Chapter 6: Social, economic and environmental issues

Contents

Introduction

URS Scott Wilson and ABPMer, and Hyder and Hartley Anderson have been commissioned by the Marine Management Organisation (MMO) to undertake **sustainability appraisal (SA)** of the East Marine Plan. SA is a mechanism for considering the impacts of a draft plan and reasonable alternatives in terms of sustainability issues, with a view to "preventing, reducing or offsetting"[1] adverse impacts and maximising the positives (see Chapter 3 for more background). It is a legal requirement that SA is undertaken in-line with the procedures prescribed by the EU Strategic Environmental Assessment (SEA) Directive[2].

A key requirement of the SEA Directive is that:

> "Where an assessment is required by this Directive, [a]… report should be prepared… identifying, describing and evaluating the likely significant environmental effects of implementing the plan or programme, and reasonable alternatives."

Annex 1 of the directive prescribes the information that must be contained within the SA Report. Providing this information involves answering a series of **12 appraisal questions** (see Table 3.1 in Chapter 3).

The approach taken to reporting as part of this SA has involved answering each question for eight sustainability topics. Each topic essentially represents a broad sustainability receptor – that is an element of the baseline that has the potential to be significantly impacted as a result of the plan.

The **eight sustainability topics** used as the basis of this appraisal are as follows:

- Air and climate
- Communities and health (including equality issues)
- Coastal process (such as geomorphology)
- Cultural heritage
- Ecology
- Economy
- Landscape and seascape
- Water (water quality and freshwater resources)

This chapter does not seek to answer all appraisal questions. Rather, it is an interim report that focuses on answering the first six questions only (with indication of focus in the text that follows). These form the basis around which the content of each topic is structured

- What is the plan seeking to achieve? (focussed on the likely links between the plan and the topic)

---

[1] SEA Directive Annex 1(g)
[2] Directive 2001/42/EC

- What is the sustainability context? (focussed on policy context and implications for sustainability appraisal and marine planning)
- What is the situation now? (baseline data)
- What would the situation be without the plan? (projection of baseline)
- What are the key issues including any sustainability problems?
- Where are the data gaps?

These questions relate to setting the **scope** of the appraisal. Once the scope of the appraisal has been established, then it becomes possible to answer the remaining appraisal questions.

This report presents a scope, with the aim of stimulating stakeholders to come forward with further information.

6.1 Air and climate

What is the link between the plan and this topic?

Given the likely strategic nature of the plan, it is important to state upfront that the way in which the plan impacts on climate change (that is, influences emissions or opportunities for reducing emissions) and air quality will be largely indirect. For example, the plan may have a bearing on the level of shipping activity, a consequence of which in turn may have a bearing on emissions (of greenhouse gasses and air pollutants). The more indirect a cause and effect relationship, then the more difficult it becomes to identify effects on the baseline with any degree of accuracy. Where this difficulty can be expected, then there is little point in seeking to generate a detailed understanding of the baseline. Rather there is a need to focus on understanding the broader issues, in terms of which the plan will have an effect. In particular, there will be a need to understand trends in terms of those activities that can lead to air pollution and greenhouse gas emissions, so that the effect of the plan in terms of those activities/issues can be effectively assessed.

This SA considers air and climate as a single topic because many of the activities that can and will be influenced by the plan are likely to result in impacts to both simultaneously. The appropriateness of considering air quality and climate change impacts simultaneously is reflected in the fact that UK government is increasingly seeking to develop air quality and climate change policy in parallel. Optimisation of climate change policy to take into consideration of air pollution issues is predicted to yield economic benefits of around £24 billion by 2050. This is largely as a result of improving health as well as reduced carbon dioxide ($CO_{2)}$ emissions as part of the transition to low carbon transport and energy generation[3].

Having said this, there are some issues that relate either specifically to air quality or to climate change. For example, there will be a need to consider the effects of the plan in terms of the roll-out of marine renewables. This is an issue that is central to climate change mitigation, but has little bearing in terms of air quality.

---

[3] Department of Energy and Climate Change (DECC) UK Offshore Energy Strategic Environmental Assessment, OESEA2 Appendix 3 Environmental baseline

Please note that this chapter focuses solely on how the plan could potentially **mitigate** impacts on climate change. Aspects relating to climate change **adaptation** are dealt with, as appropriate, within the separate topic chapters.

What is the policy context?

Air quality

Table 6.1 summarises the key elements of the air quality context, from which it becomes possible to gain a better understanding air quality issues. Following the table is a short discussion that seeks to highlight some of the most pertinent messages.

Table 6.1: Air quality context[4]

International
2008 amendment of the International Convention for the Prevention of Pollution from Ships (MARPOL) on a revised Annex VI dealing with the reduction in the emission of sulphur from shipping, enacted in 2010
Stockholm Convention on Persistent Organic Pollutants (2001)
The Convention for the Protection of the Marine Environment of the North East Atlantic (OSPAR) 1998
Montreal Protocol on substances that deplete the ozone layer (1987) and subsequent updates and adjustments
Geneva Convention on Long Range Transboundary Air Pollution (1979)
Marine Pollution Convention, MARPOL 73/78 (the International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978)
UNEP Global Mercury Partnership and Proposed Treaty
Europe
EU Sixth Environmental Action Plan (2002-2012)
Directive 2008/50/EC on Ambient Air Quality and Cleaner Air for Europe
Directive 2005/33/EC of the European Parliament and of the Council of 6 July 2005 amending Directive 1999/32/EC as regards the sulphur content of marine fuels
Directive 2005/33/EC of the European Parliament and of the Council of 6 July 2005 amending Directive 1999/32/EC as regards the sulphur content of marine fuels
EU Thematic Strategy on Air Quality (2005)
Air Quality Framework Directives (96/62/EC) and Daughter Directives (1999/30/EC), (2000/69/EC), (2002/3/EC), (2004/107/EC)
The Proposal for a Directive of the European Parliament and of the Council on industrial emissions (integrated pollution prevention and control) (Recast)
National Emissions Ceiling Directive (2001/81/EC)
Directive 2001/80/EC of the European Parliament and of the Council on the limitation of emissions of certain pollutants into the air from large combustion plants
Clean Air for Europe Programme: Towards a Thematic Strategy for Air Quality (2001)
Ozone Depleting Substances Regulation 2037/2000/EC
Directive on Integrated Pollution Prevention and Control (96/61/EC)

[4] Adapted from the DECC Offshore SEA – February 2011

National
National Policy Statement for Ports (2011)
Defra Air Quality Plans for the achievement of EU air quality limit values for nitrogen dioxide (NO_2) in the UK, Draft List of UK and National Measures (June 2011)
UK Marine Policy Statement (2011)
National Policy Statement for Energy Infrastructure EN-1 to EN-6 (2011)
Air Pollution: Action in a Changing Climate (Defra 2010)
Air Quality Standards Regulations 2007
The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (Defra 2007)
Consultations on the European Commission's proposed Directive on Industrial Emissions (Integrated Pollution Prevention and Control) (Recast)
Local
Air Quality Standards Regulations 2010
Planning Policy Statement 1 Delivering Sustainable Development (England) (2005)
Planning Policy Statement 23: Planning and Pollution Control (England) (2004)

MARPOL (Marine Pollution Convention, 1973 / 1978) is the main international convention governing the prevention of pollution of the marine environment from ships and in part oil rigs and production platforms. It covers pollution by chemicals, oil, harmful substances in packaged form, rubbish, sewage and air pollution. It was amended in 2008 to further reduce harmful emissions from ships of sulphur oxides (SOx) and nitrogen oxides (NOx).

The **Geneva Convention on Long Range Transboundary Air Pollution** (1979) addresses pollutants including heavy metals, sulphur, persistent organic pollutants, volatile organic compounds (VOCs) and nitrogen oxides. Although of limited reference to marine activities, per say, this convention is applicable to potential related land based activities supporting marine operations.

The **UK Air Quality Strategy** is clear that the significant impacts of air pollution relate primarily to health effects on people. It is estimated that the health impact of man-made particulate air pollution cost between £8.6 billion and £18.6 billion a year[5]. However, legislation and policy measures introduced over the last 30 years have successfully minimised the worst health effects of air pollutants. Declining rates of respiratory diseases and improved life chances are testimony to these policy interventions, although there is still the opportunity for continued gains, the British Lung Foundation[6] sets national air quality standards with the objectives to protect human health, vegetation and ecosystems.

The Air Quality Strategy sets standards, which are derived predominantly from EU obligations to reduce or ensure non-exceedance of certain pollutants and presents policy measures that could help to achieve these. As an addendum to the Air Quality Strategy the Department for Environment, Food and Rural Affairs (Defra) published Air Pollution: Action in a Changing Climate which focuses on how to health benefits

[5] Defra (2010) Valuing the Overall Impacts of Air Pollution
[6] British Lung Foundation, www.lunguk.org/media-and-campaigning/media-centre/lung-stats-and-facts/factsaboutrespiratorydisease, Accessed June 2011

can be best achieved through closer integration of air quality and climate change policies. The EU Air Quality Framework Directive (1996/62/EC) and daughter directives are transposed into UK law by the Air Quality Standards Regulations 2007.

The **Ambient Air Quality Directive** (2008/50/EC) sets legally binding limits for concentrations in outdoor air of major air pollutants that impact public health such as particulate matter (PM_{10} and $PM_{2.5}$) and nitrogen dioxide (NO_2) The 2008 directive replaced nearly all the previous EU air quality legislation and was made law in England through the Air Quality Standards Regulations 2010.

Directive 2004/35/EC establishes a framework for **environmental liability** based on the polluter pays principle with regard to prevention and remedying of environmental damage and imminent threat of damage resulting from occupational activities. The Directive applies to a number of activities which may cause damage by "airborne elements as far as they cause damage to water, land or protected species or natural habitats".[7]

Climate change

Climate change is recognised as one of the greatest challenges facing humanity; and, as such, must be a major focus of this SA. Increases in temperature and changes to seasonal rainfall averages will result in a range of direct effects (such as in terms of human health). However, there is also a need to consider wide ranging indirect and secondary effects – for example the effect of increased air temperature and sea temperature and knock-on effects from this – see Figure 6.1.

