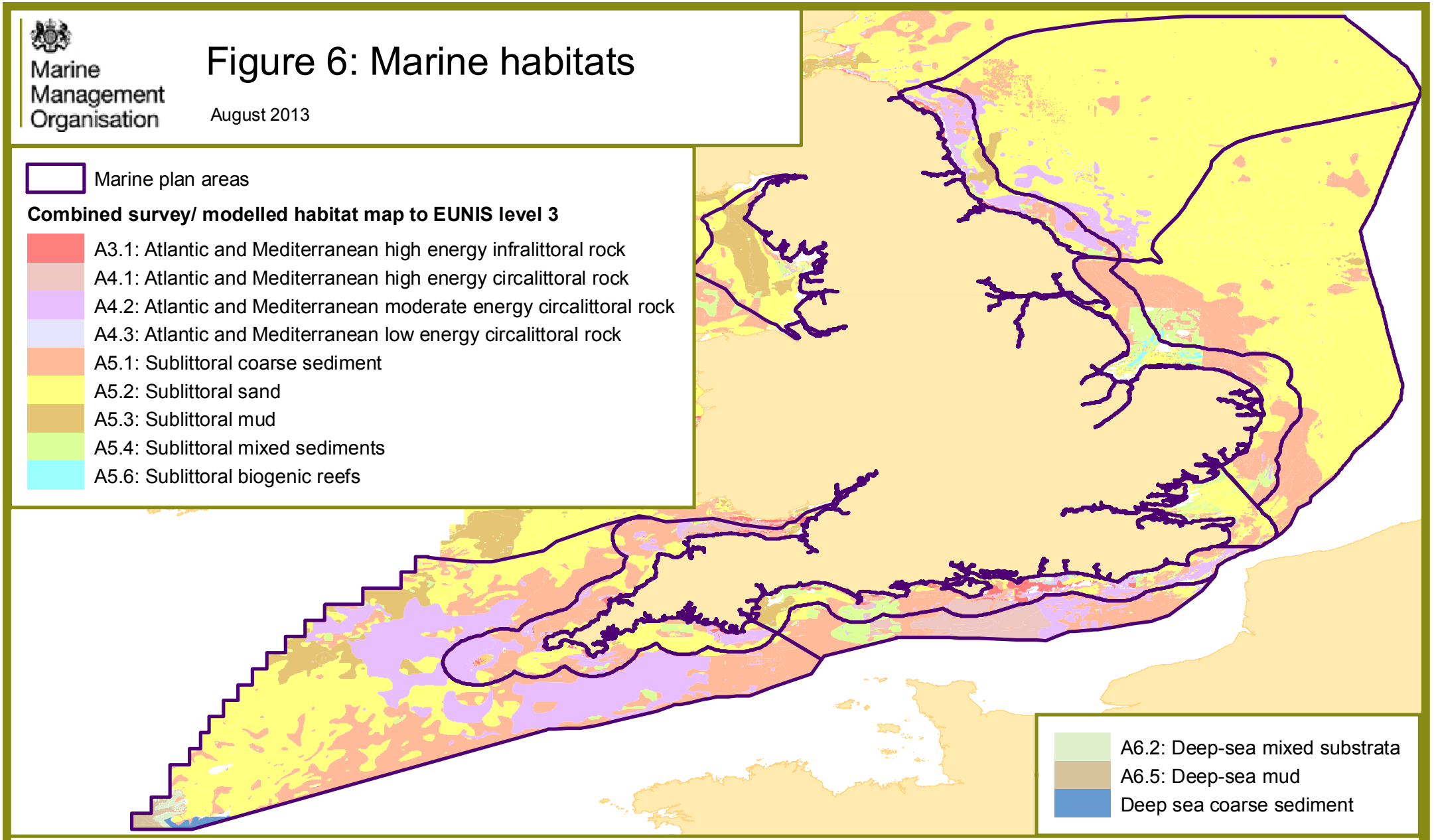
[95] HBDSEG feeder report sec 3 habitats pp.166,167

[96] Managed realignment is the landward retreat of coastal defences and other hard structures to make space for coastal habitats, these habitats often provide an element of flood and erosion defence in their own right.

Marine Management Organisation

Figure 6: Marine habitats

August 2013



NB: Due to the spatial resolution of this map, not all habitats are visible and are therefore not included in the legend. Please visit the marine planning portal (http://planningportal.marinemanagement.org.uk) to view all habitat types at a more detailed reolution.

2.2.8 Fish

National summary

The MSFD initial assessment (drawing from CP2) discusses the current state of the 330 fish species thought to inhabit the shelf seas surrounding the British Isles. The MSFD includes Coastal Waters (as defined by the WFD), but does not include WFD transitional waters (such as estuaries, sea lochs, coastal lagoons). All parts of the marine fish community have been impacted by human activities, most notably through the direct extraction of fish species by commercial fishing. Additional pressures include the removal of non-target fish that are predators, prey or competitors and physically impacting essential habitats.

There has been a substantial increase in the number of fish stocks that are harvested sustainably over the period 2000-2011 but there is some way to go before the majority of commercial fish stocks are at safe levels. There are particular concerns over the populations of several fish species that remain severely depleted with respect to the population sizes that are known to have existed 50 or 100 years ago. These include many deep-water fish species – sharks, rays and skates – as well as diadromous fish species, such as the European eel and salmon, which move between fresh and salt water during their life cycle. Many of these species have been recognised as threatened under international conventions and listed in need of protection under legislation. In contrast to declining fish stocks, there have also been improvements noted in fish communities in estuaries as a result of improved water quality.

Distribution across the marine plan areas

The following descriptions of the distribution of fish assemblages across the marine plan areas are taken from the MSFD initial assessment[97] and CP2[98].

North East – In shallow waters (50 to 100 metres depth), populations are dominated by haddock, whiting, herring, dab and plaice, while at greater depth (100 to 200 metres) Norway pout dominate. Recent research has also highlighted the increasing population of the European Anchovy in the North Sea[99].

East – The southern North Sea is generally shallower (less than 50 metres deep) than the north with the dominant fish species being those that are characteristic of inshore waters. Fish communities in the southern North Sea have been subjected to intensive trawling pressure for longer and have been heavily impacted by fishing, as well as other human pressures. Plaice, sole, dab and whiting are some of the dominant commercial species, and non-commercial species such as lesser weeverfish, grey gurnard and solenette are also prevalent.

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[97] HM Government, Marine Strategy Part 1, 'UK Initial Assessment and Good Environmental Status' (2012)

[98] UK Marine Monitoring and Assessment Strategy (2010). Charting Progress 2 Healthy and Biological Diverse Seas Feeder report. (Eds. Frost, M. & Hawkridge, J). Published by Department for Environment Food and Rural Affairs on behalf of UKMMAS. 682pp.http://chartingprogress.defra.gov.uk/feeder/HBDSEG-FeederReport-sec3_4.pdf p.382-386

[99] Petitgas et al (2012) 'Anchovy population expansion in the North Sea', Marine Ecology Progress Series, Vol 444: 1-13

South East – As the South East is at a boundary of two regional seas, it shares many of the fish assemblages common to both the East and South marine plan areas. However, it is also noted as an important nursery and spawning area for rays, especially the thornback (in addition to the region northwards to the Wash). In recent years, seahorses have extended their range into the Thames Estuary.

South – Fish in the eastern English Channel are relatively similar to those occurring in the southern North Sea, and many species of fish (such as plaice) migrate between the southern North Sea and eastern English Channel. The eastern English Channel is relatively shallow (less than 50 metres deep), with habitats in the Dover Straits and 'the narrows' (the area between the Isle of Wight and the Cherbourg Peninsula) being different to most other parts of the English Channel with greater tidal streams, coarser grounds and a high diversity of filter-feeding invertebrates. Seahorses can also be found off Sussex and Dorset.

South West – Fish diversity is considered to be greatest in the South-West and along the western seaboard of the UK. Warm temperate and subtropical pelagic fish species are relatively commonplace and several southerly species have increased in frequency of occurrence and/or relative abundance in recent years, including John Dory, and boarfish.

Monkfish, basking shark and cuckoo ray are also relatively common. The western Channel also contains many wrecks, and these can be locally important for species of fish that associate with reefs, such as conger eel and pollock.

North West – More than 170 species of marine fish have been recorded in the region and trawl surveys have revealed that dab, plaice, solenette and common dragonet are the most abundant species, along with large numbers of poor-cod, whiting and sole. The inshore grounds of the eastern Irish Sea are generally sandy, with flatfish (plaice, dab, solenette and sole), tub gurnard and sand gobies, all abundant, whereas Liverpool Bay is documented as being an important nursery area for flatfish species, notably sole and plaice.

Future trends

The future status of all fish species groups over the next 20 years is difficult to predict given the wide range of pressures on them and our lack of knowledge on the interactions between species. The following are therefore examples to illustrate trends rather than being a comprehensive assessment.

The size-composition of fish communities reflects the status of the population's overall health. The proportion of large fish may improve if relevant measures are taken, for example under the reformed Common Fisheries Policy (CFP), MSFD and through effective implementation of area-based protection measures. The implementation of MSFD integrated with new management controls from the reform of the CFP will be responsible for ensuring the four GES indicators relating to fish are achieved: 1 (maintaining biodiversity), 3 (ensuring fish are exploited within safe biological limits), 4 (biodiversity of marine food webs) and 6 (safeguarding benthic ecosystems). GES targets for fish include ensuring human activities do not impact on population size, distribution of species (particularly sensitive species) and overall ecosystem structure (with a specified proportion at the top of the food web).The

reform of the CFP calls for better integration of fisheries with wider environmental objectives and in combination with MSFD should reduce the impacts of fisheries on the marine environment. Measures to help achieve this may include technical measures on gear selectivity, eliminating discards, spatial restrictions and limits on landings. Stocks outside the CFP, including shellfish, will also be considered as part of the overall achievement of GES. The rate of improvement will depend upon life-history characteristics particular to each species and there may be time lags in responses beyond 2030.

Climate change is also beginning to have a detectable impact on fish populations, with marked changes in distribution, timing of migration and reproduction, recruitment and growth rates. The mix of species present in each CP2 region has changed over the past 50 to 100 years and predictions suggest that a very different assemblage of fish, including some introduced non-native species, might exist in UK waters in years to come.

Warm-water fish such as red mullet, seabass, anchovy and John Dory are spreading rapidly around the UK, whereas cold-water species such as cod have retreated northwards in recent years by between 50 and 400 km. At the same time, some fish species have moved into deeper waters at an average rate of about 3.5 metres per decade. Such distribution shifts will have profound consequences for commercial fisheries and for the achievement of stated conservation objectives.

Warmer temperatures around the UK are correlated with poor conditions for survival of cod larvae and cod growth, but enhanced growth rates in sole (a warm-water species). Diadromous species such as salmon and eel have been shown to be particularly vulnerable to climate change (water temperature and river flow) with impacts on both the freshwater and marine phases.

2.2.9 Mammals

National summary

The principal marine mammals in English waters are seals and cetaceans (whales, dolphins and porpoises). The grey seal and the common (also called harbour) seal are the two species of seal resident in England.

Twenty-eight species of cetacean have been recorded around the UK, with harbour porpoise and bottlenose dolphin being the principal species in England. CP2 concluded that the status of the five most abundant cetacean species in UK waters was favourable, taking into account the 2007 UK Favourable Conservation Status (FCS) assessments under the EU Habitats Directive. These are harbour porpoise, bottlenose dolphin, white-beaked dolphin, fin whale and minke whale. The status of other species was either unknown or the species were considered rare or vagrant.

Distribution across the marine plan areas

The vast majority of the UK seal population is in Scotland but there are two major grey seal breeding colonies in England at the Farne Islands in the North East Inshore Marine Plan Area and Donna Nook in the East Inshore Marine Plan Area. Minor colonies are located in Norfolk and in the South West Marine Plan Area, including on the Isles of Scilly.

Grey seal populations at colonies in the North Sea (North East and East marine plan areas) have seen significant (greater than 6%) growth since 2005[100]. Following many years of increasing populations, grey seal pup production appears to be levelling off elsewhere in the UK, although the reasons for this are not well understood.

The largest aggregations of common seals are mainly located around the Wash and north Norfolk in the East Inshore Marine Plan Area. Common seal populations are generally stabilised or recovering from regional distemper virus outbreaks in Eastern England in 1988 and 2002[101], although recovery following the later outbreak has been slower. For that reason, common seals have been assessed as having problems in the East marine plan areas, with some problems elsewhere.

Cetaceans found in UK waters are part of much larger and more widespread biological populations, which are highly mobile, including some which migrate long distances, and may be present in any one marine plan area for only part of the time. In addition, there is a variable amount of replicable survey data so an assessment of their populations does not easily relate to individual marine plan areas.

The status of cetaceans is considered to be good in the North East, East and South East marine plan areas. Although there is lower confidence in the data, evidence suggests there are some problems in the North West and South West marine plan areas. The historical problems faced in the South marine plan areas, as a result of bycatch of harbour porpoise have seen some improvement in recent years. Cetaceans are also vulnerable to noise and pollution, however there are difficulties in making direct links between individual pressures and their impact. However, the cumulative impact of pressures is of concern and may affect the long-term viability of some species[102].

Future trends

It is difficult to predict future trends for seals and cetaceans due to uncertainties in the relationship and influence of pressures on population dynamics, which in themselves are poorly understood[103]. Cetaceans and seals may be displaced by noise associated with offshore wind development (particularly in the East marine plan areas), and may be impacted indirectly through changes in prey distribution and increased susceptibility to disease and contaminants[104]. The direct impact of climate change on cetaceans is only likely to be observed in species for which the UK represents the edge of their range, such as white-beaked dolphin.

[100] www.smru.st-andrews.ac.uk/documents/678.pdf
[101] SCOS Main Advice 2011 – www.smru.st-andrews.ac.uk/documents/678.pdf, www.smru.st-andrews.ac.uk/pageset.aspx?psr=411
[102] HM Government, 2012, Marine Strategy Part One: UK Initial Assessment and Good Environmental Status
[103] Pinn, E. (2010). Charting Progress 2 Healthy and Biological Diverse Seas Feeder report: Section 3.7: Cetaceans. Published by Department for Environment Food and Rural Affairs on behalf of UKMMAS. p550-591. In: UKMMAS (2010) Charting Progress 2 Healthy and Biological Diverse Seas Feeder Report (Eds. Frost, M & Hawkridge, J).
[104] HM Government, 2012, Marine Strategy Part One: UK Initial Assessment and Good Environmental Status

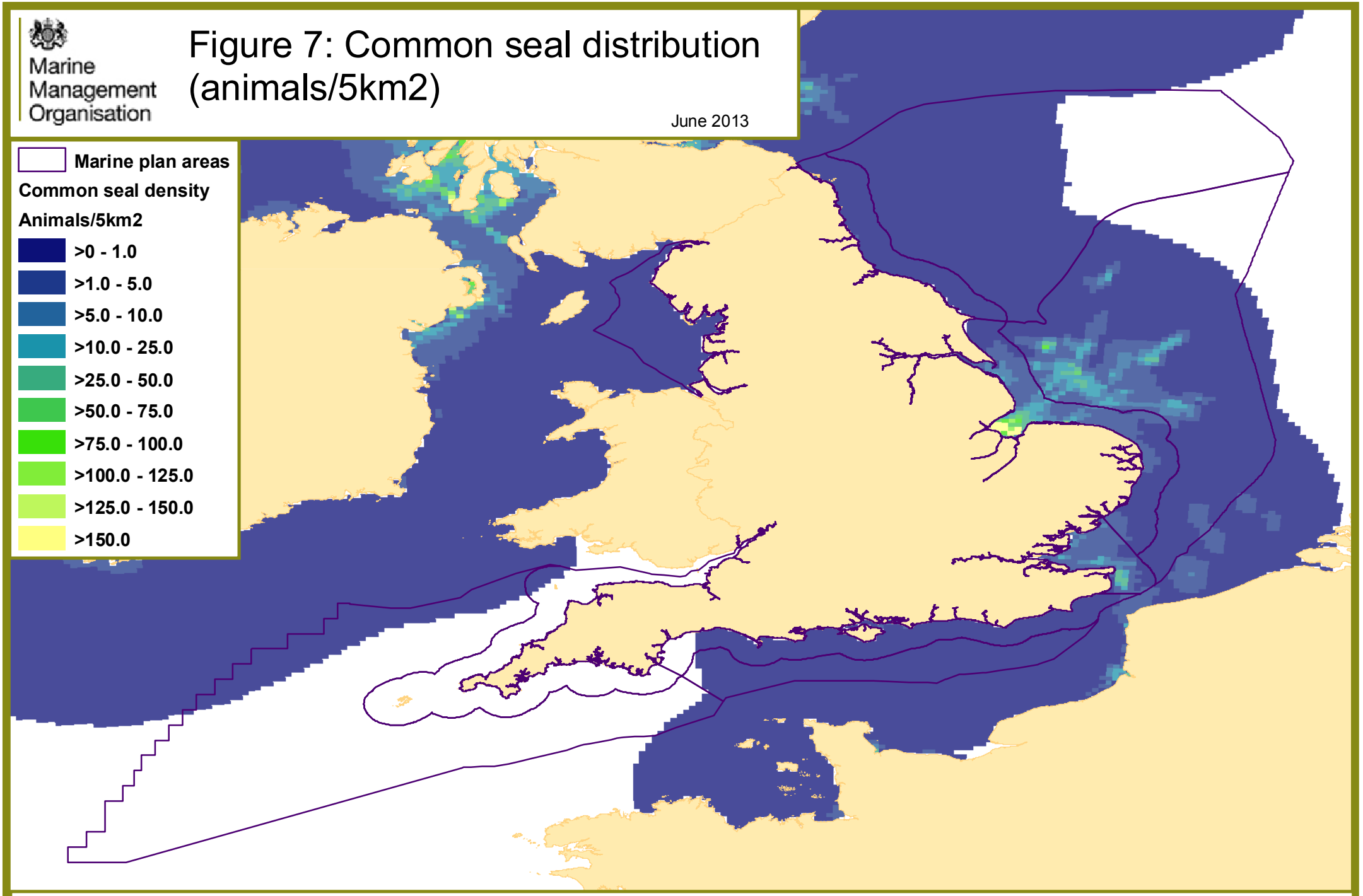
Targets for achieving GES for marine mammals are all based on existing commitments under the Habitats Directive, and relate to distribution, abundance, productivity and impacts of key pressures. Separate targets have been developed for seals and cetaceans due to their differing life histories[105].

[105] HM Government, 2012, Marine Strategy Part One: UK Initial Assessment and Good Environmental Status

Marine Management Organisation

Figure 7: Common seal distribution (animals/5km2)

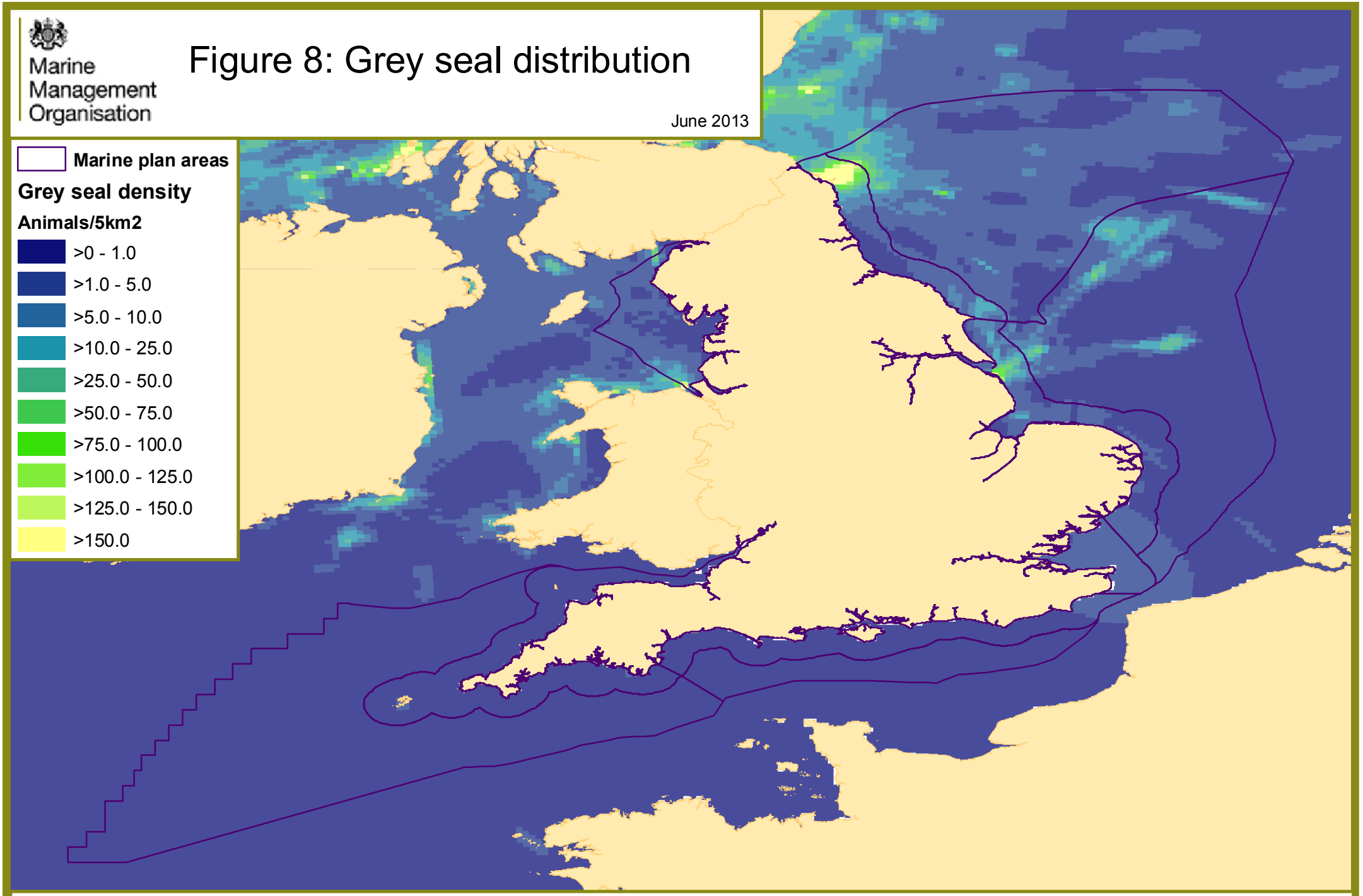
June 2013



Marine Management Organisation

Figure 8: Grey seal distribution

June 2013



2.2.10 Birds

National summary

Large numbers of sea and water birds are present in English waters all year round, with others being seasonal visitors, for breeding or over-wintering. The MSFD initial assessment[106] discusses the current state of England's seabird and waterbird populations including 38 species of seabird and 57 species of waterbird. Most seabirds spend the majority of their lives at sea, but some stay in inshore waters (such as terns, gulls, great cormorant and European shag) and others venture much further offshore and beyond the shelf-break, even during the breeding season. Some seabird species are only present during the breeding season, over winter or during migration. Waterbirds occur in large aggregations where food is abundant (such as in, and around estuaries), with most internationally important aggregations occurring during spring and autumn migrations or during winter. Of those waterbird species that breed in internationally important numbers in the UK, only five predominantly forage in the marine environment during the breeding season (red-throated diver, common shelduck, common eider, ringed plover and pied avocet).

Although numbers of seabirds breeding in the UK as a whole increased from around 4.5 million in the late 1960s to 7 million by the end of the 1990s, mainly as a result of increased protection from hunting and persecution in the UK and overseas, recent downward trends in breeding success of seabirds in the greater North Sea and the northern Celtic Seas are of concern. Pressures such as climate change, fishing activity (on prey species) and the introduction of non-indigenous mammal species (such as North American mink, near breeding colonies), have caused substantial declines in bird numbers in both offshore seabird feeding species, such as black-legged kittiwakes, and inshore feeding species, such as herring gull and Arctic skua.

Of the seabirds breeding in the UK, only northern gannet and great skua have sustained a positive trend in population size since 1969 when comprehensive monitoring of breeding numbers began. There have also been significant declines in numbers of some diving species and estuarine waders since the mid-1970s (such as goldeneye, dunlin, bar-tailed godwit).There is also evidence of a shift in aggregation areas in response to climate change causing rising sea levels and loss of intertidal feeding areas, with estuaries and coasts to the north-east being favoured by some species. There have however been some increases in numbers of some species of seabirds and waterbirds due to increased protection from hunting.

The Seabird Monitoring Programme (SMP) is an ongoing annual monitoring programme of 26 species of seabird[107] established in 1986, which regularly breed in Britain and Ireland. It aims to ensure that sample data on breeding numbers and breeding success of seabirds are collected, both regionally and nationally, to enable their conservation status to be assessed. The SMP is led and coordinated by the Joint Nature Conservation Committee (JNCC) in partnership with others[108].

[106] HM Government, 2012, Marine Strategy Part One: UK Initial Assessment and Good Environmental Status
[107] http://jncc.defra.gov.uk/page-3201
[108] http://jncc.defra.gov.uk/page-1550#partner

Distribution across the marine plan areas

Important areas for seabirds and waterbirds occur in all marine plan areas, with seven marine plan areas containing sites designated as special protection areas under the Birds Directive (East Inshore, East Offshore, North East Inshore, North West, South East Inshore, South West Inshore, and South Inshore). Impacts as a result of climate change have resulted in a north-eastward shift in distribution, meaning increases in the East and North East marine plan areas and decline in numbers in the South West Inshore Marine Plan Area[109]. Natural England are currently working on a project to map national bird sensitivity to a number of pressures, the outputs of which will be considered in future iterations of this report.

Future trends

The future status of seabirds and waterbirds is difficult to predict given the wide range of pressures on them and our lack of knowledge on how they interact with climate, plankton, prey fish and fishing. The implementation of MSFD alongside the Birds Directive and subsequent management measures, will aim to help ensure GES descriptors relevant to birds are met (1, 4 and 6). GES targets for birds include ensuring species distribution, population size, condition (including breeding success and reduced risks from non-native mammals) and productivity are not impacted by human activity. While it has not been possible to develop indicators for all species due to a lack of data, Monitoring schemes are currently being developed with the aim of including indicators for additional species in 2018. However, despite the introduction of any new management measures, declines in seabird numbers are anticipated to continue in the short-term as seabirds do not breed until three to nine years old.

The MSFD initial assessment suggests that the GES targets for birds would allow for an increased resilience of seabird populations to climate change impacts. Rising sea temperatures around the UK have contributed to a reduction in the number and quality of prey fish, such as lesser sandeel and lower breeding success and survival of some seabirds. As sea temperatures continue to rise, it is likely that kittiwakes and other seabirds that feed on sandeels will continue to experience poor breeding seasons with increasing frequency. The combination of reduced recruitment[110] and lower adult survival will lead to further large scale declines in population size. The trend in abundance of waterbird populations shifting from south-west to north-east is likely to continue as warming of the seas progresses, but little is known about the long-term implications of this range change in terms of survival and population status. There is a possibility that the international importance of the UK coast for waterbirds may diminish as a consequence. It is expected that there will be a typically northward shift in species range for seabirds, with some being absent from the UK altogether in the future (however it would be likely that species new to the UK would arrive and become established). Puffin and gannet are an example of the key seabird species likely to abandon sites in England over the next 100 years[111].

[109] UK Marine Monitoring and Assessment Strategy (2010). Charting Progress 2 Healthy and Biological Diverse Seas Feeder report. (Eds. Frost, M. & Hawkridge, J). Published by Defra on behalf of UKMMAS. 682pp.
[110] Recruitment occurs when juvenile organisms survive to be added to the population.
[111] Pinnegar et al (2012) UK Climate Change Risk Assessment for the Marine and Fisheries Sector.

Potential changes in discard policies may also lead to a decline in specific scavenging species, such as great skua and northern fulmar that currently benefit from commercial fisheries' discards as a result of human activity.

2.2.11 Ecosystem services

Key facts

- Many marine species and habitats provide a range of ecosystem services and benefits, such as coastal protection and food.
- It is currently difficult to quantify the benefits brought by ecosystem services.

The UK National Ecosystem Assessment (UKNEA) took place between 2009 and 2011, providing an analysis of the contribution of the natural environment to society and economic prosperity. As such it helps to provide context for the current state of and future trends within the natural marine environment. The UKNEA[112] found that the diversity of marine organisms and habitats provide a range of ecosystem services and benefits, which are strongly interlinked. These benefits are of significant value to the UK society, and include:

- food (fish, shellfish)
- reduction of climate stress (carbon and other biogas regulation)
- genetic resources (for aquaculture)
- blue biotechnology (e.g. biocatalysts, natural medicines)
- fertiliser (seaweed)
- coastal protection
- waste detoxification and removal and disease and pest control
- tourism, leisure and recreation opportunities
- a focus for engagement with the natural environment
- physical and mental health benefits
- cultural heritage and learning experiences

Although the goods and services provided by the natural marine environment are typically experienced by those that live by or visit the coast, many, like renewable energy and food, both directly and indirectly benefit much of UK's society[113].

The benefits brought by ecosystem services are poorly quantified. Therefore, it is difficult to fully understand the impacts of human activities. As discussed in the above sections, changes in sea temperature are already affecting species populations and habitat distribution, which in turn drives alterations to community structure and function. Climate change could also affect human health through the increase of optimum conditions for marine pathogens. However, it may bring benefits to cultural ecosystem services through warmer summers.

Human activities which have a physical impact on seafloor integrity damage regulating and supporting services. While impacts are quite localised, trawling

[112] UK National Ecosystem Assessment Technical Report, Chapter 12 – http://uknea.unep-wcmc.org/LinkClick.aspx?fileticket=HCNDuZ4ikto%3d&tabid=82
[113] UK National Ecosystem Assessment Technical Report, Chapter 12 – http://uknea.unep-wcmc.org/LinkClick.aspx?fileticket=HCNDuZ4ikto%3d&tabid=82

activity has the most widespread impact, with food provision also being affected by overexploitation[114]. Increasing activity in other marine sectors is putting additional pressure on the marine environment and the services it provides.

2.3 Protection of habitats and species

Key facts

- The UK Government is committed to halting the loss of biodiversity and restoring it so far as is feasible.
- A healthy, properly functioning natural environment is the foundation of sustained economic growth, prospering communities and personal well-being.
- There are currently 55 special protection areas (SPAs), 80 special areas of conservation (SACs) and 377 sites of special scientific interest (SSSIs) within the English marine area. The East marine plan areas are particularly significant for MPAs, with 39% of the marine plan areas made up of either existing or proposed SACs or SPAs, and with 78% of all English SACs and 42% of all English SPAs located here.
- Under MCAA, a new type of MPA was created called a marine conservation zone (MCZ). Once designated, MCZs will protect nationally important marine wildlife, habitats, geology and geomorphology and will contribute to the MPA network.

England's Biodiversity Framework

The UK Government is committed to halting the loss of biodiversity and restoring it so far as is feasible. This means:

- a halting and, if possible, reversal of biodiversity loss with species and habitats operating as part of healthy, functioning ecosystem
- the general acceptance of biodiversity's role in enhancing the quality of life, with its conservation becoming a natural consideration in all relevant public, private and non-governmental decisions and policies[115]

Both the National Ecosystem Assessment (NEA)[116] and the Natural Environment White Paper[117] (NEWP) state that a healthy, properly functioning natural environment is the foundation of sustained economic growth, prospering communities and personal well-being. The NEWP calls for key reforms for protecting and improving the natural environment including supporting local nature partnerships, creating new nature improvement areas, the need for ecologically coherent planning and piloting biodiversity offsets.

MSFD[118] also includes several key objectives in relation to marine biodiversity, with measures for achieving GES including spatial measures for biodiversity protection.

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[114] UK National Ecosystem Assessment Technical Report, Chapter 12 – http://uknea.unep-wcmc.org/LinkClick.aspx?fileticket=HCNDuZ4ikto%3d&tabid=82
[115] HM Government (2011) Marine Policy Statement, paragraph 2.6.1.1.
[116] UK National Ecosystem Assessment (2011). UNEP-WCMC, Cambridge
[117] Defra (2011) The Natural Choice: securing the value of nature. Accessed at www.official-documents.gov.uk/document/cm80/8082/8082.pdf
[118] Directive 2008/56/EC. Accessible at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32008L0056:EN:NOT

The UK Biodiversity Action Plan (UK BAP) published in 1994, was the UK Government's response to the Convention on Biological Diversity (CBD), which the UK signed up to in 1992 in Rio de Janeiro. The CBD called for the development and enforcement of national strategies and associated action plans to identify, conserve and protect existing biological diversity, and to enhance it wherever possible.

In 2010, parties to the CBD renewed their commitment to halt the alarming global declines of biodiversity and to ensure that by 2020 our natural environment is resilient and can continue to provide the ecosystem services that are essential for life. The resulting Strategic Plan for Biodiversity 2011- 2020[119], with its five strategic goals and 20 new global 'Aichi' targets, sets a new global vision and direction. The vision is that "By 2050, biodiversity is valued, conserved, restored and wisely used, maintaining ecosystem services, sustaining a healthy planet and delivering benefits essential for all people".

Biodiversity 2020: A Strategy for England's wildlife and ecosystem services[120] was published in 2011 in response to the requirement for parties to the CBD to produce a National Biodiversity Strategy and/or Action Plan (NBSAP). The UK Post-2010 Biodiversity Framework[121], succeeds the UK BAP and sets out common purposes and shared priorities to achieve the Aichi targets and identifies the activities required to complement the country biodiversity strategies and the EU Biodiversity Strategy[122].

The UK BAP priority list of habitats and species was used to draw up statutory lists of priorities for England, under section 41 of the Natural Environment and Rural Communities Act (NERC). The section 41 list is used by decision makers in implementing their duty under section 40 of the NERC, to have regard to the conservation of biodiversity in England when carrying out their normal functions. The list includes a number of marine and coastal habitats and species present in the waters around England[123]. Many of these align with the OSPAR lists mentioned below, but many are of national interest. These have not been mapped in this exercise as on a national scale the distributions cannot clearly be distinguished. The UK BAP list of priority habitats remains a useful reference and details of each habitat and species with current issues and threats can be accessed via the JNCC website[124].

The MPS requires that appropriate weight is attached to designated sites and protected species, and also to habitats and species of principal importance for the conservation of biodiversity[125] beyond the boundaries of MPAs. Marine planning has a role in delivering the requirements of the MPS, and in supporting the coherence of the MPA network in general. Figure 9 shows the location of some of the Annex 1

[119] www.cbd.int/doc/strategic-plan/2011-2020/Aichi-Targets-EN.pdf
[120] www.gov.uk/government/uploads/system/uploads/attachment_data/file/69446/pb13583-biodiversity-strategy-2020-111111.pdf
[121] http://jncc.defra.gov.uk/pdf/UK_Post2010_Bio-Fwork.pdf
[122] http://ec.europa.eu/environment/nature/biodiversity/comm2006/2020.htm
[123] www.naturalengland.org.uk/ourwork/conservation/biodiversity/protectandmanage/habsandspeciesimportance.aspx
[124] http://jncc.defra.gov.uk/page-5705
[125] HM Government, 2011, Marine Policy Statement, paragraph 2.6.1.5.

habitats that are protected under the Habitats Directive, based on best available evidence. Further detail on features of conservation importance can be found on the MMO planning portal[126].

OSPAR Convention

The Convention for the Protection of the Marine Environment of the North East Atlantic (the OSPAR Convention) acts as an intergovernmental platform for signatory countries (of which the UK is one) to cooperate to protect the marine environment of the North East Atlantic.

Contained within the OSPAR Convention are a series of Annexes which deal with the following specific areas:

- Annex I: Prevention and elimination of pollution from land-based sources
- Annex II: Prevention and elimination of pollution by dumping or incineration
- Annex III: Prevention and elimination of pollution from offshore sources
- Annex IV: Assessment of the quality of the marine environment
- Annex V: Protection and conservation of marine ecosystems and biological diversity

Under Annex V, a list was drawn up of threatened and declining species in need of protection, to guide OSPAR in its further work. A network of MPAs was proposed to contribute both to protection of OSPAR threatened species and habitats[127] and to the conservation of areas which best represent the range of species, habitats and ecological processes in the OSPAR area.

The OSPAR Commission recommended that contracting parties complete an initial consideration (by 2005) as to whether any areas within their jurisdiction justified identification as OSPAR MPAs according to the OSPAR MPA identification and selection guidelines[128]. JNCC evaluate existing MPAs designated under the Birds Directive and Habitats Directive (SACs and SPAs) for inclusion in the OSPAR MPA network. By 2011, 170 Natura sites were identified as OSPAR MPAs, with a further 13 sites – candidate SACs (cSACs), sites of Community importance, and marine nature reserves – submitted to the OSPAR Commission in 2012. All sites meet at least one of the OSPAR MPA ecological criteria. A full list[129] of the UK's OSPAR MPAs is available.

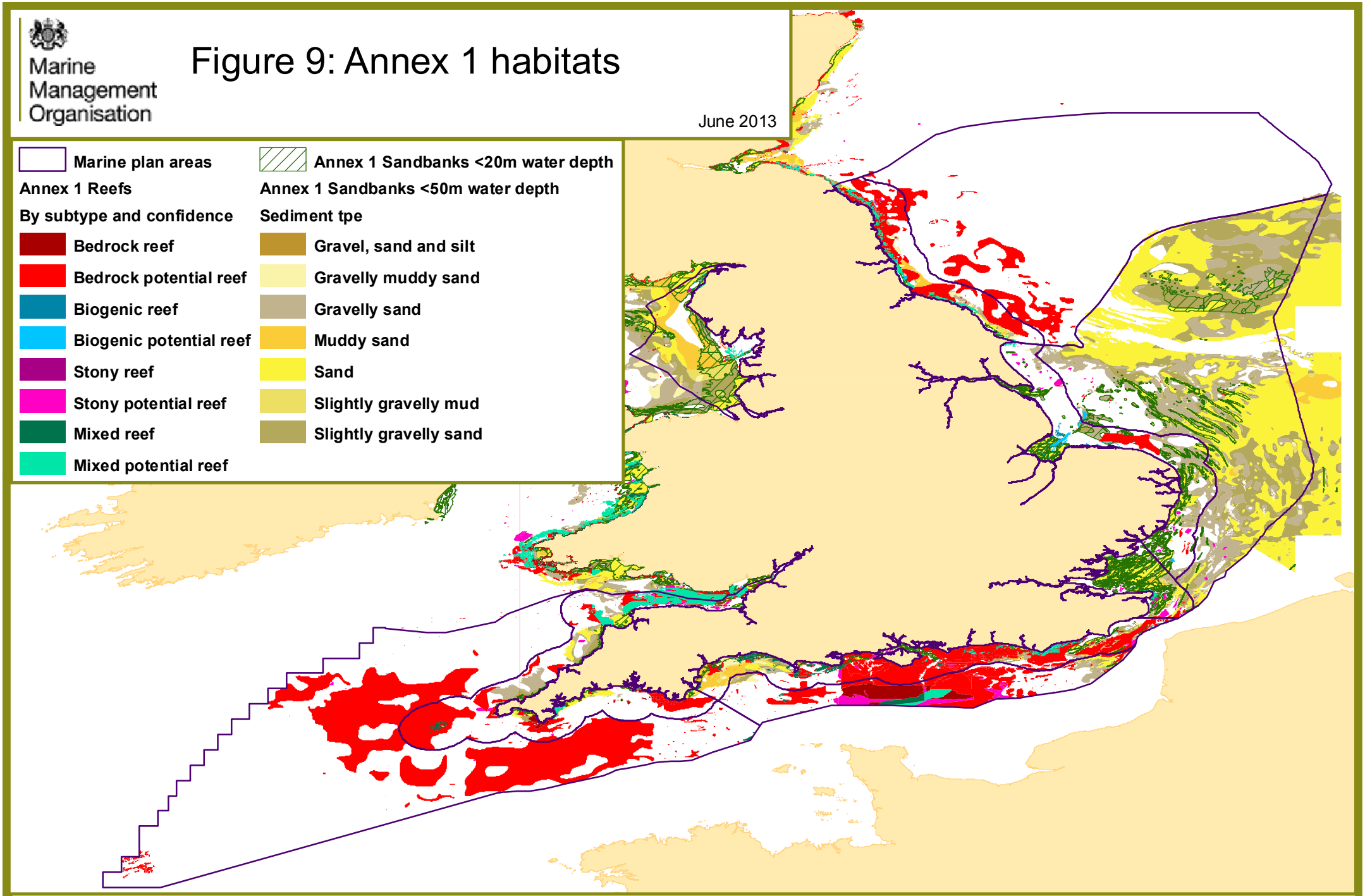
Further work on behalf of the statutory nature conservation bodies (SNCBs) is being undertaken by JNCC to assess which additional MPAs are required to support the development of an ecologically coherent, well-managed network of sites across the OSPAR maritime area. Work to map the distribution of each species and habitat was completed in the Defra research projects to inform the development of MCZs and marine planning and will be used at the marine plan area level.

[126] http://planningportal.marinemanagement.org.uk.
[127] http://jncc.defra.gov.uk/pdf/08-06e_OSPAR%20List%20species%20and%20habitats.pdf
[128] http://jncc.defra.gov.uk/PDF/OSPAR_03-17e_GuidelinesIdentificationMPA.pdf
[129] http://jncc.defra.gov.uk/page-4658

Marine Management Organisation

Figure 9: Annex 1 habitats

June 2013



England's network of marine protected areas (MPA)

The UK administrations are committed to completing an ecologically coherent network of MPAs as part of an ecosystem-based approach to nature conservation – under international agreements including the Convention on Biological Diversity[130] and the OSPAR Convention[131]. A MPA network is a key measure towards achieving GES as required by the MSFD[132]. The sites in the network will work together to provide more benefits than an individual conservation area could on its own. All those areas established under international, European and national legislation with a marine component will contribute to this network. Those around England are shown in Figure 10 and include:

- SACs designated under the Habitats Directive[133]
- SPAs classified under the Birds Directive[134]
- SSSIs with marine components designated under the Wildlife and Countryside Act 1981(as amended)
- MCZs designated under MCAA
- Ramsar sites (wetlands of international importance) designated under the Ramsar Convention[135] on Wetlands, 1971.

Existing designated sites in English waters

Existing designated sites include all the MPAs[136] plus any additional designated sites which are within or overlap the marine area, such as coastal sites without wholly marine features.

The Habitats Directive and Wild Birds Directive together provide for the creation of a network of protected areas for important or threatened wildlife habitats and species across the European Union known as Natura 2000. In many cases, but not all, the SPAs are also designated as Ramsar sites with similar if not coincident boundaries. There are no marine Ramsar sites which are not also SPAs in the English area. In some cases, SPAs and SACs also overlap. For more detail, the data can be viewed via the MMO Planning Portal[137].

Figures 10 to 12 show the distribution of MPAs across the marine plan areas. The figures are provided to give an indication of the relative differences between marine plan areas in terms of area covered by designated sites. However, it should be noted that the conservation benefits achieved by designation depend on the features present, conservation objectives and effective management. Any restrictions on activities will be determined by their potential impact on protected features and the management measures in place to achieve the conservation objectives.

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[130] www.cbd.int/
[131] www.ospar.org/content/content.asp?menu=00340108070000_000000_000000
[132] Article 13(4) http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:164:0019:0040:EN:PDF
[133] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31992L0043:EN:HTML
[134] http://ec.europa.eu/environment/nature/legislation/birdsdirective/index_en.htm
[135] www.ramsar.org/cda/en/ramsar-home/main/ramsar/1_4000_0__
[136] MPAs in the strict sense are those designated specifically for marine features of conservation interest. However, other statutory designated sites around the coast that overlap or are adjacent to the marine area are also directly relevant to marine planning given the interdependence of subtidal, intertidal and coastal habitats, species and processes.
[137] http://planningportal.marinemanagement.org.uk/

Protection of sites is provided for by existing statutory measures, including site specific objectives and management plans. Protection of areas outside of sites is also provided by existing measures such as strategic environmental assessments and environmental impact assessments which require applicants to consider features outside of designated sites. The MMO has developed a strategic approach to MPA management, and have developed a table[138] providing information about designated sites, including some of the SNCB advice about the impact of human activities upon site features[139]. The management measures for a number of proposed sites are still to be defined, with potential implications for activities.

[138] www.marinemanagement.org.uk/protecting/conservation/documents/mpas_risk.pdf
[139] Note: this table includes only the advice in relation to activities for which the MMO has management responsibility.

Marine Management Organisation

Figure 10: Marine protected areas

June 2013

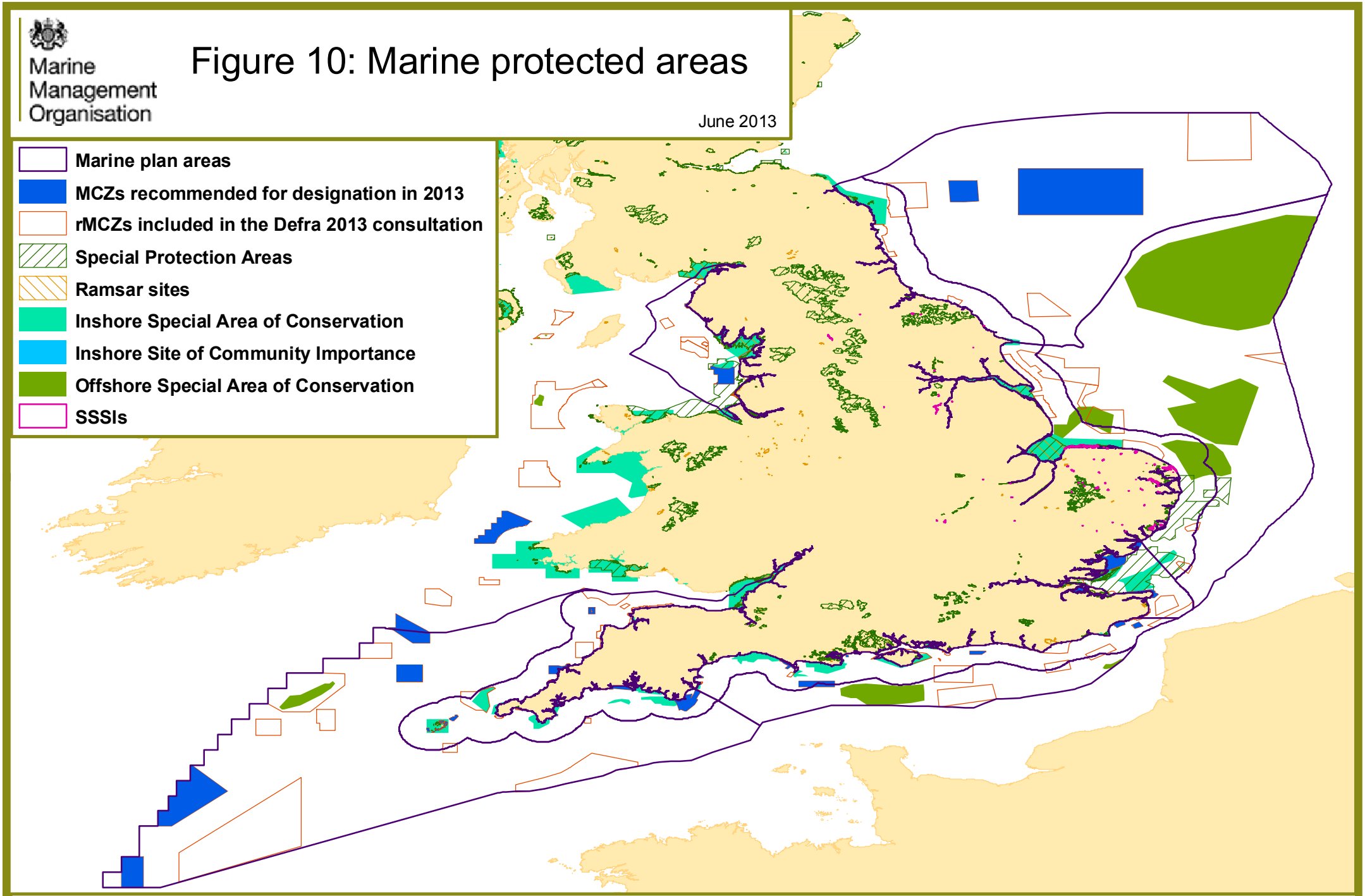

Figure 11: Relative proportion of special protection areas in each marine plan area (by area coverage in square km, as at May 2013)

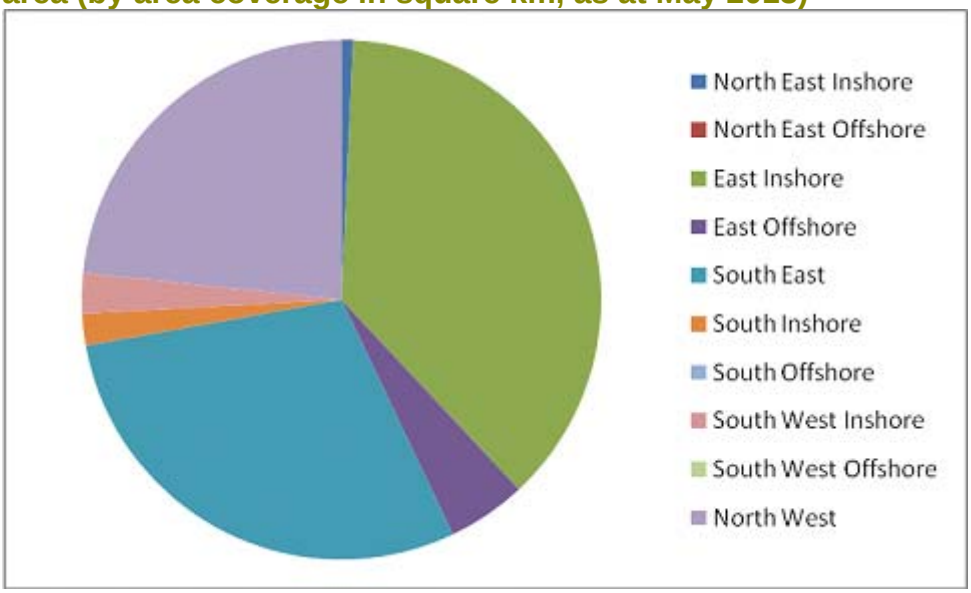

Figure 12: Relative proportion of special areas of conservation in each marine plan area (by area coverage square km, as at May 2013)

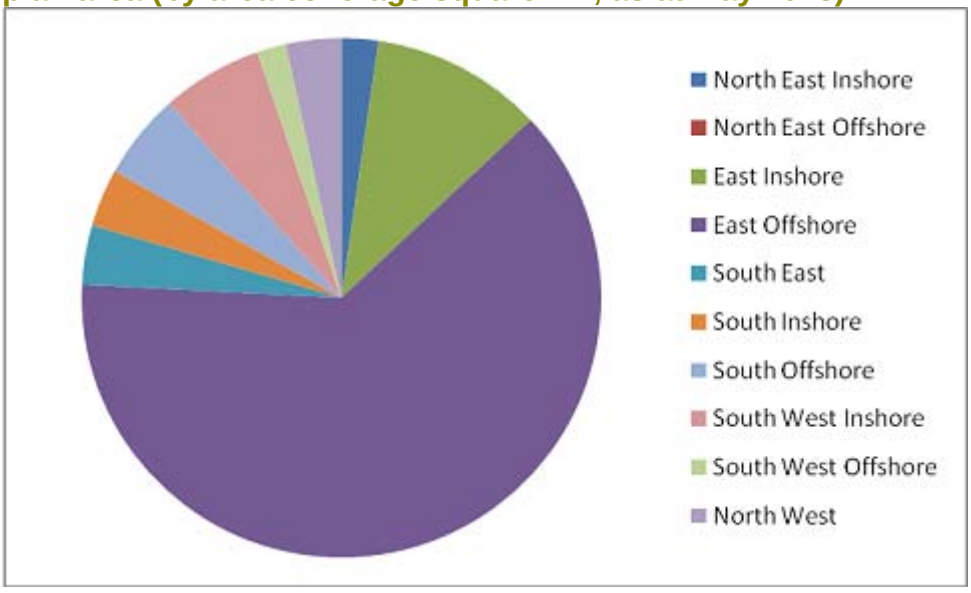

Table 3: Number, area coverage, and distribution of all SPAs, SACs and SSSIs between the marine plan areas (as at May 2013)

Marine plan area	Number of SPA sites	Area covered by SPA (square km)	Percentage of marine plan area covered by SPA	Number of SAC sites	Area covered by SAC (square km)	Percentage of marine plan area covered by SAC	Number of SSSI sites	Area covered by SSSI (square km)	Percentage of marine plan area covered by SSSI
North East Inshore	6	52	1	7	617	10	37	77	1
North East Offshore	0	0	0	0	0	0	0	0	0
East Inshore	15	2681	26	17	2892	28	52	1002	10
East Offshore	1	355	1	4	16955	35	0	0	0
South East	14	2104	54	6	995	25	35	356	9
South Inshore	11	142	1	18	964	9	0	167	2
South Offshore	0	0	0	2	1439	13	0	0	0
South West Inshore	4	179	1	23	1682	10	137	251	2
South West Offshore	0	0	0	1	482	1	0	0	0
North West	7	1671	23	7	925	13	28	701	10

Note: The numbers of SPAs, SACs and SSSIs shown in the table, when totalled, give a larger number than the total number in England. This is because the table provides a count for each marine plan area which an SPA overlaps, and therefore if a site overlaps with more than one marine plan area it will be counted within each. The SAC data includes candidate SACs (cSACs) and sites of Community importance (SCIs). The SPA data includes SPAs with boundaries that overlap the English marine plan areas and are designated for either a marine or terrestrial species.