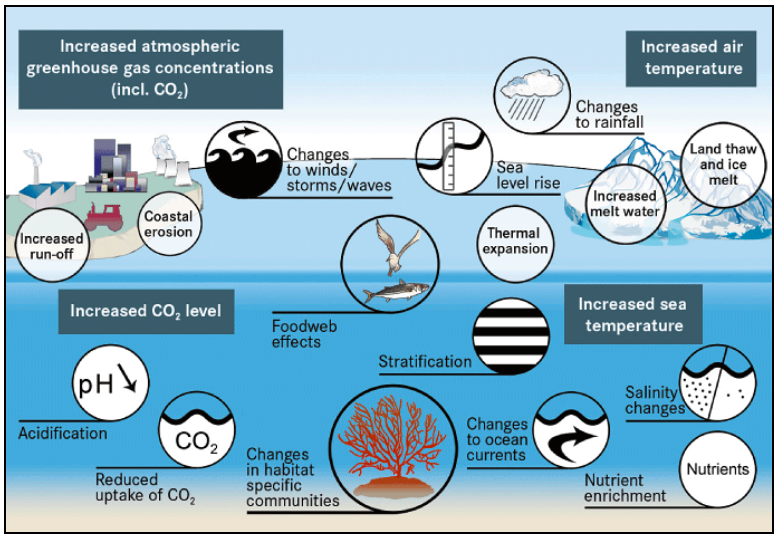


Figure 6.1: Impacts from climate change and ocean acidification[8]

[7] Directive 2004/35/CE of the European Parliament and of the Council on environmental liability with regard to the prevention and remedying of environmental damage http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2004:143:0056:0075:EN:PDF, Accessed June 2011

[8] Source: Ospar Commission, Quality Status Report 2010 http://qsr2010.ospar.org/en/ch03.html

Issues that must be the focus of the SA come under two broad categories. Firstly, there is a need to consider polluting activities that may be managed through or otherwise influenced by the plan. Secondly, there is a need to consider activities within the scope of the plan that can lead to emissions reductions including the generation of energy from renewable sources.

The urgency of climate change is further clarified by a review of the policy context (see Table 6.2) which also begins to explore our understanding of the potential solutions to climate change.

Table 6.1: Climate change context[9]

International
The Copenhagen Accord (2009)
Intergovernmental Panel on Climate Change Fifth Assessment Report (AR5) (2008)
Kyoto Protocol to the UN Framework Convention on Climate Change (1997)
The United Nations Framework Convention on Climate Change (1994)
Europe
EU Sixth Environmental Action Plan (2002-2012)
EU Renewable Energy Directive/Fuel Quality Directive (2009)
Directive 2009/28/EC on the promotion of the use of energy from renewable sources
Communication - 20 20 by 2020 - Europe's climate change opportunity (2008)
EU Green Paper 'adaptation to climate change in Europe – options for EU action' (2007)
European Climate Change Programme II (2005)
EU Emission Trading Scheme (linked to Directive 2003/87/EC)
Directive 2003/87/EC on establishing a scheme for greenhouse gas emission allowance trading within the Community
National
UK Marine Policy Statement (2011)
National Policy Statement for Ports (2011)
National Policy Framework for Energy Infrastructure EN-1 to EN-5 (2011)
Electricity Market Reform (EMR) White Paper (2011)
The Energy Act 2010
Committee on Climate Change: Building a Low-Carbon Economy - the UK's contribution to tackling climate change (2008), Meeting carbon budgets - ensuring a low-carbon recovery (2010)
The Energy Act (2008) and the current Energy Bill (2009-10)
The Climate Change Act 2008 (2020 Target, Credit Limit and Definitions) Order 2009
UK Low Carbon Transition Plan – National Strategy for Climate Change and Energy (2009)
Framework for the Development of Clean Coal (FDCC) (2009)
UK Climate Impacts Programme (UKCIP) update 2009 (UKCP09)
The Road to Copenhagen: The UK Government's Case for an Ambitious Agreement on Climate Change (2009)
Health Effects of Climate Change in the UK 2008 – An update of the Department of Health Report 2001/2002

[9] Taken from the DECC Offshore SEA – February 2011

UK Climate Change Act (2008)
Energy White Paper: Meeting the Energy Challenge (2007)
Sustainable Development Strategy (2006)
Stern Review of the Economics of Climate Change (2006)
Climate Change – The UK Programme 2006: Tomorrow's Climate Today's Challenge
Local
Adapting to Climate Change in England (2008)
Planning and Climate Change: Supplement to Planning Policy Statement 1 (England) (2007)
Planning Policy Statement 1 Delivering Sustainable Development (England) (2005)

The **UN Climate Conference at Copenhagen** in December 2009 brought together leaders from 186 countries. It recognised the scientific view that the increase in global temperature should be held below 2.0 degrees Celsius and that deep cuts in global emissions are required.

The **UK Climate Change Act 2008** commits the government to reduce greenhouse gas emissions by 34 per cent in 2020 and at least 80 per cent by 2050. The act also commits the government to prepare a carbon budget every five years in order to set a clear trajectory to the 2020 and 2050 targets and provide a credible long-term policy framework to ensure this transition is achieved. The act established the Committee on Climate Change to advise on setting and meeting carbon budgets and on preparing for the impacts of climate change. The most recent carbon budget covering the period 2023 to 2027 makes the recommendation that greenhouse gas emissions are cut by 60 per cent on 1990 levels by 2030, and recommends that international aviation and shipping are also included in the carbon budget.

The government's **UK Low Carbon Transition Plan** (2009) sets out the UK's first ever comprehensive low carbon transition plan to 2020. It details how targets for UK greenhouse gas reductions from the first three carbon budgets will be achieved. Around half the emissions reductions are expected to come from the power and heavy industry sectors with more modest contributions (about one third in total) being made by transport, homes and communities.

The **Energy Act 2010** implements some of the measures in the UK Low Carbon Transition Plan. It introduced mandatory social price support to tackle fuel poverty and several measures to ensure fairness of energy markets.

The **Electricity Market Reform (EMR) White Paper** (2011) identifies a number of key measures to attract investment and create a secure mix of electricity sources including gas, new nuclear, renewables and carbon capture and storage (CCS). The introduction of new long-term contracts to provide stable financial incentives to invest in all forms of low-carbon electricity generation and an emissions performance standard to reinforce the requirement than no new coal-fired power stations are built without CCS capacity.

The UK has a legally binding target to produce 15 per cent of its energy needs from renewable sources by 2020, required under the Renewable Energy Directive (2009).

The UK's **Renewable Energy Strategy** (2009) (published alongside the UK Low Carbon Transition Plan) outlines a number of scenarios to achieve this goal.

Planning and Climate Change – Supplement to PPS1 sets out requirements for climate change measures in regional and local planning. At the regional scale, there is a requirement to consider how the spatial strategies will support any regional targets on climate change developed through the region's economic strategy and sustainable development framework. The PPS makes clear that any references to spatial strategies also apply to successor documents.

Implications for sustainability appraisal and marine plans

The marine plan will be used by the MMO when considering the potential impacts of development applications, many of which will require to be assessed with regards to their impact on air and climate. It will be important in the drafting of the marine plan to account for the degree of air and climate change impacts and benefits that certain developments may represent; and how these could vary with different aspects of the plan proposals. Given the future trajectory for certain industries including renewable energy there is significant potential to contribute to climate change mitigation targets, for example.

What's the baseline situation?

Air quality

The greater North Sea is one of the world's busiest maritime areas with high shipping densities particularly in inshore waters (see Figure 6.2). Shipping activity, namely around the Humber Estuary, the Wash and Felixstowe contribute to detectable levels of emissions of PM_{10}, NO_x carbon monoxide (CO), SO_2 in the marine area. In some places, levels of SO_2 and NO_x are relatively higher in the marine area than in adjacent onshore areas[10]. Importantly, from 1 July 2010, ships operating in the North Sea must use fuel not exceeding 1 per cent sulphur. This limit will be reduced to 0.1 per cent in 2015 in response, primarily, to the International Maritime Organization's ambitions to reduce airborne emissions from shipping.

In terms of shipping, it is notable that:

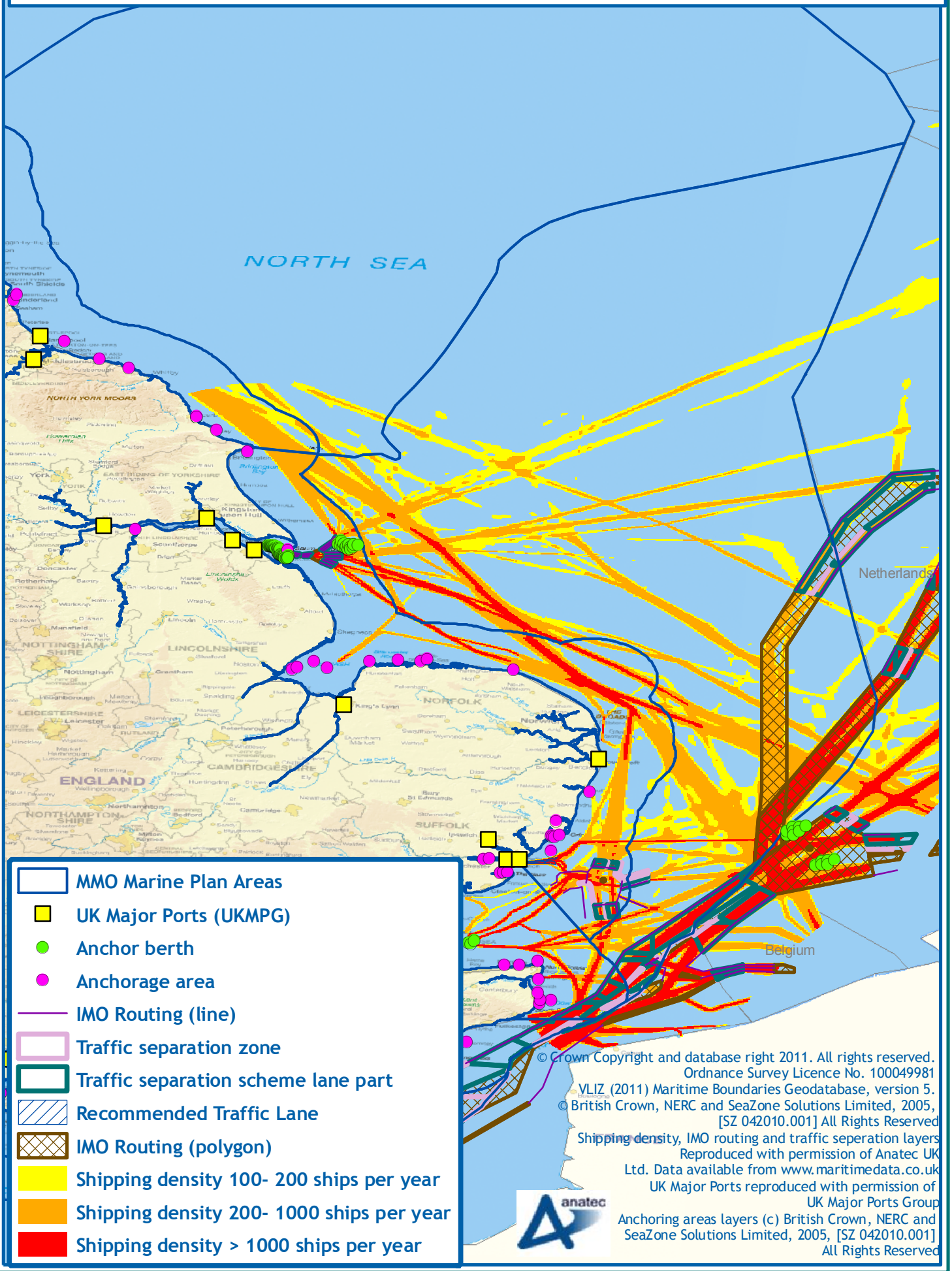
- Grimsby and Immingham was the UK's busiest port in 2009;
- ship traffic in the southern area of the East Offshore plan area has increased over the last 20 years
- domestic fishing is mostly concentrated in inshore plan area
- fishing in the plan area is undertaken by both English vessels and vessels (flag vessels) from other member states operating under UK quotas.

[10] UK Offshore Energy Strategic Environmental Assessment, OESEA2 Appendix 3 Environmental baseline (DECC 2011)

Figure 6.2: Ports and shipping

November 2011
This map has been produced using the ETRS89 Coordinate Reference System

marine management organisation



There is currently a paucity of data from which to generate a strategic understanding of where particular air quality sensitivities exist. Air quality is not routinely monitored at offshore sites; however it is monitored by coastal local authorities. In some coastal local authorities air quality management areas (AQMAs) have been established to manage exceedences of EU limits[11]. AQMAs are in place at 16 locations within local authority areas adjacent to the east inshore plan area and relate to exceedences of PM_{10} and NO_2[12]. It has not been established to what extent AQMAs – where they exist – are contributed to as a result of marine or marine related activities[13].

The most highly populated and industrial areas adjacent to the East Inshore plan area are within the main port towns and cities on the coast. These include Kingston-upon-Hull, Grimsby and Immingham, Lowestoft and Felixstowe. Elsewhere much of the remaining coastline adjacent to the inshore plan area is characterised by rural settlements and low population densities. Further afield, the North Sea is surrounded by highly industrialised and heavily populated areas and has two of the world's largest ports on its coast (Rotterdam and Hamburg). Near to the East Inshore plan area, the Felixstowe port extension is around two-thirds of the way to completion and when completed will secure Felixstowe's position as a major European port. Further afield there is significant proposed development in the Thames Gateway.

Key areas of sensitivity with regard to air quality include those ports where air quality problems have already arisen as a result of shipping traffic and associated activity. Furthermore, it will be important to consider that air quality problems can arise some distance from the source of pollution.

There may be the need to consider less obvious air quality problems. If it can be identified that there is the potential for the plan to have an effect. In addition to air quality problems that arise in one area because of pollution in another, it is important to consider that, for some pollutants, all emissions to atmosphere (regardless of where they occur) are problematic, in a similar fashion to the way in which all emissions of greenhouse gas emissions are problematic. This is particularly the case for those emissions that result in the formation of acid rain.

The main pollutants of concern to human health include nitrogen oxides, volatile organic compounds, and particulate matter PM_{10} and $PM_{2.5}$. These pollutants, largely arise as a result of the combustion of transport fuels, but can also arise from fossil fuel power generation and domestic and industrial sources.[14]

---

[11] The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (Defra 2007) www.official-documents.gov.uk/document/cm71/7169/7169_i.pdf

[12] AQMAs are in place in Kingston Upon Hull (City Centre), North Lincolnshire (Scunthorpe and Low Santon), North East Lincolnshire (Immingham and Grimsby), Boston (Boston and Bargate Bridge), King's Lynn and West Norfolk (Railway Road and Gaywood Clock), Fenland (Wisbech (x3) and Whittlesey), Broadland (Upper Hellesdon) and Suffolk Coastal (Woodbridge and Dooley Inn), http://aqma.defra.gov.uk/list.php

[13] Draft UK Marine Policy Statement: The Appraisal of Sustainability report. http://archive.defra.gov.uk/corporate/consult/marine-policy/100721-marine-policy-appraisal-of-sustainabilty.pdf

[14] Parliamentary Office of Science and Technology postnote, Air Quality in the UK, November 2002, Number 188

In addition to shipping, other major activities in the east inshore and offshore plan areas include the exploitation of oil and gas reserves, the extraction of sand and gravel, and fishing. Offshore oil and gas installations are a source of emissions, particularly in terms of sulphur dioxide (SO_2) and NO_x. NO_x from offshore installations has remained relatively stable since 1999, but emissions of SO_2 have reduced significantly, as have emissions of methane (CH_4) and non-methane volatile organic compounds[15]. Shipping activities associated with oil and gas exploration and production dominate fixed installation related emissions.

The East Inshore and East Offshore areas a significant number of elements of oil and gas infrastructure which over the next 20 years will need decommissioning resulting in a new industry in itself and associated emissions.[16]

Climate change

On average the oceans remove approximately 25 per cent of atmospheric emissions from human activities; however there is evidence that in some areas in the north-east Atlantic the efficiency of CO_2 uptake is decreasing. It is notable that some areas of sea absorb more CO_2 than others[17].

Up to 39 per cent of the atmospheric carbon captured by living organisms is taken up at sea, captured by the ocean's vegetated habitats including salt marshes, seagrass and seaweed. Although these habitats only cover a very small proportion of the sea bed they perform an important role in mitigating climate change.[18]

Some additional key figures and issues that emphasise the relationship between the marine environment and climate change are included below:

- Air and sea temperatures have risen over the North East Atlantic over the last 25 years with the largest increases of both sea surface and marine air temperature of all UK waters.
- Sea surface temperature has risen approximately 0.7 degrees Celsius per decade and air temperature approximately 0.6 degree Celsius per decade in the period 1984 to 2008[19] [20].
- The UK Climate Projections[21] suggest that the following can be expected for the East plan areas by the 2050s (central estimate under medium emissions scenario):

---

[15] OSPAR Commission Quality Status Report 2010, http://qsr2010.ospar.org/en/ch03_01.html, Accessed June 2011
[16] Strategic scoping report for marine planning in England, Marine Management Organisation (June 2011)
[17] Hardman-Mountford, N., Litt, E., Mangi, S., Dye, S., Schuster, U., Bakker, D., Watson, A.. (2009) Ocean uptake of carbon dioxide (CO2), MCCIP Briefing Notes, 9pp. www.mccip.org.uk
[18] UNEP, FAO, IC/UNESCO (2009) Blue Carbon, The Role of Health Oceans in Binding Carbon, A Rapid Response Assessment
[19] Marine Climate Change Impacts Partnership, Marine Climate Change Impacts, Annual Report Card 2010-2011
[20] Marine Climate Change Impacts Partnership, Regional Snapshot of Marine Climate Change Impacts, www.mccip.org.uk/annual-report-card/2010-2011/regional-snapshots.aspx, Accessed June 2011
[21] Defra (2009) http://ukclimateprojections.defra.gov.uk/, Accessed June 2011

    - annual mean temperature increases by 2.2 degree Celsius
    - annual mean precipitation increases by 1 per cent
- Sea level around the UK has risen at a mean rate of around 1.8 mm per year since 1955 with this increasing to 3 mm per year from 1992.
- Increasing amount of CO_2 in the atmosphere is acidifying the oceans. Approximately 40 per cent of the CO_2 released into the atmosphere since the industrial revolution – as a result of human activity – has been absorbed by the oceans[22].
- If current trends in CO_2 emissions continue it is projected that by 2050 CO_2 concentrations will be double pre-industrial levels and oceans will become more acidic than they have been for tens of millions of years[23].

In relation to climate change, there is a need to give particular consideration to the current rate of rollout for offshore wind turbines, marine renewables, and CCS technology, as this is something that may be influenced by the plan, and which should be a focus of the SA. The UK is the only country in the world to commit to long-term legally binding greenhouse gas emission targets – at least 80 per cent by 2050 with an interim target of 34 per cent by 2020. It is legally committed to produce 15 per cent of its energy from renewable sources by 2020 and prepared its Low Carbon Transition Plan and Renewable Energy Strategy (2009) which set out how it will achieve this.

Wind energy is the cheapest and fastest growing renewable energy technology[24]. The East Inshore and East Offshore plan areas account for 23 per cent of existing wind farms, 71 per cent of planned Round 2 sites, 47 per cent of Round 1 and 2 extensions and 88 per cent of Round 3 search areas (by area)[25] (see Figure 6.3 and Figure 6.4).

The proposed capacity of the Round 3 sites is 32 gigawatts (GW) with the potential to supply over 25 per cent of the UK's net electricity demand[26]. Total offshore installed capacity is projected to be around 18 GW by 2020[27]. Current offshore installed capacity is around 4 GW[28][29].

Wave and tidal technologies are emerging industries with some demonstrator sites operational but no sites are located in the East plan areas.

CCS has the potential to contribute significantly to climate change mitigation. However, the first CCS demonstration project in the UK is yet to be completed.