There are currently 55 SPAs with marine components, covering 3% of the English marine area, designated to protect seabirds, waders and waterfowl and cover areas of their migration routes, breeding and aggregation. Of these, there are only two existing English SPAs which are considered to be entirely marine. These are the Outer Thames Estuary SPA and Liverpool Bay SPA, classified in 2010 for non-breeding aggregations of red-throated diver (both sites) and common scoter (Liverpool Bay).

The East Inshore, South East Inshore and North West have the largest designated area, mainly due to the inclusion of the two marine SPAs, plus the existing intertidal expanses of the Humber and Wash (East Inshore Marine Plan Area), Morecambe Bay and Solway Firth (North West Marine Plan Area).

There are 80 SACs, covering 12% of the English marine area, located throughout all marine plan areas. However, the distribution is far from uniform Sites in the East Offshore Marine Pan Area account for 63 percent of the designated area[140], including the UKs largest sandbank, Dogger Bank, which has recently been approved by the European Commission as a site of Community importance (SCI).

Protection of sites is provided for by existing statutory measures, including site-specific objectives and management plans, delivered by competent and relevant authorities. Protection of areas outside of sites is also provided by existing measures such as strategic environmental assessments and environment impact assessments which require applicants to consider environmental features beyond designated sites.

In March 2012, the government published a review of the implementation of the Habitats Directive and Birds Directive[141], with particular reference to the burdens placed on business through the regulatory process. Defra identified four key areas where change will improve the implementation of the Directives. These are:

- facilitating nationally significant infrastructure projects
- improving implementation processes and streamlining guidance
- improving the quality, quantity and sharing of data
- improving the customer experience

A number of measures were identified to implement the changes required, to demonstrate how economic and environmental objectives are both compatible and central to long-term sustainable development.

In addition, in August 2012, Defra announced a revised approach to managing fishing activity in European marine sites (EMSs). The revised approach applies to all EMSs and potential SPAs and possible SACs in England, and will promote sustainable fisheries while conserving the marine environment and resources, securing a sustainable future for both. It aims to ensure that, in order to comply with Article 6 of the Habitats Directive, management measures are identified for high risk

[140] When including cSACs and SCIs in the area covered.
[141] Defra 2012 Report of the Habitats and Wild Birds Directives Implementation Review. Available at: www.gov.uk/government/uploads/system/uploads/attachment_data/file/69513/pb13724-habitats-review-report.pdf

features by December 2013, and any additional fishery management measures for the conservation of the abovementioned sites are in place by 2016.

There are 4112 SSSI in England designated under the Wildlife and Countryside Act 1981 (as amended), covering around 5% of the country's land area. These are cited for their biological and geological interest features. More than 70% of these sites (by area) are internationally important for their wildlife and are also designated as SACs, SPAs or Ramsar sites. The sites always have a terrestrial component as they do not extend below the low water mark. There are 377 coastal sites containing intertidal habitats included within the marine area.

Future Natura 2000 designations

Work is underway by the SNCBs to identify further fully marine SPAs in order to provide additional protection in line with the legislation. The areas of search (AoS) for new sites are available on the JNCC website[142] as a series of maps.

Within English waters, these AoS show inshore aggregations of waterbirds within both the East marine plan areas and South West Inshore Marine Plan Area and Balearic shearwater in the South Inshore Marine Plan Area. Seabird colonies in the North East Inshore Marine Plan Area have the potential for extension into the marine area and further breeding colonies of shag, tern and red-throated diver are identified in all inshore areas. In the East Inshore Marine Plan Area, an extension at Flamborough Head and Bempton Cliffs SPA is currently in progress, as is a proposed new marine SPA for Falmouth Bay to St Austell Bay in the South West Inshore Marine Plan Area.

There are four marine habitats and four marine species present in UK waters away from the coast for which the European Commission has stated that additional SACs must be designated. These are submerged sandbanks, submerged or partially submerged sea caves, reefs, submarine structures made by leaking gases, grey and harbour seals, bottlenose dolphin and harbour porpoise. The SNCBs are currently working to identify additional sites. Areas of search[143] have been defined using existing knowledge of the distribution of these habitats and species and these are being investigated and surveyed where necessary to establish their value against selection criteria.

Marine conservation zones

The MCAA created a new type of MPA called a marine conservation zone (MCZ) to protect nationally important marine wildlife, habitats, geology and geomorphology. Sites will be selected to protect not just the rare and threatened, but the representative range of marine wildlife. MCZs replace marine nature reserves[144] in England – Lundy Island in the South West Inshore Marine Plan Area, a former marine nature reserve, became the first MCZ in 2010.

[142] http://jncc.defra.gov.uk/pdf/SPA_AOS_Maps%2020100304.pdf
[143] http://jncc.defra.gov.uk/page-4543
[144] Designated under the Wildlife and Countryside Act 1981.

Recommendations for 127 MCZs were delivered to government by four regional MCZ projects[145], covering English inshore waters and offshore waters adjacent to England, Wales and Northern Ireland. Each project worked closely with stakeholders in developing the recommendations through an iterative process, working with guidance from the SNCBs detailing criteria and targets for the recommendations to meet. The SNCBs submitted formal advice on the recommendations, including an impact assessment, to government in July 2012.

The MCZ consultation closed in March 2013[146,147]. The consultation included all the recommended MCZs, with proposals for 31 sites which Defra deemed suitable for designation in 2013, based on the impact assessment, SNCB advice and an assessment by the Science Advisory Panel. Evidence received during the consultation, along with other evidence collected since SNCBs submitted their advice to government, is now being considered before ministers make their decision on which of the 31 MCZs in the first tranche to designate in 2013. An announcement on future tranches of MCZs is expected to be made in the autumn of 2013.

Table 4: Distribution of tranche one MCZs intersecting each marine plan area
Please note: the figures do not sum to 31 as where a recommended MCZ intersects more than one marine plan area it will be counted for each.

Marine plan area	Number of marine conservation zones
North East Inshore	1
North East Offshore	2
East Inshore	1
East Offshore	0
South East	4
South Inshore	12
South Offshore	1
South West Inshore	23
South West Offshore	4
North West	3

In contrast to the designation of European sites, the designation of MCZs may take socio-economic factors into account, as long as these factors do not undermine the creation of an ecologically coherent network. Where socio-economic costs were considered to outweigh the conservation benefit, the recommended MCZ was not

[145] Recommendations from the regional MCZ projects: Finding Sanctuary (south-west), Irish Sea Conservation Zones (Irish Sea), Net Gain (English North Sea) and Balanced Seas (south-east), can be accessed via: www.gov.uk/marine-protected-areas.
[146] Defra 2012 Marine Conservation Zones: Consultation on proposals for designation in 2013. Available at: www.gov.uk/government/uploads/system/uploads/attachment_data/file/82730/mcz-condoc-121213.pdf
[147] www.gov.uk/government/consultations/marine-conservation-zones-consultation-on-proposals-for-designation-in-2013

deemed appropriate for designation. Three sites (two in the South plans and one in the South West marine plan areas) will not be considered further on this basis[148].

MCZs will have variable levels of protection depending on their features of interest. This will ensure that a network of sites can be achieved in a way that minimises adverse impacts on sea users and maximises benefits for nature conservation.

Futures – climate change

Climate change may have implications for a number of areas of marine management, for example MPAs and marine conservation. For example, if an area is created to protect a certain fish spawning ground, and the fish move out of that area due to rising temperatures, the protected area boundaries may have to be flexible to ensure that the fish are still protected. This has already been seen in the Plaice Box located off the coasts of Germany, Denmark and Holland, in the southern North Sea. Approximately 38,000 square km in size, this was initially protected as an area where juvenile plaice congregated to protect them at a vulnerable time in their life cycle, however plaice have now completely moved away from the box, possibly due to warming sea temperature[149].

The temperature conditions within an MPA may become unsuitable for a particular species with time[150]. Areas designated for their biogenic habitats would be less susceptible to such effects but the qualifying criteria for designation may need to be adaptable. Although a biogenic feature may continue to exist, the assemblage of species present could be fundamentally different. Management practices within these areas will need to be closely monitored to ensure that if habitats or species become stressed due to climate change, they can still withstand the human pressures put upon them. Another example is where there are licence conditions in place to protect a mobile species. These conditions may need reviewing if the species moves as a result of climate change[151].

2.4 Historic environment, landscape, seascape and character

2.4.1 Historic environment

Some heritage assets have a level of interest that justifies statutory designation, the purpose of which is to ensure that they are protected and conserved for the benefit of this and future generations. In the English marine area, designated heritage assets may include:

- scheduled monuments designated under the Ancient Monuments and Archaeological Areas Act 1979
- protected wreck sites designated under the Protection of Wrecks Act 1973
- sites designated under the Protection of Military Remains Act 1986

[148] www.gov.uk/government/uploads/system/uploads/attachment_data/file/82730/mcz-condoc-121213.pdf
[149] MCCIP (2012) Marine Climate Change Impacts on Fish, Fisheries and Aquaculture. Summary Report, Lowestoft.
[150] Jones, M.C., et al., 2013, Predicting the impact of climate change on threatened species in UK waters Plos One 8,1:1-13.
[151] Townhill, B.L., et al, 2013, Marine Management Organisation Climate Change Adaptation Reporting - Feeder Report A report to the MMO.

Many heritage assets with archaeological interest in these areas are not currently designated as scheduled monuments or protected wreck sites but are arguably of great if not equal significance. The absence of designation for such assets does not necessarily indicate lower significance. Sites of historic interest are distributed throughout the marine environment and around the coast and hinterland. Equal value can be attributed to these features in every marine plan area and no one area ranks as more significant than another.

English Heritage published the National Heritage Protection Plan[152] in May 2011. This sets out the priorities which English Heritage will dedicate resources to in the years 2011 to 2015, for all aspects of national heritage, spanning both the pre-historic and historic periods.

In October 2011 English Heritage produced the guidance 'The Setting of Heritage Assets'[153]. This guidance sets out advice on managing change within the settings of heritage assets, including archaeological remains and historic buildings, sites, areas, and landscapes. It provides detailed advice intended to assist implementation of Planning for the historic environment and it's supporting Historic Environment Planning Practice Guide [154], together with the historic environment provisions of the national policy statements for nationally significant infrastructure projects.

[152] English Heritage (2011). National Heritage Protection Plan. Available online at : www.english-heritage.org.uk/professional/protection/national-heritage-protection-plan/all-about-NHPP/
[153] English Heritage (2011). The Setting of Heritage assets. Available online at www.english-heritage.org.uk/publications/setting-heritage-assets/
[154] English Heritage (2012). Historic Environment Planning Practice Guide. Available online at www.english-heritage.org.uk/publications/pps-practice-guide/pps5practiceguide.pdf

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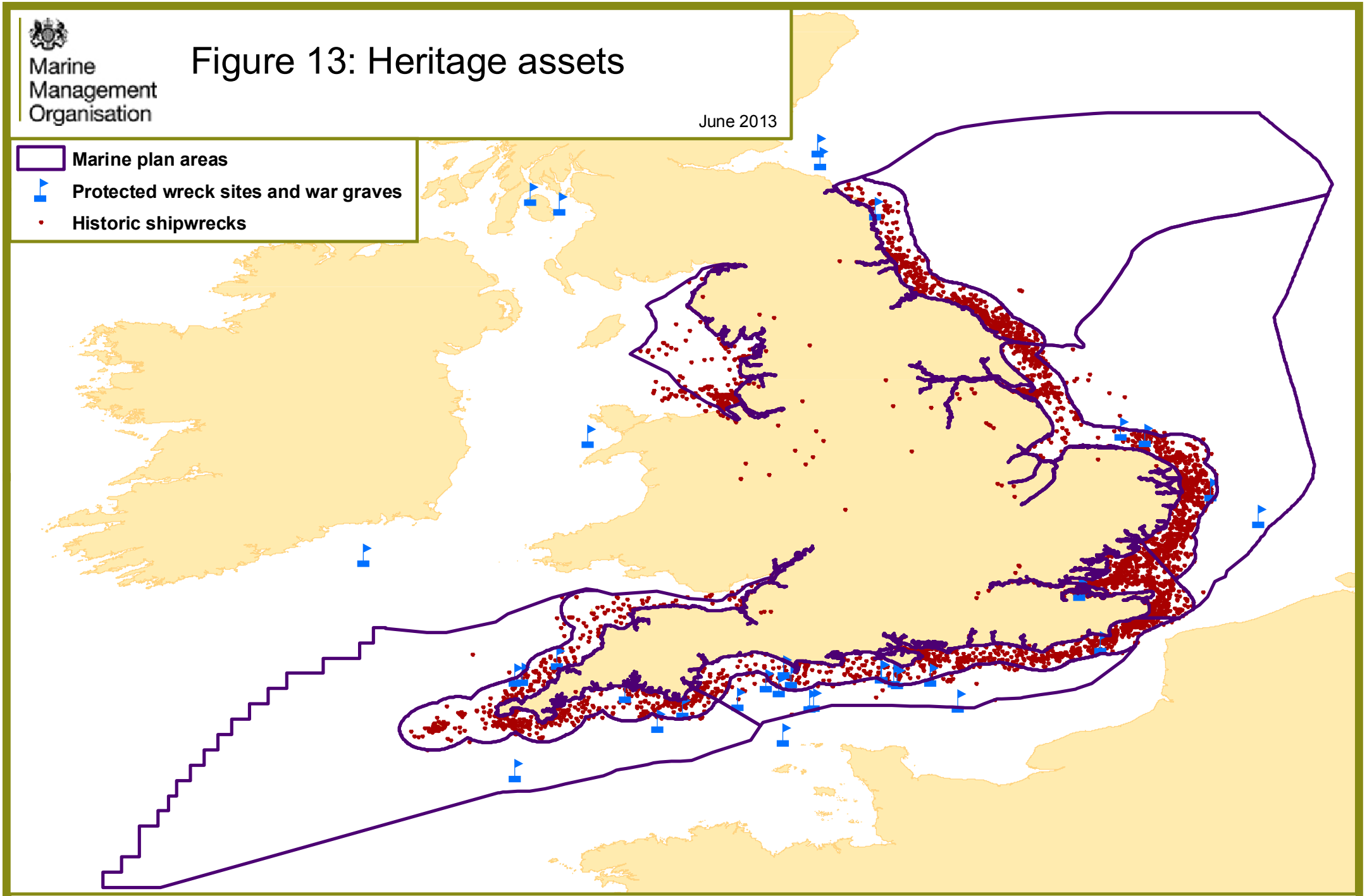
Figure 13: Heritage assets

June 2013



2.4.2 Landscape, seascape and character

The European Landscape Convention defines landscape as "an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors"[155]. This definition relates to all landscapes whether designated or undesignated, whether locally designated or nationally designated. All landscapes have character and it is their unique assemblage of characteristics, both socio-cultural and physical, that have interacted over time, which makes one landscape different from another.

Since 1949 England's finest landscapes have been designated as National Parks or areas of outstanding natural beauty (AONBs). The purposes of National Parks are to conserve and enhance an area's natural beauty, wildlife and cultural heritage and promote opportunities for the understanding and enjoyment of the special qualities of the National Park by the public. Therefore, conserving a number of the finest landscapes in England for the nation's benefit. In England there are nine national parks and the Norfolk and Suffolk Broads – six of these are associated with the coast.

AONBs are designated solely for the purpose of conserving and enhancing their natural beauty (which includes landform and geology, plants and animals, landscape features and the rich history of human settlement over the centuries). England has 34 AONBs, 16 of these have a coastal element.

Heritage coasts are stretches of undeveloped coastline of natural beauty defined by agreement between Natural England and participating coastal local authorities. They are nationally recognised and locally managed so that their natural beauty is conserved and, where appropriate, accessibility for visitors improved. England has 32 heritage coasts, covering 33% of England's coastline. Most heritage coasts (89%) are within either national parks or AONBs. Only the Durham, Flamborough Headland, Spurn, Lundy and St. Bees Head heritage coasts are independent of National Parks or AONBs. The first heritage coast to be defined includes the famous chalk cliffs of Beachy Head and the Seven Sisters in Sussex (1973), the most recent being the Durham Coast (2001).

Half of all heritage coasts in England are in the South West marine plan areas, 18% in the South and 29% in all other marine plan areas combined. There are nine UNESCO world heritage sites in the South marine plan areas including the only natural coastal site at the Jurassic Coast in Dorset, nine in the North West, eight in the South West and five in the South East. Seven of the 21 AONBs are in the South West and South, two in the Southeast, East and Northwest and one in the North East. This suggests that's the South and the South West are the most significant marine plan areas for its historic coastal landscapes which are tourist attractions.

The majority of UK's protected landscapes have strong associations with the coast and the sea. These protected landscapes with a coastal dimension lie adjacent to our marine resource which provides each with its' unique setting. These coastal protected landscapes are also part of our seascape resource.

[155] Council of Europe (2000). European Landscape Convention defines landscape as. More information available online at: www.coe.int/t/dg4/cultureheritage/heritage/Landscape/default_en.asp

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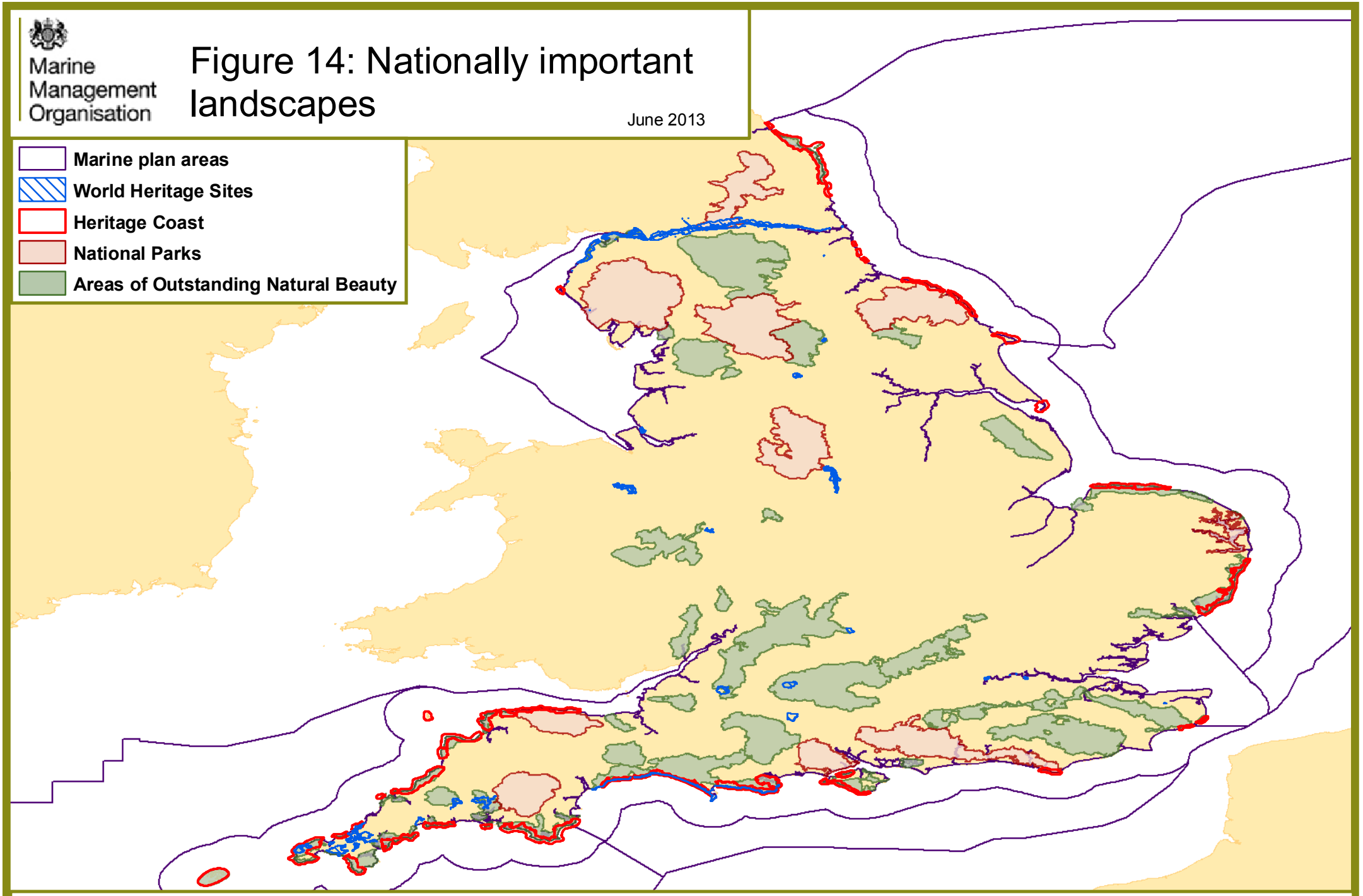
Figure 14: Nationally important landscapes

June 2013



The Marine Policy Statement (MPS) describes seascape (for the purposes of planning) as meaning landscapes with views of the coast or seas, and coasts and the adjacent marine environment with cultural, historical and archaeological links with each other.

Using 'An approach to seascape character assessment[156]' Natural England has produced the first strategic scale character assessment for the East Inshore and East Offshore marine plan areas[157]. The pilot study supports the production of marine plans by informing the evidence gathering stage of the marine plan process.

The MMO has recently contracted work to produce a seascape assessment for the South Inshore and South Offshore marine plan areas, and subsequent studies will be undertaken by the MMO for other marine plan areas as they are developed. An advisory group has been set up including Defra, Natural England, English Heritage and the MMO to steer the development of seascape assessments for the English marine area.

English Heritage's programme of historic seascape characterisation (HSC) nears completion of national coverage of England's coasts (inshore and offshore regions) with full national coverage expected by January 2014. HSC also extends to coastal land, presenting its maritime perspective, overlapping and complementing the 'terrestrial perspective' provided by English Heritage's historic landscape characterisation (HLC) programme.

Natural England is currently working to produce a suite of refreshed national character area (NCA) profiles[158]. These NCAs divide the English mainland into 159 distinct character areas. Each is defined by a unique combination of landscape, biodiversity, geodiversity and cultural and economic activity. The MMO is working closely with Natural England to align coastal NCAs with the recently announced seascape assessment currently being undertaken in the South marine plan areas.

2.5 Defence and national security

Key facts

- The Ministry of Defence (MOD) has the primary role of providing military defence and security to the people of the UK and overseas territories.
- The MOD uses the marine area for exercises and practice, particularly in the North East, East and South West marine plan areas.
- Activity encompasses the whole marine area, but is concentrated in hot spots.

Introduction

The MOD has the primary role of providing military defence and security to the people of the UK and overseas territories. Within UK waters, in peacetime, military

[156] Natural England (2011). An Approach to Seascape Characterisation. Available online at http://publications.naturalengland.org.uk/publication/2729852

[157] Natural England (2011). Seascape Characterisation around the English Coast (Marine Plan Areas 3 and 4 and Part of Area 6 Pilot Study). Available online at http://publications.naturalengland.org.uk/publication/2736726

[158] Natural England. National Character Areas. Available online at www.naturalengland.org.uk/publications/nca/default.aspx

activities comprise practice and training activities, routine patrolling, transporting equipment and personnel in and out of the country, search and rescue operations (in conjunction with HM Coastguard) and communications including using radar.

The MOD employs people throughout the UK in support of its operations in the marine environment, including HM naval bases, MOD ranges and coastal estates. Some onshore coastal defences such as aerodromes, transmitter sites and explosive stores have safeguarding zones extending over the marine area. The MOD aims to minimise the impact of its activities on the environment during its decision making processes.

National summary

Defence activities that use the marine environment, directly or indirectly, in support of operational capability are diverse but include operational vessels and aircraft, HM naval bases, surface and sub-surface navigational interests, underwater acoustic ranges, maritime and amphibious exercises, coastal training, test and evaluation ranges[159].

The UK has a military low flying system which supports training below 2000 feet throughout UK airspace except in controlled airspace dedicated to civil aviation traffic and over major built up areas. Military low flying activities are conducted over the English marine area.

A number of air bases are located in coastal areas with associated air traffic radars. In addition the MOD operates a number of air defence radars at coastal locations monitoring UK airspace.

A Cabinet Office led, cross-government agreement has seen the formation of a National Maritime Information Centre (NMIC). NMIC has been set up to bring together representatives of the MMO, Department for Transport, MOD, Home Office, Foreign Commonwealth Office, and Department of Energy and Climate Change into one location to ensure the full range of maritime security challenges can be tackled in partnership across government. The Royal Navy's command and control infrastructure and maritime surveillance capability is of upmost importance for the National Maritime Information Centre[160].

Distribution across the marine plan areas

Figure 15 shows practice and exercise areas (PEXA). These are areas available to the MOD for military practice and exercises, though any area of UK waters may be used for military activities. PEXA are found in every marine plan area but differ in use. Table 5 shows the proportion of PEXA in each marine plan area and the proportion of the marine plan area covered.

[159] HM Government (2011) MPS para 3.2.4 www.gov.uk/government/publications/uk-marine-policy-statement

[160] HM Government (2011). National Maritime Information Centre. Available online at www.nautinstlondon.co.uk/nautinstlondon/wp-content/uploads/2012/12/NMIC-information-booklet.pdf

Table 5: Distribution of the PEXA between the marine plan areas

Marine plan area	Area of PEXA (square km)	Percentage of marine plan area covered by PEXA	Percentage of total PEXA in each marine plan area
North East Inshore	2,437	39	2
North East Offshore	57,966	54	19
East Inshore	1,665	15	1
East Offshore	23,232	46	16
South East	826	17	0
South Inshore	11,889	48	4
South Offshore	19,786	66	5
South West Inshore	20,483	60	
South West Offshore	127,285	94	45
North West	2,013	14	1
Total	**267,583**		**100**

Naval exercises encompass the whole sea area, but activity is concentrated in several hotspots. There is a submarine exercise area off Flamborough Head, on the boundary between the North East and East marine plan areas. The South West and South areas contain an extensive complex of danger and exercise areas that are used for Naval training involving shipping and aircraft engaged in firing activities where access is prohibited when firing or other activities are taking place. The majority of these sites are covered by MOD byelaws. These areas can be examined in more detail from the MOD website[161].

The North West and South East Inshore areas contain extensive danger areas used for weapon test and evaluation activities. There are also has a large number of coastal sites with associated danger and exercise areas used for firing ranges and ordnance disposal

The North East and East areas are covered by extensive RAF danger areas used for military aviation training. The majority of these are for air to air activities and do not extend to sea level. RAF Holbeach is parented by RAF Marham. It is a remote

[161] HM Government (2012). MOD Byelaws. Available online at: www.gov.uk/ministry-of-defence-byelaws

Bombing Range located on the Lincolnshire coast around 8 miles North-North-East of Holbeach. 5131 Bomb Disposal Squadon based at RAF Marham have the task of clearing the targets of spent ordnance.

RAF Wainfleet weapons range is one of two such facilities situated on The Wash, the other being RAF Holbeach, there is also RAF Donna Nook to the north of Wainfleet at North Somercotes. The PEXA do not constitute closed areas and in general are not restricted for other use except at such times that special exercises are underway that preclude other users for safety reasons.

In the South two of the three main UK naval bases are the home to the Royal Navy's surface and submarine fleet of ships. Portsmouth and Devonport offer support to their base ships in the areas of personnel, engineering and supplies[162].

Portsmouth Naval Base has been an integral part of the city since 1194. It is home to almost two-thirds of the Royal Navy's surface ships, including the aircraft carrier HMS Illustrious, new formidable type 45 destroyers, type 23 frigates and mine countermeasures and fishery protection squadrons. It will be home to two new aircraft carriers – HMS Queen Elizabeth and HMS Prince Of Wales – which are currently under construction. At 65,000 tonnes they will be the biggest ships ever built for the Royal Navy. The base is a major employer with about 16,000 people working at peak times. It provides lodging facilities to Navy personnel serving at the base and on Portsmouth-based ships.

The largest naval base in western Europe, Devonport has been supporting the Royal Navy since 1691. The vast site covers more than 650 acres and has 15 dry docks, four miles of waterfront, 25 tidal berths and five basins. Devonport is home to Britain's amphibious ships and half her frigates, plus the training hub of the front-line Fleet, FOST.

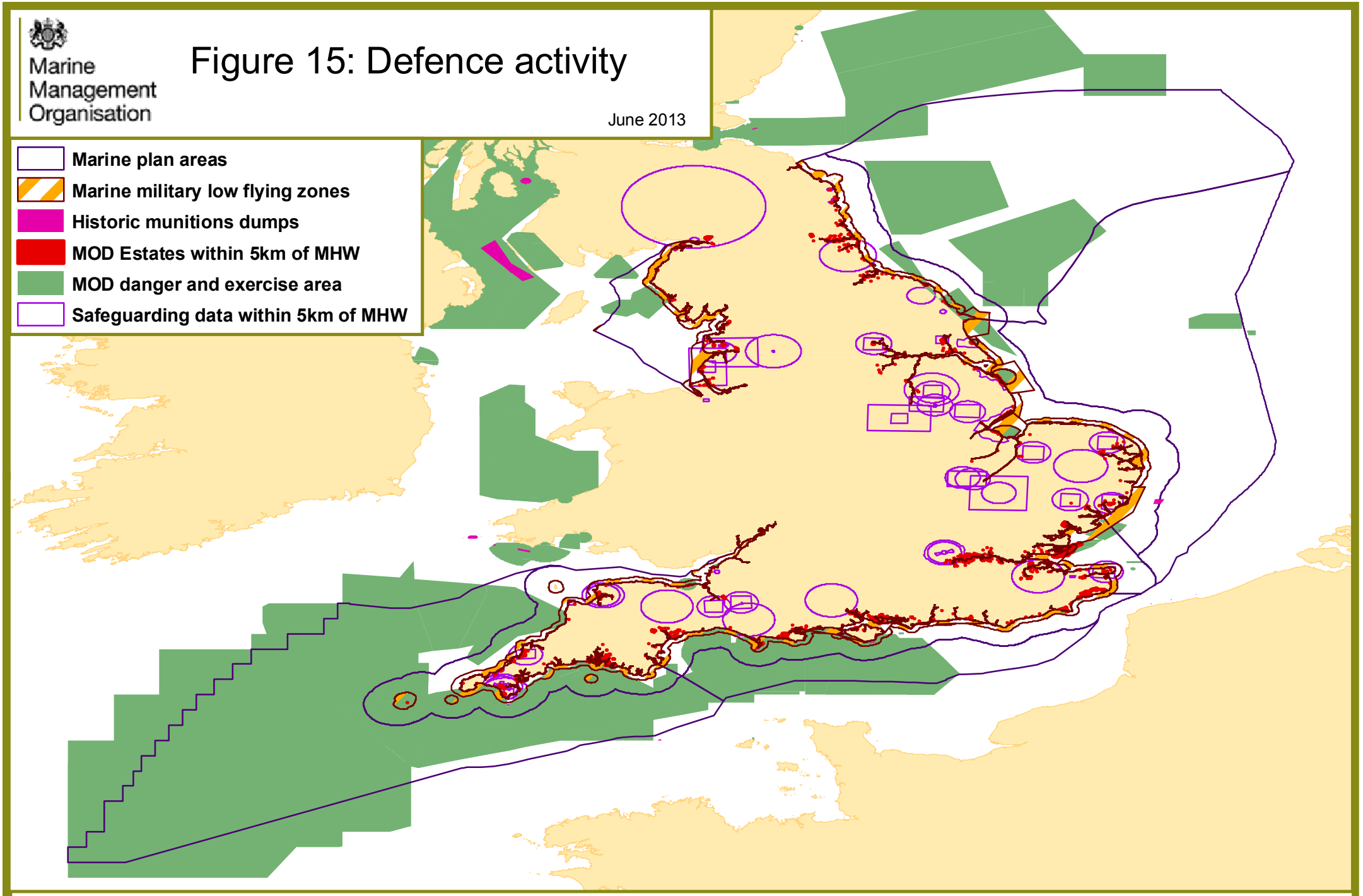
The base employs 2,500 service personnel and civilians, supports around 400 local firms and generates around 10% of Plymouth's income. There are over 5,000 ship movements annually.

[162] More information is available online at www.royalnavy.mod.uk/The-Fleet/Naval-Bases

Marine Management Organisation

Figure 15: Defence activity

June 2013



2.6 Oil and gas

Key facts

- Oil and gas production is the biggest value marine industry in England and one of the largest contributors to gross domestic product (GDP).
- Oil and gas are the primary sources of fuel and power in England.
- Total UK production peaked in 1999 and has been declining since due to decreasing reserves.
- Activity is primarily located in the North Sea and Irish Sea.
- Disused oil and gas fields could be used in future to store carbon dioxide.

National summary

The oil and gas industry is the highest value marine sector with an annual contribution of £40 billion to gross value added (GVA) in 2012. Oil and gas met 49% of UK's primary energy demand – 68% of oil demand and 58% for gas[163] which is a drop from the 2008 figures of 94% of oil demand and 74% for gas. As the primary source of energy in the UK, the industry links to almost every other sector. The cost of many activities and consumer goods is directly influenced by the price of oil via manufacturing or transport.

Production of oil and gas rose steadily from the 1970s until 1980 when Britain became a net exporter of oil. Production peaked around the turn of the century, but has been in decline since. As reserves are decreasing, the contribution of domestic sources is falling. The UK became a net importer of oil and gas in 2005. While new areas are being discovered there will be future licensing of new fields, with decommissioning of existing structures happening alongside this.

The Government's Oil and Gas Industrial Strategy[164], sets out its vision for the industry over the next 20-30 years.

Approximately 63 companies have production interests in the UK with a marine element – 355 fields (202 offshore for oil, 153 offshore for gas). There are a further 90 licences for exploration. Associated with the oil and gas production industry is the refining and distributing industry which is of significant economic value in its own right.

The individual footprints of the oil and gas installations are small but numerous. Infrastructure expected to be decommissioned from 2012 onwards (Oil & Gas UK, 2013) includes 470 installations, 15 onshore terminals and over 10,000 km of pipelines.

Distribution across the marine plan areas

Figure 16 shows the location of infrastructure used in oil and gas production. Table 6 shows the relative distribution by marine plan area. Reserves are located primarily in

[163] Oil and Gas UK economic report 2012
www.oilandgasuk.co.uk/cmsfiles/modules/publications/pdfs/EC030.pdf
[164] UK Government (2013) Industrial Strategy for Oil and Gas
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/175480/bis-13-748-uk-oil-and-gas-industrial-strategy.pdf

the North Sea and Irish Sea. In the North Sea, oil production tends to dominate the northern and central areas with gas production to the south. Significant reserves exist in Scottish waters. However, for the areas that are within the North East Offshore and East Offshore plan areas, the product is transferred to shore via pipelines to Teesside, Easington (Humber), Theddlethorpe in Lincolnshire and Bacton in East Anglia. Gas production in the North West plan area is piped into Barrow-in-Furness and the Point of Ayr in Wales.

Of the approximately 440,000 UK jobs supported by the sector, 32,000 are directly employed and 207,000 are indirectly employed in the wider supply chain[165]. The remainder of employment can be found in jobs induced by economic activity of those employed in the industry and in exporting goods and services. Scotland is the largest employer with 45% of the market. Eastern England accounts for 5% and the South East 21% of employment with a bias towards London. The North West has 6%, the remainder based inland.

In the North East there are companies with oil and gas interests on the Tyne and Tees with support for the industry in the southern North Sea based in Hull, Great Yarmouth. Dorset and the Solent area are home to local support for the south coast based industry and Morecambe for the Irish Sea[166].

Table 6: Distribution of oil and gas infrastructure by marine plan area

Marine plan area	Number of elements of infrastructure	Percentage of total infrastructure in each marine plan area
North East Inshore	21	3.0
North East Offshore	124	17.8
East Inshore	28	4.1
East Offshore	424	60.9
South East	3	0.4
South Inshore	10	1.4
South Offshore	2	0.3
South West Inshore	24	3.4
South West Offshore	0	0
North West	60	8.6

[165] Oil and Gas UK economic report 2012
www.oilandgasuk.co.uk/cmsfiles/modules/publications/pdfs/EC030.pdf
[166] Oil and Gas UK economic report 2012
www.oilandgasuk.co.uk/cmsfiles/modules/publications/pdfs/EC030.pdf

Table 7: Licensed hydrocarbon blocks (potential extraction areas) by plan area

Plan area	Licensed hydrocarbon blocks by area (square km)	Percentage of plan area covered by licences	Percentage of total licensed area in each plan area
North East Inshore	38	0.6	0.2
North East Offshore	10535	21.5	19.1
East Inshore	868	8.5	3.1
East Offshore	23590	48.8	68.4
South East	-	-	-
South Inshore	943	9	2.5
South Offshore	-	-	-
South West Inshore	-	-	-
South West Offshore	-	-	-
North West	1663	23.3	6.7

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Figure 16: Oil and gas

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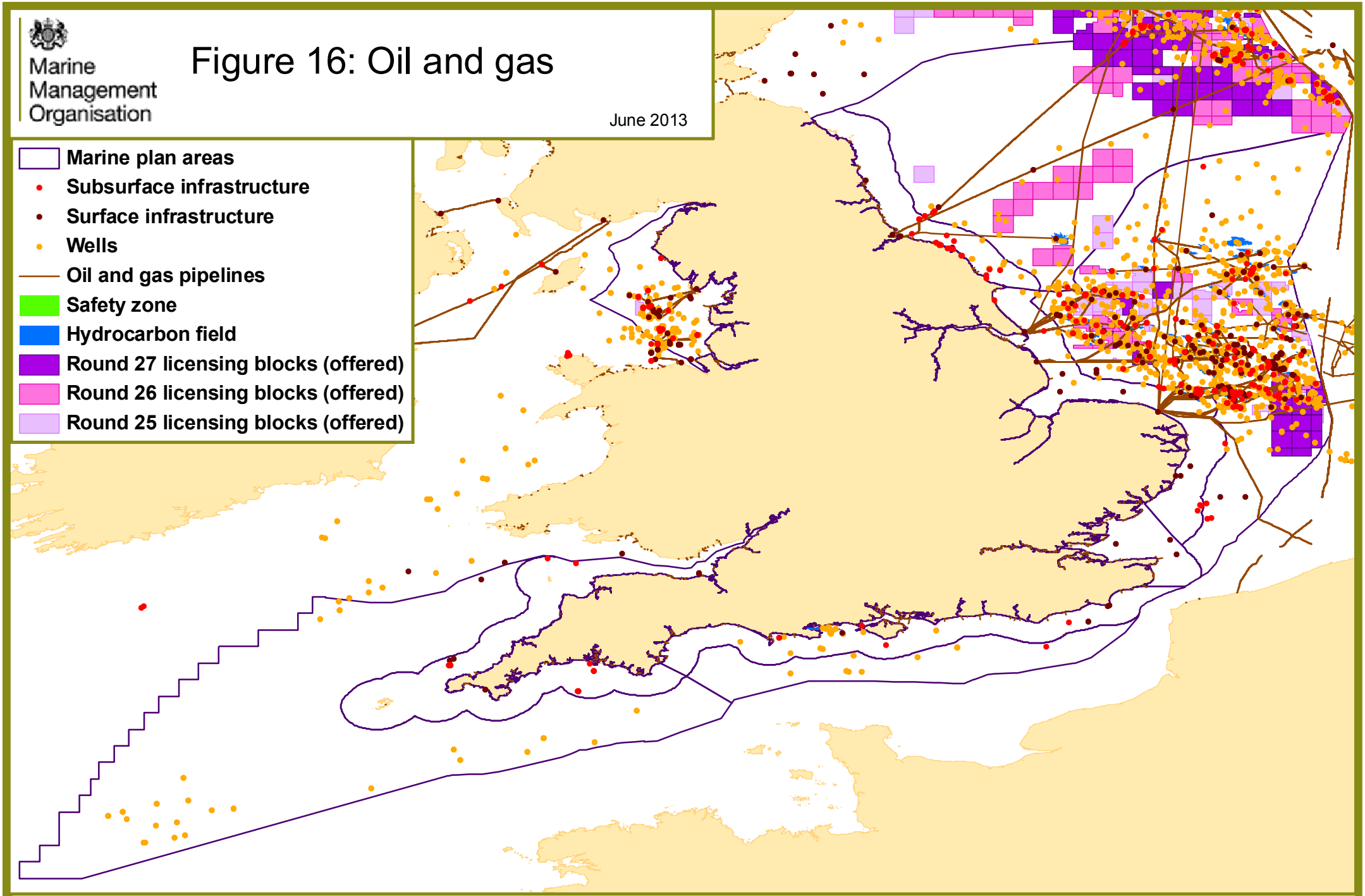

New fields and prospecting

Between 2010 and 2012, 54 fields[167] received approval by the Department of Energy and Climate Change (DECC) – 13 of these are major projects. While this means works in new locations in some cases, many of the new fields are sub-sea tie backs to existing infrastructure. Further prospecting continues and it is projected by the industry that UK oil and gas will have the potential to supply 50% of the domestic market in 2020[168] if investment is sustained.

Enhanced hydrocarbon recovery (EHR) is a developed technique that is widely deployed internationally for improving the recovery rate from hydrocarbon resources. Carbon dioxide (CO_2) is injected into declining reserves which helps drive the remaining hydrocarbons towards the production well. EHR includes enhanced oil recovery (EOR), enhanced gas recovery (EGR) and enhanced coal bed methane recovery (ECBM). Any oil or gas that is recovered through these methods would otherwise not be extracted and therefore has an economic and energy security value that should be acknowledged. EHR is widely practised around the world, particularly in the United States of America. A major barrier to the deployment of EHR in the UK has been the low availability of suitable sources of CO_2. With widespread deployment of carbon capture and storage (CCS), there will be a greater availability of CO_2 resource and there could be more widespread use of EHR in English oil and gas fields. The benefits of applying this technique (EHR) could allow for near permanent CO_2 storage in reservoirs and has the potential to provide a critical near-term solution for reducing green house gases[169].

2.6.1 Pipelines

Introduction

There are over 20,800 km of subsea pipelines in English waters carrying oil, gas and a range of chemicals. Pipelines link offshore installations such as oil and gas platforms with the mainland and provide transfers between countries for import and export. Only a small percentage are not in use. The location of these, entirely coincide with the oil and gas infrastructure and are shown on Figure 16.

Distribution across the plan areas

Pipelines are most dense in the East and North East (to a much lesser extent) marine plan areas. The North East marine plan areas have several major pipelines running out from shore well into the offshore area. The East Inshore and East Offshore marine plan areas have the vast majority of pipeline infrastructure. The remaining plan areas have little activity by comparison, the exceptions being the North West area with several wells and two significant pipelines as well as a small but significant area of infrastructure in the South Inshore Marine Plan Area.

[167] Oil and Gas UK Activity Survey 2013
www.oilandgasuk.co.uk/cmsfiles/modules/publications/pdfs/EC037.pdf
[168] www.oilandgasuk.co.uk/cmsfiles/modules/publications/pdfs/EC030.pdf
[169] DECC 2010
www.decc.gov.uk/assets/decc/What%20we%20do/UK%20energy%20supply/Energy%20mix/Carbon%20capture%20and%20storage/1006-optimization-of-co2-storage-in-co2-enhanced-oil-re.pdf

Table 8: The distribution of pipelines (by length) between the plan areas

Plan area	Length of pipeline (km)	Number of pipelines	Percentage of pipeline in each plan area (frequency)
North East Inshore	249	140	3.7
North East Offshore	3,808	242	6.4
East Inshore	2,688	358	9.4
East Offshore	12,552	1,832	48.2
South East	55	371	9.8
South Inshore	99	289	7.6
South Offshore	0	0	0
South West Inshore	38	196	5.2
South West Offshore	0	0	0
North West	1371	369	9.7
Total	**20,859**	**3,797**	**100**

Pipelines future activity

The amount of oil and gas being imported to the UK is increasing so it is likely that further pipeline projects will be needed. Also, the capacity to transport captured carbon dioxide (CCS) will probably be needed in the next few years. There are some pipelines proposed in the East Offshore Marine Plan Area.

The Crown Estate has completed futures analysis of industries that require pipelines. Figure 17 shows areas that are an 'optimal landing zone' for pipelines. This analysis was driven by the location of existing offshore oil and gas production assets, potential future fields, CO_2 storage opportunities and the presence of existing pipeline infrastructure. Areas of future technical opportunity for pipelines are focused within the East marine plan areas where the bulk of existing oil and gas infrastructure and processing facilities are located. The location of existing infrastructure and offshore resources are the primary factors determining the location of pipelines. The development of additional oil and gas resources is likely to be focused on satellite fields, access to which can be achieved from the extension of existing infrastructure. As the life of existing infrastructure could be prolonged, The Crown Estate does not anticipate significant numbers of additional pipelines being needed to support the hydrocarbon sector. The extent to which existing infrastructure is re-used by new industries such as CO_2 and gas storage is, at this time, unclear. Any future

infrastructure is likely to be located close to existing facilities to minimise infrastructure costs.

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Figure 17: Pipeline landing potential

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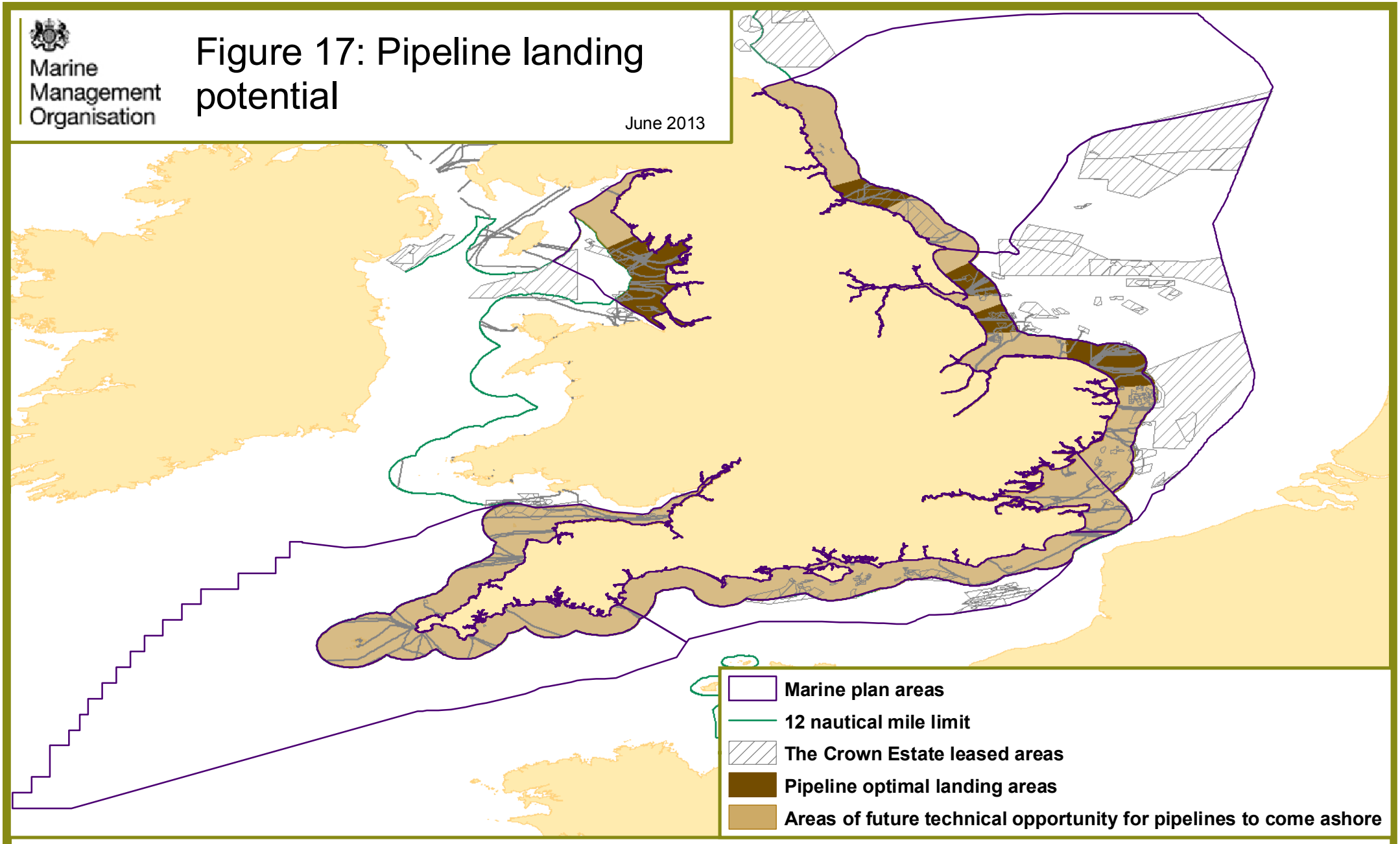


Note: The areas of future technical opportunity do not include the presence of hard constraints posed by existing uses of the marine estate or other factors including natural & cultural resources, marine users, economics & market appetite and policy drivers required for the opportunity to be supported. Cables and pipelines outside of the Territorial Waters Limit (other than export cables) are not shown as they are not subject to The Crown Estate's permission

Gas storage and carbon dioxide capture and storage

The practice of storing natural gas for future use in subsea geological structures has been ongoing for more than 30 years. Additional natural gas storage is proposed in the East Offshore and North West plan areas and is underway in the South Inshore area at the Isle of Portland. One field is already being used in the East Offshore Marine Plan Area approximately 45 km off the Humber, see Figure 27.

In recent years this same principle has been applied to capture carbon dioxide. Suitable structures include saline aquifers, salt caverns and depleted oil and gas fields, however their suitability would be determined at a project level. Carbon dioxide capture is developing as a technology and several methods are emerging. Some pre-application enquiries have been received by the MMO regarding this technology. Further information is in section 2.9.

2.7 Renewable energy production

Key facts

- Devices that harness energy from waves and tidal stream are rapidly emerging in the UK. Demonstrator sites and test hubs have been leased in several English plan areas to test new technologies.
- Wind energy is the fastest growing renewable technology and greatest single increase in activity in English waters.
- In England there are currently 20 offshore wind farms either under construction or in operation with an installed capacity of 3.7GW from 1089 turbines. Round 3 offshore wind farm development could treble the number of turbines and output, mostly located in the East Offshore plan area[170].

Requirement for renewable energy

The UK Government is committed to the reduction of greenhouse gas emissions by 80% on 1990 levels by 2050, with an interim target of 34% by 2020. These targets were set out in the Climate Change Act 2008[171] and subsequent order revising the 2020 carbon budget[172]. The UK also has a legally binding target to generate 15% of its energy from renewable sources by 2020, stemming from the EU Renewable Energy Directive[173], with offshore wind, wave and tidal energy expected to play an important role in achieving this target.

Wind energy national summary

Offshore wind is the most established renewable energy technology in English waters with 3.8GW of capacity in operation or under construction and a further

[170] Figures from UK Wind Energy Database (accessed 15/04/2013), Available online: www.renewableuk.com/en/renewable-energy/wind-energy/uk-wind-energy-database/index.cfm and The Crown Estate website(accessed 15/04/2013), available online: www.thecrownestate.co.uk/energy-infrastructure/offshore-wind-energy/our-portfolio/

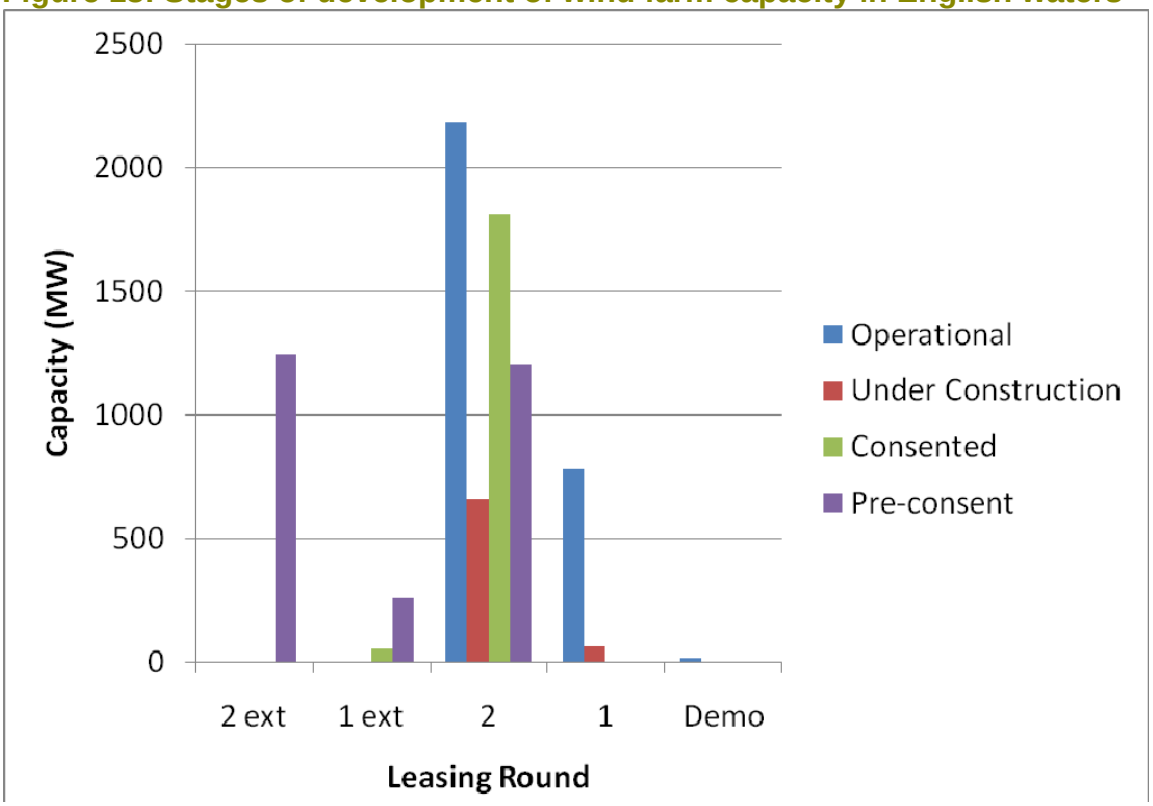
[171] HM Government (2008), Climate Change Act, Available online: www.legislation.gov.uk/ukpga/2008/27/contents

[172] HM Government (2009), S.I. 2009/1258 art. 2 (2), Available online: www.legislation.gov.uk/uksi/2009/1258/contents/made

[173] European Commission (2009), DIRECTIVE 2009/28/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL: on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC, Available online: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=Oj:L:2009:140:0016:0062:en:PDF

32GW in the development pipeline[174]. The Crown Estate, who own most of the seabed out to 12nm and have rights to lease seabed out to the Renewable Energy Limit under the Energy Act 2004[175], have undertaken several leasing rounds from 2000 to 2010. All Round 1 sites are operational or under construction with a generating capacity of 844MW from 256 turbines. 5.8GW of energy capacity has been leased under Round 2 with 2.8GW from 806 turbines currently under construction or operational. Extensions to Round 1 and 2 sites make up an extra 1.5GW of capacity but are all in pre-planning or are being developed. Figure 18 shows the progress of rollout of wind farms across English waters.

Figure 18: Stages of development of wind farm capacity in English waters



In 2009, The Crown Estate released seven Round 3 exclusivity zones either wholly or partly in English waters. These provide developers with an area of search from which projects should be brought forward for consent. An additional capacity of 27.6GW is expected to be brought forward from these zones in English waters. Figure 21 shows the percentages of Round 3 by area that fall within each plan area.

[174] Figures from UK Wind Energy Database (accessed 15/04/2013), Available online: www.renewableuk.com/en/renewable-energy/wind-energy/uk-wind-energy-database/index.cfm and The Crown Estate website(accessed 15/04/2013), available online: www.thecrownestate.co.uk/energy-infrastructure/offshore-wind-energy/our-portfolio/

[175] HM Government (2004), The Energy Act, Available online www.legislation.gov.uk/ukpga/2004/20/contents

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Figure 19: Offshore wind energy production

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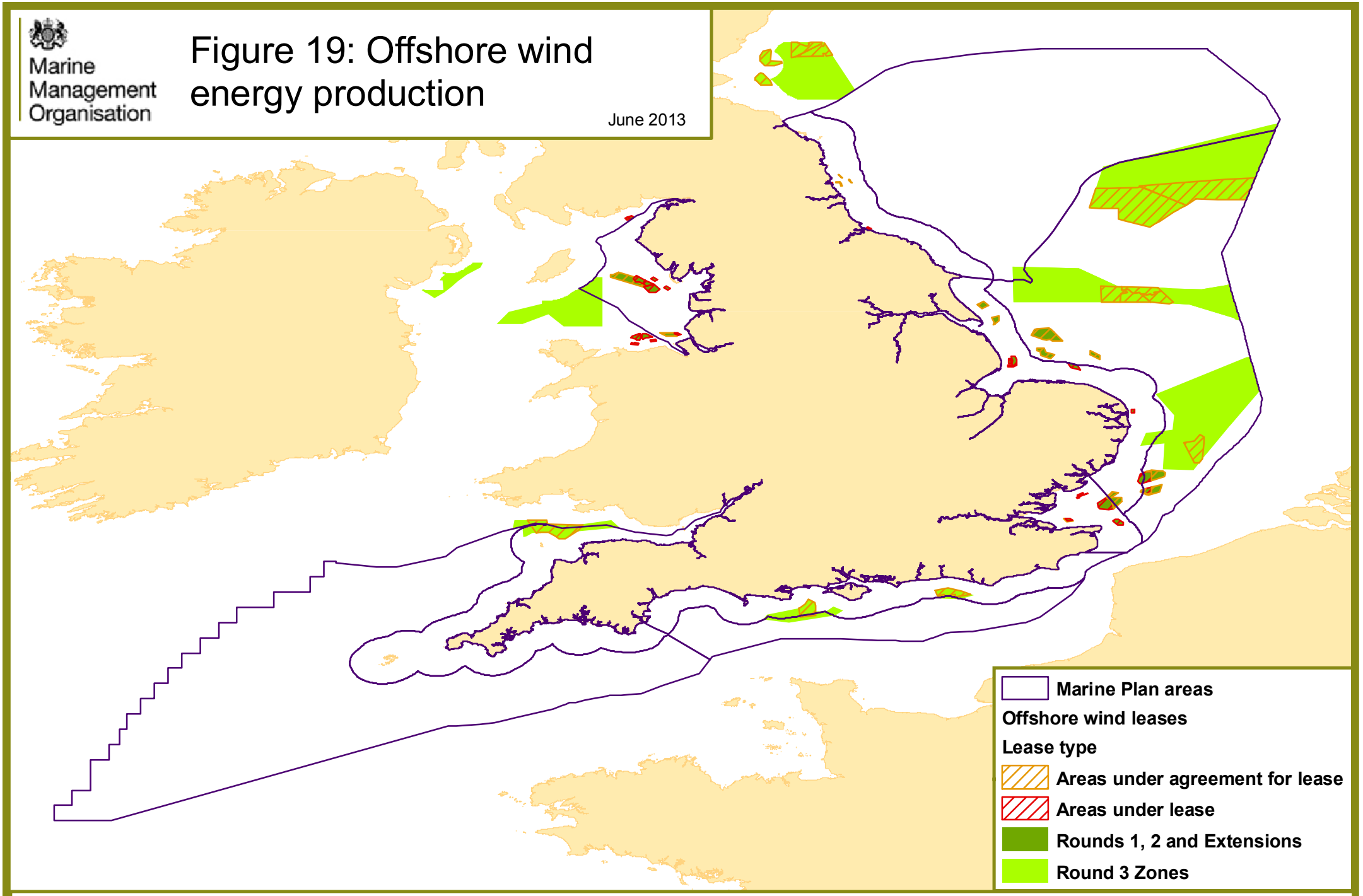


Distribution of wind energy across the plan areas

There is large variation in the distribution of area leased for wind farm development within each marine plan area as demonstrated in figures 18, 19 and 20. By far the greatest numbers of leased zones from all rounds of leasing, including Round 3 areas of search, are situated in the East Inshore and East Offshore plan areas. This is due to the availability of wind resource as well as the relatively shallow waters that provide optimum conditions for wind energy development. Figure 20 shows that Rounds 1, 2 and extensions are relatively evenly spread across the North West, South East Inshore, East Inshore and East Offshore plan areas. This is down to the of these sites being based on DECC's OESEA[176] which was limited to these areas.

Figure 20: Areas of round 1, 2 and extensions leased areas in each plan area within English waters (square km)

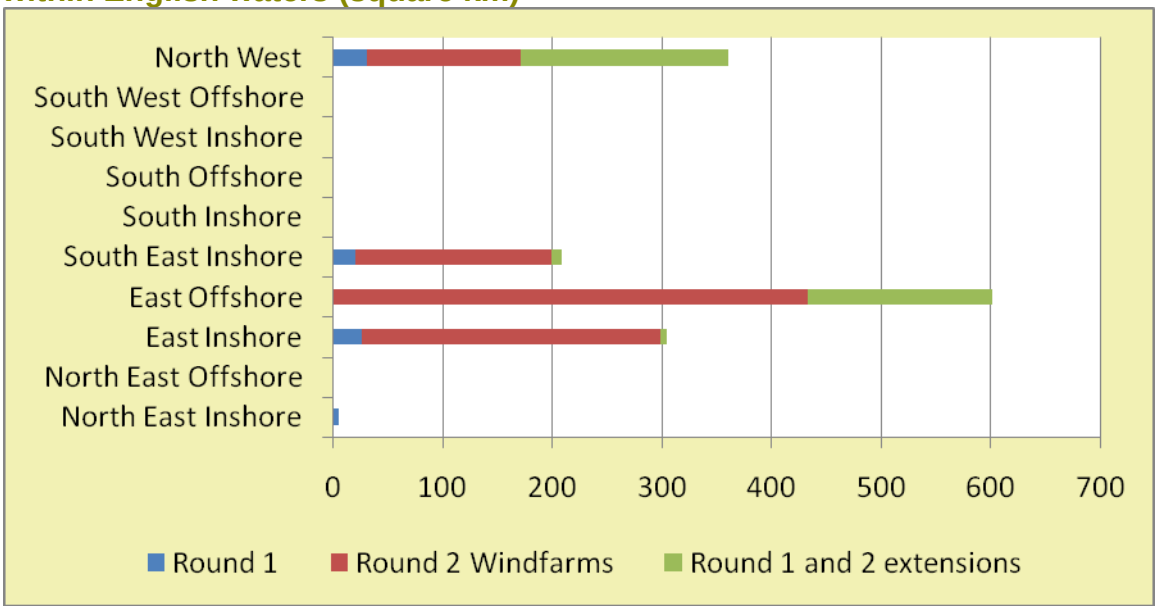
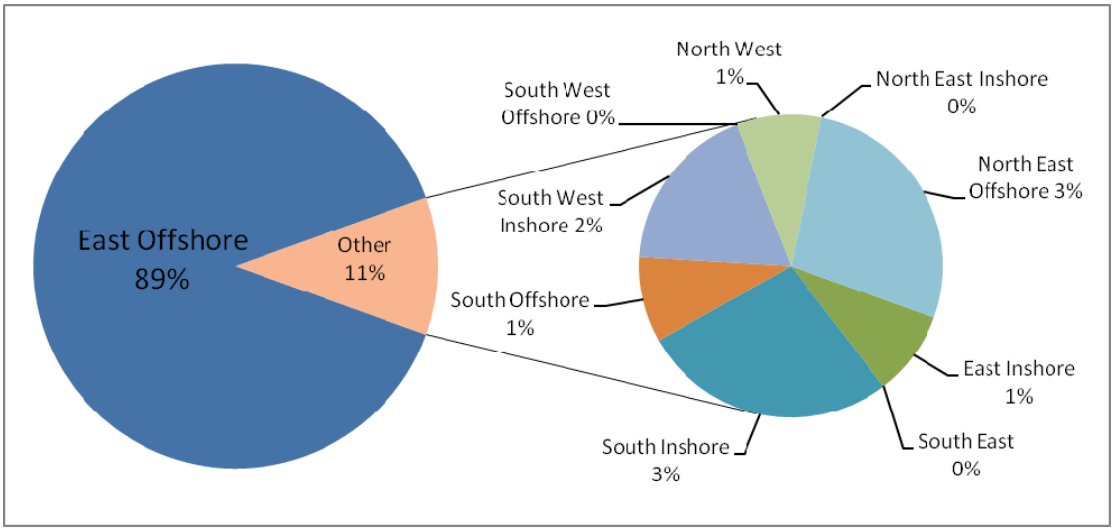


Figure 21: Percentage of Round 3 zones in each plan area within English waters



[176] DECC (2009), Offshore Energy Strategic Environmental Assessment, Available online: www.gov.uk/government/uploads/system/uploads/attachment_data/file/197690/OES_Post_Consultation_Report.pdf

Future of wind energy in English waters

The latest round of leasing by The Crown Estate, Round 3, represents the largest change in English waters over the next 20 years. The Crown Estate has allocated seabed to develop an estimated 27.6GW of installed capacity across the seven zones in English waters. Indicative installed capacities and information on the plan areas with which each zone overlaps are shown in Table 9. More detailed research and analysis is currently being undertaken by Round 3 developers within each of their zones of search in order to identify sites to be brought forward for consent based on technical conditions and other interests and activities present within each zone.

The Crown Estate energy market study[177] reviewed the current wind farm development pipeline and potential future deployment to assess the ability of the sector to deliver the government's ambition for wind farm deployment. The study concluded that government targets of 18GW offshore wind by 2020[178] is achievable, there is potential for significant deployment of offshore wind turbines into the 2020s and that the main barriers to deployment were policy certainty and availability of finance. These findings demonstrate that there could be significant further deployment of wind farms across English waters

Table 9: Round 3 – indicative capacities allocated to each zone and which plan areas the zones overlap with

Round 3 development zone	Indicative connection capacity (megawatts)	Plan area overlap
Dogger Bank	9,000	East Offshore North East Offshore
Hornsea	4,000	East Offshore North East Offshore
East Anglia	7,200	East Offshore East Inshore
Rampion	665	South Offshore South Inshore
Navitus Bay	900 to 1,200	South Offshore South Inshore
Atlantic Array	1,200	South West Inshore South West Offshore and partly in Welsh waters
Irish Sea	4,185	Partly in North West Welsh and Irish waters

[177] The Crown Estate (2013), UK Offshore Wind Market Study, Available online: www.thecrownestate.co.uk/media/392079/offshore-wind-market-study-summary.pdf
[178] DECC (2011), UK Renewable Energy Road Map, Available online: www.gov.uk/government/uploads/system/uploads/attachment_data/file/48128/2167-uk-renewable-energy-roadmap.pdf

Floating wind turbines

Fixed wind turbines have been proven at a commercial scale in the marine environment, but the depth of water into which they can be deployed limits the potential area available for future use. A considerable amount of research is ongoing to develop floating technology that would allow turbines to be deployed in deeper waters. Benefits such as easier construction and removal of structures can also be derived from this form of turbine installation[179]. There are obvious challenges in moving from fixed to floating structures, namely how to cope with wave action and overall motion of the structure supporting the turbine. The types of floating turbines that are being developed are described in more detail in Gerrard and Hassan 2009[180], which despite being an old reference offers a good synopsis of the challenges facing floating wind turbine developers. It is estimated that the potential resource that could be recovered by floating wind turbines is up to 125GW[181]. This however is based simply on the water depth and does not take into account other constraints. Other issues include development of suitable cable technology that can be installed alongside floating wind farms.

Spatial mapping of future offshore wind potential

Figure 22 demonstrates the areas of technical opportunity for offshore floating and fixed foundation wind farms. These areas were defined by combining wind speed that is optimal for generation (between 8 and 15 metres a second) and water depth constraints for floating (greater than 50 metres) and fixed foundation (up to 60 metres) turbine types. These criteria have been defined by The Crown Estate in partnership with industry experts. Not all of these areas are appropriate for development of offshore wind farms due to a number of other considerations (such as the presence of other sea users, interests and sensitivities, the existence of technology suitable for such physical conditions, the economic cost of deploying in certain areas and practical distance from shore).

The distribution of technical opportunity in Figure 22 demonstrates that a large proportion of the resource for fixed foundation wind farms in English waters are already overlapping leased areas or areas of search. The future technical opportunity for floating turbine technology covers mainly the South West and North East plan areas.

[179] Gerrard and Hassan (2009), Cost of floating wind, Available online at www.gl-garradhassan.com/assets/downloads/Cost_of_energy_of_floating_wind.pdf
[180] Gerrard and Hassan (2009), Cost of floating wind, Available online at www.gl-garradhassan.com/assets/downloads/Cost_of_energy_of_floating_wind.pdf
[181] Gerrard and Hassan (2009), Cost of floating wind, Available online at www.gl-garradhassan.com/assets/downloads/Cost_of_energy_of_floating_wind.pdf

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Figure 22: Wind energy resource potential

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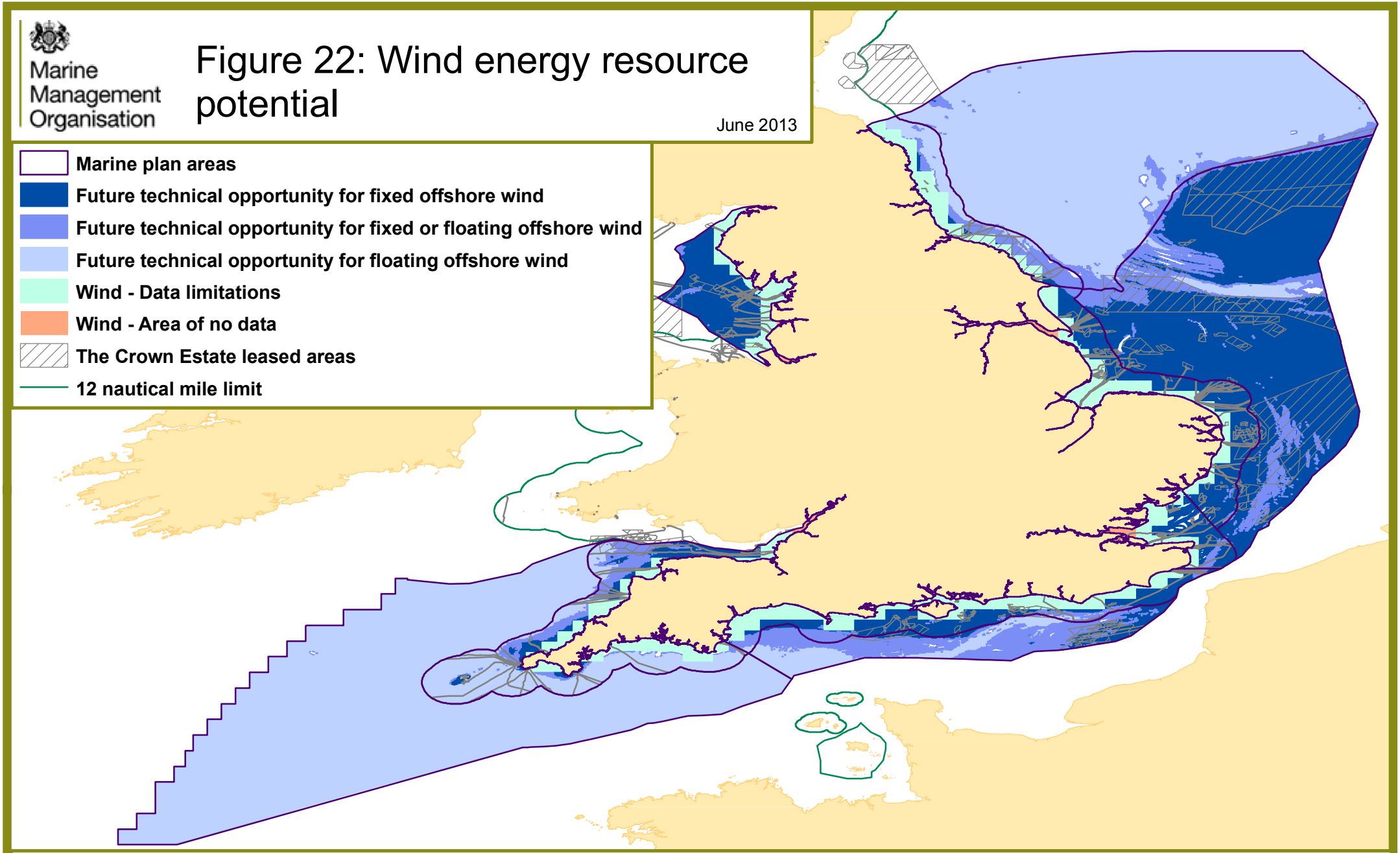

Note: The areas of future technical opportunity do not include the presence of hard constraints posed by existing uses of the marine estate or other factors including natural & cultural resources, marine users, economics & market appetite and policy drivers required for the opportunity to be supported. Cables and pipelines outside of the Territorial Waters Limit (other than export cables) are not shown as they are not subject to The Crown Estate's permission

Grid connection

The large scale development of offshore wind farms will also bring the added pressure of additional electricity transmission cables in the marine environment. National Grid has assessed the alternative scenarios for the development of transmission of electricity generated by offshore wind farms[182]. The report recommended developing a coordinated offshore grid rather than connecting wind farms directly into the nearest suitable onshore substation.

If developed, a coordinated offshore grid could put reduce pressure on the seabed, habitats and on the operations of some activities such as fishing, due to an decrease in offshore cables in comparison to a radial approach. Maps of the indicative areas that may be affected by these two development options are available in the report. In addition a potential network of interconnectors could be developed between the UK and Europe which will add to this effect[183]. The North Seas Countries Offshore Grid Initiative (NSCOGI) is a working group that is considering an approach to a coordinated grid.

Wave and tidal energy national summary

Although wind energy is the largest marine renewable energy sector in English waters, development of wave and tidal energy devices and projects are occurring with the sectors having potential for significant growth in the future. The UK has long been viewed as a focus for the development of wave and tidal energy technologies, with the majority of leading developers based here and planning to deploy commercial arrays of devices in UK waters. The wave and tidal industry has been forecast to be worth up to £6.1 billion and could supply up to 20,000 jobs by 2035[184].

A number of test and demonstration facilities available such as the National Renewable Energy Centre (NAREC) test site (in the North East), Wave Hub and FabTest (both South West Inshore) and the recently scoped Perpetuus Tidal Energy Centre also known as the Solent Ocean Energy Centre (South Inshore) all based in or around English waters.

Tidal range impoundments, such as barrages and lagoons, make use of the difference between high and low tide (the head of water) to generate electricity. The UK has some of the best tidal range resource in the world, particularly in the estuaries and bays down the West coast, such as the Severn and the Mersey. So far, no tidal range schemes have been developed in England.

A feasibility study was completed in 2010[185] exploring the development of a tidal barrage across the Severn Estuary, but high capital costs and concerns about environmental and economic effects on the estuary have stalled development. A

[182]National Grid (2011), Offshore Transmission Network Feasibility Study, Available online at www.nationalgrid.com/NR/rdonlyres/4FBE15A0-B244-4BEF-87DC-8D0B7D792EAE/49346/Part1MainBodysection191.pdf

[183]Benelux (2012), NSCOGI 2012 report, Available online at www.benelux.int/NSCOGI/

[184] Renewable UK (2013), Wave and Tidal Energy in the UK: Conquering Challenges, Generating Growth, Available online at www.renewableuk.com/en/publications/index.cfm/wave-and-tidal-energy-in-the-uk-2013

[185] DECC (2010), SEVERN TIDAL POWER: Feasibility Study Conclusions and Summary Report, www.gov.uk/government/uploads/system/uploads/attachment_data/file/50064/1._Feasibility_Study_Conclusions_and_Summary_Report_-_15_Oct.pdf

proposal to develop a 250MW tidal lagoon in Swansea Bay is currently under development[186] and registered with the Planning Inspectorate[187]. This proposal takes the form of a land attached, 10 km wall that impounds water to generate electricity on ebb and flood tides.

Distribution of wave and tidal energy across plan areas

Wave test sites are centred in the South West Inshore plan area with Wave Hub (South West Marine Energy Park) off the north coast of Cornwall and FabTest in Falmouth Bay. Tidal stream lease/agreement for lease sites are situated in: South West Inshore (Pulse Tidal Limited, Bristol Channel), South Inshore (Solent Ocean Energy Centre, around the Isle of Wight and Portland Bill) and the East Inshore area (Neptune (soon to be decommissioned), Humber Estuary). The wave and tidal stream industry are both still in development with the first commercial scale wave arrays in the pipeline in Scottish Waters. Figure 23 shows the locations all currently leased areas for tidal stream and wave in English waters.

[186] Tidal Lagoon Swansea Bay, Website (Accessed 24/04/2013), Available online: www.tidallagoonswanseabay.com/

[187] National Infrastructure Planning, Website (Accessed 27/05/2013), Tidal Lagoon Swansea Bay, Available online: http://infrastructure.planningportal.gov.uk/projects/wales/tidal-lagoon-swansea-bay/

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Figure 23: Wave and tidal stream leased areas

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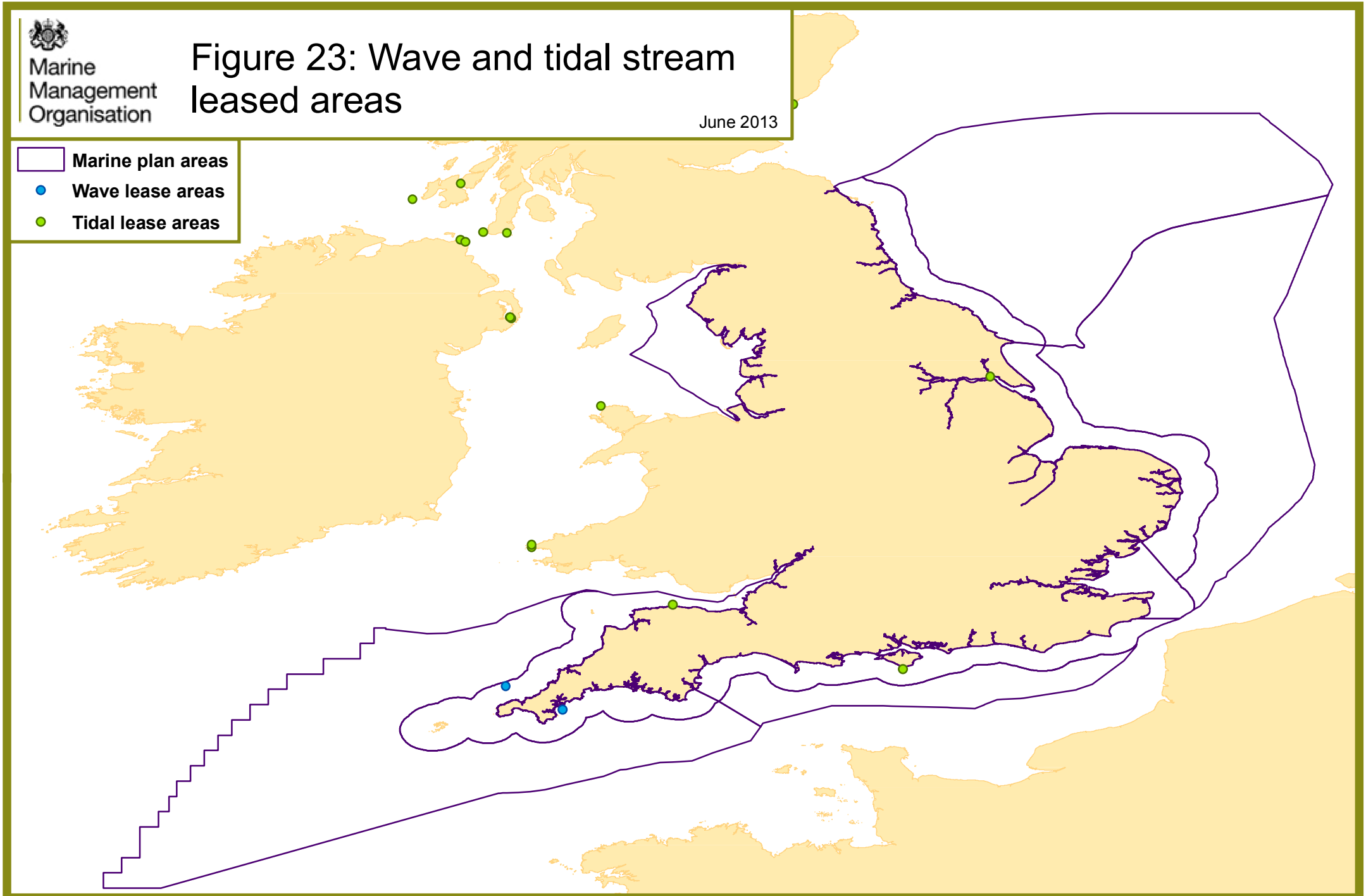

Future wave energy

The Crown Estate Key Resource Areas study[188] estimates that the theoretical potential exploitable wave resource in the UK is 69 terrawatt hours (TWh) a year with England and Wales contributing a third of this potential. Figure 24 identifies locations where this resource is situated. This analysis is primarily based on seabed elevation, distance from shore and wave resource data. These technical parameters are based on an emerging understanding about wave energy technologies and will continue to evolve as further understanding is developed.

This map was created by selecting areas that have an annual mean power density of over 20KW a metre and water depth between 10 and 200 metres. These parameters were defined by The Crown Estate though literature reviews, technical workshops and industry consultation. The potential feasible and practical resource that can be recovered from these areas will be constrained by other sea users interests and sensitivities. These have not been considered in production of the map. More information on how this map was defined can be found in the key resource areas study[189].

Figure 24 shows that the majority of wave resources in English waters are situated in the South West Plan Area.

[188] The Crown Estate (2012), UK Wave and Tidal Key Resource Areas Project, Available online: www.thecrownestate.co.uk/media/355255/uk-wave-and-tidal-key-resource-areas-project.pdf
[189] The Crown Estate (2012), UK Wave and Tidal Key Resource Areas Project, Available online: www.thecrownestate.co.uk/media/355255/uk-wave-and-tidal-key-resource-areas-project.pdf

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Figure 24: Wave energy resource potential

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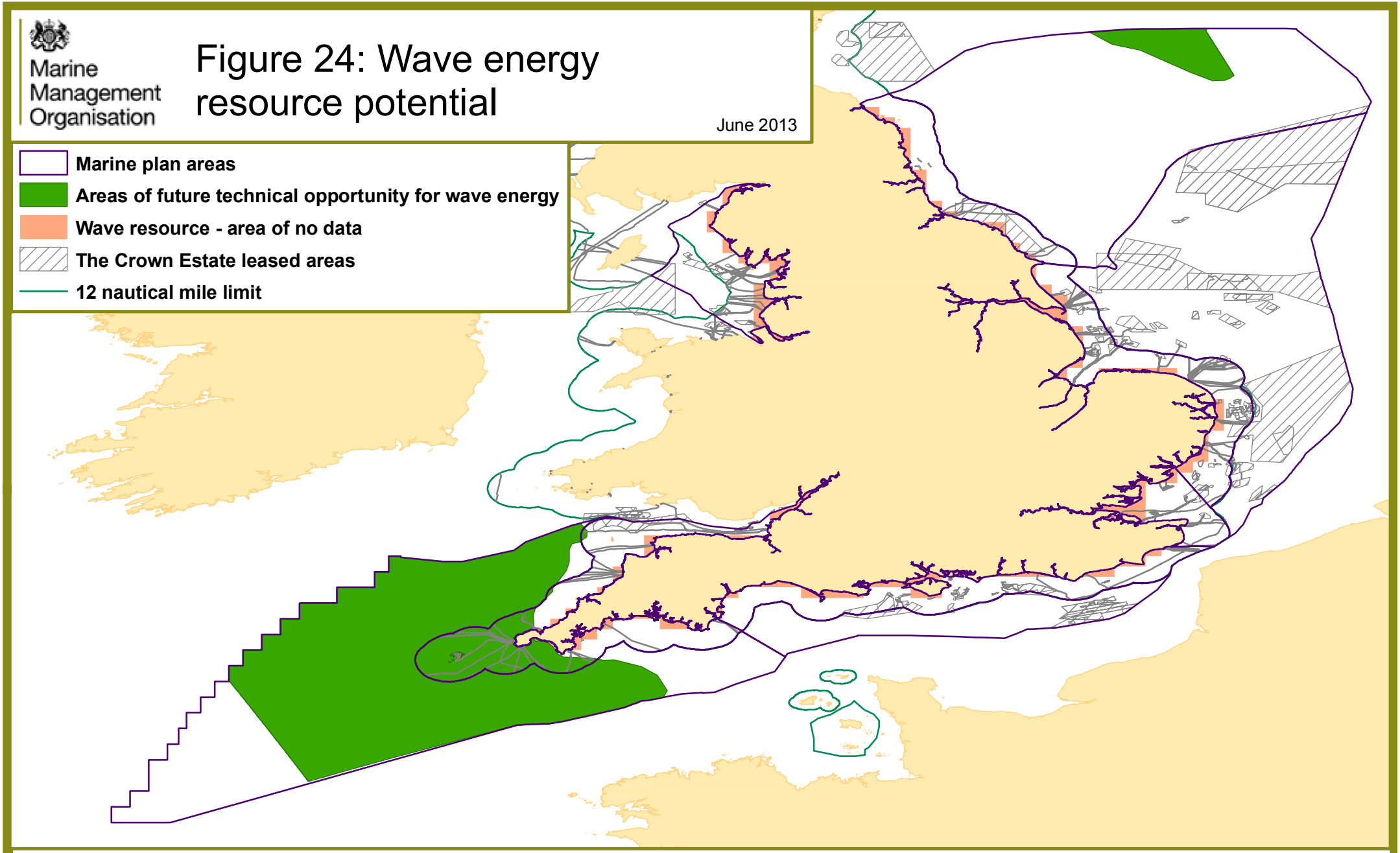

Note: The areas of future technical opportunity do not include the presence of hard constraints posed by existing uses of the marine estate or other factors including natural & cultural resources, marine users, economics & market appetite and policy drivers required for the opportunity to be supported. Cables and pipelines outside of the Territorial Waters Limit (other than export cables) are not shown as they are not subject to The Crown Estate's permission

Future tidal stream

A number of tidal stream energy devices have been installed around UK waters as test and demonstration projects including several devices, ranging up to 1MW, at the European Marine Energy Centre (EMEC) in Scotland. In addition, The Crown Estate has awarded an agreement for lease for the Solent Ocean Energy Centre which will provide a number of testing facilities for tidal stream devices in English waters. The success of these projects will determine the potential for the sector and the likely timeline for deployment.

The Crown Estate has produced theoretical resource estimates and geographic distribution of tidal stream resource through their Key Resource Areas work[190]. Overall the UK is estimated to have 95TWh/year of tidal stream resource 36% of which is in English waters.

Figure 25 identifies locations that have suitable technical conditions for tidal stream energy development using a range of technologies. This map was created by selecting areas that had a mean spring peak tidal current above 1.5 metres a second and minimum water depth of 5 metres. These parameters were defined by The Crown Estate though literature reviews, technical workshops and industry consultation. The potential feasible and practical resource that can be recovered from these areas will be constrained by other sea users interests and sensitivities. These have not been considered in production of the map. More information on how this map was defined can be found in the key resource areas study[191].

The map shows tidal stream resource around the Isle of Wight (note there will be large variation in the strength of this resource throughout the key resource area). This is a result of its location along the English Channel, at a position where interference between the diurnal and semi-diurnal tides creates a long dwell at high water and a short dwell at low water. This results in two periods of strong tidal stream (on falling and rising tides), with a fairly short temporal separation between them. The Island's bathymetry and coastal features form a number of local eddies and races, also resulting in very strong streams at a number of locations[192].

[190] The Crown Estate (2012), UK Wave and Tidal Key Resource Areas Project, Available online at www.thecrownestate.co.uk/media/355255/uk-wave-and-tidal-key-resource-areas-project.pdf
[191] The Crown Estate (2012), UK Wave and Tidal Key Resource Areas Project,
[192] Isle of White Council (2007), Feasibility Study, Solent Ocean Energy Centre: The case for establishing an evaluation and research centre for ocean energy technologies on the Isle of Wight, Available online at www.solentoceanenergy.com/marine_energy_centre_report_%203_jan_07.pdf

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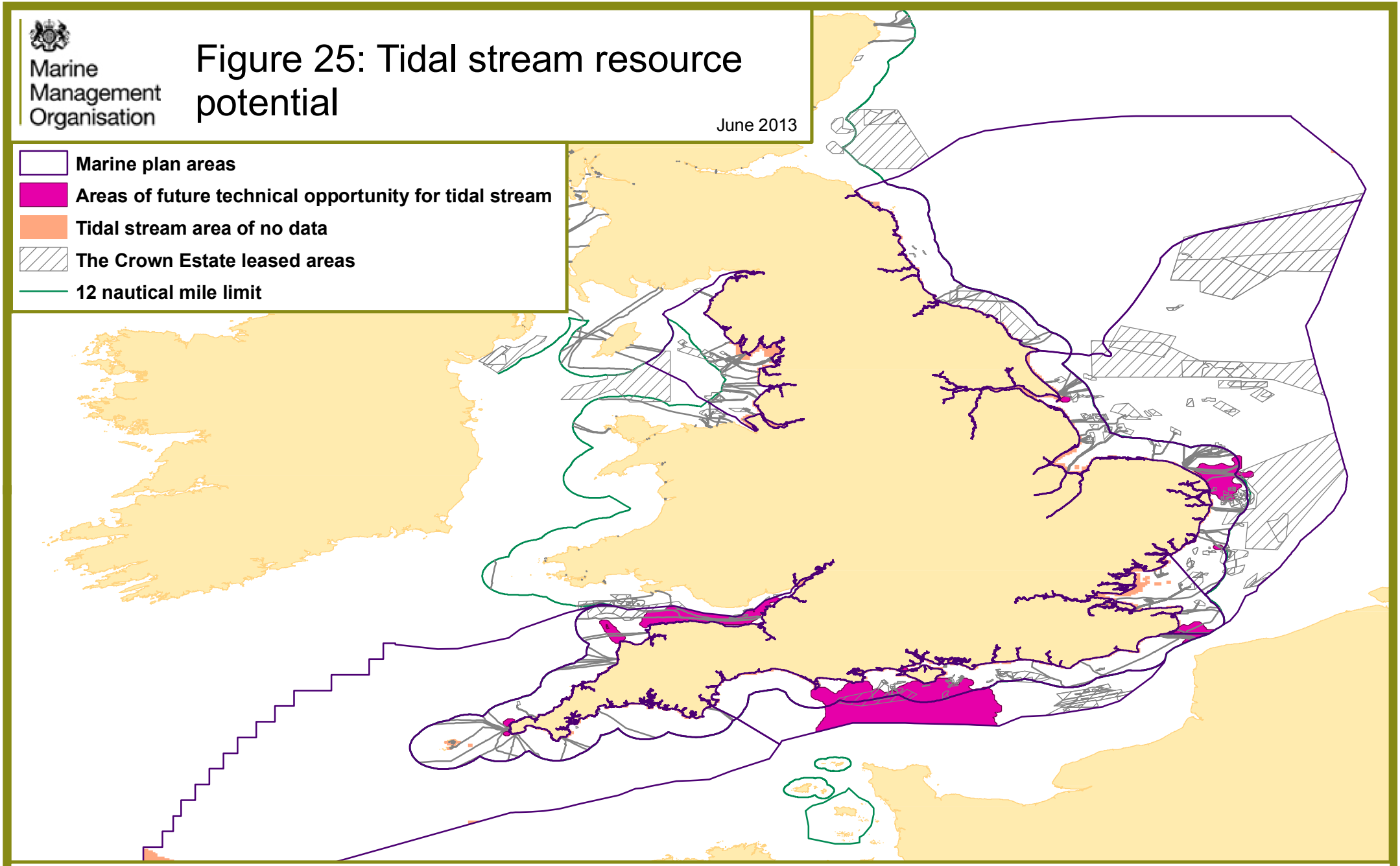
Figure 25: Tidal stream resource potential

June 2013



Note: The areas of future technical opportunity do not include the presence of hard constraints posed by existing uses of the marine estate or other factors including natural & cultural resources, marine users, economics & market appetite and policy drivers required for the opportunity to be supported. Cables and pipelines outside of the Territorial Waters Limit (other than export cables) are not shown as they are not subject to The Crown Estate's permission

Future tidal range

The Crown Estates key resource areas study[193] estimated that the theoretical UK potential resource for tidal barrage schemes is 95TWh/year, 60% of which is situated in English waters. Theoretical potential resource for tidal lagoons is estimated at 25TWh/year in UK waters with 56% of this in English waters. These figures do not take into account other sea users, interests and sensitivities. More information on how this map was defined can be found in the key resource areas study.

Table 10 shows figures of potential tidal range resource in English estuaries[194]. These figures are based on best case scenarios (with all available sites developed to full power potential, with only technical constraints having been considered and not taking into account environmental issues or other interests).

Proposed schemes in England have not advanced beyond the feasibility study stage to date. This is due to the high capital and energy costs as well as the potential impacts on the environment, through modifying estuarine tidal regimes causing habitat loss and effects on species. Detailed studies have recently been completed for several estuaries including the Severn and the Mersey. A tidal lagoon project is currently under development in Swansea Bay[195] which may affect the South West Plan Area if brought forward for development.

Table 10: Potential tidal range resources in England (from DECC, 2010a)

Location Plan area in brackets	Mean tidal range (metres)	Estimated installed capacity (MW)	Predicted annual energy output (terawatt hour)
Humber (E)	4.1	1,080	1.65
Wash (E)	4.5	2,400	3.75
Thames (SE)	4.2	1,120	1.37
Severn (SW)	8.3	8,640	16.8
Solway Firth (NW)	5.5	7,200	10.25
Morecambe Bay (NW)	6.3	3,000	4.63
Mersey (NW)	6.5	620	1.32
Dee (NW)	6.0	840	1.16

[193] The Crown Estate (2012), UK Wave and Tidal Key Resource Areas Project, Available online: www.thecrownestate.co.uk/media/355255/uk-wave-and-tidal-key-resource-areas-project.pdf
[194] DECC (2010), 2050 Pathways analysis, Available online: www.decc.gov.uk/assets/decc/What%20we%20do/A%20low%20carbon%20UK/2050/216-2050-pathways-analysis-report.pdf
[195] Tidal Lagoon Swansea Bay website (Accessed 24/04/2013), Available online: www.tidallagoonswanseabay.com/

2.8 Nuclear energy

Key facts

- The UK must meet a legally binding EU target for 15% of energy consumption to come from renewable sources by 2020[196].
- The UK Government is committed to reaching its legally-binding target of an 80% reduction in greenhouse gas emissions by 2050, compared to 1990 levels[197]
- The government aims to have 16 GWe of new nuclear capacity on line by 2030[198].