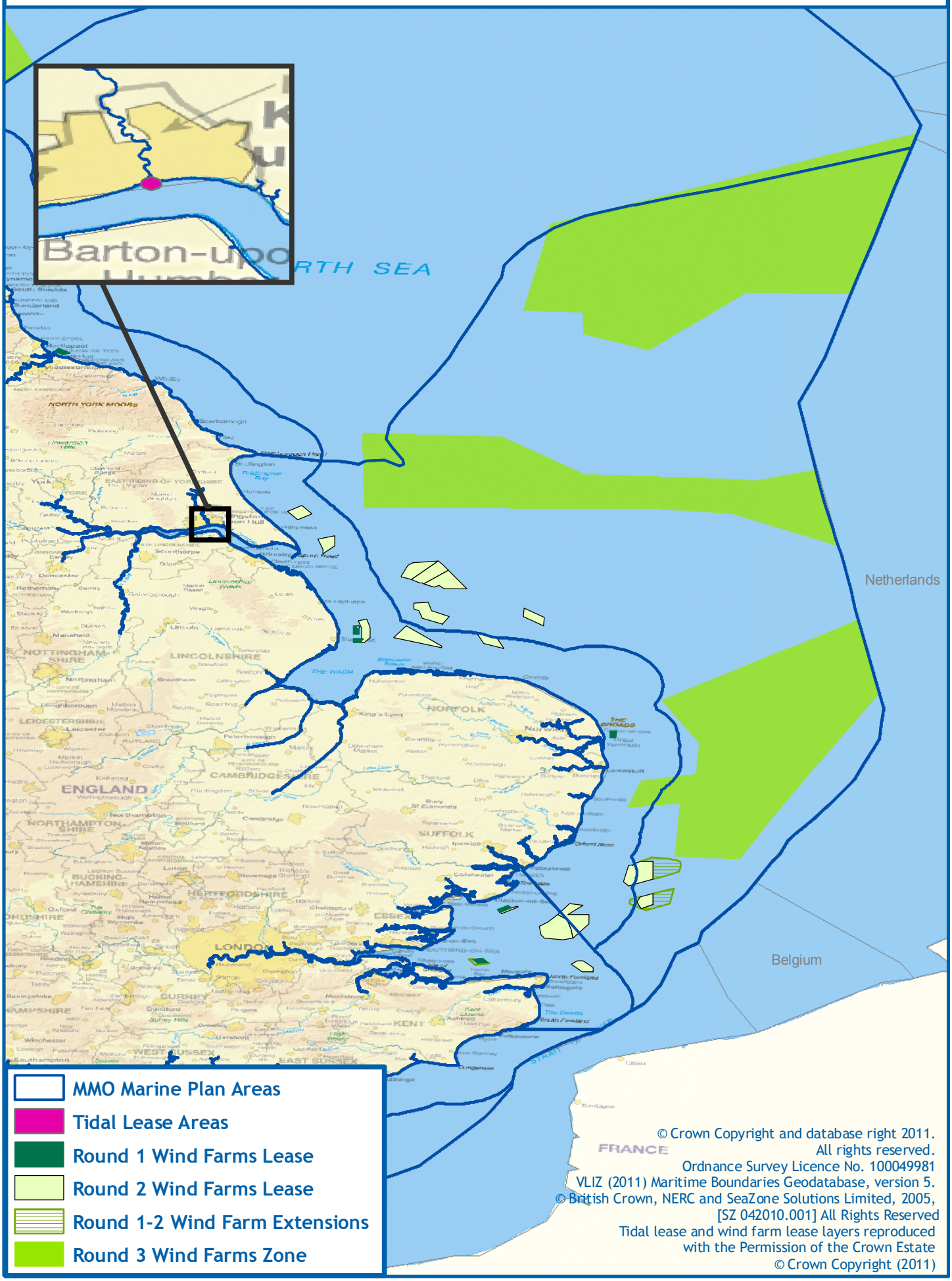
---

[22] Parliamentary Office of Science and Technology postnote, Ocean Acidification, October, Number 343
[23] Interacademy Panel on International Issues, IAP Statement on Ocean Acidification, 2009
[24] Strategic scoping report for marine planning in England, Marine Management Organisation, (June 2011)
[25] Strategic scoping report for marine planning in England, Marine Management Organisation, (June 2011)
[26] RenewableUK, Annual Review 2010
[27] DECC (2010) Renewable Energy Roadmap
[28] DECC's RESTATS database [online] available at https://restats.decc.gov.uk/app/reporting/decc/datasheet, Accessed January 2012
[29] Including “Under Construction” but excluding “Awaiting Construction” and “Pre-Consent”

Figure 6.3: Leased renewable energy areas

November 2011
This map has been produced using the ETRS89 Coordinate Reference System

marine management organisation



In terms of emissions generating activities, some issues have already been discussed under the air quality baseline above (such as the fact that shipping is a major activity in the area). Emissions from ships are estimated to be approximately 3 per cent of global CO_2 emissions, projected to rise to approximately 15 to 30 per cent by 2050 due to expected increase in global trade[30]. UK shipping emissions are estimated between 0.8 and 5 per cent of global shipping emissions[31]. Compared to other forms of freight transport including road, rail and air, shipping releases fewer $kgCO_2e$ per tonne km travelled[32]. The Committee on Climate Change recommends that international shipping emissions are included in the UK's 2050 target to reduce emissions by 80% on 1990 levels[33]. However, other mechanisms, for example, via the International Maritime Organization (IMO) could play a role in reducing relative emissions via technical and operational measures (such as efficiency improvements)[34].

Oil and gas provide around 75 per cent of the UK's total primary energy with approximately two thirds coming from indigenous sources. With sustained investment indigenous sources could still provide half of the UK's oil and gas demand in 2020[35]. Disused oil and gas fields could be used as carbon capture and storage facilities.

Another activity that is potentially significant in terms of greenhouse gas emissions is military operations. The military use large areas of the North Sea as practice and exercise areas (PEXAs), including training, equipment and personnel transportation radar communications and search and rescue operations. PEXAs extend to 22,378 square kilometres or 46.1 per cent of the East Offshore area. Naval exercises are conducted across the whole sea area but with some notable hotspots including a submarine exercise area between the North East and East areas off Flamborough Head. Military radar can be affected by electromagnetic signals from rotating turbines and it is notable that no wind farms have been located within 74 km direct line of sight of air surveillance and control systems (ASACS).

What would the situation be without the plan?

In-line with the requirements of the SEA Directive there is a need to describe "the likely evolution thereof without implementation of the plan or programme". This section meets this requirement by summarising the likely situation without the plan in terms of a range of sustainability considerations.

---

[30] DECC, UK Offshore Energy Strategic Environmental Assessment, OESEA2 Appendices 1, 2, 4 , and 5, February 2011

[31] Gilbert, P, Bows, A, Starkey, R (2010) Shipping and climate change: Scope for unilateral action

[32] Guidelines to Defra / DECC's GHG Conversion Factors for Company Reporting (2011) (Maritime Shipping General Cargo Average=0.015 $kgCO_2e$ per tonne.km) (Rail=0.037$kgCO_2e$ per tonne.km) (All HGV UK Average= 0.154 $kgCO_2e$ per tonne.km) (Air, Long-haul international=0.727 $kgCO_2e$ per tonne.km)

[33] Source: www.theccc.org.uk/topics/international-action-on-climate-change/international-shipping, Accessed January 2012

[34] Source: www.imo.org/OurWork/Environment/PollutionPrevention/AirPollution/Pages/GHG-Emissions.aspx (accessed January 2012)

[35] Oil & Gas UK Economic Report (2010)

During the time of the plan the UK is expected to undergo a significant shift in its policy on renewable and low carbon energy generation. The UK will still remain reliant to a large degree on fossil fuel powered electricity generation. However, the Clean Air Act and Large Combustion Plant Directives (LCPD) will force a number of existing coal power stations to close by 2015 with the need to replace these with other generation. Offshore wind is expected to make up some of the loss of this generating capacity, as well as contributions from new gas; and potentially new coal generation within the plan period. Moves to construct new coal are likely to require the demonstration of commercial scale carbon capture and storage and measure to facilitate this have been implemented by government and detailed in the Low Carbon Transition Plan. The Department of Energy and Climate Change (DECC) is responsible for preparing the UK CCS roadmap to help deliver the initial demonstration projects and implementing the EU directive on the geological storage of CO_2. For CCS to be a practicable policy measure, access to depleted oil and gas wells in East plan areas may be required.

Offshore wind, of which the vast majority will be developed in East Offshore plan area, is projected to provide a significant proportion of UK electricity contributing between 14 and 24 per cent. There is confidence that the UK will endeavour to capitalise on its offshore wind resource, confirmed by the commitment from General Electric, Gamesa and Siemens to set up offshore wind turbine manufacturing facilities in the UK.

Without the plan allocated Round 2 wind farm sites are expected to be built out. The extent to which Round 3 sites will be fully constructed by 2030, and beyond, is unclear. The extent to which the Round 3 sites can be fully developed to harness renewable energy could be limited by pressures to ensure full exploitation of indigenous oil and gas reserves and maintain access to depleted fields which will provide the opportunity for CCS. In particular, the East Offshore area includes significant existing oil and gas infrastructure and a number of newly discovered sites.

In terms of air quality, agreed amendments to MARPOL commit to progressively reduce sulphur oxide (SO_x) and nitrogen oxide (NO_x) with stringent controls being placed on marine engines from January 2016. This will help improve air quality at ports where ships dock. Ship based transport is expected to continue to increase (primarily as a result of the introduction of the tonnage tax in 2000) and is expected to remain the principle means for UK goods transportation. Emissions from shipping are expected to become an increasing proportion of global CO_2 emissions and it can be expected that their contribution to UK emissions will increase correspondingly.

What are the key issues and opportunities?

In-line with the requirements of the SEA Directive there is a need to describe "any existing environmental problems which are relevant to the plan or programme including, in particular, those relating to any areas of a particular environmental importance". This chapter meets this requirement by summarising key issues in terms of a range of sustainability considerations. These include:

- To ensure the maximum sustainable deployment of offshore wind and marine renewable technologies.

- To safeguard access to potentially suitable geological storage areas for carbon dioxide.
- To minimise air pollution associated with oil and gas exploitation and related industrial activities.
- To consider how marine planning can contribute to reducing further growth in emissions from the transport sector (shipping, aviation, road, rail) as a result of the marine plan(s), and associated activities.
- Identify, promote and plan for more low carbon industry, such as production of low carbon goods or services and to provide new jobs and businesses.

Are there any data gaps?

There is a need to better understand the strategic issues or priorities for the plan in order that these can be the focus of the appraisal. These include:

- There is limited information on the spatial extent of baseline information including, for example, marine related emissions on near shore and port air quality. As a consequence, it will be difficult to determine plan impacts on particular areas for air quality. Therefore it may be that there is a need to identify particular activities that should be minimised, as a priority, if the impacts of the plan on air quality are to be addressed. The effects of the plan in terms of these activities would then be a focus of the appraisal.
- It will be difficult to determine plan impacts in terms of greenhouse gas emissions. It may be that there is a need to identify particular activities that are a priority to minimise emissions and focus the appraisal of the plan in terms of these activities.
- The point of the consultation is to gather further targeted evidence, bearing in mind the objectives of the plan and what these mean for the scope of the appraisal.

6.2 Communities and health (incorporating equalities assessment)

Introduction

The sustainability appraisal (SA) considers how the marine plans may impact on communities living along the coastline and in inland areas corresponding to the East Inshore and East Offshore marine plan areas. The SA includes an integrated equalities impact assessment (EqIA). This is to enable the Marine Management Organisation (MMO), as a public authority, to fulfil its duty to give due regard to the need to promote equality, tackle discrimination and promote good relations between different groups in society. It also includes consideration of the potential health impacts of the marine plans for people living in affected communities.