Introduction

Within England there are six nuclear power sites which have been used to generate electricity for the UK since the 1950's, all based in coastal locations. Of these sites, five generate their electricity from advanced gas cooled (AGC) reactors while the remaining site uses a pressurised water reactor (PWR). Approximately 16[199] percent of the UK's electricity is provided through nuclear energy. This has proven to play an important part in energy production throughout England, due to a predictable base load of electricity generated by each site. Policies and targets have been established to identify key milestones and outputs which will aim to balance protecting the marine environment while looking at sustainable socio-economic benefits.

National summary

Table 11[200] details the current lifetime of active sites within England and their generating capacity. Over the next 10 years decommissioning will take place allowing room for a new round of reactors to be built. There have been eight proposed[201] sites already identified which are located at Bradwell, Hartlepool, Heysham, Hinkley Point, Oldbury, Sizewell, Sellafield and Wylfa. Any decommissioning of existing sites or construction of new ones should be considered in line with the National Policy Statement (NPS) for Nuclear Power Generation (EN-6). Within the NPS, polices have been outlined to contribute to ensuring minimal or no adverse effects on marine ecology.

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[196] The Marine Policy Statement (2011), Energy production and infrastructure development, p 3.3.2 www.gov.uk/government/uploads/system/uploads/attachment_data/file/69322/pb3654-marine-policy-statement-110316.pdf

[197] The Marine Policy Statement (2011), Energy production and infrastructure development, p 3.3.2 www.gov.uk/government/uploads/system/uploads/attachment_data/file/69322/pb3654-marine-policy-statement-110316.pdf

[198] World Nuclear Association Website Update, Nuclear Power in the United Kingdom www.world-nuclear.org/info/Country-Profiles/Countries-T-Z/United-Kingdom/

[199] The East Inshore and East Offshore Marine Plan Areas Evidence and Issues Report, Chapter 4, 4.3.4 Nuclear Power www.marinemanagement.org.uk/marineplanning/areas/documents/east_evidence_issues_chapter4.pdf

[200] Department of Energy and Climate Change, Maintaining UK Energy Security, Table of past and present UK nuclear reactors www.gov.uk/government/publications/table-of-past-and-present-uk-nuclear-reactors

[201] National Policy Statement for Nuclear Power Generation (EN-6), Part 4 Potentially suitable sites for the deployment of new nuclear power stations in England and Wales before the end of 2025 https://whitehall-admin.production.alphagov.co.uk/government/uploads/system/uploads/attachment_data/file/37051/2009-nps-for-nuclear-volumeI.pdf

Coastal impacts need to be considered throughout any development of nuclear infrastructure, looking at the impacts on the seabed along with any implications to existing coastal processes and the marine environment. Any applications for developments should include an environmental statement (ES)[202] in order to show what considerations have been taken with regards to coastal impacts. During this process any effects or physical changes to marine conservation zones (MCZs), special areas of conservation (SACs) or special protection areas (SPAs) should have also been identified[203] and any mitigation measures established. In instances where dredging and disposal would form part of any nuclear development the applicant would be expected to consult with the MMO[204] before such activity takes place. During this process the appropriate mitigation measures[205] should have also been identified and the relevant bodies notified.

Table 11: Capacity of reactor sites

Advanced gas cooler reactor (AGR) – British Energy	Capacity (MW)	Number of operating reactors	Published lifetime
Dungeness B	1, 110	2	1985-2018
Hartlepool	1, 190	2	1989-2019
Heysham 1	1, 160	2	1989-2019
Heysham 2	1, 250	2	1989-2023
Hinkley Point B	1, 220	2	1976-2023
Pressurised water reactor (PWR) – British Energy	**Capacity (MW)**	**Number of operating reactors**	**Published lifetime**
Sizewell B	1, 188	1	1995-2035

Distribution across the plan areas

Currently in the England there is an even distribution of active nuclear sites within each of the plan areas, Dungeness B being the only one located in the South plan areas. Although displayed on Figure 26 the Oldbury site in Gloucestershire is now in the process of being decommissioned[206] and ceased generating in 2012. The site is

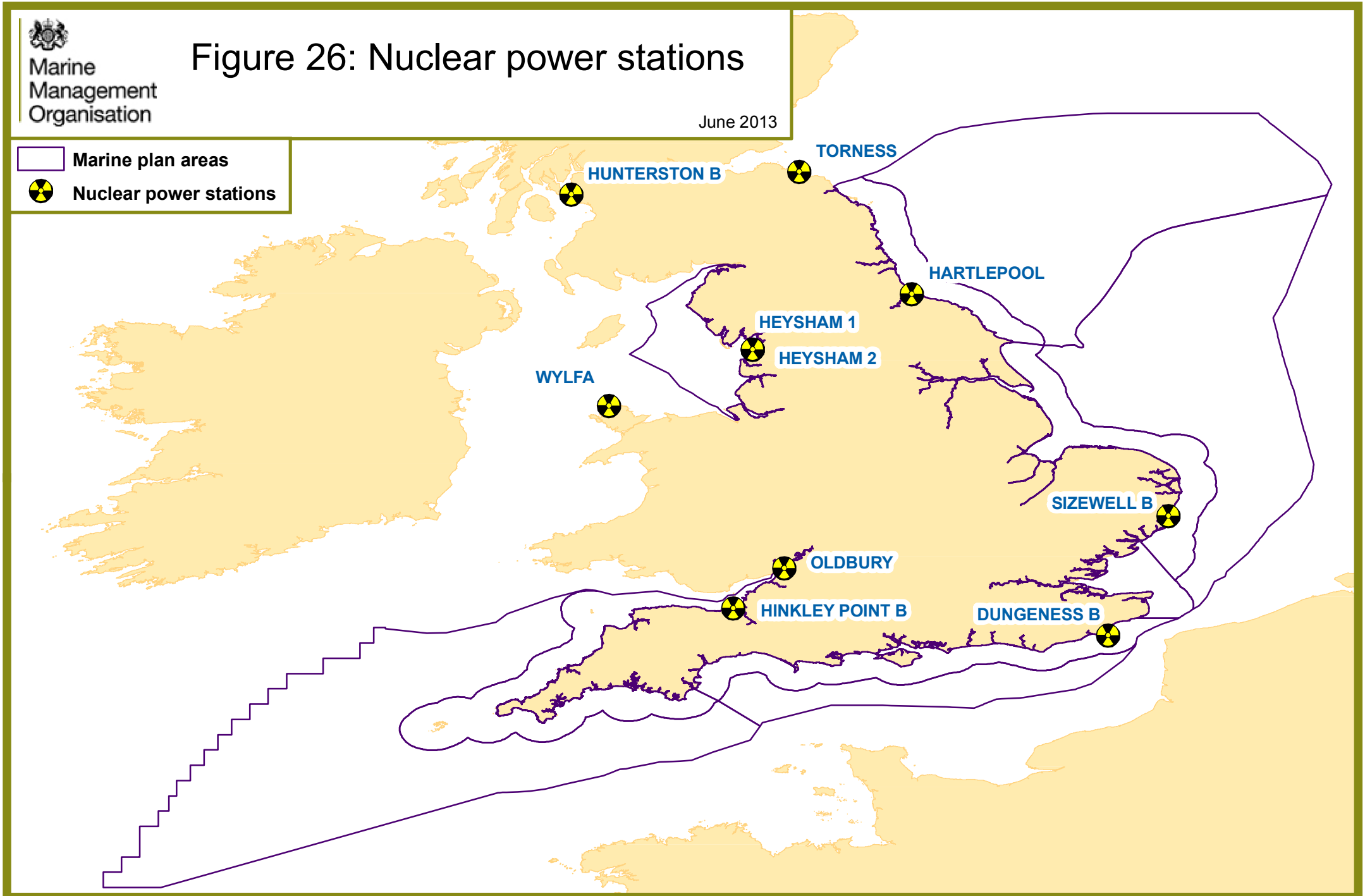
[202] Overarching National Policy Statement for Energy (EN-1), Coastal Change, p 5.5.7 www.gov.uk/government/uploads/system/uploads/attachment_data/file/47854/1938-overarching-nps-for-energy-en1.pdf
[203] Overarching National Policy Statement for Energy (EN-1), Coastal Change, p 5.5.9 www.gov.uk/government/uploads/system/uploads/attachment_data/file/47854/1938-overarching-nps-for-energy-en1.pdf
[204] Overarching National Policy Statement for Energy (EN-1), Coastal Change, p 5.5.8 www.gov.uk/government/uploads/system/uploads/attachment_data/file/47854/1938-overarching-nps-for-energy-en1.pdf
[205] Overarching National Policy Statement for Energy (EN-1), Coastal Change, p 5.5.17 www.gov.uk/government/uploads/system/uploads/attachment_data/file/47854/1938-overarching-nps-for-energy-en1.pdf
[206] Nuclear Decommissioning Authority website, Oldbury Nuclear Power Site update www.nda.gov.uk/sites/oldbury/

currently defueling with plans in place for reprocessing fuel at Sellafield once cooled, leaving Hinkley Point B the remaining nuclear site in the south west. Please refer to the table above for each of the sites planned lifetime.

Marine Management Organisation

Figure 26: Nuclear power stations

June 2013



Future trends

With plans already in place for the roll out of new nuclear sites in England the timelines identified for existing sites must remain on track if work is to continue. Hinkley Point and Sizewell have both been identified as sites where potential developments could take place to both house two European pressurised water reactors (EPRs). These four new plants could produce a total capacity of 3.2 million kW, generating enough electricity to power up to 5 million homes[207]. Existing plants at Hinkley Point and Sizewell will continue to produce electricity until 2023 and 2035 and therefore the potential for the EPRs to be developed would have to wait until this time, and any decisions made in line with NPS EN-1 overarching energy and EN-6 nuclear power generation policies. The remaining sites in England are due to cease generating sooner than Hinkley Point and Sizewell and the same considerations will need to be taken when decommissioning and further developments begin to take place.

Within the South Inshore plan area the Dungeness B site will continue to generate up to 1,100 MW of electricity from its two AGR reactors until 2018. At that time plans will be put in place to decommission the site and cease generation. This will be the first of the remaining nuclear sites in England to stop generating electricity. Following on from this there are no current plans in place for a replacement site to be established at Dungeness or elsewhere within the South plan areas. This should however bring some socio-economic benefits to the area, with the opportunity for employment roles and skills development, which will help boost income opportunities. There may be further positive impacts such as the opportunity to increase tourism within the area, generating further income.

2.9 Carbon capture and storage

Key facts

- In 2012 DECC's carbon capture and storage (CCS) commercialisation programme was launched, which will bring £1 billion of direct funding to support the design and construction of the selected CCS projects.
- The CCS commercialisation programme may help fund the proposed 426MW White Rose CCS demonstration project where carbon dioxide (CO_2) will be stored under the North Sea off the Yorkshire coast. The proposed development is England's only current large scale project being considered by the commercialisation programme.

Introduction

CCS is an emerging industry that has been primarily driven by the implementation of the EU CCS Directive on Geological Storage of Carbon Dioxide (Directive 2009/31/EC, referred to as the CCS Directive)[208] and the Climate Change Act 2008[209] to help mitigate the effects of climate change.

[207] EDF Energy website, EDF Energy's nuclear power stations www.edfenergy.com/energyfuture/edf-energys-approach-why-we-choose-new-nuclear/current-nuclear-sites
[208] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0114:0135:EN:PDF
[209] www.legislation.gov.uk/ukpga/2008/27/contents

CO_2 can be captured during the burning of fossil fuels, or as a result of industrial processes such as making cement, steel or in the chemical industry. The method of CCS is completed via three separate processes of capture, transport and storage.

During the capture process, CO_2 is separated from other gases produced by three differing technologies: pre-combustion capture, post-combustion capture and oxy-fuel combustion.

The CO_2 produced is cleaned and compressed ready for transport - this can be by shipping or via pipeline in some cases it may be possible to use redundant existing pipeline networks. Once CO_2 is transported it is injected into geological formations such as depleted oil and gas fields and deep saline aquifers found offshore.

Distribution across the marine plan areas

The practice of storage of CCS in subsea geological structures has been ongoing globally for more than 30 years, however on a large scale CCS is still in its infancy. In 2012, the UK Government announced its CCS Commercialisation Programme[210], which made available £1 billion of funding to support the design and construction of the selected CCS projects. As part of the commercialisation programme two preferred projects were identified:

- Peterhead Project in Aberdeenshire, Scotland – this proposed project would capture CO_2 from part of the existing gas fired power station at Peterhead, transporting and storing it in a depleted gas field beneath the North Sea.
- White Rose Project in Yorkshire, England – this proposed project would capture CO_2 from a new coal fired power station at the Drax site in North Yorkshire, before transporting and storing it in a saline aquifer beneath the southern North Sea in the East offshore marine plan area. This site is shown in Figure 27.

A final decision of awarding funding to the two projects is yet to be made by DECC and there remains two projects on the reserve list:

- the Captain Clean Energy Project – Grangemouth, Scotland
- the Teesside Low Carbon Project – Teesside, North East England

The Humber and Yorkshire CCS project separate to, but associated White Rose development is being progressed by the National Grid. The proposed development is to construct a pipeline for transporting CO_2 in the Yorkshire and Humber region with links to the White Rose project.

Discussions with the two projects will be undertaken over an18 month period to agree terms for front end engineering design studies. A final investment decision will be taken by the Government in early 2015 on the viability of constructing the two projects.

CCS is applicable to both the power sector and industrial sectors, many of which may rely on CCS technology to reduce their CO_2 emissions in the future. These CCS technologies will help the advancement of the power and industry sectors,

[210] www.gov.uk/uk-carbon-capture-and-storage-government-funding-and-support

maintaining associated jobs and contributions to the local community. In the future, it is estimated that CCS could create 100,000 jobs across the UK by 2030, contributing £6.5 billion to the UK's economy[211].

Future trends and policy direction

The CCS Directive[212] describes CCS as a bridging technology that will contribute to mitigating climate change. The impact assessment of the CCS Directive estimated that seven million tonnes of CO_2 could be stored by 2020 and up to 160 million tonnes by 2030, providing that CCS proves to be an environmentally safe technology.

DECC (2011)[213] indicates that by 2050 through the implementation of CCS, 28GW of energy could be produced from fossil fuel power stations that have a CCS facility, contributing towards the delivery of the UK carbon reduction targets set out in the Climate Change Act 2008.

A regulatory framework has been developed in England by DECC[214]. In addition DECC have produced a CCS Roadmap[215]. The UK Roadmap describes a shared understanding between the Government and key stakeholders of the potential role of CCS in reducing emissions from the power and industrial sectors, and the issues to be addressed to enable commercial deployment of CCS into the 2020s, including a timeline and the organisations responsible for taking action.

DECC completed some work as part of the 2050 Pathways analysis[216] to predict the capacity for CCS under different scenarios. There are a number of technical challenges to the wide scale deployment of CCS on both coal and gas sectors power generation facilities. In the short term, CCS is most likely to be applied to coal, but this will be dependent on competitiveness of cost compared to other low carbon generation technologies. CCS on gas generation capacity may be more viable in future as it is less capital intensive than coal, and this could be a more economic solution to back up intermittent renewable energy sources.

Potential resource

Figure 27 highlights the potential opportunities for CCS in the marine environment.

There are current limitations in the availability of detailed geological data and knowledge of CO_2 transportation and storage site accessibility and suitability. The future technical opportunity data used in Figure 27 was obtained from other sources (including British Geological Survey and commercial storage development companies) and was used to identify potential opportunities for deep subsurface geological storage.

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[211] MMO, 2012. Draft South Marine Plan Futures Analysis (to be published summer 2013)
[212] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0114:0135:EN:PDF
[213] www.gov.uk/government/uploads/system/uploads/attachment_data/file/47613/3702-the-carbon-plan-delivering-our-low-carbon-future.pdf
[214] www.gov.uk/government/uploads/system/uploads/attachment_data/file/48317/4899-the-ccs-roadmap.pdf
[215] www.gov.uk/government/uploads/system/uploads/attachment_data/file/48317/4899-the-ccs-roadmap.pdf
[216] www.gov.uk/government/uploads/system/uploads/attachment_data/file/42562/216-2050-pathways-analysis-report.pdf

Figure 27 identifies the suitability of potential storage sites, using the location of existing infrastructure (including pipelines) and proximity to major CO_2 emitters. Even with this information included, it is recognised that the areas of future technical opportunity presented for CO_2 transportation and storage remain incomplete.

There are currently considered to be three primary areas which have the potential for CO_2 storage: Northern and Central North Sea, Southern North Sea and the East Irish Sea. This is largely a result of the knowledge gathered through longstanding oil and gas activities in these areas. The topography of the subsurface formations (including aquifers) and the associated rock properties are much better understood than other locations beneath the seabed, and thus present a much lower risk to the development of early demonstration sites.

The primary potential for CO_2 storage is located in the North and Irish Sea with potential to store CO_2 within salt caverns in Portland in the South marine plan areas. The Portland site was identified as having the potential to store approximately 10 million tonnes (Mt) of CO_2 from the Fawley Power Station. A saline aquifer off St Alban's Head in Dorset was also identified, with the potential to store over 500 Mt of CO_2. This potential is unlikely to be taken forward within the next 20 years due uncertainties over technical and economic feasibility.

It is important to note that a number of projects and initiatives are underway that will significantly improve understanding of the potential resources for CCS transportation and storage. This includes work being undertaken by:

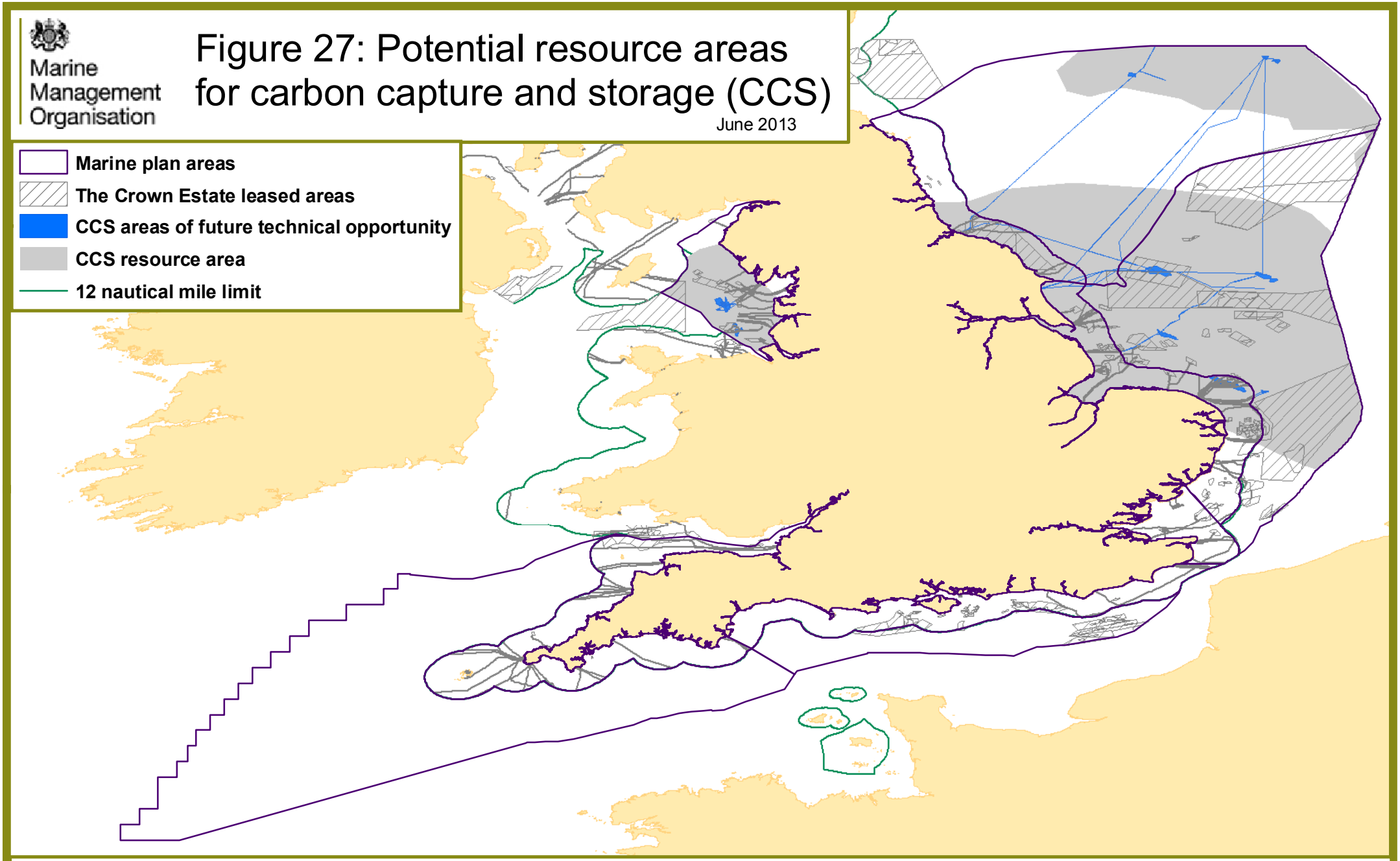
- The Crown Estate and British Geological Survey (BGS) to develop a realistic portfolio of storage sites and understand the interactions between vertically stacked, dynamically linked sites and those within the same geological formations
- CO_2 Storage Cost Reduction Task Force, to understand the key costs and opportunities for cost reductions in the industry
- Energy Technologies Institute (ETI) UK Storage Appraisal Project, which identified and appraised the storage potential of storage units across the UK continental shelf[217]
- the Multistore project, (The Crown Estate, Scottish CO_2 storage, Scottish Government, Scottish Enterprise and Shell), looking at subsurface interactions and risks in a large multi-user aquifer storage site throughout the Captain Sandstone formation in the Central North Sea

[217] www.co2stored.co.uk/

Marine Management Organisation

Figure 27: Potential resource areas for carbon capture and storage (CCS)

June 2013



Note: The areas of future technical opportunity do not include the presence of hard constraints posed by existing uses of the marine estate or other factors including natural & cultural resources, marine users, economics & market appetite and policy drivers required for the opportunity to be supported. Cables and pipelines outside of the Territorial Waters Limit (other than export cables) are not shown as they are not subject to The Crown Estate's permission

2.10 Ports and shipping

Key facts

- About 95% of goods consumed or produced in the UK are imported or exported by sea.
- UK sea ports handled over half a billion tonnes of goods in 2011, more than eight tonnes (a small lorry-load) for every person in the UK
- The maritime services sector directly created approximately 262,700 jobs in 2011 (0.8% of total UK employment)
- The maritime services sector is particularly important in the North East and London where it accounts for 2% of employment in each region
- In 2012 there were 19.7 million passengers on international short sea routes
- 85% of the South offshore marine plan area was transited by over 1000 vessels per year – the highest proportion of any marine plan area
- The South East marine plan area is home to the highest percentage (30%) of England's ports
- The Grimsby and Immingham port complex (East Inshore area) was the UK's busiest port in terms of percentage of UK traffic handled in 2011 with Felixstowe (South East marine plan area) being the UK's busiest container port, and Dover (South East marine plan area) being busiest in terms of roll-on roll-off (ro-ro) freight

Introduction

As an island nation, the UK is particularly dependent upon trade that utilises ports and shipping. Throughout the last century, the shipping industry has seen a general increase in total trade volume as industrialisation and liberation of national economies have fuelled free-trade and a growing demand for consumer products. These changes in trade and the shipping that services it, drive port development that responds to market need. While it is possible to monitor past trends in the UK from various sources, marine planning focuses on resource management in the future. This is invariably subject to a level of uncertainty as to how the ports and shipping sectors will develop due to the prevailing global and complex nature of the interdependencies. International trade drives ports development and shipping activity, therefore, it is important to view conditions in which port operators and shipping companies operate from a global perspective.

The world merchant fleet is made up of a variety of ship types. These include:

- general cargo ships (currently the largest single category in terms of number of vessels, though the trend is towards more specialised vessels)
- tankers (the second largest category)
- bulk carriers (highly efficient vessels typically transporting commodities such as grain, coal and mineral ores)
- passenger ships – including vessels designed to move people and, often, vehicles on regular itineraries like ferries, and those which the passengers see as a leisure destination in their own right, such as cruise ships
- containerships (a containership that will be the largest vessel of any class in operation will come into service between 2013 and 2015)

- roll-on roll-off (ro-ro) – vessels specialising in the transport of cargo that can be loaded and unloaded at quayside on wheels, such as lorries and cars
- fishing vessels (including fish catching vessels, fish carriers, and support vessels)[218]

Safety and efficiency have now, more than ever before, become two increasingly related priorities. Accidents are not only undesirable outcomes in themselves, they also have a negative impact on supply chains. However, shipping in the 21st century is considered the safest and most environmentally benign form of commercial transport[219].

In addition to economic challenges, a number of factors have slowed global growth. Political and social unrest, natural disasters, and rising oil prices and volatility have disrupted regional and global supply chains. Despite this world seaborne trade grew by 4% in 2011, taking the total volume of goods shipped to 8.7 billion tonnes.

Freight rates in 2011 and early 2012 were often unprofitable for ship owners. The transport cost element accounts for only a small part of the shelf price of consumer goods. This unprofitability may be compounded over various vessel classes as the world fleet has continued to expand, having reached more than 1.5 billion deadweight tons (dwt) in January 2012, an increase of over 27% since 2008. This expansion was largely in response to orders placed prior to the economic crisis, with major shipbuilders reluctant to cancel or postpone deliveries, the resulting oversupply of ships representing a serious challenge for ship-owners. Furthermore, bunker fuel prices have increased in tandem with global oil prices and this will create further, ongoing pressures on shipping operations[220].

Another major development with a bearing on the bunker market relates to the requirement under the IMO International Convention for the Prevention of Pollution from Ships (MARPOL)[221], for ships to use low-sulphur fuel. This requires ships to burn a more expensive but less polluting fuel with a timetable set out to 2020. The price difference between the fuels required and standard fuels was estimated at 50% in 2012, projected to increase due to growing demand and limited supply.

In this light, cost control and fuel consumption management is essential and may involve a range of measures including speed management through slow steaming, selection of the most economical routing options and technology-based solutions [222].

[218] International Maritime Organisation Maritime Knowledge Centre, 2012. International Shipping Facts and Figures – Information Resources on Trade, Safety, Security, Environment. 3.8. Overview of Ship Types
[219] International Maritime Organisation Maritime Knowledge Centre, 2012. International Shipping Facts and Figures – Information Resources on Trade, Safety, Security, Environment. 5. Maritime Safety
[220] United Nations Conference on Trade and Development, 2012. Review of Maritime Transport 2012. Executive Summary
[221] Specifically Annex VI, governing air pollution and Emission Control Areas (ECAs) in the European Union and North America
[222] United Nations Conference on Trade and Development, 2012. Review of Maritime Transport 2012. P. 27

It is for shipping companies themselves to explore opportunities to minimise adverse impacts regarding matters such as slow steaming and technology-based solutions. However, in the context of shipping operating in English waters, the interrelationship between shipping and other activities has the potential to influence routing options and the prevailing international operating conditions for shipping should therefore be a key consideration in providing for efficient, competitive shipping activity in marine plans.

The picture for ports has changed much in recent times. Fifty years ago, many cargoes were still loaded and unloaded individually. Most goods now arriving in the UK are carried by trucks and trailers which roll on and off (ro-ro), or in large containers. Specialised equipment at terminals conveys grain and other dry goods and liquids ('non-unitised flows') from tankers to onshore pipelines. Meanwhile, the volume of freight and bulk movements has continued to grow. In 2010, ports in England and Wales handled 410 million tonnes of goods, out of a UK total of 512 million tonnes, representing about 95% of the total volume of UK trade and 75% of its value. Ports also have a vital role in the import and export of energy supplies, including oil, liquefied natural gas and biomass, in the construction and servicing of offshore energy installations and in supporting terminals for oil and gas pipelines. Furthermore, sea ports play an important role in the tourism and leisure industries, including passenger cruise liners, Channel ferries, sea going yachts and dinghies.

Alternative goods transport mechanisms to and from the UK that may be considered as alternatives to shipping are constrained by the volumes that can practically be carried in the case of air (as well as cost and environmental disadvantages), and by capacity in the case of rail links through the Channel Tunnel. As a consequence, shipping will continue to provide the only effective way to move the vast majority of freight in and out of the UK, and the provision of sufficient sea port capacity will remain an essential element in ensuring sustainable growth in the UK economy.

Ports also play an important part in local and regional economies. As well as port-related employment, by bringing together groups of related businesses within and around the estate, ports create a cluster effect supporting economic growth by encouraging innovation and the creation and development of new business opportunities.

A more regional consideration for the both the ports and shipping sectors is the increasing prevalence of offshore renewable energy production that poses both opportunities and challenges. For some shipping operators, such installations may be viewed primarily as an evolving navigational consideration. However, such developments create business for installation and maintenance vessels and, at ports, supply chain bases are being established[223, 224, 225]. Furthermore, it is important that landfall and near-shore development requirements relating to cabling (telecommunications or energy-related) or pipelines continue to anticipate and accommodate the ongoing development aspirations of ports and navigation requirements of vessels.

[223] Department for Business, Innovation and Skills, 2011. Centres for offshore renewable engineering (COREs)
[224] Department for Transport, 2012. National Policy Statement for Ports
[225] Department for Energy and Climate Change (2009). UK Offshore Wind Ports Prospectus.

National summary

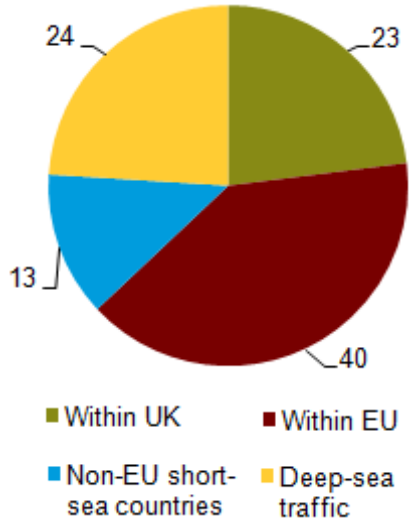
It is estimated that the maritime services sector[226] directly employed 272,800 people in 2011 (117,200 related to ports, 145,500 related to shipping)[227], with direct employment in the ports and shipping sectors representing 0.4% and 0.5%[228] respectively of total UK employment[229]. These figures indicate that the maritime services sector was a larger employer than a number of other sectors, including that concerned with the maintenance and repair of motor vehicles. Between 2009 and 2011 there was a 6.1% increase in employment in the maritime services sector, equivalent to the creation of an extra 9,500 jobs in the UK. In comparison, economy-wide employment fell by 0.4% over the same period[230].

The total number of UK seafarers fell by 10% compared to 2011, the second consecutive year of decline following a recent peak in 2010[231]. In 2012, an estimated 24,100 UK nationals were seafarers working regularly at sea, with cadets in training for the financial year 2011/2012 peaking at 2,160. This was a 19% increase since 2010/11. Numbers have more than doubled in the decade since 2001/02[232].

The maritime services sector made an estimated £13.8 billion direct value-added contribution to GDP in 2011, equivalent to 0.9% of the UK economy.. In addition, the maritime services sector directly generated nearly £2.7 billion for the UK Exchequer[233].

[226] The activity of UK ports, shipping and maritime business services (excluding sectors such as North Sea oil and gas extraction, the manufacture of marine equipment and the naval defence industry). In this context, the maritime business sector services includes ship broking, insurance and related financial and legal services and the activities of classification societies, including Lloyds Register.
[227] Oxford Economics (for Maritime UK), 2013. The Economic Impact of the UK Maritime Services Sector
[228] Oxford Economics (for Maritime UK), 2013. The Economic impact of the UK Maritime Services Sector: Shipping
[229] Oxford Economics (for Maritime UK), 2013. The Economic impact of the UK Maritime Services Sector: Ports
[230] Oxford Economics (for Maritime UK), 2013. The Economic Impact of the UK Maritime Services Sector
[231] Department for Transport, 2013. Seafarer Statistics Statistical Release - January 2013
[232] Department for Transport, 2013. Maritime Statistics – January 2013
[233] Oxford Economics (for Maritime UK), 2013. The Economic Impact of the UK Maritime Services Sector

Figure 28: Summary of port trade trends

UK major port traffic origin (to or from, % of total)  	In terms of volume, the UK relies on shipping for about 95% of its imports and exports (with most of the rest going via the Channel Tunnel)[234]. In 2011, total freight traffic through UK ports was 519 million tonnes (Mt)[235], an increase of 1% on 2010, yet 11% below the 2005 level. This volume constitutes more than eight tonnes (a small lorry-load) for every person in the UK. Compared with 2010, in 2011 inward traffic increased by 5% to 328 Mt, while outward traffic decreased by 4% to 192 Mt. Over the ten years since 2001, imports have increased by 9%, exports have decreased by 23%, and domestic traffic has fallen by 18%.

Beyond trade in goods, in 2012 there were 19.7 million passengers on international short sea routes, a fall of 7% from 2011. However, in 2012 the Channel Tunnel carried 20 million passengers, exceeding international short sea passengers for the first time since the Channel Tunnel opened in 1994[236].

The Department for Transport (DfT) recommend to all major ports that they produce port master plans, and consult on these with local stakeholders, including planning authorities in order to help co-ordinate medium-term planning[237].

The main purposes of port master plans are to:

- clarify the port's own strategic planning for the medium to long term
- assist regional and local planning bodies, and transport network providers, in preparing and revising their own development strategies
- inform port users, employees and local communities as to how they can expect to see the port develop over the coming years

Port development is supported by dredging and disposal activity[238] [239]. This enables the access to ports to maintained and/or adapted to ensure changing shipping patterns can be accommodated. Dredging to deepen and/or widen channels for

[234] Department for Transport, 2013. Maritime Statistics – January 2013
[235] Traffic was characterised as being made up of: liquid bulk 46%, dry bulk 20%, other general cargo 4%; lift-on lift-off (lo-lo) containers 11%; and roll-on/roll-off (ro-ro) cargo 19%.
[236] Department for Transport, 2013. Sea Passenger Statistics Statistical Release - February 2013
[237] Department for Transport, 2008. Guidance on the preparation of port master plans
[238] European Commission (2011). Commission Staff Working Document - Integrating biodiversity and nature protection into port development (Section 3.2)
[239] European Commission (2011). Guidelines on the implementation of the Birds and Habitats Directives in Estuaries and Coastal Zone with particular attention to port development and dredging (Section 3.3.5)

vessels is known as capital dredging [240]. As the trend towards larger, more efficient vessels has continued, the need for capital dredging has increased. However, it is not possible in all ports and harbours for access to be altered and as the use of wider vessels with deeper draughts have increased, so the number of ports being able to compete for such traffic has diminished.

Distribution of trends across the marine plan areas

In the East, which has 12% of English ports, Grimsby and Immingham remained the UK's leading port complex in 2011, handling 57 Mt (11% of total UK traffic). It was followed by London with 48.8 MT (9%) in the South East – a marine plan area home to the highest proportion of English ports (30%), Milford Haven with 48.7 Mt (9%), and in the South marine plan area, where 18% of English ports can be found, Southampton with 38 Mt (7%). Dover, the top UK port for roll-on roll-off (ro-ro) freight, handled two million ro-ro main freight units (road goods vehicles, unaccompanied trailers and shipborne port-to-port trailers). Felixstowe was the UK's largest container port handling two million containers[241]. The South West has 22% of English ports handling mainly passenger and fishing traffic and the North East and North West with 10% and 7% of English ports respectively.

Thames and Kent ports handled 12 million passengers in 2012, continuing their position as the largest port group in terms of passengers handled. This was primarily due to Dover, the UK's busiest ferry port, which handled 11.9 million passengers. In 2012, Dover to Calais remained the most popular international passenger route carrying 9.4 million passengers and accounting for 48% of all short sea international passengers. In 2012 there were two million passenger movements between Great Britain and Northern Ireland, the most popular destination for domestic sea crossings[242].

The following maps and tables provide a summary of distribution of shipping and ports across the marine plan areas.

[240] The MMO define capital dredging as " Material arising from the excavation of the seabed, generally for construction or navigational purposes, in an area or down to a level (relevant to Ordnance Datum) not previously dredged during the preceding 10 years. Marine Management Organisation (2010). Marine licensing guidance 3 – Dredging, disposal and aggregate dredging.
[241] Department for Transport, 2012. UK Port Freight Statistics Statistical Release - September 2012
[242] Department for Transport, 2013. Sea Passenger Statistics Statistical Release - February 2013

Marine Management Organisation

Figure 29: Ports and shipping

June 2013

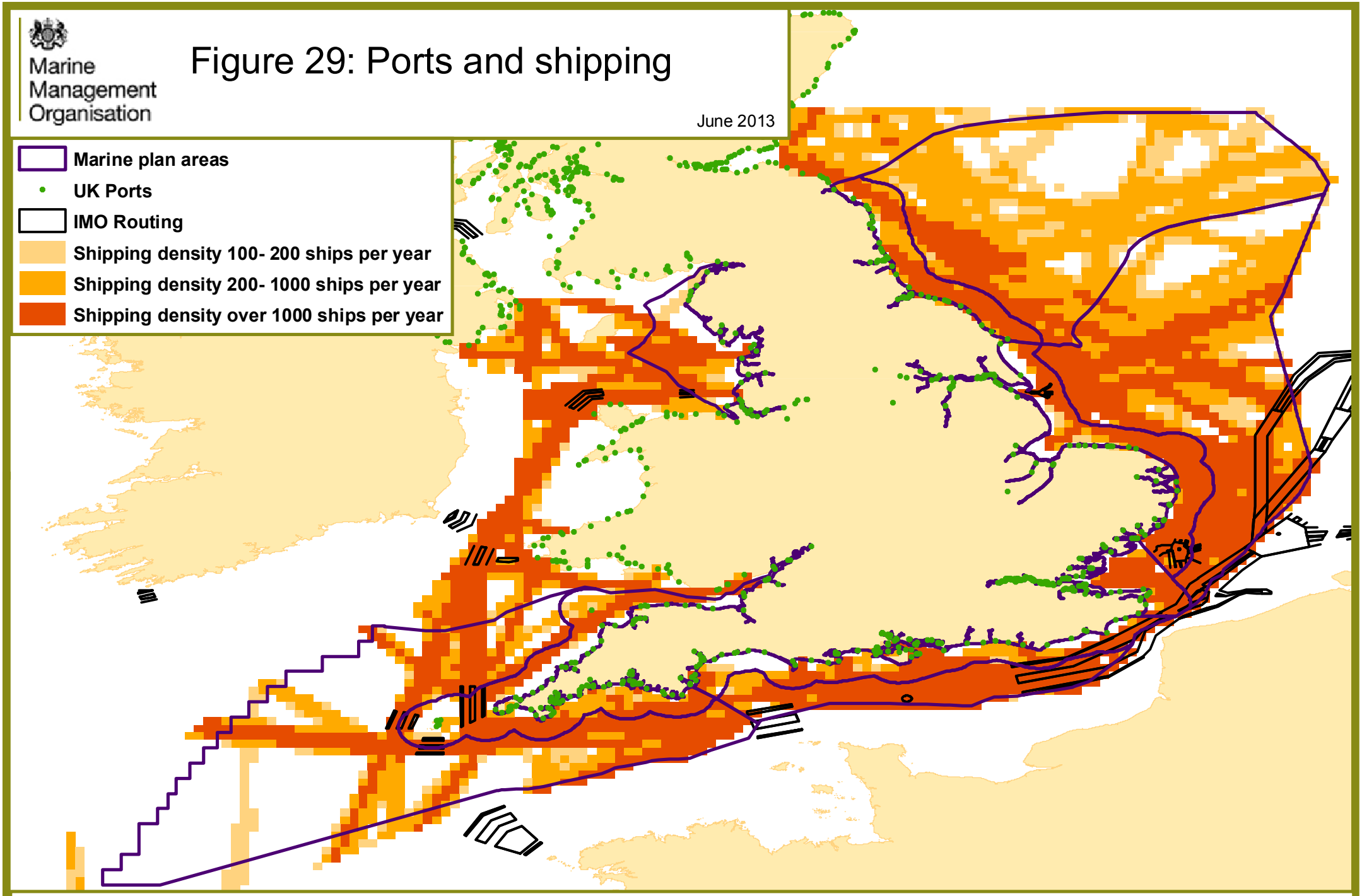


Table 12: Indication of shipping use (transits) and port distribution by marine plan area (note: figures may not sum due to rounding)

Marine plan area	Size of marine plan area (squarekm)	Area transited by over 1,000 vessels per year (%)	Area transited by 200 to 1,000 vessels per year (%)	Area transited by 100 to 200 vessels per year (%)	Number of ports	Percentage of English ports in area (%)
North East Inshore	6,033	70	24	1	51	10
North East Offshore	49,080	13	51	18	N/A	N/A
East Inshore	10,211	73	7	3	66	12
East Offshore	48,360	51	31	7	N/A	N/A
South East	3,921	69	7	0	162	30
South Inshore	10,531	52	20	4	96	18
South Offshore	10,834	85	9	1	N/A	N/A
South West Inshore	16,231	51	18	5	118	22
South West Offshore	65,606	29	16	7	N/A	N/A
North West	7,125	43	14	11	39	7

Table 13: GVA and employment associated with ports and shipping
Reproduced from Oxford Economics (for Maritime UK), 2013[243]

Region	Marine plan area(s)	GVA (£million)					Employment				
		Direct	Indirect	Induced	Total	% of GVA	Ports	Shipping	Business Services	Total	% of Employment
South West	South West Inshore/ South West Offshore	550	720	630	1,900	1.9%	11,700	15,000	13,100	39,700	1.5%
South East	South Inshore/ South East Inshore	1,460	1,540	1,030	4,030	2.1%	21,400	31,700	21,500	74,600	1.7%
London	South East Inshore	2,590	2,500	1,520	6,610	2.2%	13,000	51,600	31,800	96,400	2.0%
East of England	East Inshore/ South East Inshore	1,240	830	640	2,710	1.3%	19,100	17,100	13,300	49,500	1.7%

[243] The economic impact of the UK maritime services sector sets out the geographical breakdown for England of the total economic impact of Maritime Services in 2011 (adjusted to remove the impact of double counting; figures may not sum due to rounding). Note that "regions" in this table are not equivalent to marine plan areas but instead are those referred to for statistical purposes by the Office for National Statistics. GVA from the maritime services sector in the table below includes 'indirect' (where service providers will source goods and services from UK-based suppliers, which, in turn, have their own domestic supply chain) and 'induced' (people employed by the maritime services sector and its suppliers spending wages on consumer goods and services in the UK economy) impacts.

Region	Marine plan area(s)	GVA (£million)					Employment				
		Direct	Indirect	Induced	Total	% of GVA	Ports	Shipping	Business Services	Total	% of Employment
East Midlands	East Inshore	40	550	480	1,060	1.2%	1,000	11,300	9,900	22,200	1.0%
West Midlands	Next to South West Inshore and North West Inshore	30	710	640	1,380	1.4%	800	14,800	13,300	28,800	1.1%
North West	North West Inshore	720	990	880	2,590	2.0%	15,500	20,500	18,400	54,400	1.4%
Yorkshire and the Humber	North East Inshore/East Inshore	760	630	520	1,910	2.0%	14,200	13,000	10,800	38,000	1.5%
North East	North East Inshore	490	280	280	1,050	2.5%	10,400	5,900	5,800	22,100	2.0%
England		**7,880**	**8,750**	**6,620**	**23,240**	**2.0%**	**107,100**	**180,900**	**137,900**	**425,700**	**1.6%**

Future trends and policy direction

The key factor for development of both the ports and shipping sectors is the nature of ongoing growth in world trade. Based upon projected economic and trade growth global freight transport is expected to expand with world freight flows estimated to increase two to four times above their 2010 levels by 2050 for Organisation for Economic Co-operation and Development (OECD) member states.

One factor driving the need for continued development of ports comes from trends in container vessel characteristics. Container vessels currently in construction are of 18,000 twenty-foot equivalent units (TEU)[244] and possibly 22,000 TEU capacity. Such large vessels require ports with deepwater access channels, alongside berth depths of around 18 metres, adequate turning areas and specialised cargo handling equipment. The implications for ports are that larger shore-side gantry cranes, with an outreach of 72 metres (an outreach of 23 containers wide will be needed) and a lift height of 52 metres above quay will be required. The port of Felixstowe already has container gantry cranes with an outreach of 24 containers. There are a range of technical challenges presented by larger cranes with further possible implications for ports emerging from the views of local residents whose concerns may include the visual impact of the cranes.

While the example of container traffic is cited here, dry bulk and tanker sectors are also expected to grow in coming years and the need to accommodate this growth in light of the varying types of cargo involved will bring with it specific requirements for port development.

The impact of increased ship size upon ports and, consequently their surrounding communities, can be substantial. For example, settlements can grow around ports over time, constraining landward growth. This stimulates expansion via building further into the sea as this satisfies the need both for land and for the depth required to accommodate larger ships. Despite the option for seaward expansion, at some ports (for example, gateway and transit ports) the need for hinterland connections to facilitate the movement of cargo remains.

Meanwhile, ports continue to develop in the UK, responding to the market and facilitating the need to handle larger vessels. An example include work that began in March 2010 on the London Gateway Port where new facilities will enable a fully developed capacity of 3.5 million TEUs a year[245]. Another example is the development of new deep water berths at the Port of Southampton, set for completion in 2014[246].

From a policy perspective, the National Policy Statement (NPS) for Ports[247] has been established as part of the planning system established to deal with nationally significant infrastructure proposals, providing the framework for decisions on proposals for new port development. It is also a relevant consideration for the MMO,

[244] Standardised unit for measuring container capacity on ships.
[245] Port of London Authority (accessed June 2013) www.pla.co.uk/display_fixedpage.cfm/id/2215/site/pla
[246] DP World Southampton (accessed June 2013) www.dpworldsouthampton.com/why-southampton/new-deep-water-berth/
[247] Department for Transport, 2012. National Policy Statement for Ports

which determines other port development proposals, and for local planning authorities. The NPS sets out the Government's conclusions on the need for new port infrastructure defining for planning decision-makers the approach that should be taken to proposals, including the main issues which, in the Government's view, will need to be addressed. Guidance within the NPS includes the need to cater for long-term forecast growth in volumes of imports and exports by sea for all commodities indicated by Government demand forecast figures (an example of which is included in the NPS).

In the face of expected growth, shipping is set to be subject to a number of international standards. This includes Annex VI of the MARPOL Convention, which entered into force in 2005, and sets limits on SOx and NOx emissions from ship exhausts and prohibits deliberate emissions of ozone depleting substances[248]. In England's seas, the North Sea (including English Channel) Sulphur Emission Control Area (SECA) has been in force since 2007. The measures are expected to have a significant beneficial impact on the atmospheric environment and on human health particularly that of people living in port cities and coastal communities[249]. However, these benefits will be realised at a cost related to the measures needed, in particular use of specialised fuels, to meet these standards. A suggested consequence of limiting the sulphur content of fuel to 0.1%, as proposed in SECAs as of 2015, is that it could result in a modal shift from water to other transport means (rail, road, air), which could be detrimental for local shipping and the environment.

Another change in the character of shipping around the UK may arise following the Olympic Games in 2012. Associated preparation increased land-bound congestion around London so there has been a revival of barge traffic along the River Thames. Two barges normally used for transporting non-containerised cargo on the Thames were deployed from Tilbury to Northumberland wharf – a few kilometres from the Olympic village – to carry 48 40-foot equivalent units (FEUs). Post-games, this service could be extended further west along the Thames to Fulham, Battersea or Wandsworth. Elsewhere in the country, barge traffic is also making a comeback, for example between the cities of Liverpool and Manchester. Together, these developments may mark the start of a shift to a more sustainable freight transport[250].

[248] In October 2008 MARPOL Annex VI was amended. The main changes are a progressive reduction in sulphur emissions from ships, with the global sulphur cap reduced initially to 3.50% from January 2012; then progressively to 0.50 %, effective from 2020 (subject to a feasibility review). The limits applicable in Sulphur Emission Control Areas (SECAs) have been reduced to 1.00% since 1 July 2010 (from the previous 1.50 %); being further reduced to 0.10 %, effective from 1 January 2015.
[249] International Maritime Organisation Maritime Knowledge Centre, 2012. International Shipping Facts and Figures – Information Resources on Trade, Safety, Security, Environment. 7.5. Ship-generated air pollution
[250] United Nations Conference on Trade and Development, 2012. Review of Maritime Transport 2012. P. 87

2.11 Marine aggregates

Key facts

- Marine sand and gravel supplies 20% of the overall sand and gravel used for construction in England and Wales.
- The marine environment supplies 13 percent of concreting aggregates for the UK, and all the aggregate sourced for beach replenishment purposes.
- 87% of marine aggregates landed for construction is used for high value and specification concrete and concrete products.
- The main aggregate extraction areas are in the Southern North Sea and English Channel.
- Marine minerals are currently only extracted in England and Wales.

Introduction

The UK's aggregate industry is one of the largest in Europe and the UK's territorial waters hold some of the best aggregate potential resource in the world[251]. These large resources accumulated over the past two million years via deposits from historic riverbeds that flowed out to sea during glacial times, when the current seabed was dry land. This has resulted in large immobile aggregate deposits locked in the ancient riverbeds held within the UK's territorial waters.

Marine aggregates in tandem with terrestrial extracted resources underpin the construction sector and provide the raw material on which the built environment, manufacturing and the maintenance of infrastructure depends.

Additionally, marine aggregate resource is used for beach replenishment purposes that play an important role in coastal defence management and protection, for which over 38 million tonnes have been produced since 1990.

National summary

Marine supplies contribute around 20% of the sand and gravel demand in England and Wales. In 2012 a total of 16.79 million tonnes (Mt) of marine sand and gravel were extracted in England and Wales with 4.5 Mt exported in 2012[252].

The aggregate industry minimises its transport costs and environmental impacts or carbon footprint by landing the extracted minerals at specialised wharves strategically located close to the point of demand. In 2012 wharves along the river Thames received 5.6 Mt of marine sand and gravel, equivalent to 34 % of national production.

The value of aggregate extraction to the UK economy can be seen by figures produced in 2008. The landed value was £116 million with a gross value added

[251] www.gov.uk/government/uploads/system/uploads/attachment_data/file/69322/pb3654-marine-policy-statement-110316.pdf

[252] The Crown Estate, 2012. Marine Aggregate The Crown estate Licences summary of statistics

(GVA) of £54 million. Processing and concrete sales associated with marine aggregates represent a further £303 million GVA[253].

Marine aggregates provide large volumes of contract fill material in support of the delivery of major infrastructure projects such as nuclear builds, port development, road construction and offshore wind farms. The most recent nuclear build at Sizewell B in the East marine plan area required 1.64Mt of marine sand and gravel delivered by sea [254]. In addition, marine aggregates were used in the construction of the 2012 Olympic sites, Crossrail, Thames Tideway Tunnel and the Channel Tunnel Rail Link.

Distribution across the marine plan areas

Aggregate extraction takes place across most of the English marine plan areas apart from the North East inshore and offshore marine plan areas. Over half of the total production by tonnage in England comes from the East marine plan areas which accounts for 77% of the licensed area. A further third is produced in the South marine plan areas and smaller contributions from the South East, South West and the North West. A report is produced annually by The Crown Estate and the British Marine Aggregate Producers Association[255] (BMAPA) and gives detailed descriptions of activity and output.

Areas of aggregate extraction are currently limited to areas less than 60 metres depth due to the technical constraints of the current vessel fleet. Several of the existing extraction sites in the East have been exploited for many years and therefore have a large footprint. Some sites are nearing the end of their commercial viability with diminishing resource, which makes it difficult for vessels to secure full cargo.

Figure 30 shows the areas currently licensed for aggregate production, though it should be noted that the actual footprint of activity is typically much smaller, around 10- 15% with the proportion of licensed areas subject to extraction annually decreasing (The Crown Estate and BMAPA, 2011).

New sites such as in the South marine plan areas have recently been licensed, so production from these sites is expected to increase in the future as they gradually replace older licence areas that become exhausted. As well as supplying marine sand and gravel for ongoing general construction activity, there is also a requirement for larger volumes of material to be supplied on a contract basis in support of major infrastructure projects, such as the extension ports and development of power stations. The industry has to respond to changes in demand as aggregates are not usually stored for later sale due to physical constraints in wharf space.

[253] http://chartingprogress.defra.gov.uk/report/CP2-OverviewReport-screen.pdf
[254] www.agg-net.com/resources/articles/a-sea-change-for-the-marine-aggregate-sector
[255] www.bmapa.org/documents/BMAPA%20_14th_annual_review.pdf

Table 14: Percentage of aggregate extraction licence activity across each marine plan area

Marine plan area	Total marine plan area (square km)	Percentage of area covered by aggregate extraction licenses	Percentage of area covered by aggregate exploration and option areas	Percentage of area covered by marine aggregate application areas
North East Inshore	6,033	0	0	0
North East Offshore	49,080	0	0	0
East Inshore	10,211	1.8	1.9	2.56
East Offshore	48,360	0.36	1.78	0.72
South East	3,921	0	0	0
South Inshore	10,531	0.64	1.03	1.7
South Offshore	10,834	0.73	8.83	1.67
South West Inshore	16,231	0.03	0.12	0
South West Offshore	65,606	0	0	0
North West	7,125	0.95	0	0.01

Table 15: Total area subject to extraction activity

Marine plan area	Marine plan areas (square km)	Total area subject to extraction in 2011(square km)
North East Inshore and Offshore	55,113	0
East Inshore and Offshore	58,571	68.8
South East	3,921	0
South Inshore and Offshore	21,365	37.2
South West Inshore and Offshore	81,837	7
North West	7125	0.4

In order to maintain supplies to existing, well established markets, as well as having the flexibility to respond to new market demands, the industry needs to maintain access to existing licensed areas. New resources also need to be identified and secured to ensure supply can be maintained into the future. These search areas are shown in Figure 31.

Future trends and policy direction

The future potential for marine aggregate extraction is influenced by two principle issues: the potential resource that is available and current and future demand, influenced by UK government policy.

Marine aggregates are naturally occurring raw materials essential for the development of the built environment. Aggregate resources are finite and can only be extracted where they occur and are subject to constraints. It is therefore important that resource can be mapped and identified to ensure extraction takes place sustainably[256].

Marine minerals resource on the UK continental shelf has been identified on a national scale by data compiled by the British Geological Survey (BGS), commissioned by The Crown Estate (TCE). Figure 30 below incorporates this data identifying at a high level the spatial distribution of aggregates on the UK seabed.

[256] www.thecrownestate.co.uk/media/340963/BGS%20east%20coast%20report.pdf

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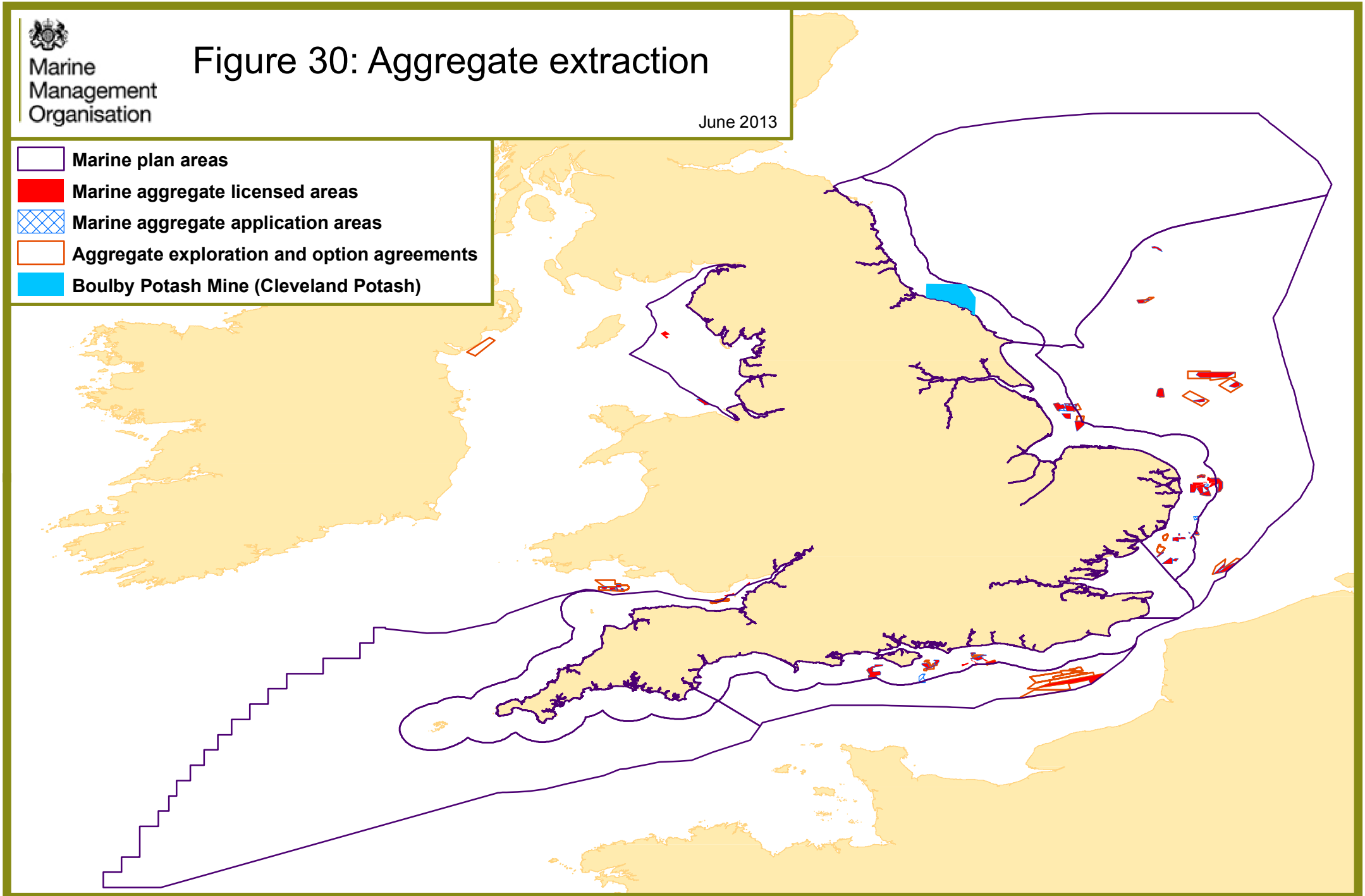
Figure 30: Aggregate extraction

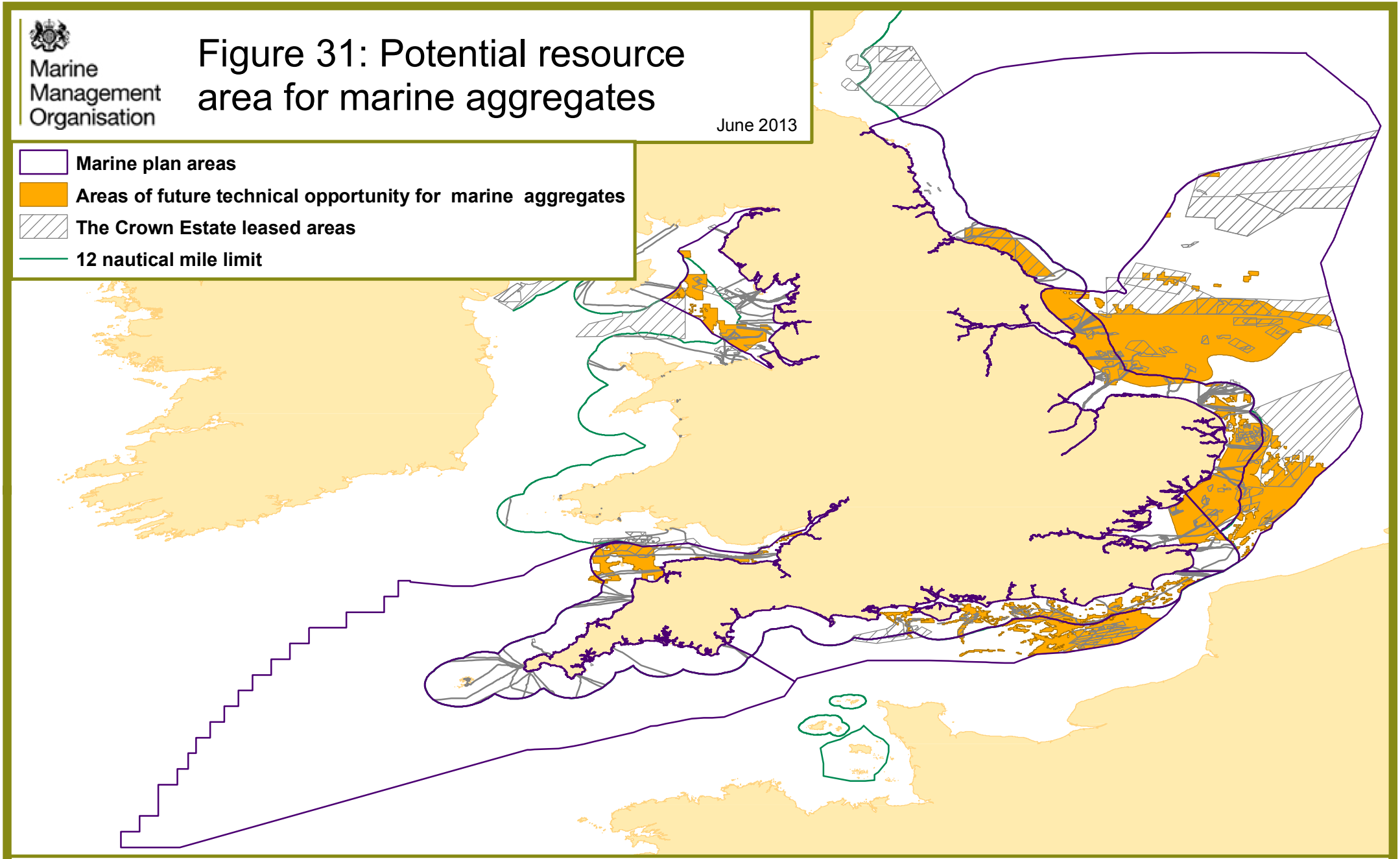
June 2013



Marine Management Organisation

Figure 31: Potential resource area for marine aggregates

June 2013



Note: The areas of future technical opportunity do not include the presence of hard constraints posed by existing uses of the marine estate or other factors including natural & cultural resources, marine users, economics & market appetite and policy drivers required for the opportunity to be supported. Cables and pipelines outside of the Territorial Waters Limit (other than export cables) are not shown as they are not subject to The Crown Estate's permission

Figure 31 highlights those areas of marine aggregates with potential resource found off the coasts of East Yorkshire and Lincolnshire, Norfolk, Suffolk, West and East Sussex, the Irish Sea and the Bristol Channel. Sea bed sediments are defined as unlithified, granular material excluding biogenic reefs and the potential resource areas can be separated into five aggregate classes:

- mud is defined as material less than 0.063mm
- particles of a diameter of 0.063 to 2mm
- gravel is defined as material over 4mm in diameter, excluding biogenic material
- gravel, sand and mud contents are based on grab samples of sea bed sediments
- the divide between coarse and fine sand is defined as 0.35mm

These classifications, detailed as nationally important 'fine aggregate (coarse sand)' and 'coarse aggregate', are used to define the core areas of potential in Figure 31. Due to general abundance and low strategic importance, 'aggregates suitable for fill' have not been included [257]. Spatial areas of nationally important 'fine aggregate (fine sand)' are found on the south and Welsh coasts where it is defined as being of higher importance due to the uniformity or quality of the deposits at specific locations.

The prospective areas marked in Figure 31 highlight where resource is known to be located. Further survey data is needed to describe the complexity of the geology within these locations. The prospective areas are therefore still an important component of the marine aggregate potential resource.

The demand for marine aggregates may increase in the future given the pressure on land-based sources in the regions. A decline in the supply of marine aggregates to meet this demand could lead to increased transportation distances and higher unit costs of aggregate for construction projects..

Over the next 20 years the maximum extraction scenario for marine aggregate extraction will include the licence renewals and application areas currently in the consenting system. These licences may be renewed to supply aggregates beyond the 15-year licence renewal period in order to continue to meet the demand for aggregates. In addition the potential for increased demand for marine aggregates may be as a result of additional infrastructure and beach replenishment schemes, it is considered that over the 20-year scenario the maximum footprint of marine aggregates is likely to include the progression of current prospecting areas into licence areas[258].

Government policy

The National Planning Policy Framework[259] (NPPF) highlights that minerals are essential to support a sustainable economy. Therefore any plan should safeguard areas of aggregate extraction that are of local or national importance, which includes the marine area. The NPPF and the supporting guidance Managed Aggregate

[257] www.thecrownestate.co.uk/media/340963/BGS%20east%20coast%20report.pdf
[258] MMO, 2013. South Marine Plan Futures Analysis
[259] www.gov.uk/government/uploads/system/uploads/attachment_data/file/6077/2116950.pdf

Supply System[260] (MASS) indicates that a plan should be put in place for a steady supply of aggregate by preparing local aggregate assessments. It is the responsibility of the local mineral planning authorities to produce these local aggregate assessments.

The MASS details that the aggregate assessments should forecast demand on:

- the average forecast of demand over 10 years sales data
- analysis of supply options as indicated by land banks, mineral plan allocations and capacity data, such as marine licences for marine aggregate extraction and the potential throughputs from wharves
- the balance between demand, supply and the economic and environmental opportunities and constraints that may influence the supply – if there is a shortage of supply, the plan should detail how the shortage will be addressed

The assessments are submitted to aggregate working parties (AWPs), of which the MMO is a member. In addition, the national and regional guidelines for aggregates provision in England for the period 2005 to 2020[261] details the role and supply of construction aggregates to the end of 2020. The guidelines set out that 16 Mt per annum of aggregate should be produced from marine sources to contribute to the national supply for England until 2020.

The future demand for marine aggregate production also relates to government policies on energy security and climate change, and the delivery of major infrastructure projects such as new nuclear builds, tidal power developments and offshore wind farms. An example is the potential use of marine aggregate in concrete used for the production of gravity base foundations as offshore wind farm construction moves into deeper waters[262].

2.11.1 Potash

Key fact

- There is only one marine potash (used in fertiliser) mine located in North Yorkshire in the North East inshore marine plan area. Rock salt used on roads in winter is a by-product of the operation.

In the UK, rock salt was formed 200 to 300 million years ago when most of the present land area was under a shallow sea and surrounded by desert. As the water evaporated, salt crystals formed in the brine, with other minerals such as gypsum (used in plaster) and potash (used primarily in fertiliser, with a small amount going to the chemical and pharmaceutical industries).

Boulby mine is the only UK site currently extracting potash and is located on the North Yorkshire Coast in the North East Inshore Marine Plan area (shown in Figure 30). Over half the total UK produced potash is exported. Rock salt is a by-product of

[260] www.gov.uk/government/uploads/system/uploads/attachment_data/file/14721/2238394.pdf
[261] www.gov.uk/government/uploads/system/uploads/attachment_data/file/7763/aggregatesprovision2020.pdf
[262] www.bmapa.org/documents/QMJ_Marine_Aggregates_Dec2010.pdf

the process and is used on roads in winter, representing 15% of the domestic supply. The mine has been in operation since 1973 and employs around 800 people. The site is on land near to the cliffs and the mine workings extend over 1 km down and 5 km out under the sea. An on-site refinery separates the products from waste materials and some of these are taken back down the mine to back fill previously worked areas. Current production rates are 1 Mt per year of Potash and 0.5 Mt per year of salt. The rate of production is largely determined by potash demand projections.

Globally, potash demand has grown steadily over the last thirty years and prices have also increased. This is mainly is response to the increased cultivation of arable land and shift from low value staples to higher value crops in more intensive production.

2.12 Submarine cables

Key facts

- Cabling has dense concentrations in most marine plan areas (except the North West) with the South West having a significant number of installations, with landing points particularly associated with the south west tip and Bristol Channel.
- Over 20,000 km[263] of submarine cables are used for telecommunications and electricity transmission in the UK.
- Significant numbers of additional power cables will be needed for new offshore energy generation.

Introduction

Submarine cabling is used for telecommunications (telephony, internet and data) and electricity transmission. An annual turnover of around £5 billion is reported from the telecoms sector which employs in the region of 27,000 people (Pugh, 2008). Discussion with industry suggests this figure may be higher.

The actual footprint of cabling is thought to be around 0.00002% (0.2 square km) of the seabed within the continental shelf area[264]. However when planning the use of the seabed, an exclusion zone of 250 metres either side of the cable plus an additional 250 metre buffer zone are suggested to avoid damage. Therefore the spatial footprint in terms of managing other activities which pose a threat is much larger. This approach of factoring in a buffer zone into cable installations is being rolled out as best practice in various sets of guidelines issued by TCE working with industry[265],[266]. Multiple subsea cables and pipelines can have implications for other users, for example those wishing to anchor vessels in certain areas or use certain types of fishing gear.

[263] These figures will be updated following data from the TCE cable data refresh due in Summer 2013
[264] Defra (2010). Charting Progress 2 Feeder Report: Productive Seas, pp464
[265] www.thecrownestate.co.uk/media/313713/submarine_cables_and_offshore_renewable_energy_installations_proximity_study.pdf
[266] www.thecrownestate.co.uk/media/343985/Subsea%20Cables%20UK%20Guideline%20(SCUK)%20No.%206.pdf

National summary

There are around 15,000km of telecom cables[267] and 1,000 km of power cables[268] in the English marine plan areas. Data cables have significant value due to the growth in internet use particularly internet shopping over the last 3 to 4 years[269] and the value of the financial sector to the UK economy[270].

Distribution across the marine plan areas

Cabling has dense concentrations in most marine plan areas except the North West, with the South West marine plan areas having a significant number of installations. The North East Inshore area has only one major cable running out from the shore. The East Inshore and South East areas have a number of cables linking to the continent and this is replicated more sparsely along the South marine plan area across to France. As well as this activity, an interconnector 'Nemo' from Kent to Belgium is in development. A number of cables run along the length of the Channel to Ireland, western France and the South West. The North West area has several cables crossing the Irish Sea linking England with Ireland, Northern Ireland and a power interconnector to the Isle of Man. Also in development are the proposed North West and North East England to Scotland interconnectors.

The South West area has a significant amount of cabling activity with landing points spread throughout the whole area but particularly associated with the south west tip and Bristol Channel. This marine area provides the starting point for the large international fibre optic telecom cables crossing the North Atlantic. There are high numbers of cables which are no longer in service (7,000 km), but it is not always economically viable to remove them and removal in some cases could have an adverse impact upon the local environment.

Table 16: The distribution of cables (by length) between the marine plan areas

Marine plan area	Length of cable (km)	Percentage of total cable length in each marine plan area	Percentage of cables in each marine plan area (frequency)
North East Inshore	120	1	2
North East Offshore	6,096	42	8
East Inshore	617	4	9
East Offshore	2,304	16	6
South East	520	4	13
South Inshore	914	6	6

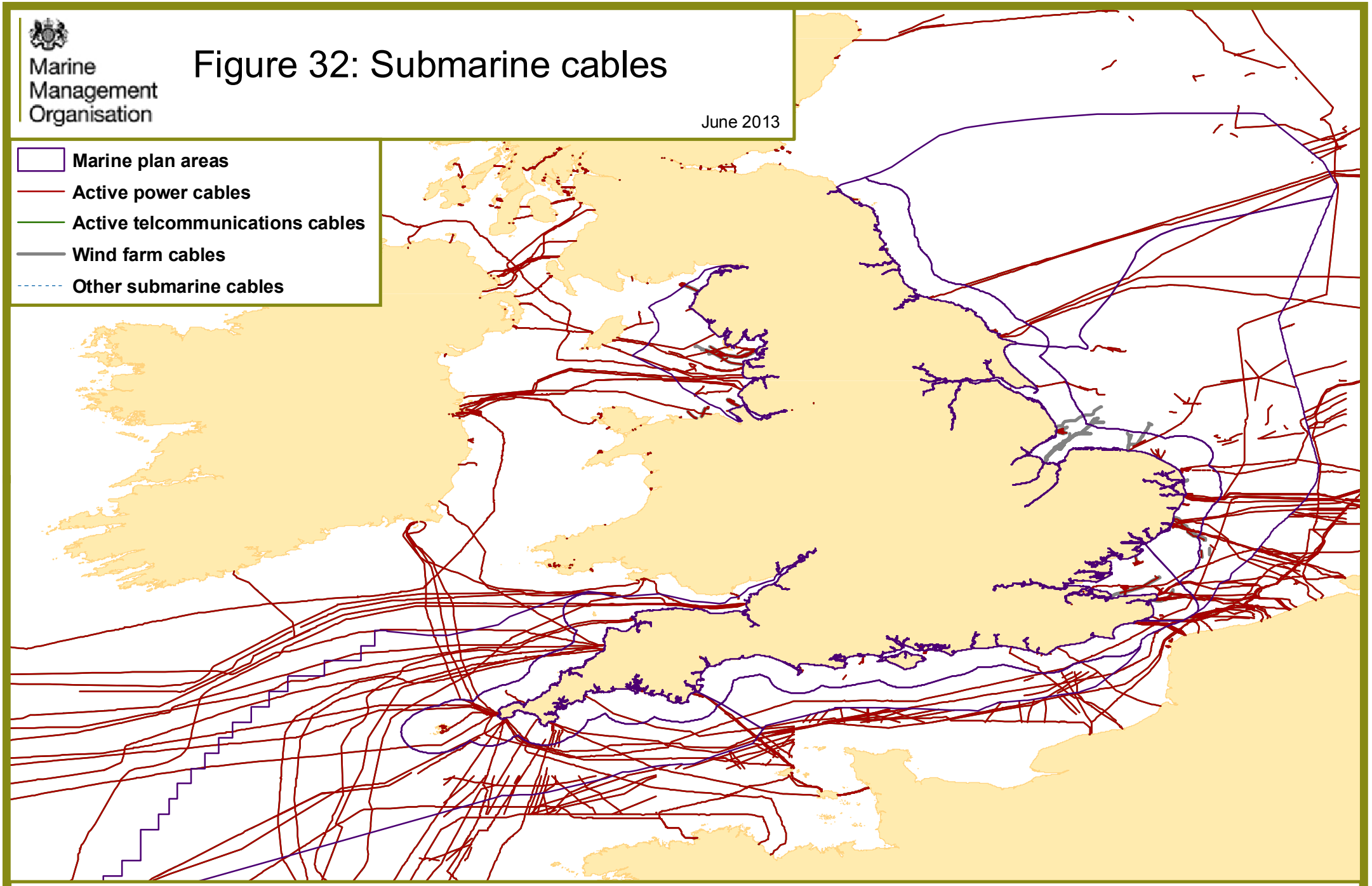
[267] These figures will be updated following data from the TCE cable data refresh due in Summer 2013
[268] These figures will be updated following data from the TCE cable data refresh due in Summer 2013
[269] www.ons.gov.uk/ons/dcp171778_307078.pdf
[270] www.ons.gov.uk/ons/dcp171778_305136.pdf

Marine plan area	Length of cable (km)	Percentage of total cable length in each marine plan area	Percentage of cables in each marine plan area (frequency)
South Offshore	443	3	25
South West Inshore	1,939	13	28
South West Offshore	682	5	1
North West	940	6	1
Total	**14,575**	**100**	**100**

Marine Management Organisation

Figure 32: Submarine cables

June 2013



Future trends and policy direction

Continued growth in offshore renewable electricity generating capacity will result in new marine electricity export cable infrastructure. Further electricity interconnectors between the UK and neighbouring countries are also possible to support fluctuation in national supply and demand. Several new power cables are planned in the near future, high. For example, the high voltage cable from Kent to Rotterdam and the North Sea Interconnector from Seaham (North East) to Sweden as well as projects in their early stages linking England with Norway as well as Belgium via the Nemo link for which an application has now been received by the MMO.

Additional cables to connect offshore energy generation installations to the national grid will also be needed. In section 2.7, the future of renewable energy production is covered in more detail, especially the National Grid proposal for developing an Offshore Transmission Network[271] to allow more effective connection and transmission of power generated by offshore wind farms

Renewable energy installations are reliant on cables to transfer the power generated to the grid, so will drive some future additional cabling needs. A project to establish an interconnector from Scotland to North East England to harness generating capacity is underway. Offshore electricity cable assets will seek to minimise costs by using the shortest route possible between offshore wind farms and terrestrial substations. However, available landing sites for new connections are very limited and so conversely it could be an influencing factor in choosing locations for future offshore power generation sites alongside many other factors. This is due to a lack of adequate areas for bringing cables to shore e.g. difficulty in avoiding MPAs and eroding beaches.

In the next three years due to the amount of projected data transmission (the Olympics and Football World Cup in Brazil in 2016) across the Atlantic, more data cable capacity will be required. Also in the next 20 years further development of submarine telecom cables is likely to be required in order to incorporate more resilient networks with an increased diversity of bandwidth due to the development of higher speed internet connection. Cables have a lifespan of approximately 15 to 20 years so the majority of cables would require replacement within the 20-year horizon of the marine plans[272]. A project in development proposes to connect the South Coast with the Channel Islands.

The Crown Estate completed futures analysis of the cables industry (both power and telecoms), showing areas that are a 'preferred landing zone' for cables (figure 33). This analysis was driven by the location of developing offshore generating assets and the presence of onshore electricity and telecommunication infrastructure. The areas of technical future opportunity for cables are mainly focused around England and Wales with the potential for interconnectors between Northern Ireland and Scotland.

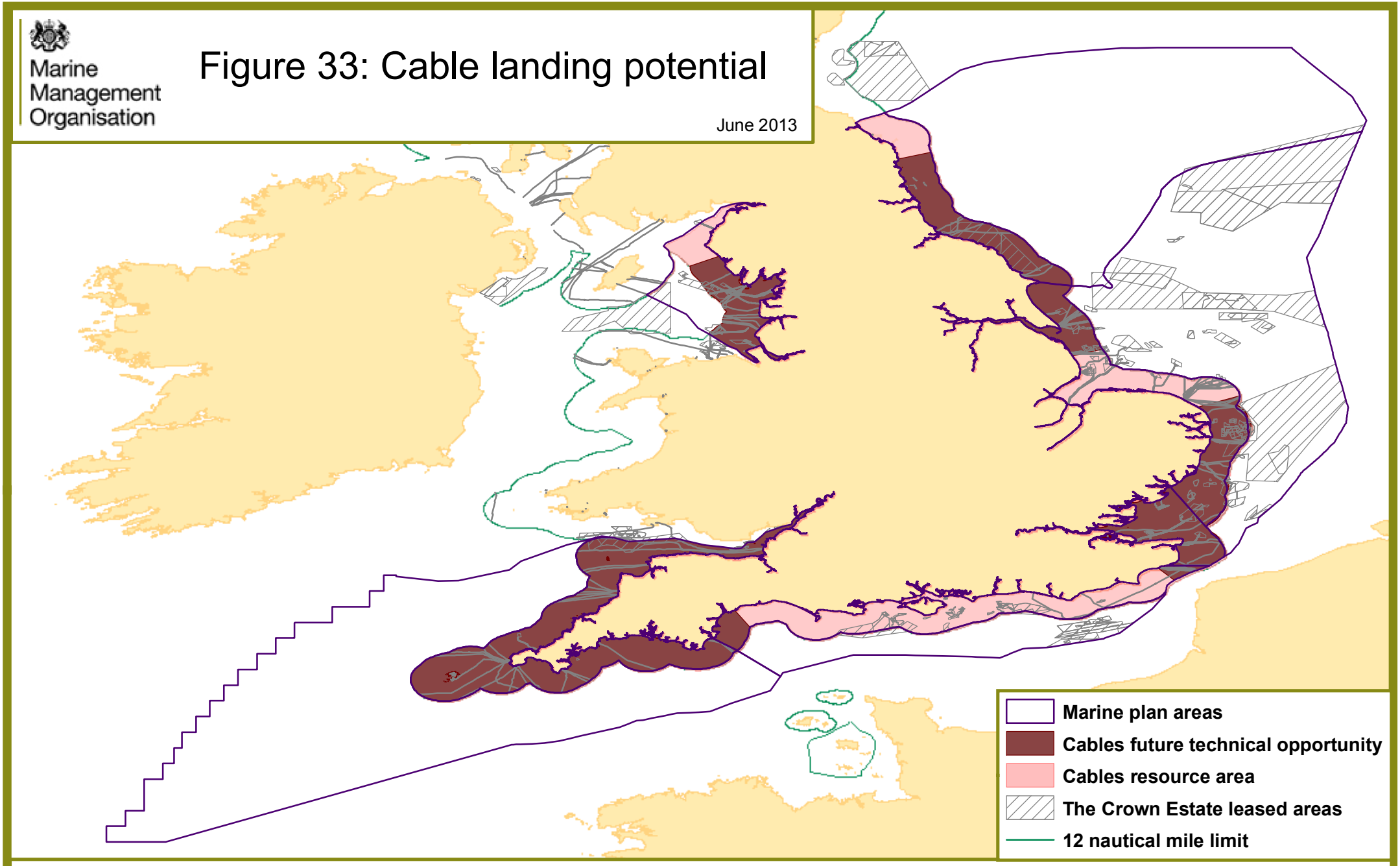
[271] National Grid (2011), Offshore Transmission Network Feasibility Study, Available online at www.nationalgrid.com/NR/rdonlyres/4FBE15A0-B244-4BEF-87DC-8D0B7D792EAE/49346/Part1MainBodysection191.pdf

[272] MMO (2013) – Draft South Marine Plans futures analysis (to be published summer 2013)

Marine Management Organisation

Figure 33: Cable landing potential

June 2013



Note: The areas of future technical opportunity do not include the presence of hard constraints posed by existing uses of the marine estate or other factors including natural & cultural resources, marine users, economics & market appetite and policy drivers required for the opportunity to be supported. Cables and pipelines outside of the Territorial Waters Limit (other than export cables) are not shown as they are not subject to The Crown Estate's permission

2.13 Fisheries

Key facts

- Domestic fishing activity occurs through all marine plan areas but is more concentrated around the coast.
- England's fishing industry has an important social, cultural and heritage value.
- The majority of English vessels (82%) are smaller, under-10 metre vessels that fish mostly in the inshore area[273].
- A wide variety of techniques are used to catch a diverse range of fish and shellfish, with many fleets targeting multiple species.
- The contribution of the fisheries sector to GDP is relatively low, but can be regionally important to employment in some coastal regions where as much as 20% of jobs are dependent on the fishing industry[274].

Introduction

England has a long history of fishing in both inshore and offshore waters[275], managed by a range of national and local policy and bylaws supporting the Common Fisheries Policy – the reform of which is due to come into force on 1 January 2014.

The English fishing fleet is extremely diverse, ranging from large pelagic vessels, earning (and costing) millions of pounds, to low-activity under-10 metre boats, with annual earnings of less than £10,000. English waters are also fished by non-UK vessels, particularly those from neighbouring European countries and over-15 metres in length[276]. The non-UK fishing fleet use a variety of gear and target a variety of species.

Understanding the nature and distribution of fishing activity is a key priority, not only for marine planning and the MMO, but a number of other organisations including the Centre for Environment, Fisheres and Aquaculture Science (Cefas), Defra and the inshore fisheries and conservation authorities (IFCAs). Multiple datasets must be assessed to get a full picture of England's fishing activity, with each giving a different look at this complex industry. For example, vessel monitoring system (VMS) data may help us to understand activity in the offshore area for the largest and most productive vessels, but tells us very little about inshore activity or that of smaller vessels. Data on number of vessels might tell us little about the most economically valuable fishing grounds, but it is a useful indicator of the social value of the fishing industry to England as a whole. For this reason, a variety of figures are presented.

Both data and evidence reports have been used to help us understand fishing activity. Data on commercial fish landings are collected by the MMO and stored in the Fishing Activity Database (FAD) alongside VMS data (only for vessels equal to and over-15 metres in length but to a greater resolution). While a useful illustrator of

[273] MMO UK Sea fisheries Statistics 2011 pp11
[274] MMO UK Sea fisheries Statistics 2011 pp11
[275] Defra, Marine Policy Statement
[276] Finding Sanctuary, Irish Seas Conservation Zones, Net Gain and Balanced Seas. 2012. Impact Assessment materials in support of the Regional Marine Conservation Zone Projects' Recommendations.

some fishing activity, VMS does have a number of limitations. Not all vessels use VMS (the majority of the fleet being under-10m in length) and while it may show where a vessel has been, it does not differentiate between slow speed transiting and actual fishing activity, nor does it discriminate between static fishing activity (pots and traps) and mobile methods such as trawling. Other useful data collected by different organisations is available for marine planning, such as vessel sightings data collected by the IFCAs or data on fishing grounds collected by the Marine Conservation Zone Project. Complementing the information provided by spatial and non-spatial data are a number of important evidence reports, some of which have been commissioned by the MMO to address identified evidence gaps.

The MMO report 'Evaluating the distribution, trends and value of inshore and offshore fisheries in England'[277] undertook a baseline assessment of the current range of available evidence and made recommendations on where to focus effort in the short and medium term future. This resulted in the commission of a number of additional research reports including work to further understand the socio-economic aspects of the industry, and to improve the spatial resolution of evidence on essential fish habitat. These new pieces of research will ensure that the marine planning evidence base continues to strengthen over the next few years.

National summary

In 2012 the MMO published a report which took a broad look at the operation of the UK fishing industry[278]. The report showed a decrease in the number of registered fisherman year on year, with 5800 fisherman in England in 2011 down 13% since 2001. In addition, the number of people employed in fish processing has fallen with a reduction of 17% positions (full time equivalent) in 2012 compared with 2010[279]. Compared with the Scottish fleet, English fishermen are typically working in lower volume but higher priced fisheries. The characteristics of the English fleet have allowed a large number of smaller vessels to continue to be economically viable by catching smaller quantities of more valuable fish. This is reflected in the large proportion of vessels that are 10 metres or under in length therefore highlighting the social importance of the fishing sector to our cultural heritage.

In 2011, 99,000 tonnes of fish (caught by UK vessels) were landed into English ports with a value of £164 million[280]. Of these, 56,000 tonnes were shellfish (such as nephrops, crabs and scallops), 24,500 tonnes were pelagic fish (such as mackerel and herring) and 18,200 tonnes were demersal species (such as cod, haddock and plaice). Landings of pelagic species have increased by 40% since 1960, whereas landing of demersal species were less than 20% of 1960 levels due to factors such as reduction in fleet size, declining fish stocks and restricted fishing opportunities. Landings of shellfish into UK ports are five times what they were in 1960, partly due to fishing activity moving into this sector as there are fewer restrictions, but also partly due to an improved reporting rate- particularly for smaller vessels.

[277] www.marinemanagement.org.uk/evidence/1011.htm
[278] MMO UK Sea fisheries Statistics 2011
[279] Seafish '2012 Survey of the UK fish processing industry'
[280] MMO UK Sea fisheries Statistics 2011

Distribution across the marine plan areas

Through careful analysis of a variety of datasets, a number of conclusions can be drawn on the spatial distribution of fishing activity across the marine plan areas. While all marine plan areas are fished to some extent, different types and levels of activity can be found in specific locations. Figure 34 shows the spatial distribution of fishing activity for over-15 metre vessels and highlights the South and South West offshore marine plan areas as having the greatest level of activity. Figure 35 shows the activity of inshore vessels and highlights significant activity in the majority of the inshore areas, but especially the North East, South and South West Inshore areas. When considering the effort of the English fishing fleet in its entirety, albeit at a coarser resolution, the activity is both varied and widespread (Figure 36). Despite the coarser resolution, it is clear that the inshore marine plan areas are particularly heavily fished, with the area between Weymouth and Plymouth appearing as the area with the highest level of effort.

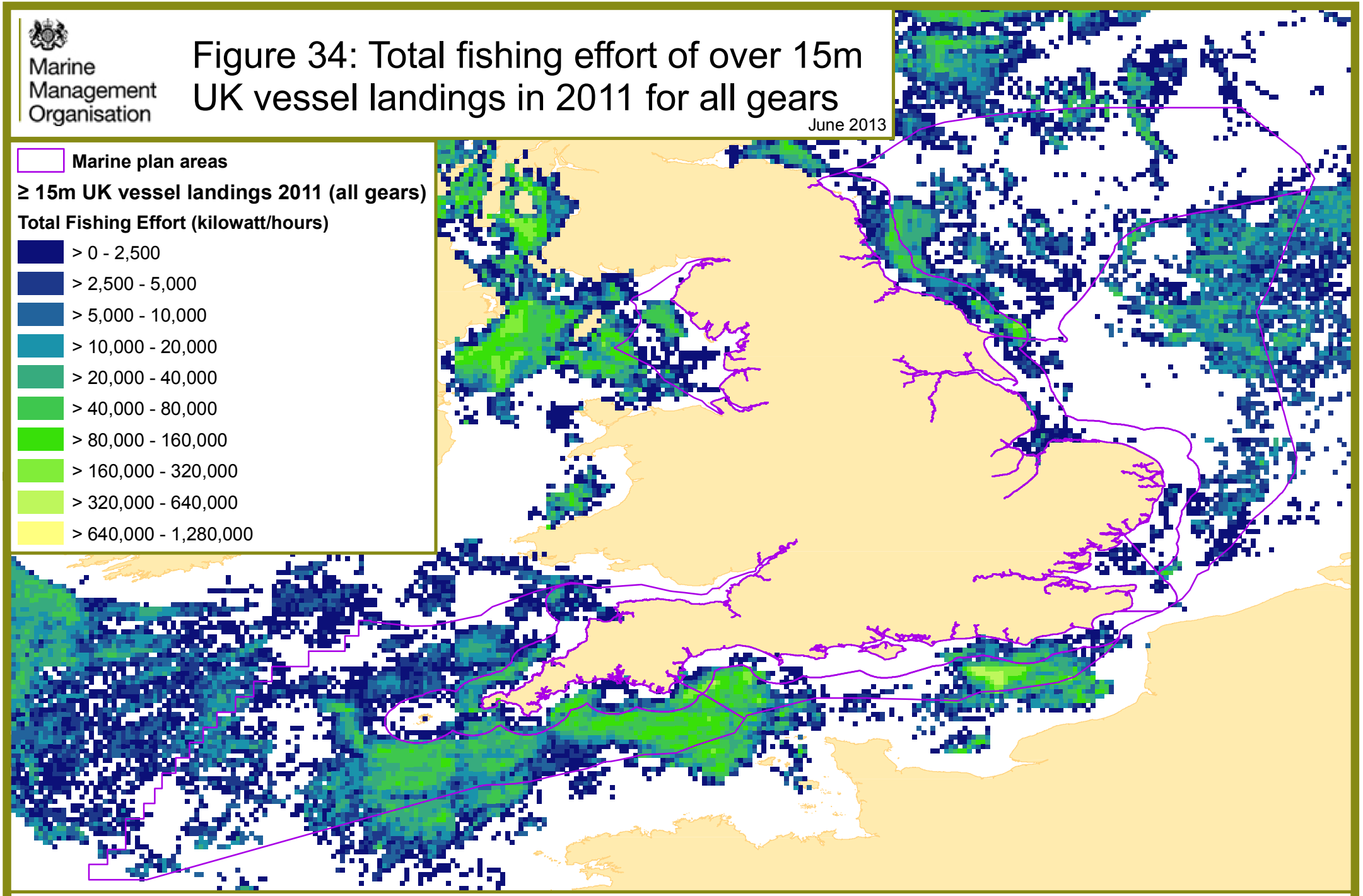
In 2011, 39% of landings into English ports (by UK vessels) landed into Plymouth, Brixham and Newlyn (with Plymouth landing the most at 14,000 tonnes), with the remainder more evenly spread around the English coast. However, figures 37 and 38 demonstrate the importance of a more detailed analysis of port landings data in order to fully understand both the social and economic value of the industry. Figure 39 shows the spatial variation of port landings broken down by number of vessels, value and tonnage with each variable offering a different insight into the activity at a particular location.

For example, while there are a number of ports across all marine plan areas showing high value catch, the ports of Shoreham and Plymouth (in the South and South West) show particularly high value when compared with the number of vessels. In contrast there are a number of ports which show a comparatively greater volume of fish landed when compared with its overall value such as Great Yarmouth and Bridlington in the East, North Shields in the North East and Newhaven in the South. The South West Inshore area is home to the greatest number of vessels (with Newlyn home to 203 vessels in 2011) but there is also significant activity in the South and North East marine plan areas.