Social deprivation in cities, towns and rural communities relate to a range of dimensions, including the quality of the physical environment and housing infrastructure, employment opportunities, income and wealth of individuals and households, mental and physical health and the range and quality of services, shops and leisure activities available to people. Where a significant numbers of people experience disadvantage in their access to and possessing of these various forms of assets or services within a local area, the effects can be detrimental for people's

health and wellbeing, may be associated with increased crime levels and safety concerns, and can be damaging to community cohesion, to social mobility and to the life chance of individuals.

What is the link between the plan and this topic?

Given the scope of the plan, there is clear potential for impacts to communities. Community impacts refer generally to impacts on the people as individuals and communities who live in coastal communities adjoining the marine plan areas. They include impacts on community cohesion, deprivation, health, equality and social regeneration opportunity.

These various dimensions are closely inter-related. For example, common characteristics of areas lacking in community cohesion have been identified as: economic inequality, variable access to high quality services, and incidences of poor mental health[36].

Health status is certainly known to be influenced by a range of physical, social and economic factors. These can include employment status, housing conditions, racism and other forms of discrimination, and neighbourhood economic conditions. Health tends to deteriorate in poor quality environments resulting in premature mortality and increased morbidity[37]. Furthermore, there is a social gradient in health, with worse social position leading on average to worse health, and associated costs. Good health and wellbeing bring economic benefits in increased productivity and tax revenue, lower welfare payments and lower health treatment costs.

It is also important to recognise that equality and health issues are closely related to employment and economic investment, through changes to existing patterns of employment and unemployment. Nationally, rates of unemployment are highest among those with no or few qualifications and skills, people with disabilities and mental ill health, those with caring responsibilities, lone parents, those from some ethnic minority groups, older workers and, in particular, young people[38]. Where regeneration initiatives are underway, the marine plan has the potential to support these and in doing so contribute to addressing existing inequalities and deprivation.

What is the policy context?

There is a wide array of social and economic policy and legislation which shapes community issues, whilst the wider economic context is also important. The devolution of powers from regional to local and also neighbourhood levels represents a potentially important change regarding policy delivery.

Major government legislation is currently proceeding through Parliament which is likely to alter the context for local decision-making, welfare reform and delivery of

---

[36] Social capital and its relationship with measures of health status: evidence from the Health Survey for England 2003, abstract, http://onlinelibrary.wiley.com/doi/10.1002/hec.1242/abstract, Accessed 28 September 2011

[37] Community cohesion is an important contributor to health, Institute of Community Cohesion, www.cohesioninstitute.org.uk/Resources/Toolkits/Health/HealthAndCommunityCohesion/AContributorToHealth, Accessed 28 September 2011

[38] Fair Society, Health Lives. The Marmot Review (2010)

health and social care services, relevant to wellbeing, deprivation, equality and health, including the Localism Bill and the Health and Social Care Bill.

Table 6.3 summarises the key elements of relevant policy and guidance, from which it becomes possible to gain a better understanding of communities, health and equalities' issues. Following the table is a short discussion that seeks to highlight some of the most pertinent messages.

Table 6.3: Communities, health and equalities

Europe
Together for Health: A Strategic Approach for the EU 2008-2013
The European Environment and Health Action Plan 2004-2010
Draft Directive on Equal Treatment (2008)
EU Sustainable Development Strategy (EU SDS) First issued 2001, Revised 2006
National
UK Marine Policy Statement (2010) The national flood and coastal erosion risk management strategy for England (2011)
Mental health and well-being (2011)
Draft Rural White Paper Action Plan: Consultation (2011)
Equality Act 2010
Draft National Planning Policy Framework (2011)
Sustainable Development: The key to tackling health inequalities (2010)
Strategic Review of Health Inequalities in England Post-2010 (The Marmot Review)
NHS Choice Agenda (2009)
Healthy weight, healthy lives: a cross government strategy for England (2008)
Health Effects of Climate Change in the UK (2008)
Securing Good Health for the Whole Population Report to the Treasury (Wanless, 2004)
Sustainable Communities: building for the future (2003)
Tackling Health Inequalities: A programme for Action (2003)
Saving Lives: Our Healthier Nation White Paper (July 1999)
Local
Rural Development Programme for England (2011)
North Lincolnshire Health and Well Being Strategy 2009 - 2011
Planning Policy Statement 5: Planning for the Historic Environment (2010)
Planning Policy Statement 25: Development and flood risk (2010)
Yorkshire and Humber Regional Economic Strategy (2007)
Kelling to Lowestoft Shoreline Management Plan Review (2006)
Planning Policy Statement 1: Delivering Sustainable Development (2005)
Planning Policy Statement 7: Sustainable Development in Rural Area (2004)
Sustainable Communities in the East of England (2003)
Sustainable Communities in the East Midlands (2003)
Sustainable Communities in Yorkshire and the Humber (2003)
The Humber Estuary Coastal Authority Group Shoreline Management Plan (2011)
Humber Flood Risk Management Strategy (2008)
First Review of Shoreline Management Plan Sub cell 3c, Lowestoft Ness to Landguard Point (agreed subject to caveats)

PPS1: Delivering Sustainable Development (2005), the existing planning guidance notes that plans should address accessibility to health facilities – both in terms of location and physical access – for all members of the community. They should deliver safe, healthy and attractive places to live; and support the promotion of health and well being by making provision for physical activity. Environmental issues (such as waste) should be managed in ways that protect the environment and human health.

The draft National Planning Policy Framework (NPPF) 2011 states that alongside planning for economic purposes and for environmental purpose, the planning system has a social role in delivering sustainable development, summarised as:

> "use the planning system to promote strong, vibrant and healthy communities, by providing an increased supply of housing to meet the needs of present and future generations; and by creating a good quality built environment, with accessible local services that reflect the community's needs and supports its health and well-being".

The Localism Bill includes measures to devolve greater power to neighbourhood level concerning planning decisions, provides new powers to help save local facilities and services threatened with closure, and gives voluntary and community groups the right to challenge local authorities over their services. It abolishes regional spatial strategies which included housing targets.

The Local Economic Growth White Paper includes provision for local enterprise zones. These are intended to boost investment and job creation in selected zones, which include the Humber Economic Partnership and the New Anglia Economic Zone, whose geographies include inland areas corresponding to the East Inshore and East Offshore plans.

The Health and Social Care bill proposes a very significant restructuring of the NHS and delivery of health and social care. The bill extends the role of local authorities in the health system by creating health and wellbeing boards (HWBs) and giving them responsibility for public health. This will require effective working between GP consortia and local authorities to ensure that services meet the full range of local population health needs. The Bill extends existing patient choice for a wider range of services.

Since April 2009, under the NHS Choice agenda, patients have the right to choose the hospital to which they are referred. This is expected to improve patient choice, but can also increase the need to travel.

Fair Society, Healthy Lives, the 2010 Marmot Review of health inequalities, highlighted the need to reduce health inequalities as a matter of fairness and social justice. It concluded that action on health inequalities requires action across all the social determinants of health. It identifies the creation of healthy, sustainable communities as one of a priority set of objectives for improving health, the promotion of which is via measures which also help tackle climate change and achieve sustainability objectives.

High Quality Care for All, the 2008 Darzi review of the National Health Service, supported services to promote health including combating obesity, consumption of healthy food, increased levels of physical activity, and encouragement to companies to invest more in the health of their workforce.

The Sustainable Development Commission's 2010 report 'A key to tackling health inequalities' concludes that measures such as active travel, promoting green spaces and healthy eating will yield co-benefits for both health and carbon emissions and requires that opportunities for healthy, low-carbon living should be distributed in ways that favour people with low incomes and so help to reduce their vulnerability to ill-health.

The Equality Act 2010 covers nine protected characteristics – age, disability, gender reassignment, pregnancy and maternity, race, religion or belief, sex, sexual orientation, marriage and civil partnership (applicable only to the need to eliminate unlawful discrimination) – which cannot be used, either directly or indirectly, as a basis for unequal treatment. A new equality duty, set out in Section 149 of the Equality Act requires public bodies to give due regard to the need to:

- promote equality of opportunity,
- to tackle unfair discrimination; and
- to promote good relations between different groups.

What's the baseline situation?

Introduction

The Marine Policy Statement (MPS) sets out to "ensure a strong, healthy and just society'" where the use of the marine environment is benefitting society as a whole and contributing to cohesive communities and physical and mental wellbeing. This means that marine plans should contribute to both positive marine and terrestrial impacts. The MPS aims to ensure equitable access to the coast and seas and recognises that the marine area provides national social and economic benefits and contributes to the well being and quality of life of coastal communities. It states that marine planning should contribute to securing sustainable economic growth in regeneration areas and areas that already benefit from strong local economies.

The Appraisal of Sustainability[39] report of the Draft MPS extends this and identified key objectives of the appraisal. The Appraisal of Sustainability objectives for Population and human health for the UK Marine Policy Statement include:

- To protect and where possible enhance the physical and mental health of populations living in the marine and coastal environment.
- To support the development of sustainable coastal communities.
- To contribute to a reduction in levels of social deprivation and inequality.

It identifies those populations in coastal communities, particularly those with links to the seas as potentially sensitive receptors.

[39] UK Marine Policy Statement: The Appraisal of Sustainability report

This assessment is strategic in nature. It is important to identify baseline information on which the plan could have a clear cause and effect relationship, without which it will be difficult to identify effects with any degree of accuracy. Where this difficulty can be expected, then there is little point in seeking to generate a detailed understanding of the baseline - rather there is a need to focus on understanding the broader issues, in terms of which the plan will have an effect. In particular, there will be a need to understand trends in terms of those activities that can lead to impacts on communities, their health and equality groups, so that the effect of the plan in terms of those activities or issues can be assessed.

In order to clearly present the baseline data this chapter is divided into four key areas identified below, from which the impact of the East Inshore and East Offshore plan on communities, health and equalities can be clearly presented:

- Health and wider determinants of health
- Deprivation
- Regeneration areas and coastal communities
- Equalities.

The boundary of the east inshore plan area extends from Flamborough Head in the East Riding of Yorkshire to Felixstowe in Suffolk Coastal, a distance of over 300 miles. For the purposes of this appraisal it is assumed the effects of the plans will be experienced predominantly by communities in local authorities along the coastline between these points. In practice it is likely that effects will also be felt further afield both to the north and south of the plan area and further inland.. However, it is understood that these spill-over effects will be captured by the assessment of adjacent plan areas and wider cumulative impact assessments of the marine plans at the UK level. Therefore baseline data has been drawn from local plan and strategic documents for the following local authority areas:

- East Riding of Yorkshire
- Kingston Upon Hull
- North Lincolnshire
- North East Lincolnshire
- East Lindsey
- Boston
- South Holland
- King's Lynn and West Norfolk
- Fenland
- North Norfolk
- Great Yarmouth
- Broadland
- South Norfolk
- Waveney (Suffolk)
- Suffolk coastal (Suffolk).

Regional and county level data has also been included as appropriate. Due to the spatial extent of the plan it is difficult to consider in detail all issues for each

area/town that could potentially be affected by the plan. However, where available specific information is presented to best understand the spatial distribution of likely key receptors and identify potential cumulative impacts.

Health

The World Health Organisation (WHO) defines health as "state of complete physical, mental and social well-being and not merely the absence of disease or infirmity"[40].

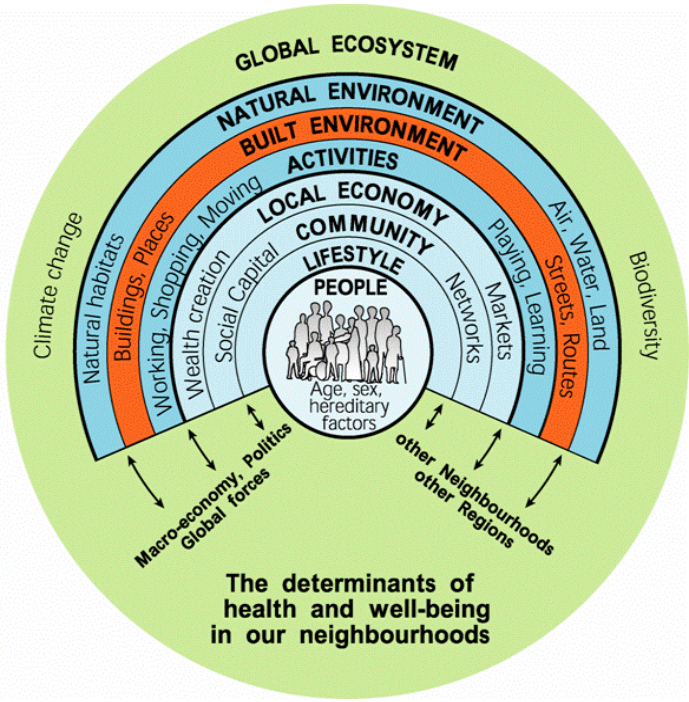


Figure 6.4: Determinants of health and well-being (Barton & Grant, 2006)

As Figure 6.4 illustrates, a number of the other topic areas have implications for human health as they address the global ecosystem and natural environment determinants of health at global and macro-level. These include air quality, climate change, the marine economy, the water environment including water quality, coastal processes including coastal erosion and flood risk.

Nationally comparable indicators of health include rates of limiting long term illness, self reported not good health and life expectancy rates for males and females. However, throughout much of England, percentages of residents with long-term limiting illness or self-assessed health not good are higher in coastal areas compared to inland. However, these figures are likely to reflect other patterns in demographics such as age structure, as a number of coastal settlements have large populations of elderly people. Similarly, a number of coastal settlements exhibit high levels of deprivation.

[40] World Health Organisation, www.who.int/suggestions/faq/en/index.html, accessed 28 September 2011

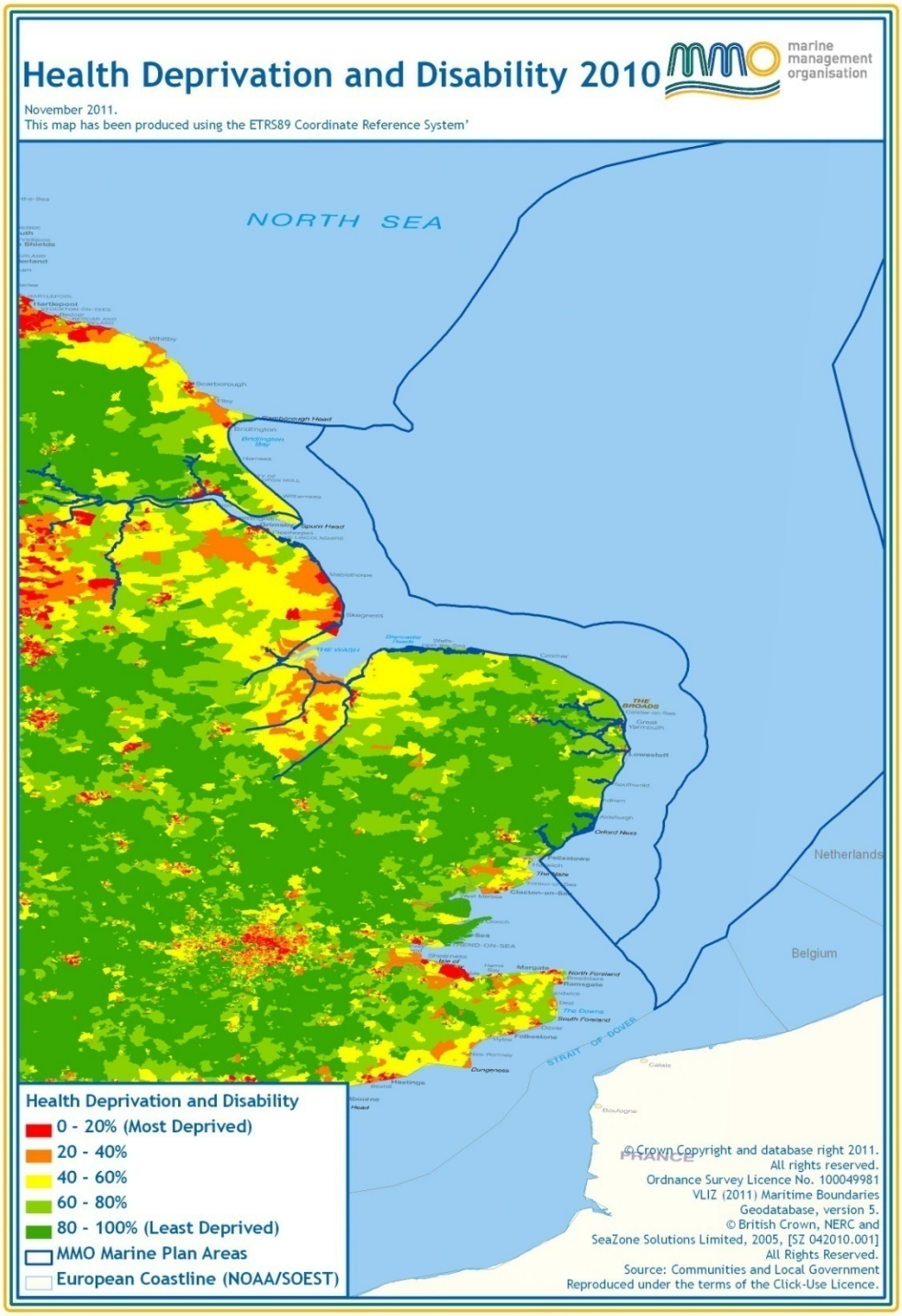


Figure 6.5 Index of Deprivation 2010: health deprivation and disability

This map provides an overview of levels of health deprivation in the coastal settlements. It provides a basis for identifying where investment and other interventions associated with the plan have the potential to address existing health deprivation.

Self-reported not good health is regarded as a helpful indicator of health deprivation. It shows concentrations of poor health particularly marked in Hull, Mablethorpe,

Felixstowe and surrounding communities, but also along much of the remainder of the coastal fringe adjoining the plan areas.

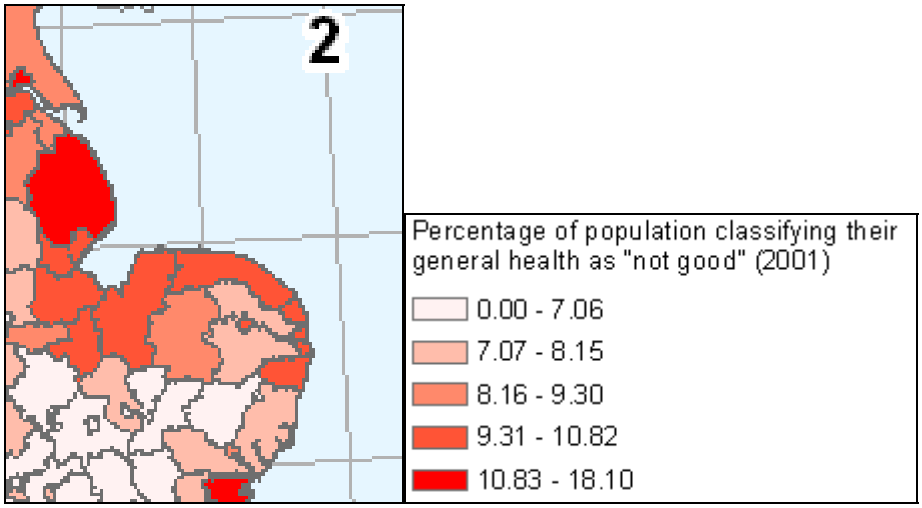


Figure 6.6: Percentage of population with 'not good' health[41]

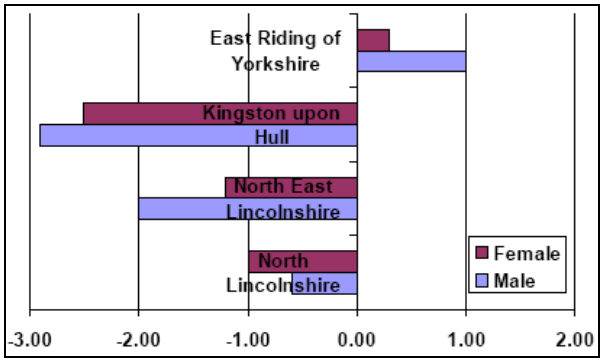


Figure 6.7: Difference in average life expectancy in the Hull city region compared to the England average 2006-2008[42]

Figure 6.7: Shows that life expectancies for both men and women are shorter than the national average in Kingston upon Hull, North East Lincolnshire and North Lincolnshire.

A limited set of wider determinants of health have been identified to focus on those that the plans may have some influence or which may be particularly significant in terms of shaping how far the plan can achieve benefits in terms of improved health.