Marine Management Organisation

Figure 34: Total fishing effort of over 15m UK vessel landings in 2011 for all gears

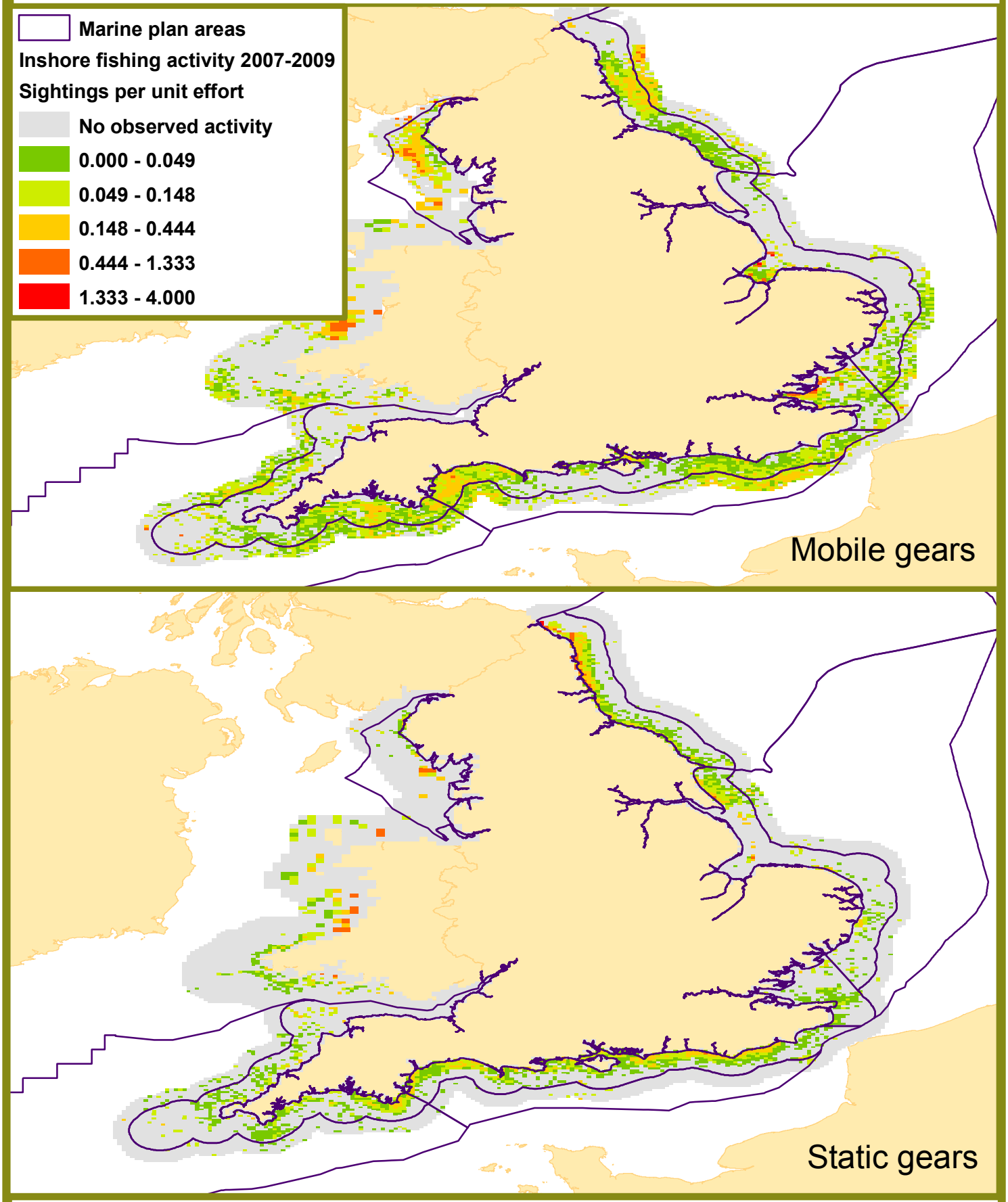
June 2013



Marine Management Organisation

Figure 35: Inshore fishing activity based on sightings from 2007-2009 and split by mobile and static gears

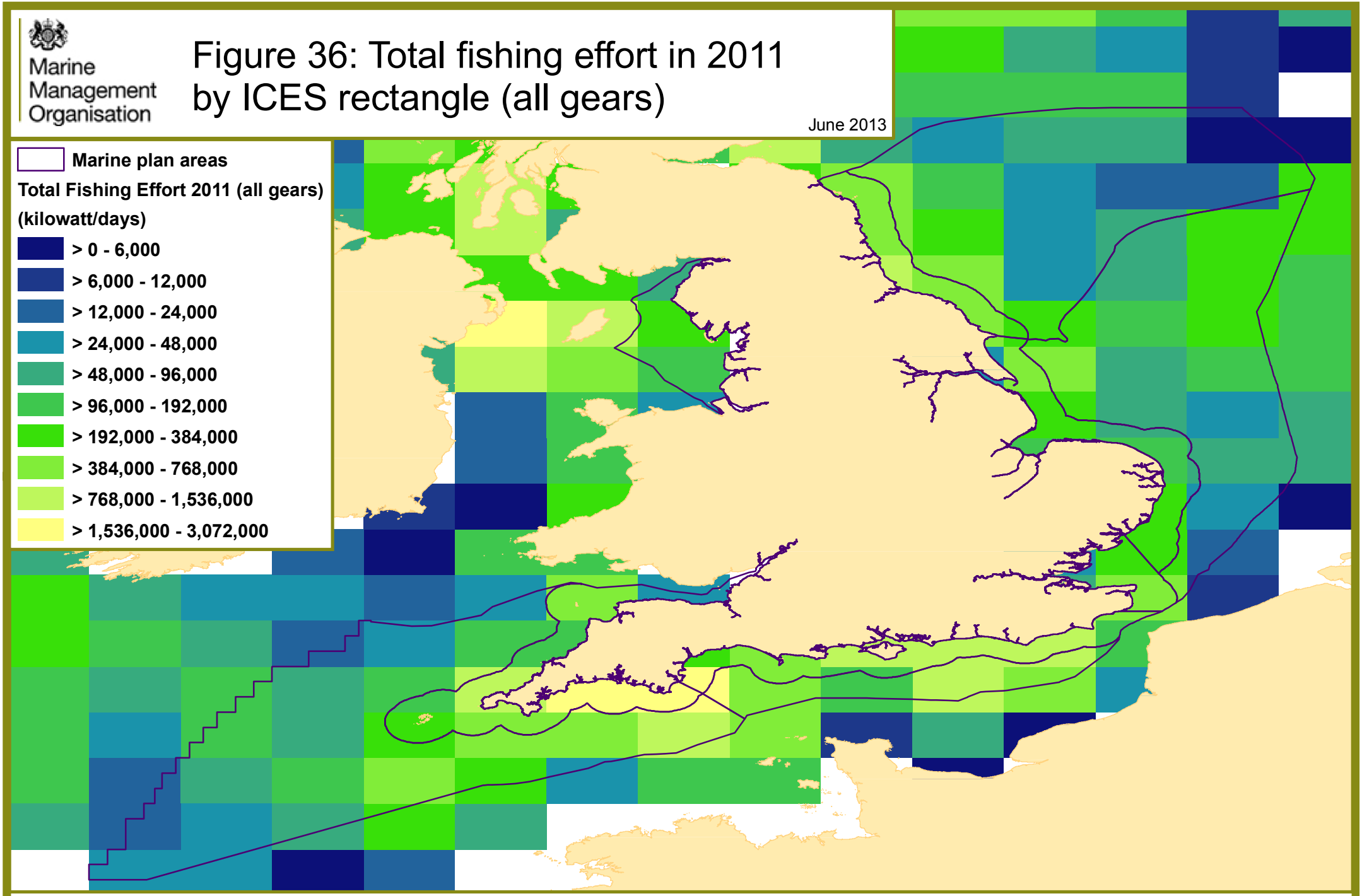
June 2013



Marine Management Organisation

Figure 36: Total fishing effort in 2011 by ICES rectangle (all gears)

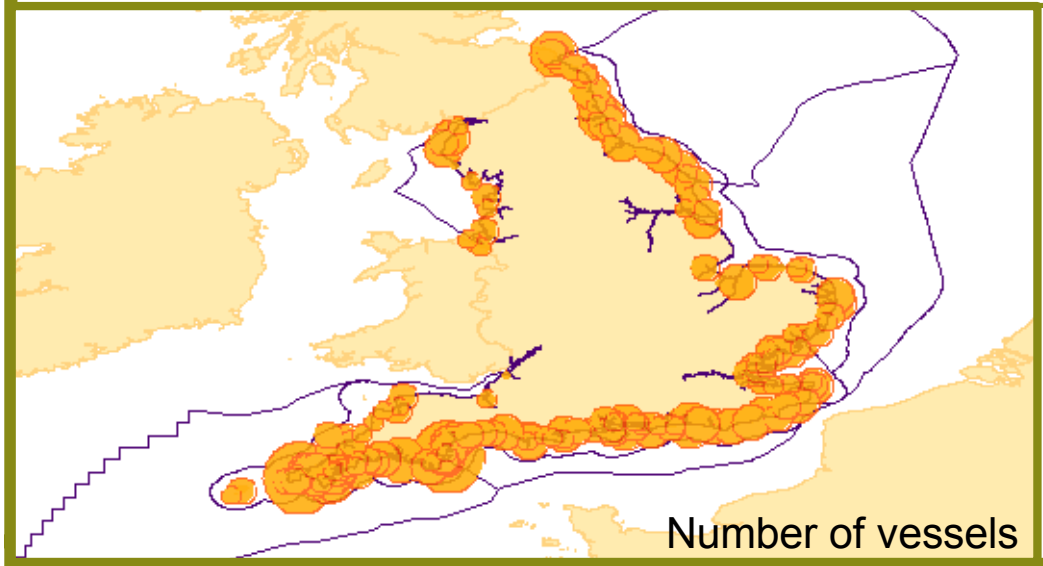
June 2013



Marine Management Organisation

Figure 37: Port fish landings in 2011 (all vessels)

June 2013

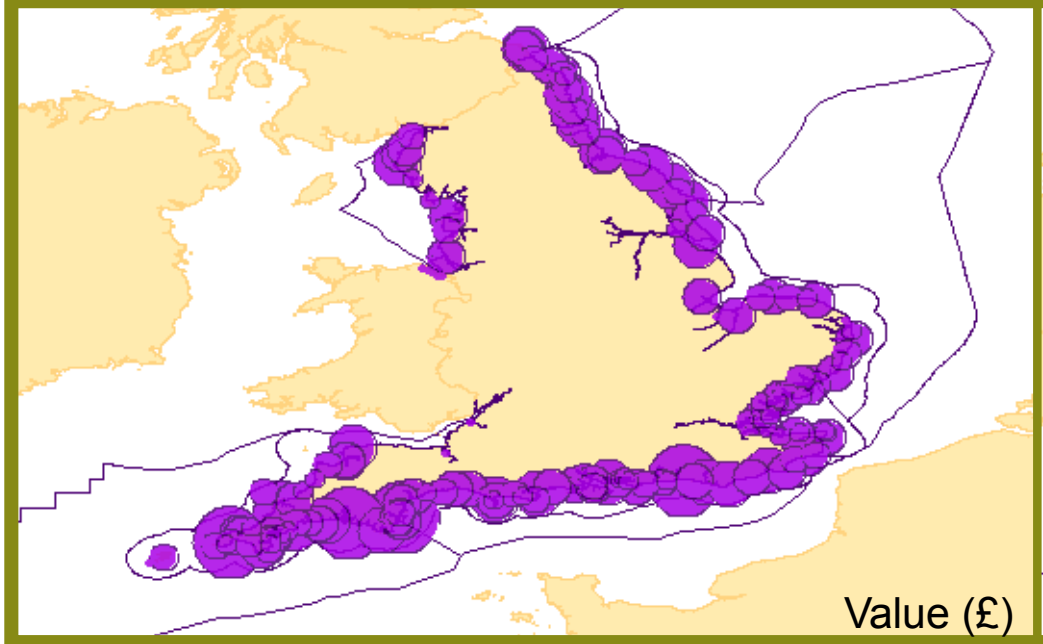


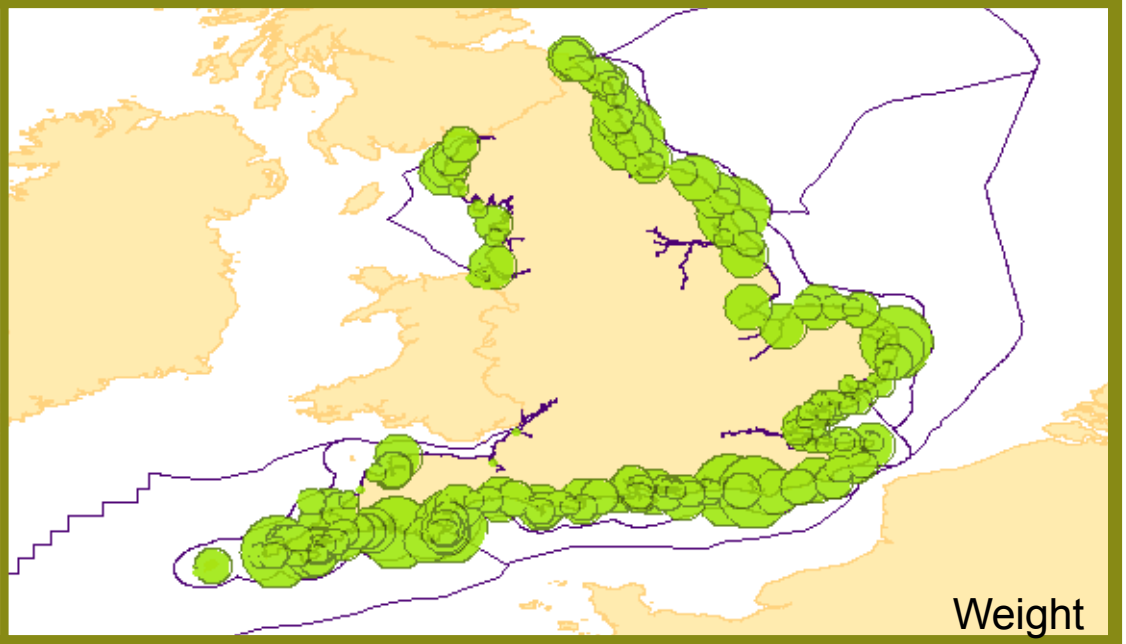
Marine Plan areas

Port Landings by No. of Vessels
(No. of vessels)
- 1 - 3
- 4 - 12
- 13 - 48
- 49 - 192
- 193 - 729
- 730 - 3,072

Port Landings by Value
(£ Sterling)
- > £0 - £7,000
- > £7,000 - £42,000
- > £42,000 - £252,000
- > £252,000 - £1,512,000
- > £1,512,000 - £9,072,000
- > £9,072,000 - £54,432,000

Port Landings by Weight
(Tonnes)
- > 0 - 2
- > 2 - 12
- > 12 - 72
- > 72 - 432
- > 432 - 2,592
- > 2,592 - 15,552





Once these indicators are disaggregated according to vessel length (see Figure 38) it is clear that there are some ports (such as Plymouth, Shoreham, Newhaven, Brixham and Newlyn in the South and South West) where a large proportion of high value catch is caught by a few, large vessels over-15 metres overall length. Brixham was the port with the highest value of landings in 2011 worth £26 million, largely due to the greater proportions of demersal fish and shellfish, which typically sell at higher prices per tonne than pelagic species (which constitute the majority of landings into Plymouth). Since 2001 fishing effort from over-10 metre vessels has decreased due to stock recovery regimes targeting cod in the North Sea and sole in the western channel. The landings caught in many of the other ports are landed by much smaller vessels. Figure 39 highlights that smaller vessels (particularly those under-10 metre) represent a high proportion of the value of fish caught in all marine plan areas.

Non-UK fleets fish throughout all 11 marine plan areas. This is largely concentrated in the offshore areas, although some fleets still have historical rights in the inshore area between 6 and 12 nm. Dutch, Danish, French, and Belgian fleets are prevalent in the North East and East plan areas (such as Dogger Bank) and French, Belgian and Spanish in the South East and South plan areas. The North West plan areas are used by Belgian, Scottish, Welsh and Northern Irish fleets and there is significant Spanish long line activity targeting hake in the South West offshore marine plan area and Spanish bottom trawlers targeting hake, megrim and monkfish[281].

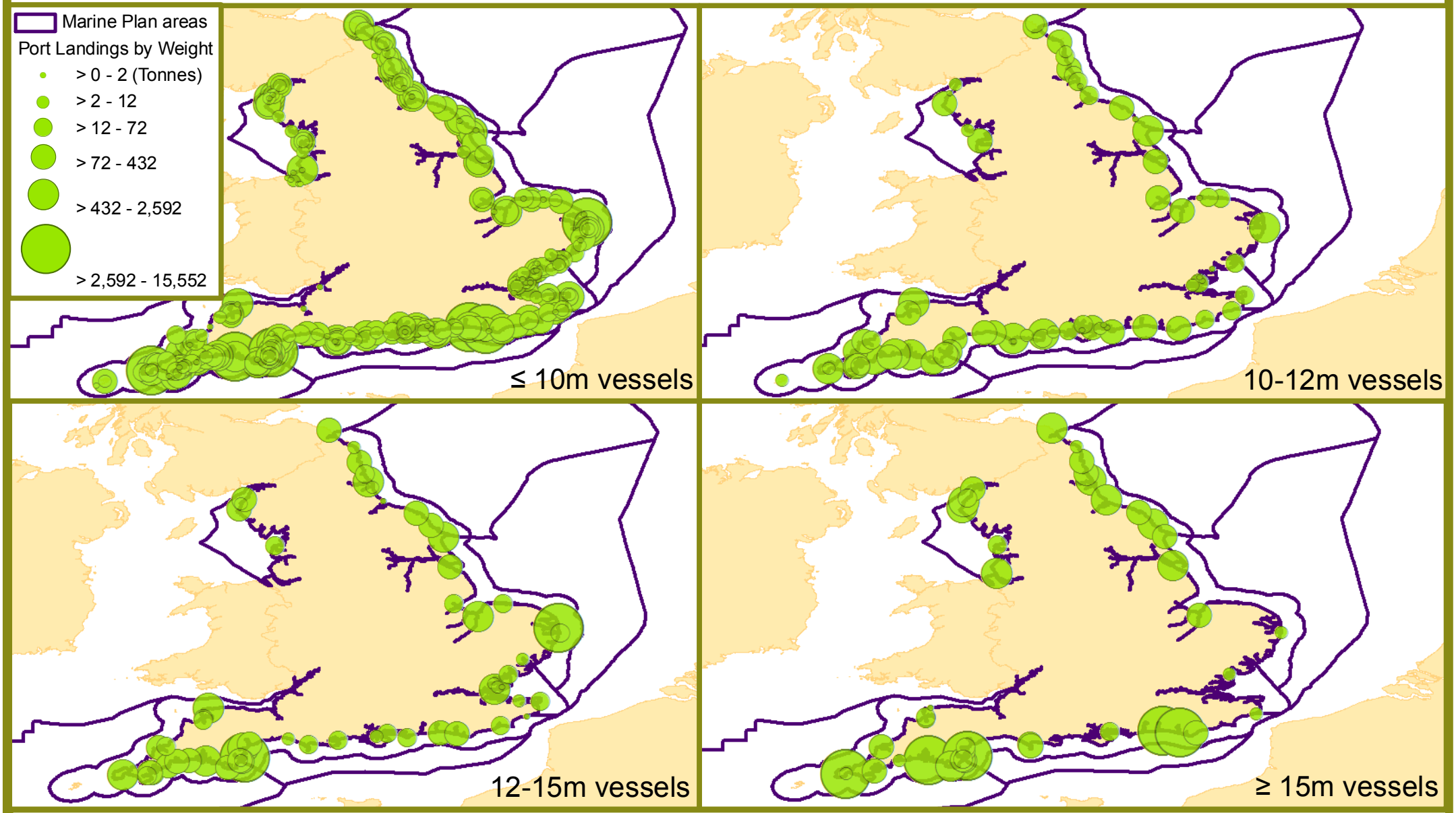
In addition to areas important for fishing, the spatial distribution of those employed in supporting industries must also be considered in an assessment of the industry's social and economic value. Hull and the Humber have the greatest number of fish processing units in England[282] (and indeed the UK as a whole) and employ over 3,000 people, highlighting the importance of the sector for the regional economy of the East marine plan areas.

[281] Finding Sanctuary, Irish Seas Conservation Zones, Net Gain and Balanced Seas. 2012. Impact Assessment materials in support of the Regional Marine Conservation Zone Projects' Recommendations.
[282] Seafish '2012 Survey of the UK fish processing industry'

Marine Management Organisation

Figure 38: English port landings by weight in 2011 seperated by vessel length

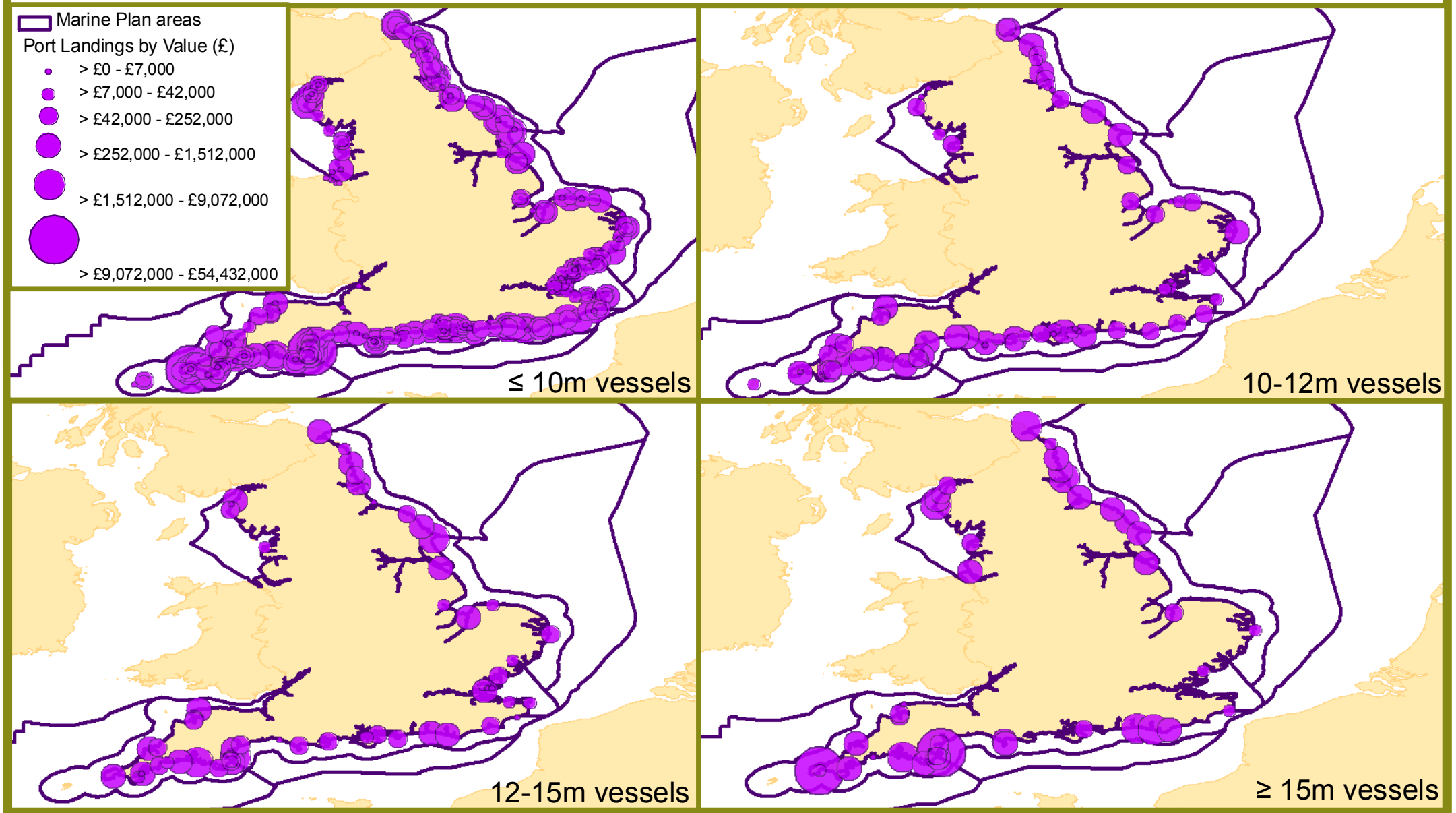
June 2013



Marine Management Organisation

Figure 39:English port landings by value (£) in 2011 seperated by vessel length

June 2013



Future trends and policy direction

Predicting the future trends for the fishing industry is extremely challenging due to the number of factors at play. Recent indications have shown a decline in fishing activity due to a reduction in fishing opportunities and a number of decommissioning exercises undertaken by the UK administrations[283] to help achieve a sustainable future. While it is unknown as to the extent this trend may continue into the future, possible new management measures introduced either as a result of the CFP reform or the designation of new MPAs may affect how fishing is undertaken in the future (including Defra's revised approach to management of fishing in European marine sites).

Increased competition for space (such as a result of offshore wind generation) may have an impact on some grounds currently fished, although the nature of this effect remains unknown. The MMO has commissioned an assessment of future trends for fishing which when completed will feed into the next iteration of the SSR together with projects on inshore fisheries (Defra MB0117), evaluating ecosystem services utilising fishing as a case study, identification of future trends in fishing and additional research on displacement.

Further improvements to our understanding on the distribution of fishing activity will be made as a result of the roll-out of VMS for 12 to 15 metre vessels which is due to be completed December 2013. This will allow the activity of a greater proportion of vessels to be mapped to a much higher resolution.

2.14 Aquaculture

Key facts

- In 2010, English aquaculture production totalled 4,122 tonnes.
- Around 78% of aquaculture produced in English waters are mussels.
- A large scale mussel farm is being developed in Lyme Bay.
- There has been recent interest in offshore aquaculture in the southern North Sea by Scottish investors.

Introduction

Aquaculture is seen as an industry with growth potential within Europe and has been included in proposed reforms of the Common Fisheries Policy (CFP). The EU Commission's 'Strategy for the Sustainable Development of European Aquaculture[284]' (adopted in 2009), was welcomed and endorsed by the Council and the European Parliament. This strategy noted the need for the creation and promotion of a level-playing field for aquaculture as the basis for its sustainable development, reiterating the importance of having an aquaculture strategy in each member state.

The majority of English marine aquaculture consists of shellfish farming, particularly mussels. In 2009, Defra commissioned a 'Strategic review of the potential for aquaculture to contribute to the future security of food and non-food products and

[283] MMO UK Sea Fisheries Statistics 2011 pp10
[284] http://ec.europa.eu/fisheries/cfp/aquaculture/strategy/

services in the UK and specifically England'[285]. This led to the development of a document which was in effect the start of a draft aquaculture strategy 'Planning for sustainable growth in the English Aquaculture Industry' [286] that went out to consultation in 2012.

Understanding the future potential for the marine aquaculture industry is important, and we are aware of current limitations in our evidence base and these are acknowledged in the MMO's Strategic Evidence Plan. In order to begin to address a number of gaps in our understanding, the MMO commissioned a report 'Spatial Trends in Aquaculture Potential in the South and East inshore and offshore marine plan areas'[287] which sought to highlight potential future sites for different forms of marine aquaculture including shellfish, finfish and seaweed production.

National summary

In 2010 English marine aquaculture production totalled 4,128 tonnes. This comprised of mussels and pacific oyster, with smaller amounts of native oyster and other shellfish such as scallops. All production was inshore, most within 1nm of mean low water.

Current barriers[288] to industry growth in England include the access to finance, availability of seed supply, an increasing competition for space in near-shore waters, a complex legislative and licensing framework that can be difficult for practitioners to understand and a lack of co-ordination across the industry. The success of the aquaculture industry is also closely tied to water quality (especially in coastal waters for shellfish) and the success of wild capture fisheries.

Distribution across the marine plan areas

The species cultured and tonnage produced vary across the plan areas, but mussels remain the main species. The East inshore and South inshore marine plan areas currently hold the majority (73%) of all production, with 41% and 32% in each area respectively. Other species include scallops as well as pacific and native oysters.

[285] http://archive.defra.gov.uk/foodfarm/fisheries/documents/aquaculture-report0904.pdf
[286] www.defra.gov.uk/consult/2012/01/12/aquaculture-1201/
[287] www.marinemanagement.org.uk/evidence/index.htm (to be published)
[288] http://archive.defra.gov.uk/foodfarm/fisheries/documents/aquaculture-report0904.pdf and www.defra.gov.uk/consult/2012/01/12/aquaculture-1201/

Marine Management Organisation

Figure 40: Aquaculture

June 2013

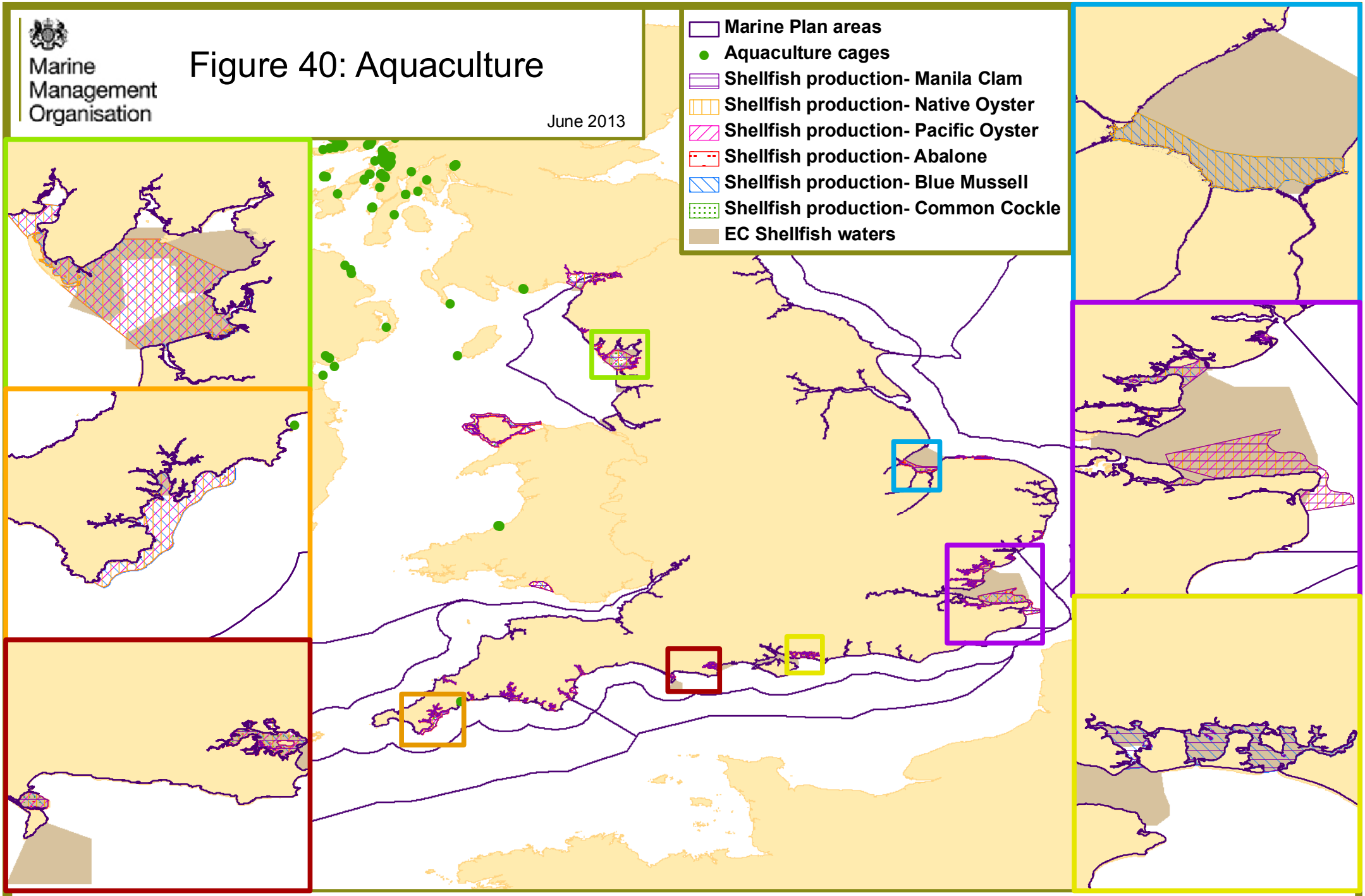


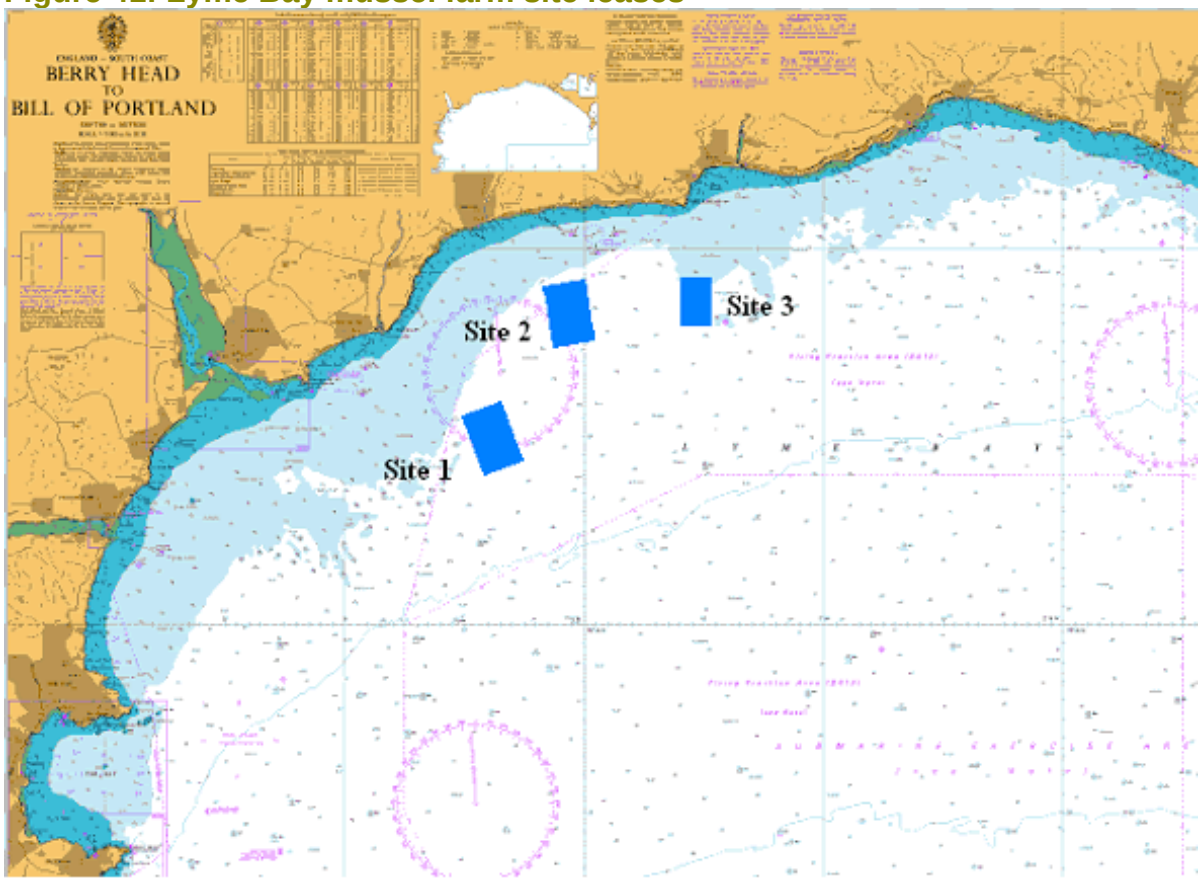
Table 17: Detailed aquaculture production across the marine plan areas
(Obtained via personal communication with Cefas from the data they collate annually for Eurostat.)

Marine plan area	Shellfish production (tonnes)	Number of shellfish production sites	Percentage plan area utilised
North East Inshore	Data not available to MMO due to commercial sensitivity	Data not available to MMO due to commercial sensitivity	1.6
North East Offshore	0	0	-
East Inshore	1,688	15	9.1
East Offshore	0	0	-
South East	239	14	38.2
South Inshore	1,338	12	8.8
South Offshore	0	0	-
South West Inshore	Data not available to MMO due to commercial sensitivity	Data not available to MMO due to commercial sensitivity	12.8
South West Offshore	0	0	-
North West	Data not available to MMO due to commercial sensitivity	Data not available to MMO due to commercial sensitivity	29.4

Within the marine plan areas there are various new aquaculture projects in train. Over the past three to four years The Crown Estate has granted commercial leases for three shellfish long-line developments in Cornwall, and an agreement for lease, including trial sites, for a very large offshore shellfish farm in Lyme Bay. Recently a lease has been agreed for an estuary based oyster farm in north Devon. It should be noted that all of the long-line developments in Cornwall are in more exposed locations than previous developments in order to allow for increased space for scale and better water quality, while the proposed shellfish farm in Lyme Bay represents

the largest equipment-based aquaculture development yet seen in the UK[289]. The farms are to be situated between 3 and 6nm offshore (from mean low water) at 20 to 24 metre depth and will consist of mussels grown on long lines, with an annual production of approximately 5,000 tonnes[290].

Figure 41: Lyme Bay mussel farm site leases[291]



Water quality is highly important to aquaculture, particularly shellfish aquaculture. Poor water quality can lead to reduced growth of the species in question, increased risk of disease to the farmed species, and increase disease risk to humans via consumption. If farmed shellfish are not harvested from within shellfish harvesting waters of class A, B or C they cannot be sold for human consumption[8]. With regards to water quality, this has generally improved around England to meet the faecal coliform standards of the Shellfish Waters Directive. In 2012/2013[292], improvements have occurred in West Mersea and Portland where two classified waters have gone from B to A, and previously unclassified waters in the River Crouch obtained class C. There have also been improvements in the Dee Estuary. Where water quality has not improved this is generally due to the increased rainfall experienced in the last two years leading to storm drain overflows and greater diffusion of agricultural

[289] Pers. comms. Alex Adrian The Crown Estate 2013
[290] 'UK Offshore Aquaculture Prospects A Crown Estate Perspective', presentation given at UK Aquaculture forum Oct 2012
[291] www.offshoreshellfish.com/
[292] For current classifications of shellfish waters: www.food.gov.uk/enforcement/monitoring/shellfish/shellharvestareas/shellfishharvestingclassengwales/

pollution[293]. Some waters were unclassified last year and shellfish harvesting prohibited. Classifications of shellfish harvesting waters have reduced for sites in the Thames, Chichester Harbour and Salcombe.

Future trends

The MMO have recognised the importance of understanding future trends by commissioning a futures project on fisheries and aquaculture as mentioned in the fisheries section. It will deliver in September 2013.

There are various ways in which the aquaculture industry could develop. The industry is seen as one way to ensure food security with regards to seafood, and thus key driving forces in its development will be changes in the food market and the success of wild capture fisheries. The Crown Estate[294] believe regulatory bodies should look to co-location of aquaculture with other marine interests, most notably capture fisheries from the perspective of aggregation of target species around fish/shellfish farms, and for strengthening seafood production onshore.

In terms of future conditions, it is currently thought that climate change is unlikely to have a significant effect on UK mariculture in the short term[295]. The following have been highlighted as key effects to aquaculture by Defra's Climate Change Risk Assessment[296]:

- rising average water temperatures could result in faster growth rates for species more tolerant of higher temperatures (such as Atlantic salmon, mussels and oysters)
- prolonged periods of warmer summer temperatures may adversely affect cold water species (such as cod and Atlantic halibut) and intertidal shellfish (particularly oysters)
- the culture of species which thrive in warmer conditions (such as bass, sea bream and tilapia) could provide positive new opportunities
- species stressed by warmer water temperature are likely to become more prone to disease
- increased storm frequency is likely, increasing the risk of escapes of cultured species and meaning changes to equipment design are required

The other large scale change in environmental conditions that will affect aquaculture is ocean acidification. Among other effects, this process may affect the calcification processes of marine organisms, including valuable marine species (shellfish in particular). Due to the chemical makeup of their shells, mussels are particularly affected, with a recent study estimating the economic impacts of acidification to the UK aquaculture industry as between £59.8 amd £124.6 million a year by 2080 and that 6.1 to 12.6% of shellfish aquaculture in the UK could be lost due to reduced pH of seawater[297].

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[293] South Plan Marine futures analysis: www.marinemanagement.org.uk/evidence/index.htm
[294] Pers. Comms. Alex Adrian The Crown Estate, 2013
[295] www.mccip.org.uk/media/7562/mccip-report-2010-2011.pdf Climate change report card 2011
[296] Climate Change Risk Assessment for the Marine and Fisheries Sector, January 2012, Pinnegar, J., Watt, T. and Kennedy, K. (DEFRA document)
[297] Climate Change Risk Assessment for the Marine and Fisheries Sector, January 2012, Pinnegar, J., Watt, T. and Kennedy, K. (DEFRA document)

2.14.1 Marine biomass

Marine biomass is an emerging sector. It is in effect a combination of the aquaculture and renewable energy sectors in that the source (algae) is cultivated at sea, but the products (methane and ethane) are used to provide renewable energy. Currently there are no commercial developments in English waters, although there are small scale trails occurring within Scottish waters.

Marine biomass, in particular seaweed cultivation (the harvesting and processing of marine macro-algae (seaweed) at a large scale for commercial exploitation), is of current key interest to numerous regulatory bodies. Where the algae is farmed – it's growth is artificially increased and/or artificial structures involved – it is considered to be a form of aquaculture and thus of relevance to marine planning. Marine biomass is emerging as one of the newest prospective business sectors and research and development is well established in terms of identifying the resource opportunity that exists around the UK.

There are a number of products that can be developed from this sector – chiefly ethanol and methane for energy purposes. The Crown Estate is currently carrying out an ecosystem effects modelling project with Cefas, principally examining four seaweed farm sites, each of 1,500 hecatres, on the west coast of Scotland.

From this and other work areas, future opportunities for marine biomass have been broadly identified as being located relatively close to shore (within 50km) around much of the UK coastline. Particular areas of focus are around the western isles of Scotland. However, there are good opportunities shown elsewhere in the UK such as the Irish Sea, Bristol Channel and the south and east coasts of England. The key factors in selecting the optimum sites are: for the site to be within around 50 km of a suitable coastal site with a processing or port facility from which it can be collected by a coastal tanker for use elsewhere, within a water depth of between 25 to 50 meters to allow for photosynthesis but to reduce exposure, and to have a tidal flow of 0.5 to 2.0 metres a second to allow for flushing while reducing exposure.

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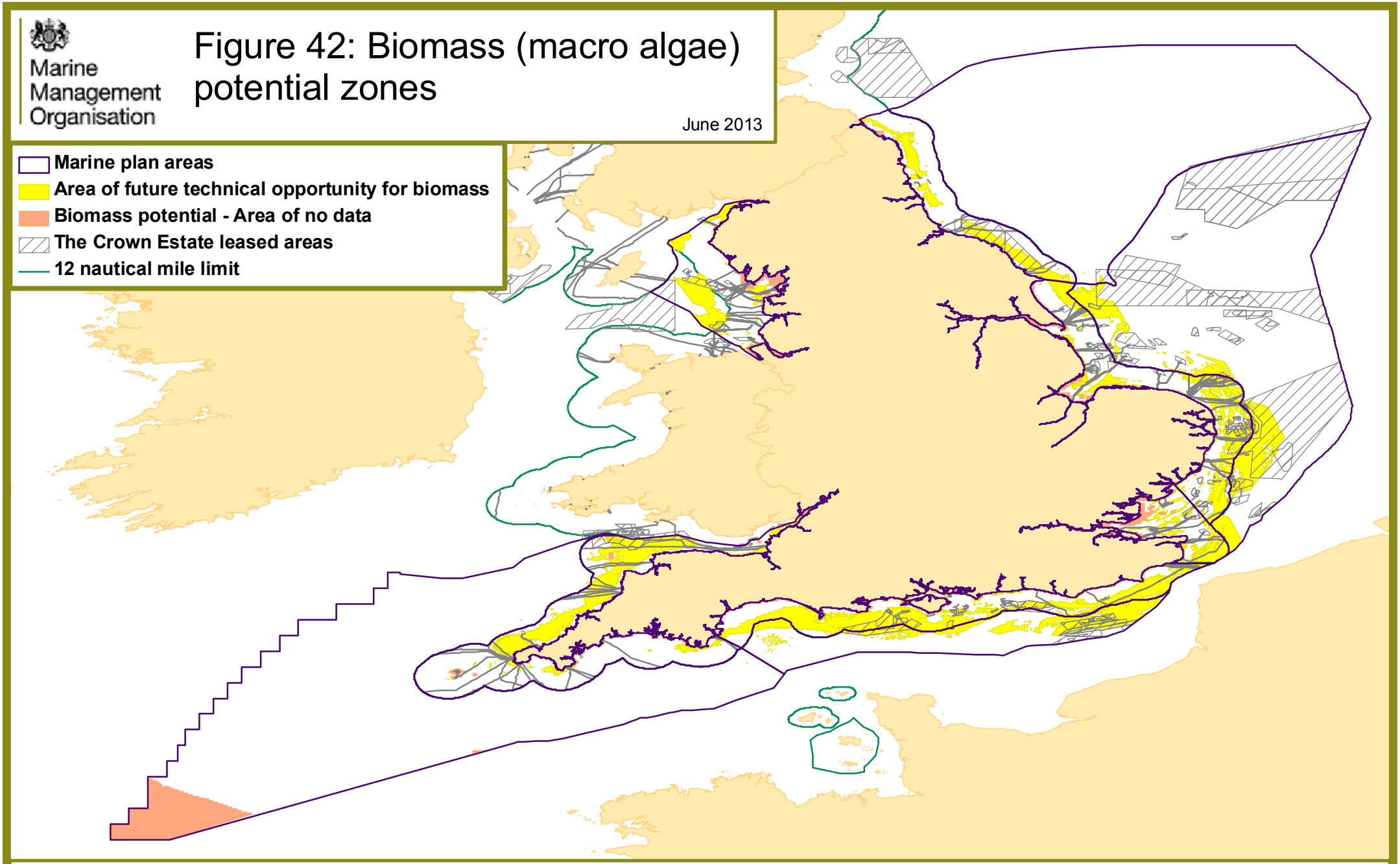
Figure 42: Biomass (macro algae) potential zones

June 2013



Note: The areas of future technical opportunity do not include the presence of hard constraints posed by existing uses of the marine estate or other factors including natural & cultural resources, marine users, economics & market appetite and policy drivers required for the opportunity to be supported. Cables and pipelines outside of the Territorial Waters Limit (other than export cables) are not shown as they are not subject to The Crown Estate's permission

2.15 Tourism and recreation

Key facts

- People in England take 21.6 million days on seaside holidays spending £4 billion per year.
- In 2012, 11.2 million people participated in water sports.
- 2.8 million people participated in at least one boating activity, continuing a pattern of slight decline since 2003.
- The sector is heavily dependent on the state of the UK economy and the health of the marine environment.
- Under the Marine and Coastal Access Act 2009, a new continuous coastal trail will be completed around the English coastline.

Introduction

Tourism can be defined as the activities of persons travelling to and staying in places outside their usual environment, as described by the World Tourism Organisation[298]. Recreation can be defined as people carrying out activities who are either visiting the area (tourists) or local residents who regularly participate in a particular type of recreation. Marine recreational activities are one type of attraction that will draw people to an area.

Proximity to the coast is positively associated with good health, with a small, but significant increase in the percentage of people reporting good health among populations residing closer to the sea. A study using data from the UK's census to examine how health varied across the country has found that people are more likely to have good health the closer they live to the sea[299]. The coast has long been used as an environment for convalescence, holidays and physical activity[300] this includes tourism and recreational activities.

Coastal tourism is difficult to quantify at marine plan area level, yet there are certain features and attractions which draw more people to the coast, including heritage coasts, coastal paths, marine recreational opportunities, seaside towns and visitor attractions. Tourist visitor numbers and other economic statistics related to employment in tourism and recreational related industries, provide some context on which to consider coastal tourism in this report.

2.15.1 Tourism

National summary

The UK Administrations' aim for tourism is to take steps to improve the competitiveness of the tourism industry, recognising the important part that it plays in the national economy and to encourage growth within environmental limits. Furthermore, tourism is one of the top three growth sectors of the economy and

[298] This definition has been adopted by the UK Government.
[299] This may not be the case in certain areas of social deprivation.
[300] European centre for Environment and Human Health
http://ecehh.org/publication/does-living-coast-improve-health-and-wellbeing

supports 1.5 million jobs and contributed nearly £90 billion to the economy in 2009[301].

People in England take 21.6 million days on seaside holidays, spending £4 billion per year (Pugh, 2008)[302]. There are many different reasons why people visit the coast and holiday in seaside towns, but mainly it is for leisure purposes. Sport and recreation spend in relation for tourism in the UK was over £2 billion in 2011[303] (this figure is for the whole country and not just marine related recreation).

The extent to which people find an area attractive to visit depends heavily on the appearance and health of the marine and coastal environment. Some of these activities (which are directly relevant for marine planning) include water based recreation such as boating and yachting, walking on beaches and the enjoyment of historic landscapes, for which access to the coast is very important.

Heritage Coasts represent stretches of our most beautiful, undeveloped coastline, which are managed to conserve their natural beauty and, where appropriate, to improve accessibility for visitors[304]. There are many areas of outstanding natural beauty which have a coastal element and many heritage coasts – for more on AONB and heritage coasts see section 2.4 on seascape. Additionally there are 31 UNESCO world heritage sites and 69 blue flag beaches across England[305].

Coastal towns also have the opportunity to capitalise on the attractiveness of their national environment to attract visitors. This is particularly the case with ecotourism and the development of niche markets which relate directly to the sea, such as fishing.

Distribution across the marine plan areas

There are many tourist attractions along the coastline drawing people to an area. These include heritage coasts, world heritage sites and AONBs (see section 2.4 on historic seascapes for details). This suggests that the South and the South West are the most significant marine plan areas for historic coastal landscapes.

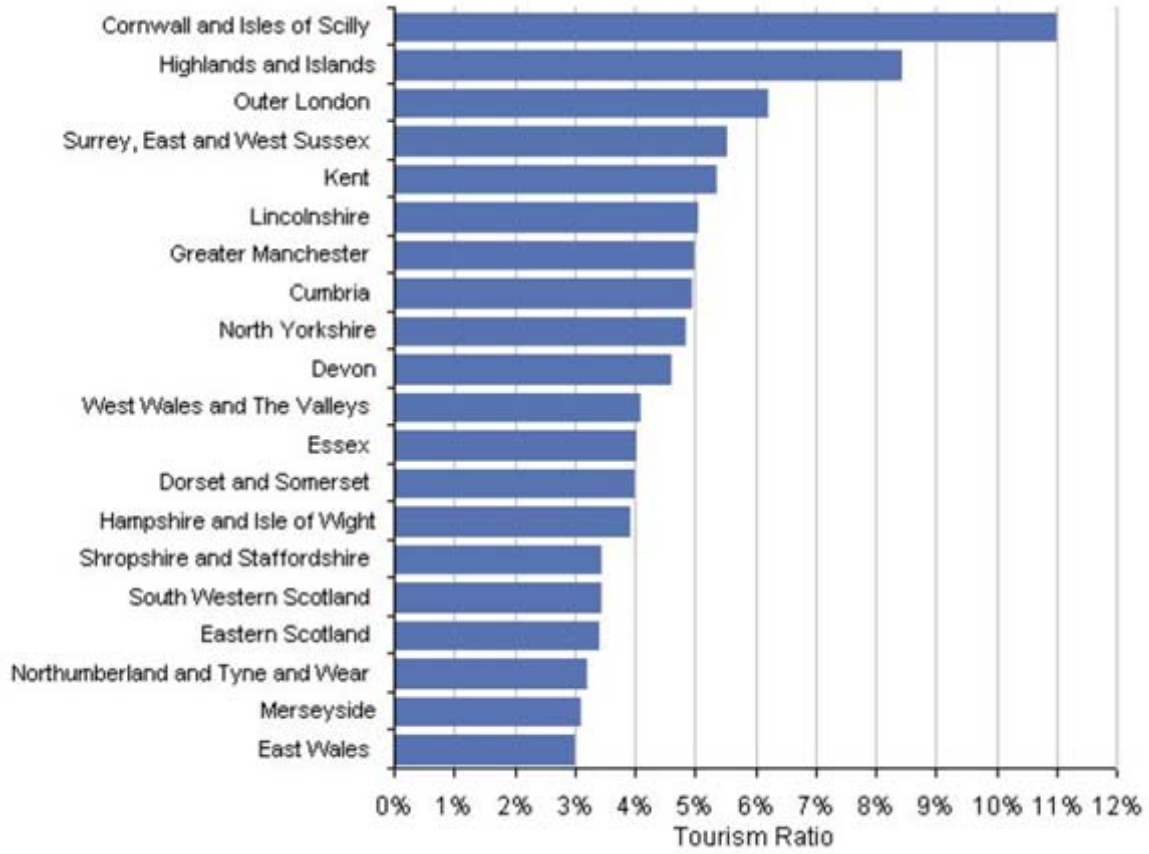
Olympic sailing at Weymouth in Dorset was a big tourist attraction in 2012 with its legacy continuing to attract visitors. There are 22 blueflag beaches in the South, 22 in the South East, 15 in the East, ten in the South west, seven in the North East and none in the North west. This indicates the health of the marine environment in the southern marine plan areas and its importance for marine recreation in these areas. See also the recreation section 2.15.2.

In terms of eco-tourism and linkages with wildlife areas, there are 16 RSPB reserves in the East, 11 in the South, ten in the South West, six in the North West, three in the

[301] Marine Policy Statement (2011). Pg 46, 3.11.1. Defra
[302] Pugh, D., 2008. Socio-Economic Indicators of Marine-Related Activities in the UK Economy. The Crown Estate. 40 pp. March 2008.
[303] www.tourismalliance.com/downloads/TA_327_353.pdf
[304] www.naturalengland.org.uk/ourwork/conservation/designations/heritagecoasts/
[305] Not all local authorities apply for blue flag beach awards and there are other awards such as the Marine Conservation Society good beach guide available .