There are high numbers of young people not in education, employment or training along the Eastern coastline adjoining the plan areas[43]. The plan may have the potential to encourage creation and uptake of training and employment opportunities

[41] ONS Census 2001, reproduced from Draft UK Marine Policy Statement: The Appraisal of Sustainability report (2010)
[42] Hull and Humber Ports City Region, Economic Assessment – March 2010, Humber Economic Partnership
[43] The English Indices of Deprivation 2010, Communities and Local Government (2010)

by young people. On the other hand, high levels of not in education, employment or training (NEET) may prevent young people from the area possessing sufficient skills to share in the benefits of newly created employment associated with the plans.

Long-term unemployment is a problem in some coastal communities[44]. While there may be opportunities for individuals to benefit from new employment creation, they may be disadvantaged in competing for jobs by their lack of work experience, lack of relevant skills and other factors.

Health is closely related with deprivation. The following section is complementary to the evidence provided regarding wider determinants of health and health deprivation.

Deprivation

The following section provides information on deprivation across Yorkshire and Humber, the East Midlands and East of England, covering the coastal areas adjoining the East Inshore marine plan area.

[44] The English Indices of Deprivation 2010, Communities and Local Government (2010)

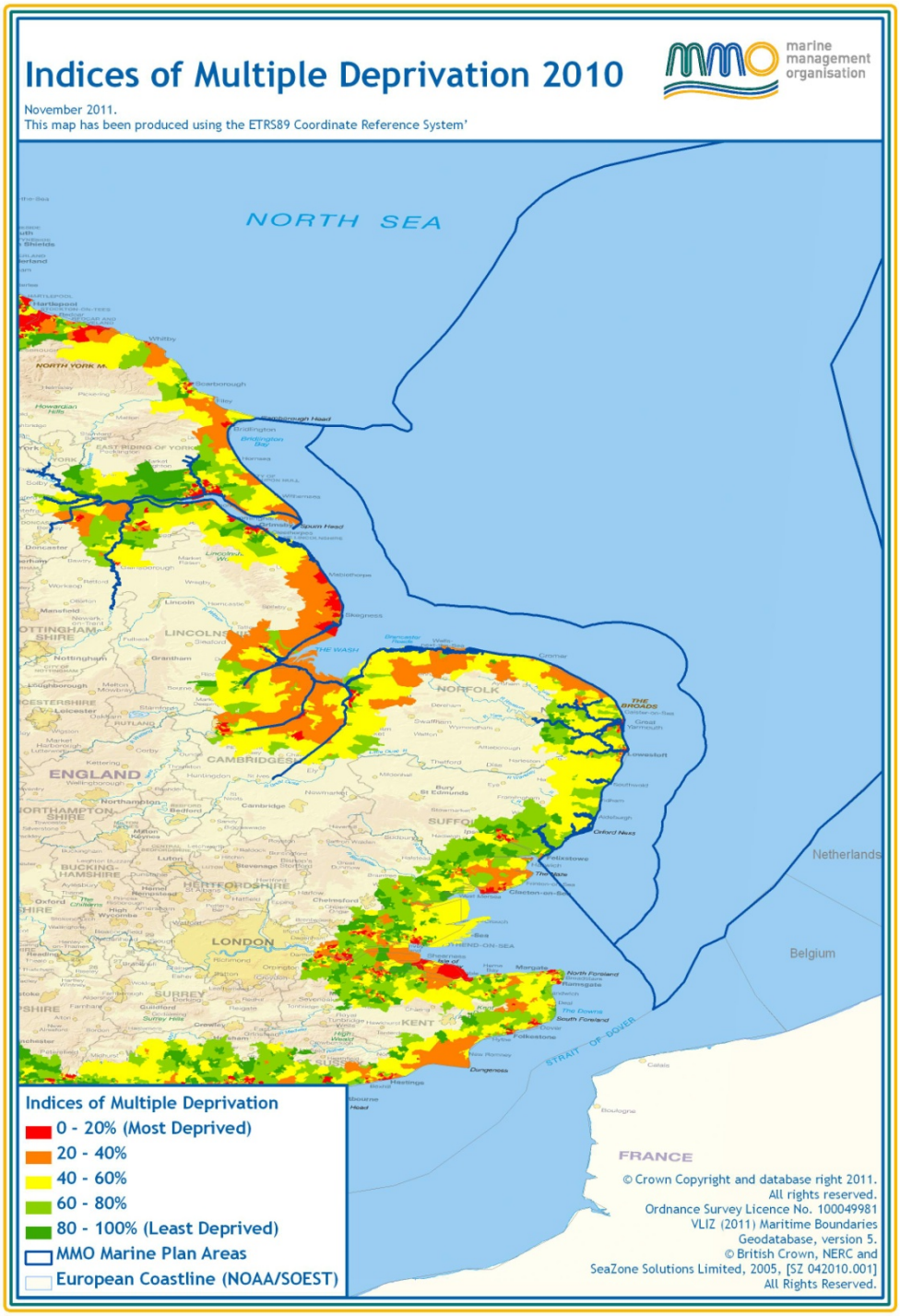


Figure 6.8: 2010 Indices of Multiple Deprivation map

The coastline adjacent to the east inshore plan area experiences above average levels of deprivation, with particular towns, experiencing significant levels of deprivation within the worst 10 per cent in England (see Figure 6.8). Deprivation disparity in the East of England is one of the highest in England. Yorkshire and the Humber also have notable deprivation disparity (see Figure 6.9).

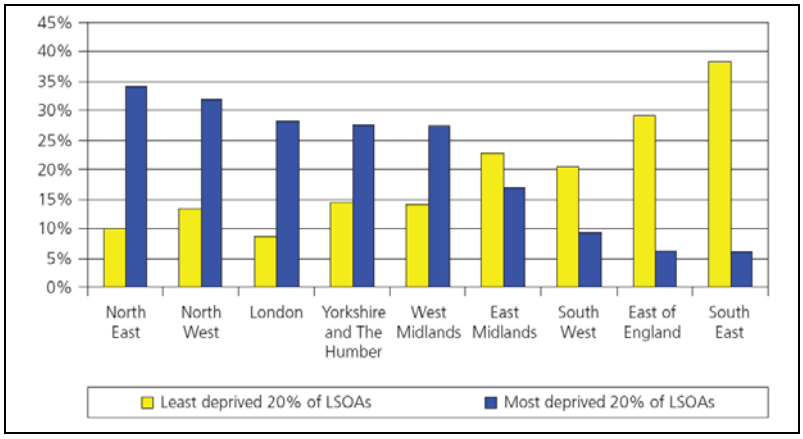


Figure 6.9: Percentage of LSOAs in the most deprived and least deprived 20 per cent on the IMD 2007 by region[45]

Compared to England and, in particular, Yorkshire and Humber, the East Riding of Yorkshire has a relatively low percentage of super output areas (SOAs) in the most deprived 10 per cent SOAs in England. However, this figure masks significant variation in deprivation in the region. In addition to high levels of deprivation in Bridlington, Kingston upon Hull had the highest percentage of LSOAs in the 10 per cent most deprived LSOAS in the country (44.2 per cent), in 2007. Although this figure was lower than that for 2004 it was still much higher than other local authorities in the region.

The 2007 Index of Multiple Deprivation showed that overall North Lincolnshire had a deprivation score similar to the national average and between 2004 and 2007 the national ranking improved due to improvements in health, employment and average income[46]. However, between 2004 and 2007 the number of SOAs among the worst 10 per cent increased from 8 to 9 (of 100 within North Lincolnshire) indicating potentially growing inequality. Evidence suggests a widening of health inequality between the richest and poorest residents with a 10-year age gap in life expectancy for men, and 8 for women, living in the richest and poorest areas. Approximately 25 per cent of people in employment in North Lincolnshire work in low paid and relatively low skilled processing jobs, compared to 18 per cent nationally. In 2007, 6 SOAs were among the 10 per cent most deprived in the country for child deprivation with two wards in Scunthorpe among the 3 per cent most deprived in the country[47].

In 2004 North East Lincolnshire ranked 52nd out of 354 on the index of multiple deprivation placing it among the countries 20 per cent most deprived districts. 25 per cent of the population live in neighbourhoods amongst the 10 per cent most deprived areas in the country[48]. Deprivation is centred in central and eastern parts of Grimsby with smaller concentrations of deprivation in northern Cleethorpes and Immingham.

---

[45] The English Indices of Deprivation 2007, Communities and Local Government (2008)
[46] North Lincolnshire Health & Well Being Strategy 2009-2011
[47] North Lincolnshire Health & Well Being Strategy 2009-2011
[48] New Horizons, A regeneration strategy for North East Lincolnshire, 2006-2022

North East Lincolnshire's economy has been traditionally based on manufacturing, food and processing industries which provides employment for around 33 per cent of the local workforce. Retail and wholesale also play a strong role accounting for 33 per cent of business activities. Information technology and professional services jobs have remained static at around 12 per cent, approximately half the national average. The local employment rate is approximately 69 per cent and has suffered from job losses in the food processing industries and is lower than the sub-regional (74 per cent) and Yorkshire and Humber (75 per cent) averages[49].

The area experiences the highest unemployment rate among young people with few qualifications. Many employment opportunities are low skilled and low paid and consequently full time earnings remained on average 20 per cent below the UK average[50].

Many of the areas with high levels of deprivation and unemployment also experience poor health, housing and education attainment and high rates of crime. Nunsthorpe, East March, Grange, Northern Cleethorpes and Immingham are in the top 10 per cent nationally in terms of these indices of deprivation. For both men and women in North East Lincolnshire, life expectancy at birth was below the national average with some of the most deprived wards being 6 years less than the England average.