South East, three in the North East. Again this indicates the significance of the South West, South and also the East for these nature areas.

Figure 43: Tourism ratios for the sub-regions of the UK (NUTS 2 regions top 20 shown) in 2008



Future trends

British coastal towns may be recovering from a long-term decline in tourist numbers as many people take short breaks, in addition to their more expensive overseas holidays. They are increasingly popular as retirement locations, but these trends can also bring social problems such as the outward migration of young people and an increased requirement on health and social services because of the higher than average age of people[306].

2.15.2 Recreation

National summary

There are many recreational activities that occur in England's marine area including (but not limited to) sailing, swimming, snorkelling and diving, surfing, kite surfing, wind surfing, angling, wildlife watching, boat trips, cycling, walking and rambling, visiting local reserves and sites of cultural or heritage interest and these almost always occur in the inshore area. This list is not exhaustive because marine recreational activities are often changing and evolving, with new sports or activities developing which people are eager to try.

[306] www.publications.parliament.uk/pa/cm200607/cmselect/cmcomloc/351/351.pdf.

People travel from afar to take part in these activities, often trying a new recreational activity while on holiday, but these are also popular among local people living in the area. Recreational activities are enhanced by a well-managed and healthy marine environment, attractive and well-maintained beaches, foreshore and clean bathing water[307]. As mentioned in the tourism section above, blue flag beaches are one indicator of a healthy marine environment and are present in all inshore marine plan areas (except the North West). The blue flag award demonstrates compliance with criteria including water quality and environmental management.

The MMO commissioned a study in 2012 to compile existing data and evidence on marine recreational activities. The study collected some datasets at both a national and marine plan areas scale but overall, the study highlighted the paucity of centralised spatial data at both scales[308].

The Watersports Participation Survey[309] is conducted on an annual basis, commencing in 2004, initially focusing on recreational boating activities, and later broadened to include other watersport activities. This study estimates that 11.2 million people participated in a watersport activity in 2012 with approximately 66% of all these activities taking place at the coast. This is a 2.2% decline (from 25% of UK adults in 2011 to 22.7% in 2012) on previous years which can be attributed to fluctuations in individual recreation activities, namely the decline in outdoor swimming and coastal walking.

The majority of watersport activities take place in the summer (57.3%) with sea angling being the activity most likely to be undertaken during the winter months. The majority of boating-related activities occur at the coast (with the exception of small sail boat racing which is more prominent in inland waters) as well as using personal watercraft, wind-surfing, angling and surfing.

During the 12 months to September 2012, 5.8% (2.8 million) of the UK population participated in at least one of the core boating activities[310]. This is a 3% decline compared to 2005 and follows the broad trend of decline since 2002[311]. Of the 2.8 million participating in boating activities, 743,000 UK households own at least one boat.

Despite this decline, the British Marine Federation (BMF) reported the total revenue of the UK leisure, super yacht and small commercial marine industry in 2012 to be up 0.3% from 2010/11, totalling £2.855 billion[312].

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[307] Marine Policy Statement (2011)
[308] Compilation of spatial data marine recreation activities (2012). MMO
[309] www.britishmarine.co.uk/what_we_do/statistics__market_research/current_projects/watersports_participation.aspx
[310] Small sail boat racing, Other small sail boat activities, Yacht racing, Yacht cruising, Power boating, General motor boating, Canal boating, Canoeing, Rowing, Windsurfing, Water skiing, Using personal watercraft.
[311] Watersports Participation Study (2012)
[312] UK Leisure, Superyacht and Small Commercial Marine Industry, Key Performance Indicators (2011/12)

Distribution across the marine plan areas

Within the decision document supporting selection of the next marine areas for plan production, evidence indicated the South marine plan areas had a high recreational value[313]. Some of the information available on the distribution of recreational activities across the marine plan areas in England is summarised below.

The number of participants taking part in surfing varies greatly across England though this is not always dependent on the quality of the waves in an area. For example, the South coast of England is very popular for surfing but the consistency and quality of the waves is low. The North East, similar to part of the South West of England, is popular with surfers and the quality and consistency of waves is high[314]. Surfing also contributes to local economies with many surfing-related businesses, for example in Cornwall, benefitting from the interest in and attraction of the activity.

The watersports participation survey reflects this value, indicating that over 30% of participation occurs in the South East and South West collectively, with the North West, East and North East of England each representing about 16 to 17% of participation.

The South Coast of England has the highest percentage of boat-related activity in England (16%), with the South West home to 12% followed by the North West and East/South East marine plan areas with 10% respectively.

The high percentage of boat-related activity off the South coast can be linked to the high number (67) of Royal Yachting Association (RYA) marinas in the South marine plan areas, enabling access to the sport for regulars and beginners alike. It is worth noting that there will be many marinas not associated with the RYA so further increasing the opportunity for people to access this sport on the South coast. The South East and South West marine plan areas have the second and third highest number of marinas respectively indicating the high levels of boating activity in the south of the country. Furthermore, the South and South West inshore marine plan areas each have over 140 recognised RYA cruising routes.

This information indicates the wealth of marine recreational activities available in the South of England and the popularity of many activities such as boating in this area. There are also pockets of intense activity in other parts of the country, particularly the North and East of England but much of the activity in the south can be attributed to the warmer weather and predominantly stronger economy than other parts of England.

Future trends

At a national scale, there is little information about the future trends of recreation. The Strategic Plan for Water Related Recreation in the East of England (which includes London) aims to improve the existing provision of water-based recreation as well as open up new areas for recreation through improved transport networks and promote environmentally friendly recreation activities to ensure sustainable

[313] Decision on selection of third and fourth marine areas for plan production (2012). MMO.
[314] The Waves As Resource (WAR) Report (2010). Surfers Against Sewerage.

recreation[315]. This plan was from 2009-2014 and indicates the recognition of and desire to improve water based recreation along the East coast of England.

A recent report commissioned by the MMO focuses on future trends of the South marine plan areas[316]. The study indicates that recreation and tourism are expected to increase in the South marine plan areas, as a result of economic recovery, increasing population size, and milder weather conditions in the longer term extending the tourism season.

Nevertheless, the magnitude, rate and consequences of climate change are still uncertain, and may result in increased storminess. Furthermore there have been reports from Europe indicating warming seas may increase the risk of Vibrio during periods of high recreational activity coupled with warmer sea surface temperature[317].

The spatial distribution of most tourism and recreation activities is likely to remain constant, with the distribution of major coastal attractions (such as seaside towns and landscape features) unlikely to change. However, there may be increases of visitor numbers to Brighton, Southampton and Bournemouth as result of planned investment in coastal development in these areas.

Recreation and tourism will be further supported by continued improvements in water quality as a result of standards that must be met under the Water Framework Directive and Bathing Waters Directive driving investments in water treatment, sewage and drainage systems[318].

[315] A Strategic Plan for Water Related Recreation in the East of England (2008). The University of Brighton, Rubicon Associates and Exegesis
[316] MMO (2013) South marine plans futures analysis
[317] MCCIP 2010-2011 Annual Report Card, Climate Change: Impacts of our vision for clean safe seas. Available at www.mccip.org.uk/annual-report-card/2010-2011/clean-and-safe.aspx
[318] MMO (2013) South marine plans futures analysis

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Figure 44: Recreational boating

June 2013

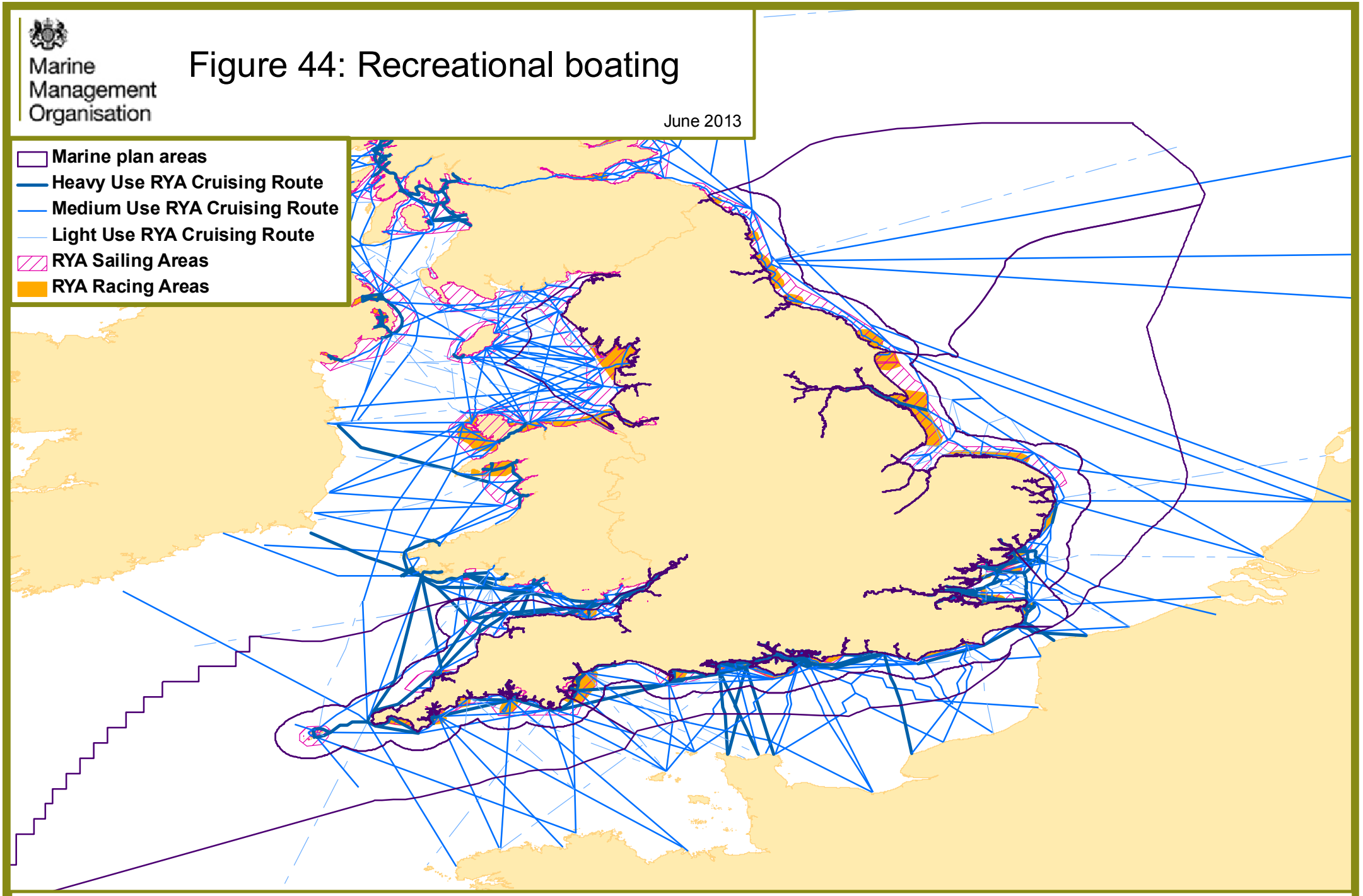

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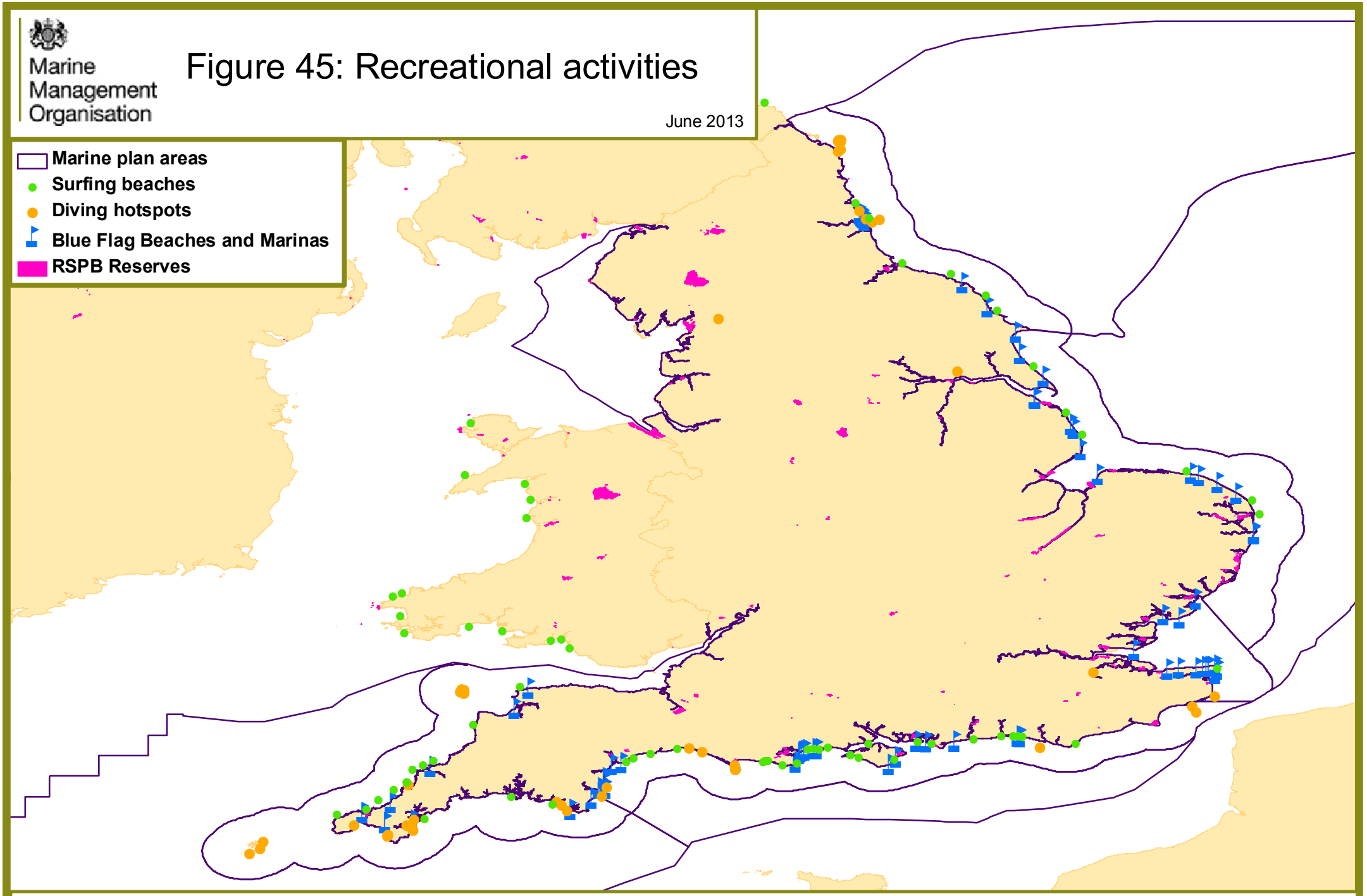
Figure 45: Recreational activities

June 2013



2.16 Social and economic considerations

Key facts

- Coastal communities are very diverse.
- Employment growth in coastal towns has been better than average.
- Generally population appears to be declining in coastal areas.
- There are relatively high concentrations of older people.
- Some coastal areas historically based around activities such as fisheries, tourism, shipbuilding and ports, struggle to diversify their economies
- Some coastal areas are up against natural obstacles due to their peripheral location.
- Coastal flooding is identified as the second highest risk of civil emergency in the UK.

Introduction

The Marine Policy Statement (MPS) recognises the contribution marine plans can make to socio-economic conditions for communities "properly planned developments in the marine area can provide environmental and social benefits as well as drive economic development[319]". Furthermore, the MPS recognises that marine based activities can provide opportunities for employment in both long-established and developing industries that provide wide and long term benefits for both national and local economies[320].

This section has not duplicated the analysis contained in the other sector-specific sections of this report which have socio-economic dimensions.

In order to better understand the types of communities bordering the East inshore marine plan area and how they could benefit from, or respond to, (the introduction of) marine plans, the MMO commissioned, a study in July 2011, which produced two socio-economic reports – 'Maximising the socio-economic benefits of marine planning for English coastal communities', and 'The East marine plan areas: maximising the socio-economic benefits of marine planning'. These reports still comprise the most directly relevant analysis of the socio-economic processes at work in English coastal communities and the benefits to, and opportunities for, marine planning. However, as the reports relied to a degree on a synthesis of 2001 census data, there are limitations in the confidence that can be placed on their findings.

Data from the Office of National Statistics does not distinguish between coastal and non-coastal areas and furthermore, there is generally a limited amount of evidence gathered on marine and coastal socio-economic matters. Charting Progress 2 was demonstrably unable to draw on the same level of socio-economic research as that for the environment. This is a considerable challenge to developing evidence-based socio-economic policies. To help address this shortfall the MMO has commissioned a number of research projects to add to the socio-economic evidence base for marine planning. These include work on the economic baseline, futures, tourism and recreation which report in June 2013. Research on fisheries trends and a further

[319] Marine Policy Statement (2011). Defra. 2.5.2.
[320] Marine Policy Statement (2011). Defra. 2.5.3.

project entitled 'Social Impacts of Fisheries, Aquaculture, Recreation, Tourism and Marine Protected Areas (MPAs) in Marine Plan Areas in England' will be completed by August 2013.

National summary

The MMO's two socio-economic reports on marine planning consider economic productivity and competitiveness to be at the centre of wider explanations of the social and economic processes under way in different communities. More productive areas are not only wealthier, but also tend to provide a better social, cultural and environmental quality for their residents, compared to other less productive areas. From this perspective, it is important to understand the drivers of productivity growth in coastal areas. A government review of the economic literature set the following five drivers of productivity growth.

Competition

Frequently, coastal status means that coastal areas are peripherally located, creating difficulties in competing successfully in labour and product markets, due to increased cost bases. Traditional industrial activities where coastal areas may have a domestic competitive advantage are often open to international competition, which affects productivity levels for these industries.

Innovation (including technological progress)

Innovation is a key productivity driver, but relatively little is currently published about the prevalence of innovative knowledge-based industries in coastal areas. Some evidence suggests that some local coastal cultures, due to the presence of an older population, do not prioritise change and innovation. This may adversely affect the local scope for taking full advantage of new opportunities.

Investment (physical capital)

Some coastal areas are up against formidable natural obstacles where investment is concerned. Frequently, coastal status means that coastal areas are peripherally located, so reducing levels of investment the market is willing to make. The lack of a 360 degree economic hinterland means that coastal towns experience difficulties in attracting investment. There are reasons to think that these difficulties associated with peripherality and hinterland may have increasing importance in the modern economy. This has the biggest impact in the context of retailing (an increasingly important town function in a consumer age), but also a wide range of other services. This means that coastal towns might struggle to focus the same volume of service functions and consumer spending in their towns as comparable areas further inland.

Skills (human capital)

Educational attainment and workforce skills in coastal areas are not generally worse than the English average, but this hides pockets of real problems. A number of seaside towns – for example, Clacton, Great Yarmouth and Skegness – have a very low proportion of workers with high-level qualifications. On the other hand, Greater Brighton and Whitley Bay are exceptional in having a share of highly qualified workers well in excess of the English average.

Enterprise

Business stock and start-up rates in coastal communities, the key indicators of levels of enterprise, are slightly below average though are not greatly out-of-line with the figures for several regions outside London.

Some people in coastal communities have made a choice to trade a reduced income for a higher quality of life (lifestyle shifters). The Local Growth White Paper[321] acknowledges that not every place "will, or will want to, become an economic powerhouse". For example, reviews of Brighton and Hove's economy, have found that the area has been a relatively successful economy that has grown rapidly in employment terms in recent years, but in value terms the area still lags some way behind what might be expected of a city of its size and assets. This lifestyle factor is perhaps one reason why this might be the case.

Distribution across marine plan areas

A typology of coastal communities

Population densities throughout coastal England are shown on Figure 46. The map shows the generally high densities in the South and South East marine plan areas and the relatively more dispersed populations elsewhere. However, there are higher and lower densities within marine plan areas. It is pertinent to think about the socio-economic characteristics of different populations and these are addressed more readily through use of coastal typologies. The coastal typology, developed as part of the MMO socioeEconomic study[322], provides a swift overview of the types of coastal communities and their social and economic characteristics including current position and recent trends in relation to the national average. The purpose of this typology is to provide a simple way of understanding key differences between coastal communities and to then start to understand how this might affect their relation to marine activities and usage of the waters around England.

[321] www.gov.uk/government/publications/local-growth-realising-every-places-potential-hc-7961
[322] www.marinemanagement.org.uk/marineplanning/key/se.htm

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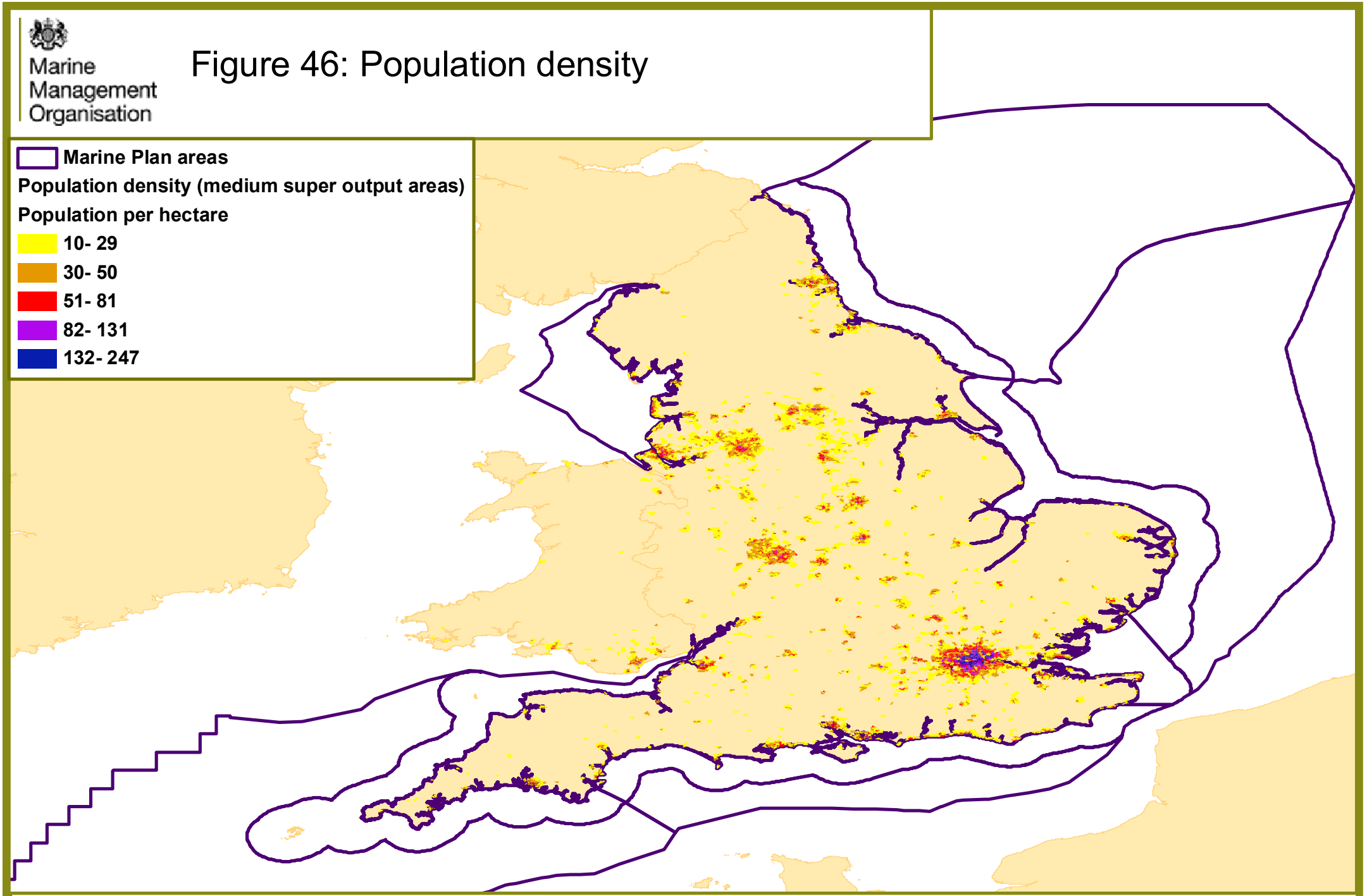
Figure 46: Population density



June 2013

Table 18: Typologies of coastal communities

Typology category	Overview	Above the coastal average	Below the coastal average
A1 Coastal retreats: Silver seaside	Retirement areas primarily located in smaller, less developed resorts	People of pensionable age Part-time employment Home working Self employment People employed in tourism	People receiving Jobseekers Allowance People receiving incapacity benefits ID 2010 Crime domain
A2 Coastal retreats: Working countryside	Largely rural areas, low population density or in smaller settlements, with people employed in lower skill occupations	Travel time to key amenities People working from home Second homes	Population density People qualified to degree level People living in flats Jobseekers allowance claimants Attendance allowance claimants
A3 Coastal retreats: Rural chic	Largely rural areas, low population density or in smaller settlements, with a well qualified population	Travel time to key amenities People qualified to degree level Dwellings with 8 or more rooms Percentage of dwellings in council tax band E to I Jobs growth Self employment	Population density Households with no car or van ID 2010 Crime domain Child and pensioner poverty

Typology category	Overview	Above the coastal average	Below the coastal average
B1 Coastal challenges: Structural shifters	Towns and cities which have lost their primary markets, and are facing the challenge to find new ones. This group includes a range of single industry coastal towns, including seaside resorts, mining areas, industrial heartlands and former agricultural centres	People working in manufacturing jobseekers allowance claimants incapacity benefit claimants disability living allowance claimants All people with a limiting long-term illness aged 0-64	People qualified to degree level Overall employment rate Jobs growth People living in flats
B2 Coastal challenges: New towns and ports	Challenges relating to poor skills and high levels of worklessness, but counterbalanced by relatively strong economy and often located close to areas of economic growth	Jobs growth Child and pensioner poverty Jobseekers allowance claimants Incapacity Benefit claimants	People qualified to degree level
B3 Coastal challenges: Striving communities	High levels of deprivation across all indicators, and a very high proportion of people living in social rented accommodation	Social housing Jobseekers allowance claimants Incapacity benefit claimants Disability living allowance claimants Child and pensioner poverty People providing intensive unpaid care People working in wholesale, retail and motor vehicle repair	People qualified to degree level Overall employment rate Jobs growth

Typology category	Overview	Above the coastal average	Below the coastal average
C1 Cosmopolitan coast: Reinventing resorts	Primarily tourist economies with high levels of deprivation, but diversifying to attract a more highly skilled population	Private rented housing People working in tourism Jobseekers allowance claimants Incapacity benefit claimants People qualified to degree level People moving in and out of the area Full-time students aged 16-74 Seasonal unemployment Household vacancy rate People travelling more than 40 km to work People living in flats ID 2010 Crime domain	People living in houses Owner occupied Overall employment rate Part time employees
C2 Cosmopolitan coast: Coastal professionals	City and market town service centres with highly skilled populations and dynamic economies	People qualified to degree level Full-time students aged 16-74 People who have moved address in the last year People travelling more than 40 km to work Private rented housing ID 2010 Crime domain People living in flats	People of pensionable age Part time employees People living in houses

Typology category	Overview	Above the coastal average	Below the coastal average
D1 Coastal fringe: Prosperous suburbia	Affluent areas predominantly on the edge of towns and in satellite towns around larger coastal cities	People qualified to degree level Overall employment rate Owner-occupied households Pupil attainment: average point score at GCSE Dwelling with 8 rooms or more	Jobseekers allowance claimants (unemployment benefit) People receiving workless benefits due to poor health Child and pensioner poverty Households with no car or van
D2 Coastal fringe: Working hard	Towns characterised by high levels of employment typically in industrial sectors, and a stable population	Overall employment rate People working in manufacturing Owner-occupied households	People qualified to degree level People who have moved address in the last year Jobseekers allowance claimants (unemployment benefit) People receiving workless benefits due to poor health Self-employed people Social rented housing

The distribution of these typologies is presented in Figure 47 and Table 19 below

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Figure 47: Socio-economic coastal typologies

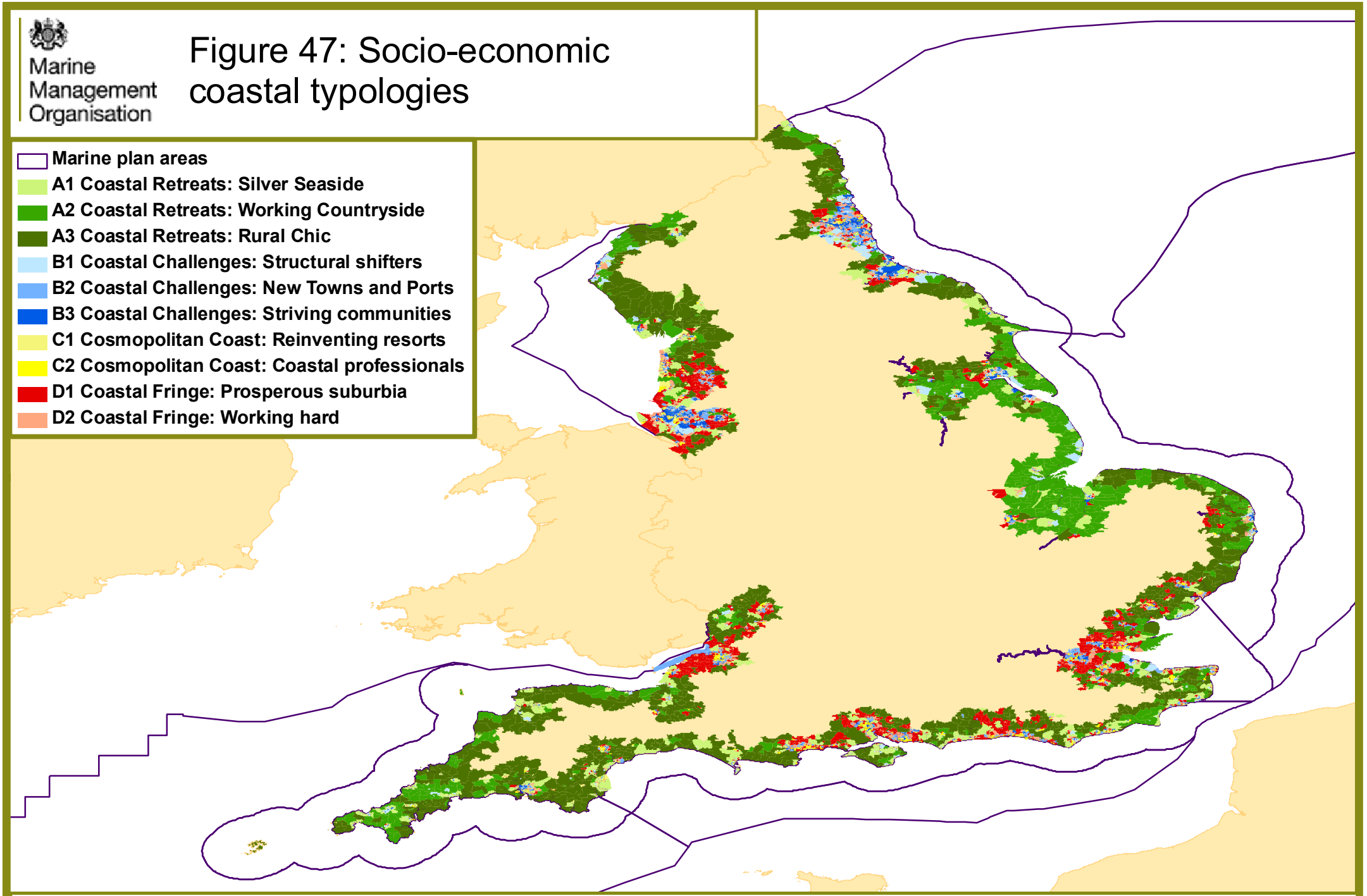


Table 19: Spread of typologies across marine plan areas

Coastal typology	North East	%	East	%	South East	%	South	%	South West	%	North West	%
A1 Coastal Retreats: Silver Seaside	62	4	132	10	98	6	257	11	174	12	82	4
A2 Coastal Retreats: Working Countryside	30	2	223	17	52	3	55	2	110	7	39	2
A3 Coastal Retreats: Rural Chic	35	2	91	7	90	5	175	8	170	11	73	4
B1 Coastal Challenges: Structural shifters	186	12	251	20	82	5	99	4	122	8	231	11
B2 Coastal Challenges: New Towns and Ports	247	16	50	4	276	17	293	13	165	11	198	10
B3 Coastal Challenges: Striving communities	372	25	148	12	85	5	116	5	92	6	440	22
C1 Cosmopolitan Coast: Reinventing resorts	82	5	65	5	84	5	188	8	112	7	132	7
C2 Cosmopolitan Coast: Coastal professionals	85	6	65	5	213	13	420	18	173	12	125	6
D1 Coastal Fringe: Prosperous suburbia	129	9	100	8	368	22	402	17	190	13	307	15
D2 Coastal Fringe: Working hard	275	18	156	12	297	18	327	14	190	13	395	20
Total	**1503**		**1281**		**1645**		**2332**		**1498**		**2022**	

The South marine plan areas' communities have the highest percentage of 'coastal professionals' areas, as well as the second highest levels of 'silver seaside' and the joint-lowest levels of 'working countryside' and 'striving communities', suggesting it has a high level of affluence and lack of deprivation. It also has the highest number of areas with below average levels of people above retirement age and conversely the second highest number of areas with above average levels of people over retirement age.

The North East and North West marine plan areas both have high levels of 'striving communities', suggesting there are particular social and economic challenges for a significant number of coastal communities in these areas. The North East also has relatively high levels of 'structural shifters' and 'new towns and ports', reinforcing this.

The North West has some of the highest numbers of 'prosperous suburbia' and 'working hard' communities indicating a strength in employment in some parts of the marine plan area. This also indicates the diversity between communities within a marine plan area.

The East marine plan areas has the highest number of 'structural shifters' indicating the need for investment, possibly through new technologies, to create jobs in new industries to enable the shift in economic structure indicated by this typology. At the opposite end of the scale, the East also has the highest number of 'working countryside', characterised by rural areas with most people in low-skilled jobs and a below average level of welfare claimants.

Prime examples of the most deprived of the coastal typologies exist in the East, North East, North West and some in the South marine plan areas. The socio-economic study identified that deprived coastal communities were most likely to benefit from marine planning where connections were made with the growth of offshore industries as it could create jobs and prosperity in those areas. The study further identified which types of industry and activity would particularly suit which typologies, as detailed below.

The coastal retreat typologies (A1, A2, A3) are not reliant on employment growth due to the above average levels of employment and skilled people. Therefore marine activities that have little impact on land would be a probable good fit such as marine dredging and disposal because this activity occurs offshore, providing little disruption to these communities. Beach replenishment can be a by-product of this activity which local communities would benefit from. Telecommunications is also a good fit with this type of community for similar reasons mentioned above. Fishing is a good fit because it is perceived as a distinguishable feature which can bring character to an area. Small scale infrastructure would be appropriate, but due to the residential nature of these communities and the high employment rates there maybe some challenges with these activities.

The coastal challenges (B1, B2, B3) typologies are a probable good fit with many marine activities, particularly industry, both well established and emerging. This is because there is a need for employment in these communities for a range of skills. Industrial activities such as ports and shipping, offshore renewable energy and

marine aggregates fit with the geographical character of the area and the potential labour markets are attractive to investors. In turn, the communities will benefit from these activities through jobs and investment and much of the land-based infrastructure may already be in place. These are the only typologies which are a probable good fit with almost all marine activities.

Cosmopolitan coast (C1, C2) is similar to the coastal retreat typologies in that marine dredging and disposal and telecommunications are a probable good fit for these communities, because they have little impact on land. The cosmopolitan coast typologies are characterised by over employment rates, low crime rates and highly qualified people, but there are pockets of deprivation (under reinventing resorts) which would benefit from diversification of activities and thus job opportunities. Tourism and recreation is a probable good fit with these communities, because they have already modernised and rebranded their offer and this is likely to continue. This attracts people to the area and inward investment as it is considered a place where people want to live.

Coastal fringe (D1, D2) is a probable good fit for marine dredging and disposal (other than estuary areas which are locally valued) and telecommunications cabling, because they occur offshore and have little impact on land. Fishing is also a probable good fit, because it maintains the character of an area which can attract people. Furthermore, associated process infrastructure, as long as it is small scale and carefully sited, would also be appropriate because it would provide jobs. Together with B1, B2 and B3, these are the only typologies with a probable good fit for aquaculture due to a positive view of employment opportunities. The extent to which tourism and recreation will be a good fit for these typology areas will depend to a great degree on local conditions. City break markets could contribute to the development of the tourism offer. The jobs brought by almost any tourism development would prove particularly popular in these areas.

The above summary of the marine activities most suited to the different typologies needs to be considered alongside the many other factors that influence where activities occur and is not intended to be used solely for decision making.

Future trends and policy direction

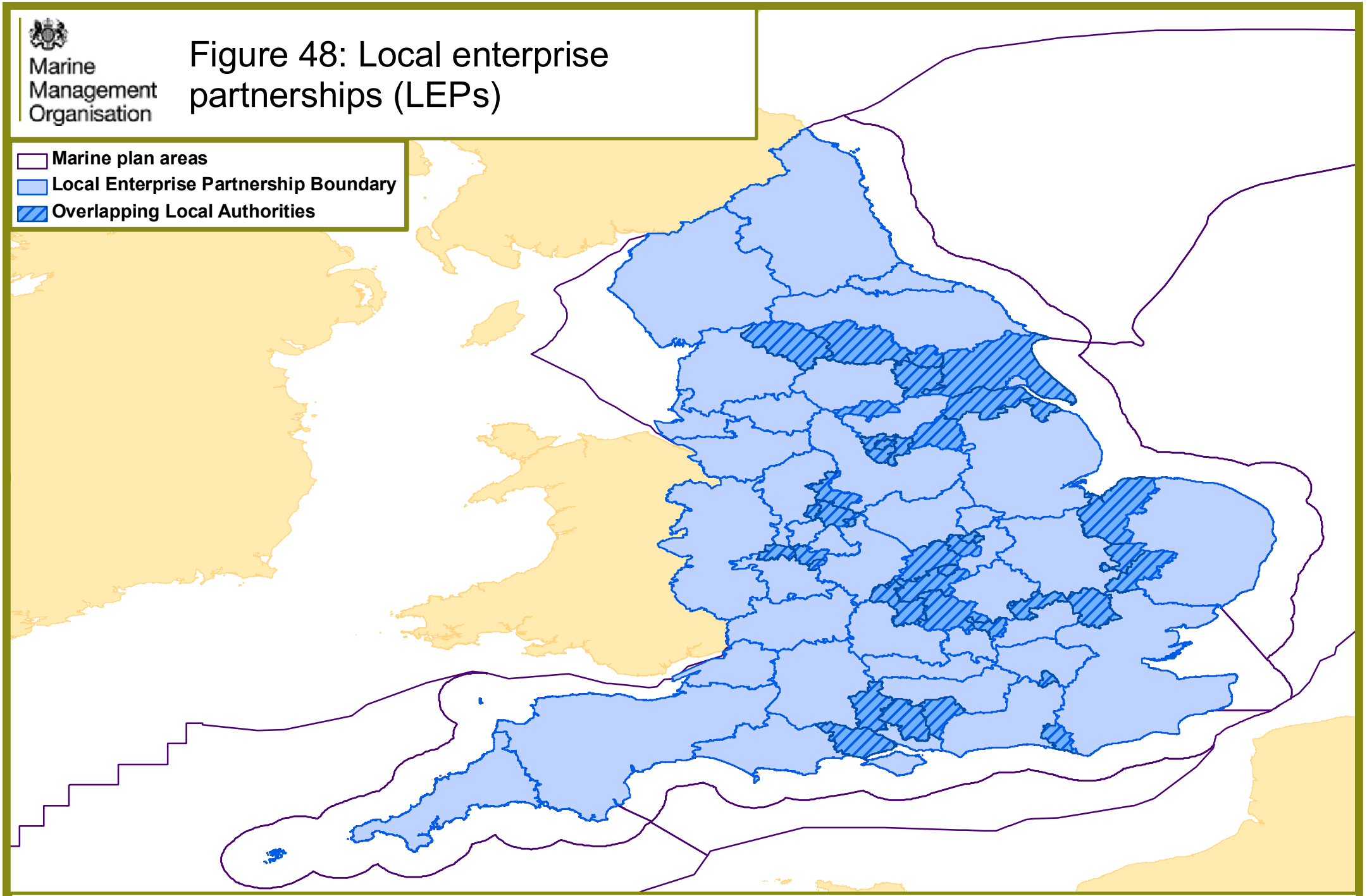
There are a number of policy initiatives which both highlight current economic strengths and are likely to influence the future trends for economic development. These are detailed below together with a discussion on coastal flooding.

Local enterprise oartnerships

Local enterprise partnerships (LEP) were introduced in June 2010 following the local growth white paper, which set out their roles dependent on local priorities. The aim of LEPs is to diversify the range and location of businesses across the country and reduce burden on businesses, by identifying economic priorities and influencing spending in their locality. They were established between local authorities and businesses and there are currently 39 LEPs in England, shown on Figure 48 below. Enterprise zones are areas around the country that support both new and expanding businesses by offering incentives. There are 24 enterprise zones (also shown on Figure 48) which are all awarded to LEPs.

Marine Management Organisation

Figure 48: Local enterprise partnerships (LEPs)



There are ten LEPs based at the coast in England with an additional four slightly inland, on estuaries. The majority of coastal LEPs are adjacent to the North East (2), East (3), South West (2) and North West (2) Inshore marine plan areas. The South and South East have one LEP each. The LEPs are characterised under different sectors and five are focused on marine industries (Great Yarmouth and Lowestoft, Greater Lincolnshire, Humber, North East and the Solent). All but one of those with marine industries as a focus are based in the East and North East marine plan areas with the other situated on the South coast. Nine of the Enterprise Zones have a coastal link (see figure 48).

Many of these marine industries are targeting the emerging industry of offshore renewable energy technology, whether it is for manufacturing, maintenance or to improve skills and knowledge. The majority of marine-focused LEPs are situated in areas where deprivation is an issue (as highlighted through the MMO Socio-economic study). Jobs are required in these areas to reduce unemployment, and diversity of industry to attract new investment and new skills to ensure the labour markets are developing alongside the industries. LEPs aim to 'pave the way' for new investment and industry to address these challenges and drive economic growth. Alongside LEPs, the Government has introduced City Deals, whereby more money and greater power is given to local government (councils) for planning and business issues. Similar to LEPs, this will give more local areas control over the opportunities and challenges they face.

European Fisheries Fund

Around £38 million is available through the European Fisheries Fund (EFF) to help the fishing industry in England to adapt to changing needs. Money is available for fishermen, processing and aquaculture businesses, towards marketing fish products and for projects which will benefit groups of people who work in the fishing industry, such as harbour improvements. The funding pots for Cornwall are ring-fenced as the county has been designated as a relatively weak economy compared with the EU average. The EFF is also available to support the sustainable development of smaller communities in areas where fishing is in decline. It is delivered through local groups who represent the area.

Coastal Communities Fund

The Coastal Communities Fund (CCF), initiated in 2012, aims to encourage the economic development of UK coastal communities by giving them funding to create sustainable economic growth and jobs. In only its second year, it is not possible to know the CCF's outcomes and impacts. The Government has committed £27.8 million to support the CCF in 2013/14 with money generated by The Crown Estate's marine assets (in 2012 the order of size of revenue contribution was aggregates, coastal ports, moorings, jetties, cables and pipelines, renewables and finally aquaculture). The Big Lottery Fund is delivering the CCF on behalf of Government, operating under the name Big Fund. Funding awards of over £50,000 are available for projects lasting up to two years. 26 projects received funding in 2012-13 including:

- over £1.3 million for the development of social enterprise, home industry start-ups and green infrastructure in Torbay

- £2 million to develop Europe's first National Coastal Tourism Academy in Bournemouth
- £600,000 to develop social enterprises in Great Yarmouth
- £1.24 million to develop a restaurant and training centre in Hastings Pier Gateway
- £1.47 million to reinstate the Swanage to Wareham railway.

This fund offers communities the opportunity to shape the future direction of their local area. Having the opportunity to choose how to invest in their community's future will ensure support for the activities and that they address the challenges posed in their community.

Coastal flooding

Coastal flooding is identified as the second highest risk of civil emergency in the UK[323]. With improved flood defences the likelihood of this occurring has reduced. However, as consequence, this has led to significant development of homes, businesses and infrastructure behind the flood defences. Thus, if flood defences are topped or breached, the consequences of coastal flooding are much greater. Sea level rise (and possibly increased storminess), due to climate change, may increase the risk of coastal flooding (see section 2.2.1). Flood and coastal erosion risk management are the principal responsibilities of Defra (acting with Department for Communities and Local Government with regard to planning), Environment Agency, lead local flood authorities and regional flood and coastal committees.

3. Marine plan area summaries

This section takes the information from the previous chapters and summarises some of the key points for each region and the characteristics that distinguish it from others. The summaries are not exhaustive – the aim is to provide the headline information that planners and others need to characterise each marine plan area and to understand its relative contribution to resources and activity. The inshore and offshore marine plan areas have been considered together to minimise duplication.

Activity count maps have been included for each region highlighting the number of sectors present across each marine plan area up to a maximum of 11. These maps were created by dividing the marine plan areas up into a grid of 0.05 decimal degrees and then calculating the number of sectors that use each individual grid cell. For example, a square in a shipping lane with fishing and sailing also occurring in it would count as three sectors. Red areas are those with more activity and green areas less activity. An additional activity count map has been displayed towards the end of this chapter, which also takes into account how activity numbers may change in the future (see Figure 55). This map has been calculated using data from both the current activity and future potential maps found throughout this document.

Activity count maps have been created using the MMO geographic information system (GIS) toolbar which enables easy calculation of the number of sectors in a particular grid cell using a variety of data. A full list of the datasets used in this analysis can be found in Annex 2 along with the methodology used.

[323] National Risk Register of Civil Emergencies (2102), Cabinet Office

3.1 North East – Marine plan areas 1 and 2

Marine plan area characteristics

- There are six special protection areas (SPAs) and seven special areas of conservation (SACs) designated in the North East Inshore area.
- There are three marine conservation zones (MCZs) recommended for designation in 2013.
- Over 70% of the North East Inshore area is transited by over 1,000 ships per year.
- The North East offshore marine plan area has 42% of all cables by length, but only 8% by frequency, meaning there are a small number of long cables.

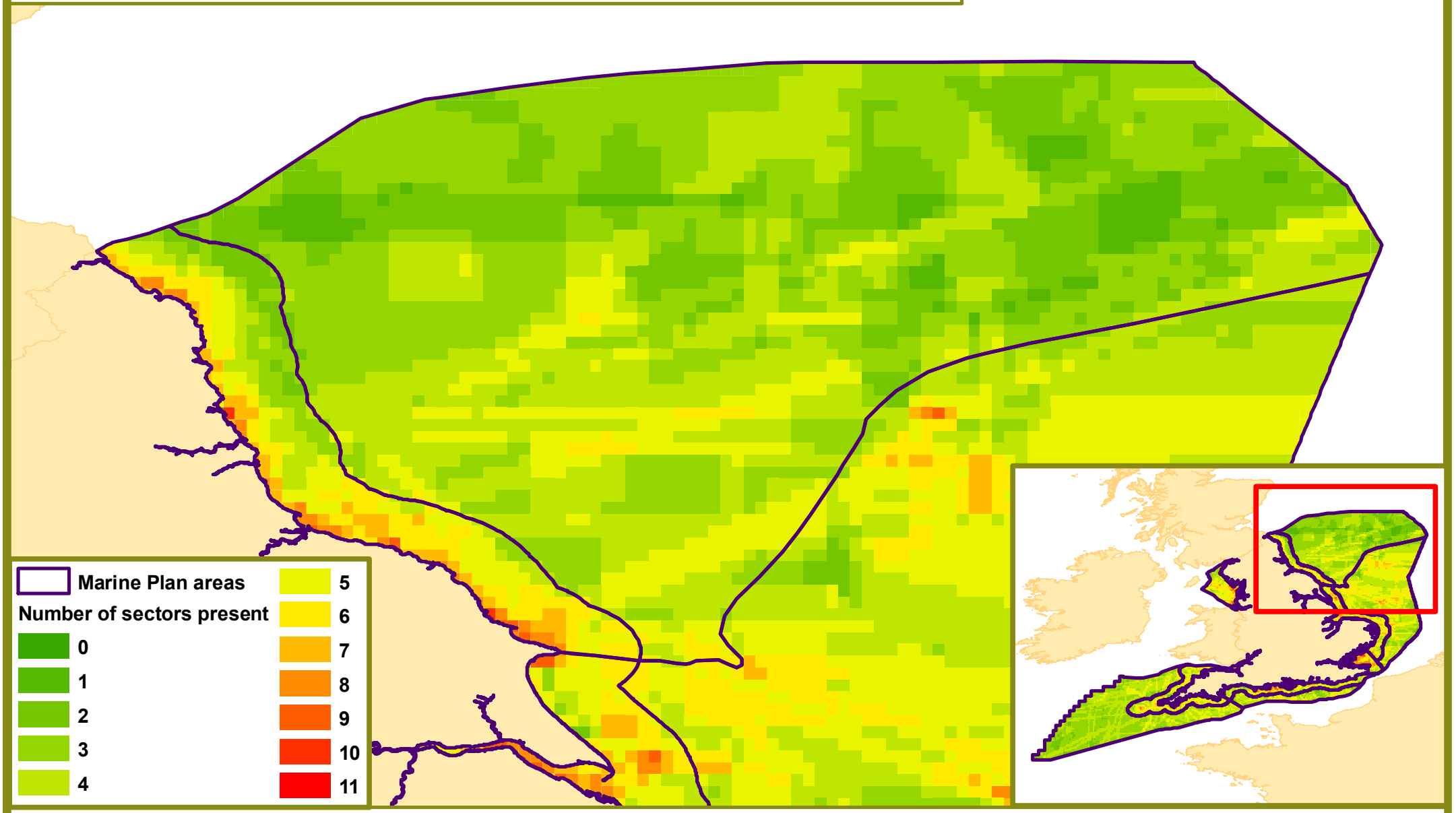
Figure 49 shows the North East marine plan areas to be some of the least busy, particularly in the offshore. However, there are still areas where a high volume of activities are using the same space. North Sea oil reserves mean that oil production is an important activity for the area with product transferred to shore via pipelines, for example to Teeside. Nearly 18% of all of England's oil and gas infrastructure and 19% of licence blocks are located in the North East offshore marine plan area. The area is also home to the only marine potash mine in England, located off the North Yorkshire coast.

The North East is home to a variety of important wildlife including a major grey seal breeding colony at the Farne Islands. The inshore marine plan area also has predominantly good ecological water quality compared with other inshore marine plan areas. There are seven blue flag beaches and three RSPB reserves and the area is popular with surfers, due to the quality and consistency of the waves, though the seasonal mean and extreme wave size is forecast to decrease, due to climate change.

A significant portion of the North East marine plan areas are Ministry of Defence planning and exercise areas (PEXA). 54% of the offshore marine plan area and 39% of the inshore marine plan area. There is a test site for wave and tidal energy in the Inshore area managed by the National Renewable Energy Centre (NAREC) and on the coast at Hartlepool is a nuclear power station, due for decommissioning from 2019. The Inshore area is particularly important for fishing for smaller vessels, working both mobile and static gear. Ports and shipping employment is the lowest of all marine plan areas, though transit levels are high.

Marine Management Organisation

Figure 49: Number of sectors present in North East Inshore and Offshore plan areas



June 2013

3.2 East – Marine plan areas 3 and 4

Summary

- 89% of Round 3 wind farm sites (by area) are in the offshore marine plan area.
- 77% of the total area licensed for aggregate extraction falls in the East Inshore and East Offshore marine plan areas.
- Grimsby and Immingham port complex was the UK's busiest port with the highest percentage of traffic handled in 2011.
- The areas are particularly significant for marine protected areas (MPAs) with 39% of their footprint made up of either existing or proposed SACs or SPAs. 78% of English SACs and 42% of English SPAs are located here.
- Hull and the Humber have the greatest number of fish processing units in England, employing over 3000 people.
- The East Inshore areas has 41% of England's aquaculture production by tonnage.
- Some areas at risk to coastal flooding.

The East Inshore and East Offshore marine plan areas have the largest and most diverse amounts of activity – a factor influencing the decision to produce marine plans in these areas first. Having undertaken significant analysis during plan development in these areas, it has been discovered that this 'busyness' is characteristic of both the present situation and planned future activity. The East offshore marine plan area is home to the vast majority of England's energy production including oil and gas activity, with over 231 installations. Oil and gas products are transferred to shore via pipelines at Teesside, Easington, Theddlethorpe in Lincolnshire and Bacton in East Anglia. The East has 56% of the total oil and gas pipeline coverage.

In addition, the East offshore marine plan area has the greatest potential for renewable energy production due to the availability of wind resource as well as shallow waters that provide optimum conditions for wind energy development. The East marine plan areas hold almost seven times the leased areas of all the other marine plan areas combined. There is also some tidal stream resource in the East Inshore area around the Humber estuary. Currently the East inshore and offshore marine plan areas hold 15% of cables in English waters, by frequency, though this is likely to rise significantly as a result of offshore wind deployment.

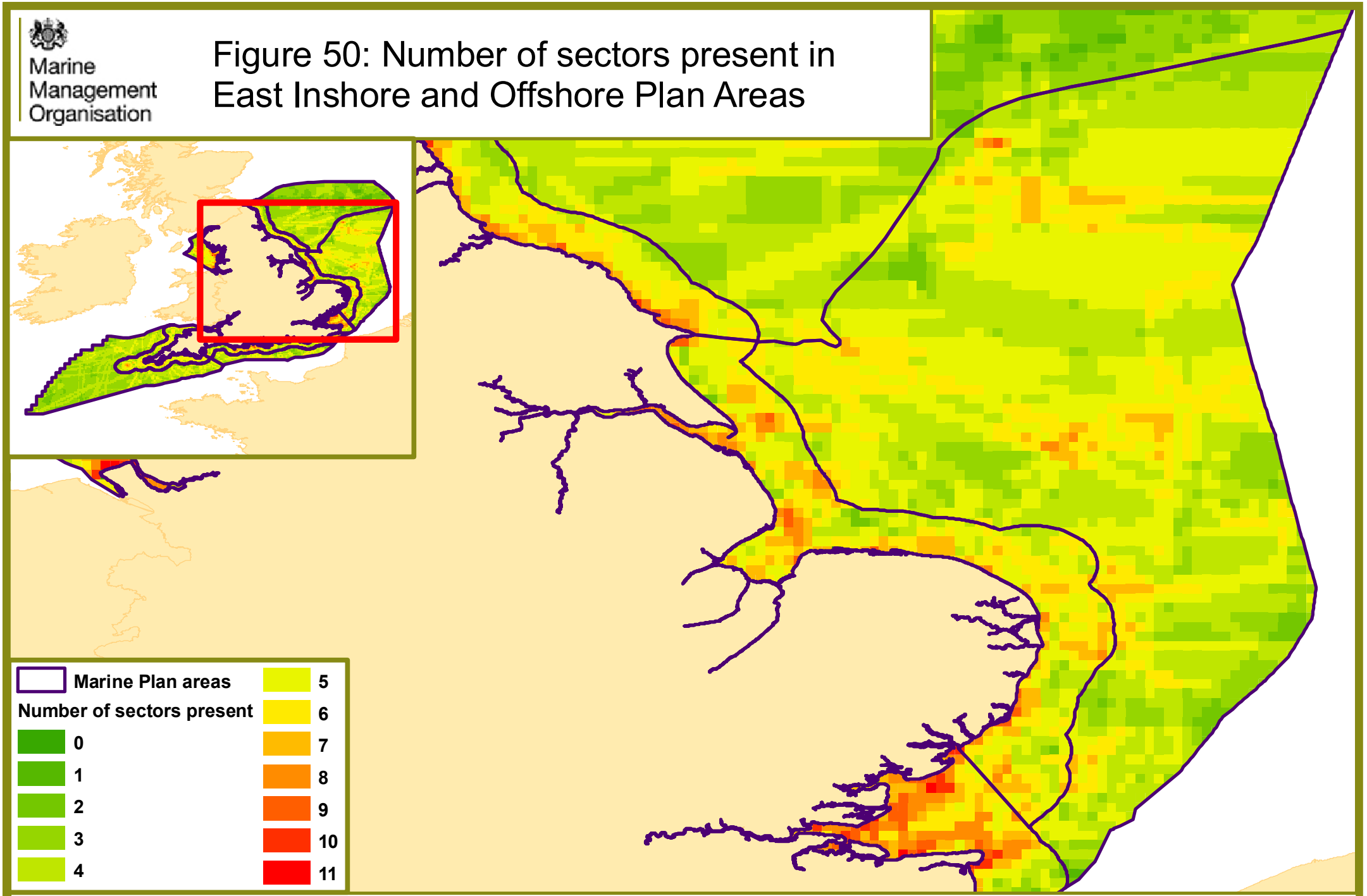
Sizewell B is a functioning nuclear power station in the East inshore marine plan area and is due for decommissioning in 2035. The proposed White Rose CCS demonstration project, where carbon dioxide (CO_2) will be stored under the North Sea, is situated in the East marine plan areas and will involve capturing 90% of the carbon dioxide from a new 426MW coal power station on the Drax site. Grimsby and Immingham remained the UK's leading port complex in 2011, handling 57 million tonnes (Mt) of freight (11% of total UK traffic). However, the East Inshore Marine Plan Area has the lowest number of people employed in the ports and shipping industries of all inshore marine plan areas.

Over half of the extracted marine-won aggregate by weight comes from the East marine plan areas. Aquaculture is also particularly important (primarily mussel farming), with 15 registered shellfish production sites being located in the East inshore area.

The East marine plan areas are particularly significant for MPAs with 39% of their footprint made up of either existing or proposed SACs or SPAs. 78% of English SACs and 42% of English SPAs are located here. Sea surface warming is likely to be more pronounced than further north, with coastal groundwater systems that are vulnerable to sea level rise. This has implications for coastal flooding in the East inshore marine plan area.

Marine Management Organisation

Figure 50: Number of sectors present in East Inshore and Offshore Plan Areas



June 2013

3.3 South East – marine plan area 5

Summary

- 21% of UK oil and gas jobs are located here.
- Six SACs and 14 SPAs are located here, including one of only two entirely marine SPAs, the Outer Thames Estuary SPA.
- The area houses 30% of England's ports including Felixstowe (the busiest container port in 2011) and Dover (with the greatest amount of roll-on, roll-off freight).
- Many submarine cables linking the UK to continental Europe.
- Large concentrations of Pacific and native oyster production sites.

The South East is a densely populated area due largely to its proximity to London, with many important activities competing for a small amount of space as shown in Figure 51. It is an important area for a variety of industries with a number of Round 1 and Round 2 wind farm sites adjacent to important shipping lanes to Europe.

There are 162 ports and harbours in the South East Inshore Marine Plan Area, the highest in England. The South East inshore marine plan area contributes over £2.5 billion to the national economy from ports and shipping, the greatest amount of GVA of all the marine plan areas. Furthermore, this marine plan area has the highest number of people employed through the ports and shipping sector.

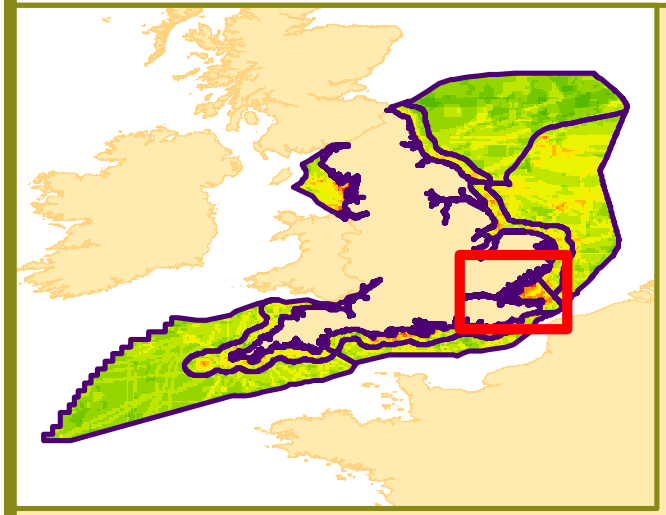
The Port of London handled 48.8 Mt (9%) of total traffic in 2011. Dover, the top UK port for roll-on roll-off (ro-ro) freight, handled two million ro-ro main freight units. Felixstowe was the UK's largest container port handling two million containers. Dover, the UK's busiest ferry port, handled 11.9 million passengers in 2012.

In addition to industry, the area is also important for many leisure activities. 22 blue flag beaches are located here as well as two AONBs and five UNESCO world heritage sites. Boating activity is also prevalent throughout the area, with over 140 recognised recreational Royal Yachting Association (RYA) cruising routes. Fishing is at a lower intensity in this marine plan area compared to others but there are a significant number of vessels operating out of ports such as Ramsgate and West Mersea.

Although the South East is the smallest of all the marine plan areas, it has a comparatively large number of sites designated for environmental protection, with 54% of the area designated as a SPA under the Birds Directive and 25% as a SAC under the Habitats Directive.

Marine Management Organisation

Figure 51: Number of sectors present in South East Inshore plan area



June 2013

3.4 South – marine plan areas 6 and 7

Summary

- There is significant tidal stream resource concentrated in the South Inshore Marine Plan Area around the Isle of Wight and Portland Bill.
- Long border with France and proximity to London.
- A number of Ministry of Defence (MOD) danger and exercise areas used for armed forces training.
- A telecoms project in its early stages proposes to connect the South coast and the Channel Islands.
- 32% of England's aquaculture (by tonnage) is produced in the South Inshore area.

The activity count map in Figure 52 shows that the South marine plan areas are very busy, particularly in the Inshore and around the Isle of Wight.

Tourism and recreation are particularly important in the South marine plan areas, with the inshore having the greatest number of blue flag beaches of all English marine plan areas (22). The South marine plan areas have the highest percentage (16%) of boating activity in England due in part to the high number of Royal Yachting Association (RYA) marinas (67) enabling access to the sport. Dorset was particularly important for tourism in 2012 as it was home to the Olympic sailing competitions in Weymouth – the legacy of this activity continues to attract visitors. There are nine UNESCO world heritage sites in the South marine plan area including the only natural coastal site, the Jurassic Coast in Dorset.

There is significant fishing activity in the South marine plan areas, particularly for over-15 metre vessels. Brixham was the English port with the highest value of landings in 2011, worth £26 million[324] due largely to the greater proportion of demersal and shellfish landed there, which typically sell at higher prices per tonne than pelagic species.

The South marine plan areas have the only cSACs in England and significant numbers of existing designations including 18 SACs and 11 SPAs in the inshore area. The Isle of Wight has almost all of its coastline under designation.

There is high density shipping activity, particularly in the South offshore marine plan area of which 85% is transited by over 1,000 vessels per year. This area is of strategic importance to a number of countries, providing routes through to Europe and beyond. The Port of Southampton handled 38 Mt (7%) of total traffic in 2011.

Two of the three main UK naval bases are in the South Inshore Marine Plan Area and are home to the Royal Navy's surface and submarine fleet of ships. Portsmouth nbase is home to almost two-thirds of the Royal Navy's surface ships, and will be home to two new aircraft carriers, HMS Queen Elizabeth and HMS Prince Of , currently under construction. The base is a major employer with about 16,000 people working at peak times. The largest naval base in Western Europe, Devonport has been supporting the Royal Navy since 1691. The site covers more than 650 acres

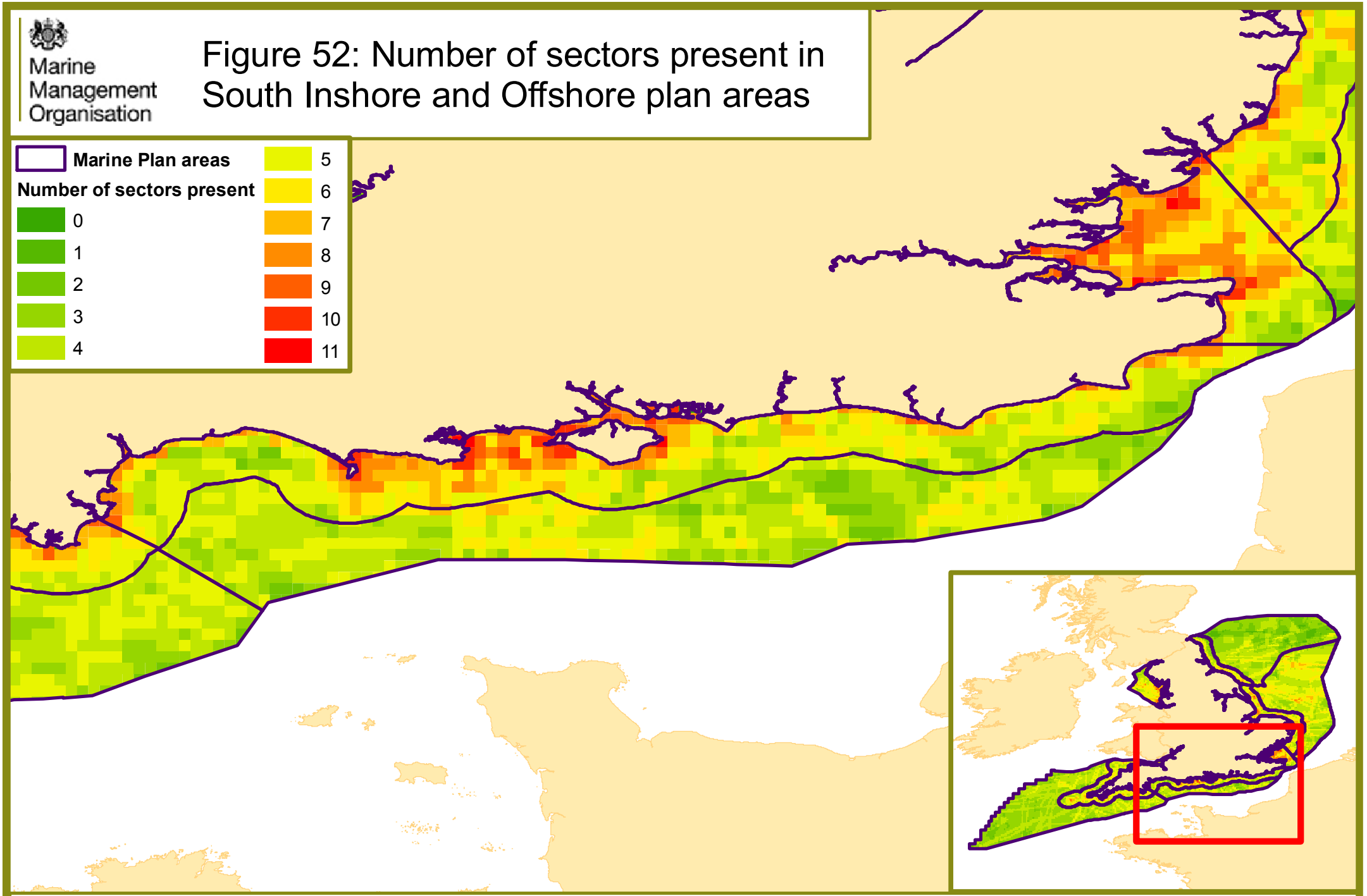
[324] MMO UK Sea Fisheries Statistics 2011

and has 15 dry docks, four miles of waterfront, 25 tidal berths and five basins. It is home to Britain's amphibious ships and half her frigates, plus the training hub of the front-line Fleet, FOST. The base employs 2,500 Service personnel and civilians, supports around 400 local firms and generates around 10% of Plymouth's income.

The South marine plan areas have sites that are important for aggregate extraction. The areas contain 31% of all the cables in English waters (but only 9% of cables by length as there are many short cables). Two Round 3 offshore wind zones exist in the South marine plan areas (Navitus Bay and Rampion) with a combined leased capacity of up to 1,865MW. The Solent Ocean Energy Centre on the Isle of Wight is currently going through an application phase and could provide offshore testing facilities for tidal stream devices. The tidal stream is very powerful around the Isle of Wight due to the interference of diurnal and semi diurnal tides, combined with local relief natural features. Dungeness B is the only nuclear power station located in the South marine plan areas. Currently the site has a capacity to generate 1,110MW, with decommissioning due to take place in 2018.

Marine Management Organisation

Figure 52: Number of sectors present in South Inshore and Offshore plan areas



June 2013

3.5 South West – marine plan areas 8 and 9

Summary

- The offshore marine plan area is the largest marine plan area at over 65,000 square km.
- Significant cabling activity including large international fibre optic telecom cables crossing the North Atlantic.
- The inshore plan area has four SPA sites, 23 SAC sites, and the only designated MCZ surrounding Lundy Island.
- Over 50% of England's heritage coast borders the South West Inshore area.
- Significant MOD danger and exercise areas.
- Hinkley Point B nuclear power plant is located here. Hinckley Point C is under development.

While the activity count map in Figure 53 suggests that the South West marine plan areas are less busy than some of the other areas, they are still home to a significant number of activities, particularly in the inshore.

Fishing is an important activity in the South West Inshore area, which is home to the greatest number of vessels in England (with Newlyn home to 203 vessels in 2011). In 2011, Plymouth was the English port landing the largest quantity of fish (14,000 tonnes) and over the last three to four years, The Crown Estate has granted leases for three shellfish long-line developments in Cornwall as well as an aquaculture lease for a farm in North Devon.

The South West has significant potential for wave energy production, with Wave Hub in the north west of Cornwall and FabTest in Falmouth Bay already set up as test sites. An important area of tidal stream resource is also located in the Bristol Channel. The areas also house a Round 3 wind energy zone – the Atlantic Array.

The South West is a popular area for recreational activity, particularly surfing due to the high quality and consistency of waves. Surfing contributes significantly to the local economy with many surfing related business located in Cornwall. There are also eight world heritage sites in the South West, important for attracting visitors to the area and 10 blue flag beaches, as well as 140 Royal Yachting Association (RYA) cruising routes. Half of all Heritage Coasts designated in England are in the South West marine plan area.

Deep sea habitats are only found in the South West Offshore marine plan area. These are presently in a good condition but do experience impacts from abrasion and litter. The Western English Channel is also important for basking sharks. There are a significant number of areas of outstanding natural beauty (AONBs), inshore SACs and sites of special scientific interest (SSSIs), with several offshore MCZs recommended for designation in 2013 (the first tranche). The South West marine plan areas have the most SSSIs of all marine plan areas, though they cover a relatively small area.

These marine plan areas have 29% of the total installed cables by frequency, with the Inshore having 13% of cables by length. This includes a significant number of economically important connections across the Atlantic to North America. The South

West inshore marine plan area is home to the Hinckley Point B nuclear power station, which produces 1,220MW of energy through two AGR generators. In 2023 plans for decommissioning will begin. Hinckley Point C is under development, with a proposed generating capacity of 3,200MW.

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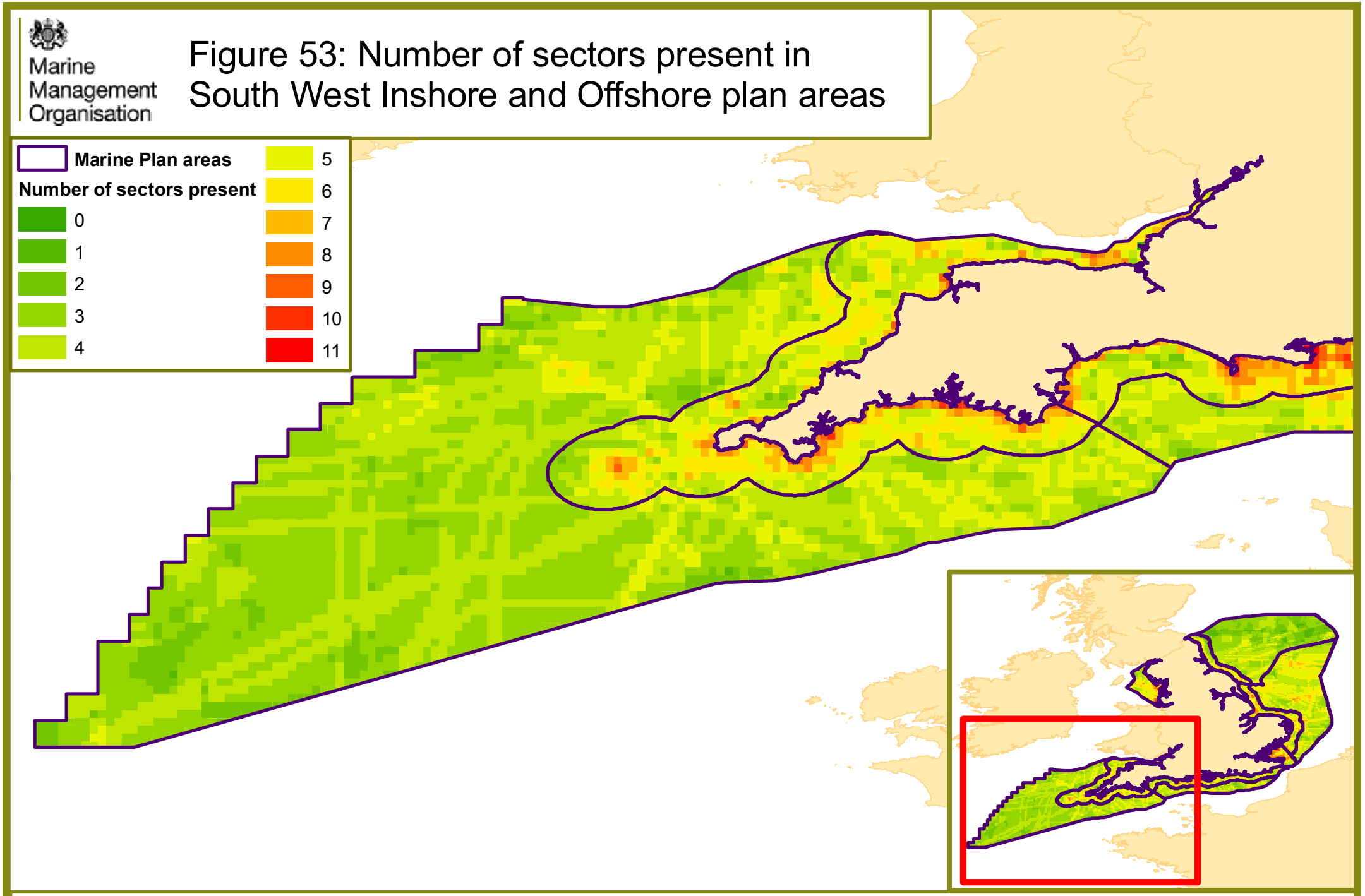
Figure 53: Number of sectors present in South West Inshore and Offshore plan areas



June 2013

3.6 North West – marine plan areas 10 and 11

Summary

- Seven SPAs and seven SACs including one of the only two entirely marine SPAs, Liverpool Bay.
- Nine UNESCO world heritage sites.
- The North West has the highest proportion of inshore waters categorised as poor ecological water quality and no blue flag beaches.
- Extensive MMO weapons testing sites.

Figure 54 highlights the busyness of the North West marine plan areas compared with many of the others, particularly in the inshore. The variety of activities present here and the administrative complexity of being surrounded by six different governments has meant that the area has been used for several marine planning pilot studies in the past[325].

The area is important for energy production, both through discrete gas reserves, but more recently through renewable energy production. The Irish Sea Round 3 wind farm zone is located here as well as a significant number of Round 1 and Round 2 projects. Six % of all UK oil and gas production jobs are located here.

Fishing is also an important activity here with a larger proportion of over-15 metre vessel activity than the other marine plan areas. There are also several cables crossing the Irish Sea linking England with Ireland, Northern Ireland and a power interconnector to the Isle of Man.

The North West Inshore area contains extensive danger areas used for weapon test and evaluation activities. There are also a large number of coastal sites with associated danger and exercise areas used for firing ranges and ordnance disposal.

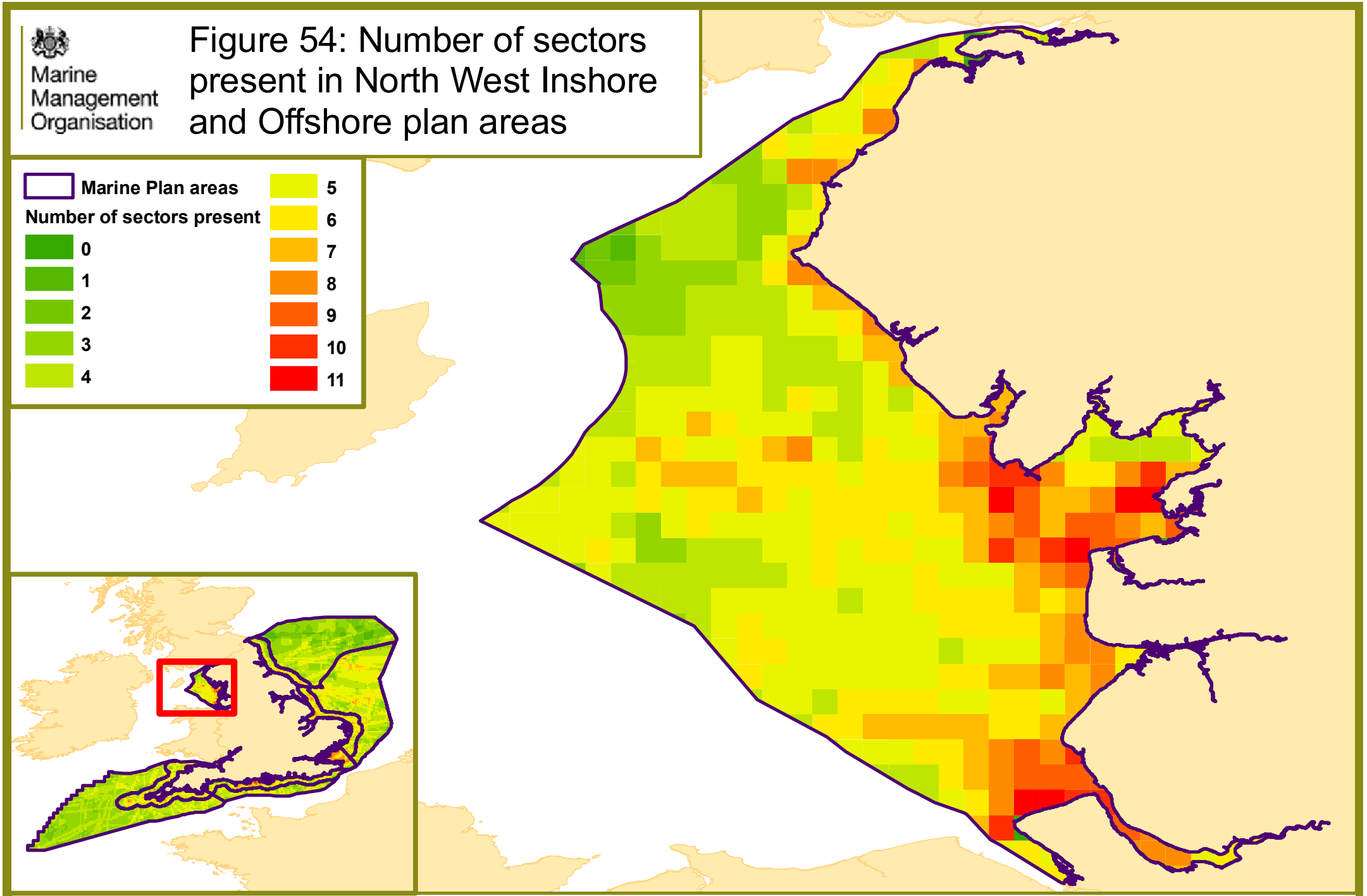
The North West marine plan areas have two active nuclear sites. Heysham 1 generates 1,160MW of energy from two AGR reactors and is due to be decommissioned in 2019. Heysham 2 also has two AGR reactors with a capacity to produce 1,250MW, and will commence decommissioning in 2023.

Sea surface warming is more pronounced here than in other marine plan areas. Any sea level rise will affect intertidal habitats which balance delicately on the basis of tidal inundation. This is noticeable already in the North West Inshore Marine Plan Area.

[325] Including the Irish Sea Marine Planning Pilot http://jncc.defra.gov.uk/page-2767

Marine Management Organisation

Figure 54: Number of sectors present in North West Inshore and Offshore plan areas



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3.7 Forward look

The marine area is becoming increasing busy and is therefore subject to an increasing number of pressures from users. It is the role of marine planning to anticipate future change and balance the varying needs of a variety of sectors. Factors such as the growth in marine energy and the increasing number of environmental designations must be considered in marine planning, alongside existing users of the marine area such as fishing or recreational users.

Figure 55 shows a comparison between the number of sectors currently taking place, and potential future change. It highlights potential increases in the majority of the inshore marine plan areas but also in the East, South and North West offshore marine plan areas. Please see Annex 2 for a list of the datasets used to develop this map.

While maps such as this are a useful tool in helping us to anticipate future change, it is important to note that the datasets used to create Figure 55 merely show potential based largely on technical opportunity to undertake a particular activity. For this reason they are only to be considered indicative of where activities 'could' increase in number based on optimal area (whereas in reality, many of the areas highlighted as optimal for a particular activity will not see an increase in development). It is also important to note that rather than increasing, activity numbers could actually reduce in particular areas as a result of future management measures. This fact has not been taken into account when calculating Figure 55.

Figure 55 also highlights just how busy England's marine area could potentially become and how difficult it will be to realise the aspirations of every sector. This potential busyness further demonstrates the increasing need for planning in the marine area.

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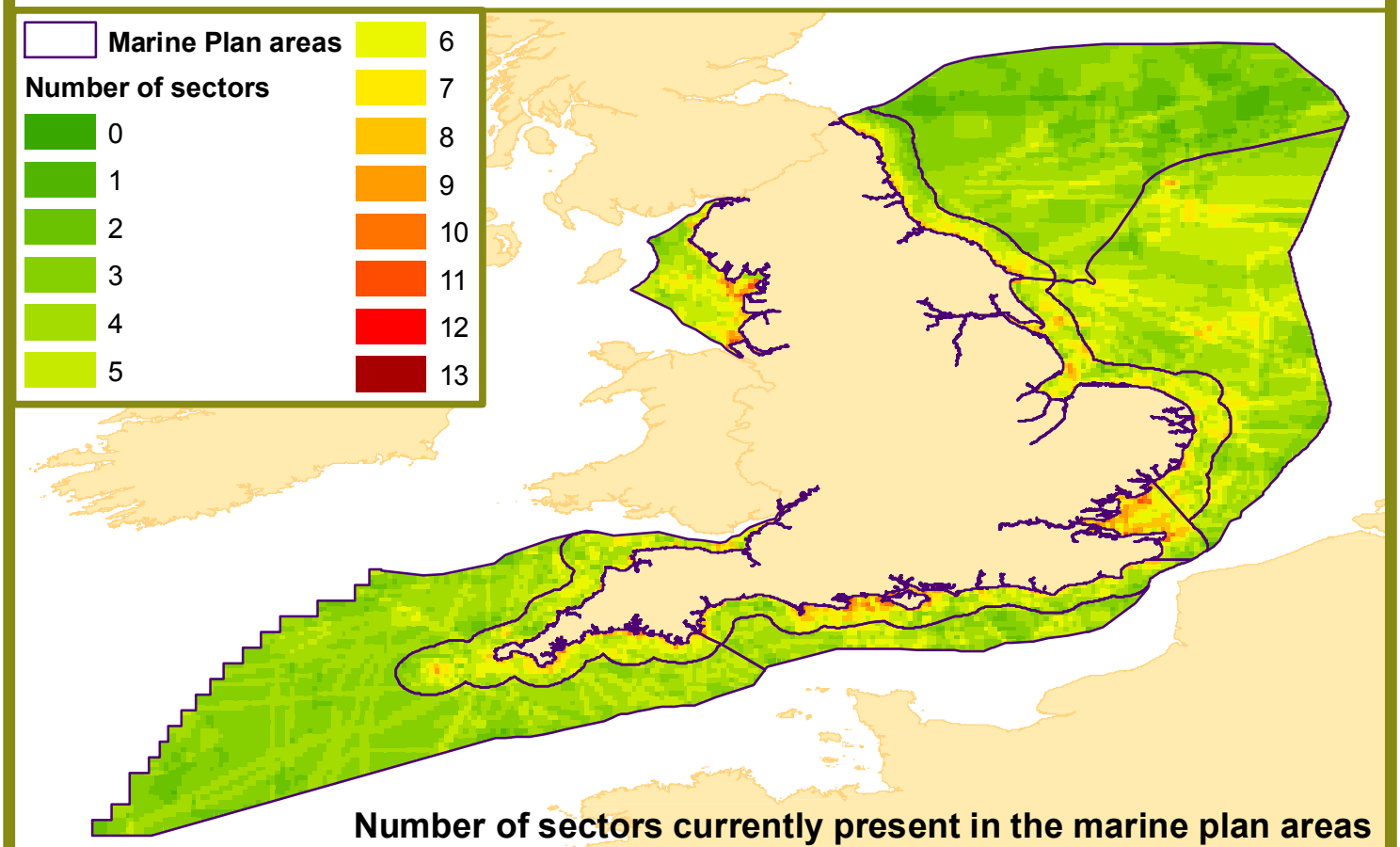
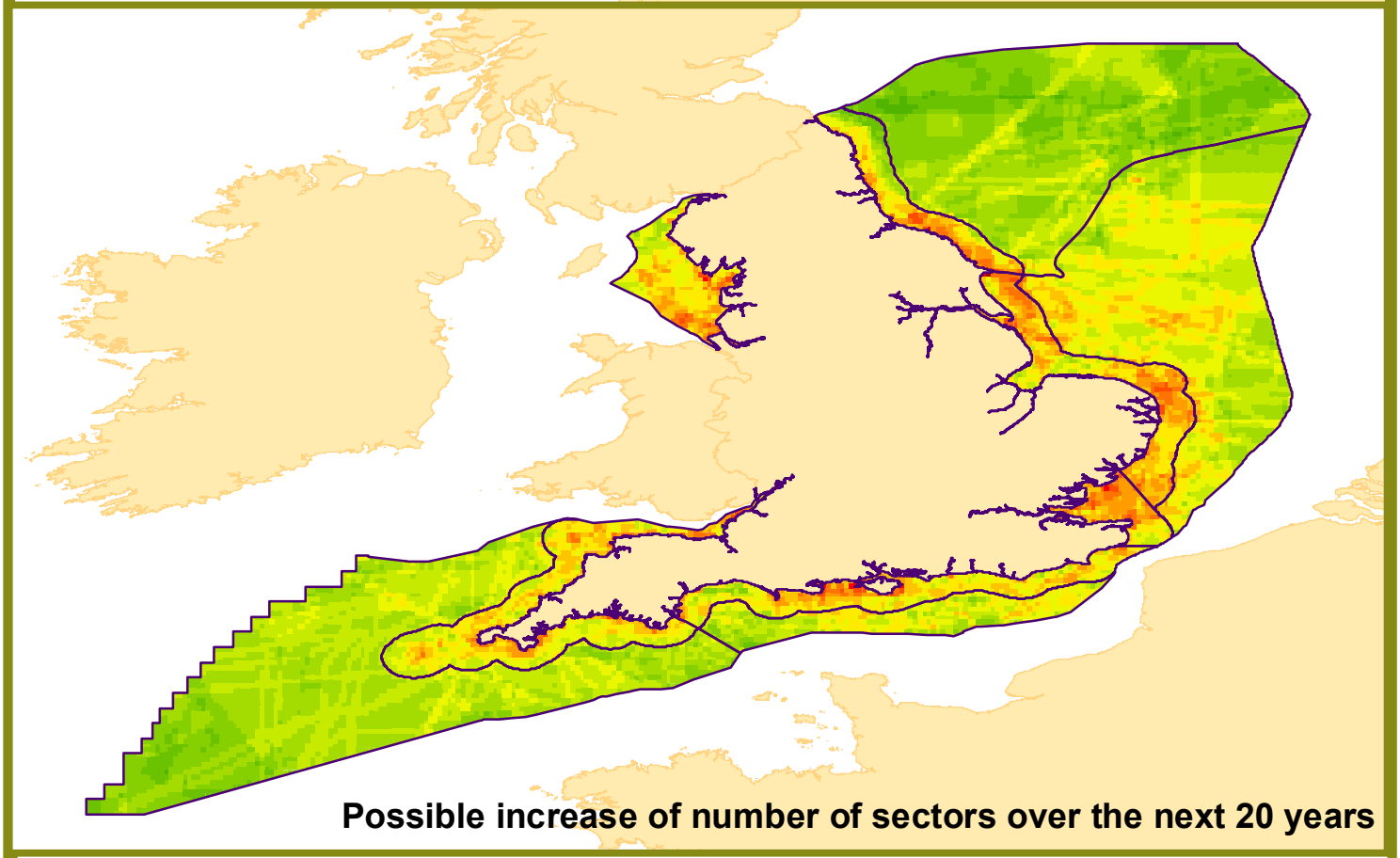
Figure 55: Comparison between actual number of sectors using the plan areas now and potential number of future sectors

June 2013





Annex 1: Methodology used by The Crown Estate to determine resource areas and areas of technical opportunity

Resource areas identify an area of the marine space which contains natural resources including energy, land and storage resources including cables, pipelines and carbon dioxide (CO_2) storage and transportation. Future technical opportunity has been identified in locations where a particular resource is extractable given assumptions about available technology to 2030. It is important to note that these areas of future opportunity look at technical feasibility only and do not consider locations which are unsuitable due to the presence of hard constraints posed by existing uses of the marine area, or by other factors including natural and cultural resources, marine users, economics and market appetite and policy drivers required for the opportunity to be supported.

Areas of future technical opportunity have been presented homogenously – that is the assumption could be made that there is no difference in opportunity within the areas). However, it is important to note that in reality there are varying degrees of technical suitability within them due to natural variation of optimal resource and/or depth conditions across and within the areas themselves.

The methodology used to determine future technical opportunity varies depending on the availability of relevant datasets, industry knowledge, technology maturity and government policy. Despite this variability, care has been taken to ensure that there is sufficient consistency to allow for relevant comparisons to be made between areas of future technical opportunity from different sectors.

The Crown Estate's Marine Resource System (MaRS) has been used as the primary tool to model future technical opportunity. However, for some sectors, data limitations or gaps in knowledge mean that it is not possible to 'model' opportunity using MaRS tools. In these cases, expert knowledge or existing plans and proposals have been used to formulate an understanding of future technical opportunity. The approach to the identification of future technical opportunity for each sector and the main sources of data and knowledge, along with any criteria used are summarised below.

Table 20: Areas of future technical opportunity identified and the criteria used

Sector	Key resource area identified	Critieria used
Cables	Key landing zones (or future technical opportunity) have been established by identifying important sections of territorial waters driven by the location of existing offshore generation assets, onshore infrastructure, and the presence of existing telecommunication cable infrastructure.	No specific criteria used.
CO2 transportation and storage	Future technical opportunity was established by combining known CO_2 storage interests and associated infrastructure (where infrastructure are not specifically identified as a known interest, existing pipelines intersecting storage site interests have been included), the Captain Sandstone geological formation, the Hewett field including infrastructure that intersect these areas, and major existing and planned CO_2 emitters as identified by the CO_2 storage team.	No specific criteria used.
Marine minerals	Future technical opportunity has been derived from the BGS Resource Assessment Study, a project commissioned by The Crown Estate that produces a classification of the aggregate available on the seabed of the UK continental shelf.	No specific criteria used.
Offshore wind fixed foundation	MaRS modelling has been used to identify future technical opportunity. A minimum wind resource threshold of 8 metres a second was applied and areas less than 60 metres in water depth were considered appropriate for fixed foundation turbines and areas over 40 metres in water depth were considered suitable for floating wind technology. A minimum depth threshold of 5 metres was used and no maximum depth threshold was applied.	Wind speed: 8 to 15 metres a second Water depth: 5 to 60 metres
Offshore wind floating technology		Wind speed: 8 to 15 metres a second Water depth: greater than 40 metres

Sector	Key resource area identified	Critieria used
Pipelines	Key landing zones (or future technical opportunity) have been established by identifying notable sections of territorial waters driven by the location of existing offshore oil and gas production assets, potential future fields, CO_2 storage opportunities and the presence of existing pipeline infrastructure.	No specific criteria used.
Tidal stream	MaRS modelling has been used to identify future technical opportunity. A minimum tidal resource threshold of 1.5 metres a second mean spring peak current was applied and areas over 5 metres in water depth were considered appropriate for tidal stream technology development out to 2030. No maximum depth threshold was applied as all locations of good tidal resource are located in relatively shallow waters.	Tidal resource: greater than 1.5 metres a second (mean spring peak current) Water depth: greater than 5 metres
Wave	MaRS modelling has been used to identify future technical opportunity. A minimum wave mean power density threshold of 20kW a metre was applied and areas between 10 and 200 metres in water depth were considered appropriate for wave energy technology development out to 2030.	Wave resource: greater than 20kW a metre Water depth: 10 to 200 metres
Emerging sectors		
Marine biomass	MaRS modelling has been used to identify future technical opportunity. A minimum and maximum tidal resource threshold of 0.5 and 2 metres a second mean spring peak current were applied and areas between 25 and 50 metres in water depth were considered appropriate for marine biomass projects.	Tidal resource: 0.5 to 2 metres a second (mean spring peak current) Water depth: 25 to 50 metres

Annex 2: Activity count map methodology

Both the current and potential future activity count maps were made using the 'activity count tool' in the MMO geographic information system (GIS) toolbar. The tool works alongside ArcGIS, allowing easy calculation of multiple standard queries. A number of data layers showing the location of current activities were entered into the tool and cut to the extent of the marine plan areas. A 0.05 decimal degree grid was then overlaid over these cut datasets and the number that fell within each individual grid cell was calculated.

In order to ensure that each activity was only counted once, activities that required more than one dataset to represent them were combined and merged into one. For example, marine protected areas (MPAs) were represented by data showing a number of different designations – such as special protection areas, special areas of conservation or sites of special scientific interest. These individual layers were merged together to create one MPA layer. This ensured that areas that were subject to more than one environmental designation were treated as one MPA for the sake of the analysis. An arbitrary buffer of 1 km was applied to point and line data to ensure they had a consistent spatial footprint.

The output layer showed the spatial distribution of busyness ranging from 0 activities occurring (coloured green) to 11 activities in the busiest areas which were coloured red. This method was then repeated using the same data layers but with the addition of nine extra data layers showing future potential. This secondary output shows potential future busyness when compared with the first output showing current busyness.

Limitations

Spatial variability has not been assessed within continuous datasets. For example, data showing shipping density has only been assessed for presence or absence of shipping rather than volume of traffic.

The second output showing potential future change has been limited by the data available. There are a number of sectors for which information on future potential is not available.

Table 21: Data used for activity count maps

Data used for activity count maps		
Group	**Title**	**Owner**
Marine protected areas	Special protection areas	Joint Nature Conservation Committee (JNCC)
Marine protected areas	Special areas of conservation	JNCC
Marine protected areas	Ramsar Sites	JNCC
Marine protected areas	Marine conservation zones (MCZs) recommended for designation in 2013 (and Lundy MCZ)	Natural England
Marine protected areas	National nature reserves	Natural England
Marine protected areas	Areas of outstanding natural beauty	Natural England
Marine protected areas	Sites of special scientific interest	Natural England
Defence	Military practice areas	Ministry of Defence (MOD)
Defence	Munitions dumping grounds	MOD
Oil and gas	Current hydrocarbon licence blocks	UKDeal
Oil and gas	Pipelines	UKDeal

Data used for activity count maps		
Group	**Title**	**Owner**
Oil and gas	Surface infrastructure	UKDeal
Oil and gas	Subsurface infrastructure	UKDeal
Renewables	Round 1, 2 and 3 areas	The Crown Estate
Renewables	Tidal lease area	The Crown Estate
Renewables	Wave lease areas	The Crown Estate
Renewables	Wind farm cables	The Crown Estate
Ports and shipping	Shipping activity (areas over 1 ship per year)	Anatec
Ports and shipping	UK ports	Department for Transport
Aggregates	Aggregate application areas	The Crown Estate
Aggregates	Aggregate production licences	The Crown Estate
Aggregates	Aggregate prospecting or options areas	The Crown Estate
Dredging	Areas licensed for dredging activity	Marine Management Organisation (MMO)
Cables	Submarine cables	Kisca and Seazone

Data used for activity count maps		
Group	**Title**	**Owner**
Fishing	VMS fishing activity for over-15 metre vessels (areas fished by over 1 vessel a year)	MMO
Fishing	MCZ Fishermap (areas fished by over 1 vessel a year)	Natural England
Aquaculture	EC shellfish waters	Centre for Environment, Fisheres and Aquaculture Science (Cefas)
Aquaculture	Shellfish production	Cefas
Waste water	Consented discharges	Environment Agency
Tourism and recreation	Blue flag beaches and marinas	
Tourism and recreation	Royal Yachting Association (RYA) cruising routes	RYA
Tourism and recreation	RYA racing areas	RYA
Tourism and recreation	RYA sailing areas	RYA
Tourism and recreation	Marinas	RYA
Tourism and recreation	Diving hotspots	Wanna dive
Tourism and recreation	Surf sites	Wanna surf

Data used for activity count maps		
Group	**Title**	**Owner**
Historic environment	Heritage coast	English Heritage
Historic environment	Historic shipwrecks	English Heritage
Additional data used to map future potential		
Future opportunity	Technical opportunity for pipelines	The Crown Estate
Future opportunity	Technical opportunity for wave	The Crown Estate
Future opportunity	Technical opportunity for tidal	The Crown Estate
Future opportunity	Technical opportunity for fixed wind	The Crown Estate
Future opportunity	Technical opportunity for carbon capture and storage	The Crown Estate
Future opportunity	Technical opportunity for minerals	The Crown Estate
Future opportunity	Technical opportunity for cables	The Crown Estate
Future opportunity	Technical opportunity for biomass	The Crown Estate
Future opportunity	Offered licence blocks for oil and gas (rounds 25,26 and 27)	Department of Energy and Climate Change