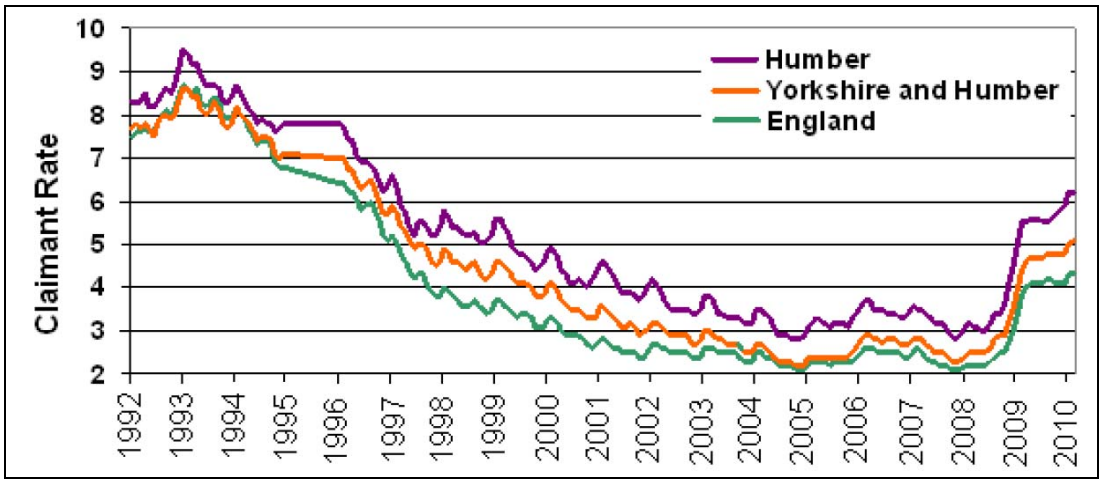


Figure 6.10: Claimant rates, 1992-2010[51]

The recent financial crisis has resulted in marked increases in unemployment across England. While many regions have experienced increases in unemployment levels, Kingston upon Hull, in particular has experienced the highest increase in number of people unemployed and remains significantly above average levels both regionally and nationally[52]. This has been as a result of continued falls across all business

[49] New Horizons, A regeneration strategy for North East Lincolnshire 2006-2022, North East Lincolnshire Council
[50] New Horizons, A regeneration strategy for North East Lincolnshire 2006-2022, North East Lincolnshire Council
[51] Hull and Humber Ports City Region, Economic Assessment – March 2010, Humber Economic Partnership

sectors, including the continued fall in manufacturing jobs. Correspondingly, across the East Riding of Yorkshire, Hull and Lincolnshire discretionary household incomes - money available to spend on lifestyle choices – are relatively low, and as in the case of Hull nearly 75 per cent less than the England average (see Table 6.4).

Table 6.4: Discretionary incomes, 2010, £ a week

East Riding of Yorkshire	£158
Kingston upon Hull	£52
North East Lincolnshire	£86
North Lincolnshire	£112
England	£200

West Norfolk has only a small proportion of employment in knowledge driven sectors. In West Norfolk approximately 74 per cent of the population was economically active, below that of Norfolk (78.9 per cent and the region (80.5 per cent). Unemployment has been consistently below or at national and county level but above the regional figures. West Norfolk experiences issues of under-employment. Five wards in King's Lynn are in the top 10 per cent of the most deprived wards in England (Employment domain). A low level of skills and qualifications in the local workforce is a challenge with below average levels of high-end skills. West Norfolk has below average incomes but its deprivation score based on Super Output Area is above the national average. Deprivation in King's Lynn and West Norfolk is generally in line with national data except for particularly poor performance in the area of education and skills[53]. West Norfolk ranks 150 out of 408 districts nationally in the 2004 IMD and ranks 21st in terms of inequality. Pockets of deprivation and isolation are key issues and West Norfolk was awarded funding from the Government's Safer and Stronger communities fund to help address this.

Long-term population and health trend for Great Yarmouth shows that inequality between Great Yarmouth and the rest of England continues to widen. In the East of England (which has 73 of the 10 per cent most deprived SOAs in England) the majority are located in the coastal area with the highest proportion in Norfolk and Great Yarmouth[54]. One fifth of the population of Great Yarmouth live in LSOAs that are among the most deprived 10 per cent in the country. Correspondingly Great Yarmouth has one of the shortest female and male life expectancies in the East of England. The Great Yarmouth population experiences high levels of circulatory diseases with some areas experiencing rates over twice as high as other areas[55].

---

[52] Hull and Humber Ports City Region, Economic Assessment – March 2010, Humber Economic Partnership

[53] Borough of King's Lynn and West Norfolk Local Investment Plan for the Homes and Communities Agency, March 2010

[54] Great Yarmouth Borough Council Local Development Framework Sustainability Appraisal: Scoping Report, www.great-yarmouth.gov.uk/ldf-sa-scoping-report-part1.pdf?bcsi_scan_E956BCBE8ADBC89F=1&bcsi_scan_AB11CAA0E2721250=0&bcsi_scan_filename=ldf-sa-scoping-report-part1.pdf, Accessed 27 September 2011

Great Yarmouth's also has a higher proportion of people with no qualifications than the England and county average.

Suffolk is not as deprived as Norfolk, but fares worse than the other four counties in the East of England. In 2004, only 10 (2 per cent) of SOAs in Suffolk were in the most deprived in the UK. These were in Ipswich and Lowestoft. Suffolk Coastal has no areas which rank within the worst 20 per cent nationally. However, Felixstowe is within the 40 per cent most deprived[56].

As identified below life expectancy and deprivation are intrinsically linked (Figure 6.11).

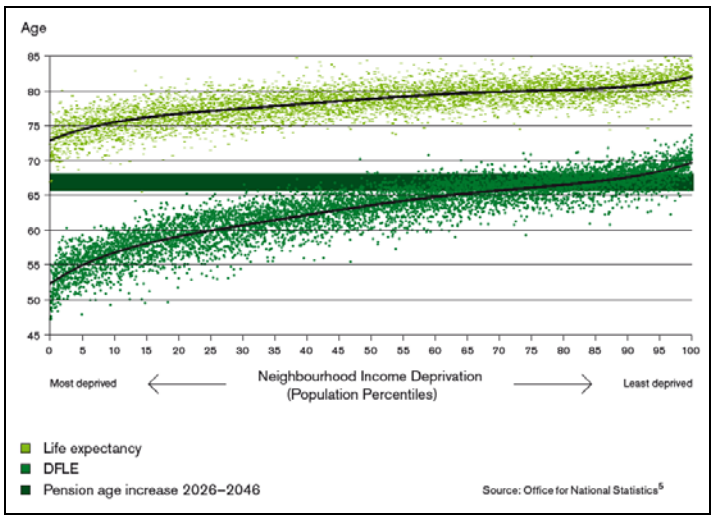
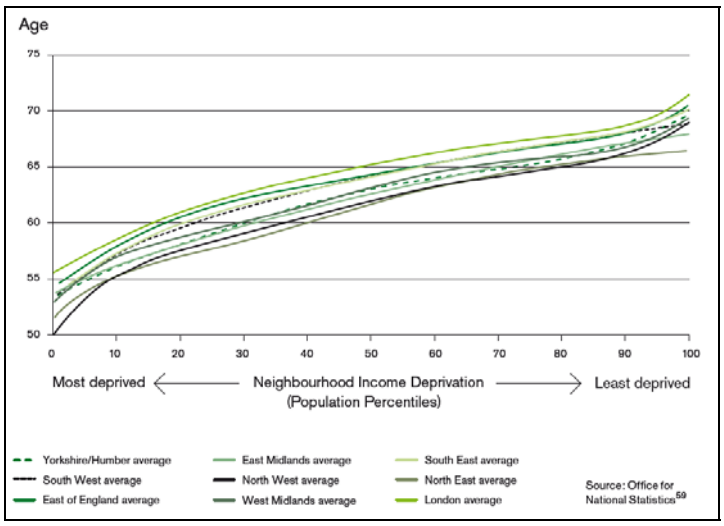


Figure 6.11: Life expectancy and disability-free life expectancy (DFLE) at birth, persons by neighbourhood income level, England, 1999-2003[57]



[55] Great Yarmouth Borough Council Local Development Framework Sustainability Appraisal: Scoping Report 2006, www.great-yarmouth.gov.uk/ldf-sa-scoping-report-part1.pdf?bcsi_scan_E956BCBE8ADBC89F=1&bcsi_scan_AB11CAA0E2721250=0&bcsi_scan_filename=ldf-sa-scoping-report-part1.pdf, Accessed 27 September 2011
[56] Sustainability Appraisal of Core Strategy and Development Management Policies, June 2010
[57] Fair society, Healthy Lives: The Marmot Review (2010)

Figure 6.12: Disability-free life expectancy at birth, persons: regional averages at each neighbourhood income level, England, 1999-2003

The quality of life index, which covers health, economy and inclusion, neighbourhoods, housing, crime and safety, sport, culture, education and skills fell between 2006 and 2008 in the Yorkshire and Humber region, which was in line with the national average. Within the Hull and Humber Ports City Region the score for Kingston upon Hull increased to their highest level since the index was introduced but the other three local authority areas decreased[58].

A widespread problem of lack of well-paid and high skill opportunities currently contributes to a brain drain from the region, an outcome as well as factor in perpetuating deprivation.

Regeneration areas

The inland marine plan area adjoining coastal strip includes a number of areas where investment has been directed towards achieving regeneration in order to address deprivation and health inequalities.

The Coastal Typologies study identifies three kinds of coastal challenges localities, referred to as structural shifters, new towns and ports, and striving communities[59].

In the East, structural shifters are identified as:

- areas around deprived agricultural centres such as Wisbech (central and Waterlees), Gainsborough, Boston (Skirbeck)
- seaside or port towns of Great Yarmouth (Caister, St Andrews), Lowestoft (Harbour, Kirkley, Normanstown), Grimsby or Cleethorpes (Croft Baker, Sydney Sussex).

These are characterised as towns and cities which have lost their primary markets, and are facing the challenge to find new ones. Indicators reported to be above the coastal average include:

- people working in manufacturing
- Jobseekers Allowance claimants
- Incapacity Benefit claimants
- Disability Living Allowance claimants
- all people with a limiting long-term illness aged 0 to 64.

Some areas in and around Peterborough fit within the typology new towns and ports, characterised as experiencing "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". Females make up a higher proportion of benefit claimants than in other areas.

---

[58] Progress in the Hull and Humber Ports City Region (2008) Updated 2010
[59] Marine Management Organisation Coastal typologies: detailed method and outputs Final Report by Roger Tym & Partners July 2011

Striving communities in the East are identified as including areas in and around Kingston-upon-Hull (Orchard Park, Bransholme, Longhill, Marfleet) and Scunthorpe (Crosby and Park, Brumby). These are characterised as having high levels of deprivation across all indicators, and a very high proportion of people living in social rented accommodation. Indicators reported to be above the coastal average include:

- 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.

Scarborough in North Yorkshire is located just to the north of the plan area. It has benefitted from major investment directed towards regenerating the town's key attractions in order to revitalise its image as a resort destination. Scarborough currently suffers from a low wage economy and declining house prices. It has distinct pockets of multiple deprivation and with poor road infrastructure, struggles to compete in the new global economy. Investment in infrastructure is intended to attract new blue chip companies and stimulate growth[60]. However, in terms of deprivation, Scarborough did not experience any improvement between 2004 and 2007 with seven SOAs among the 10 per cent most deprived.

The South Humber Gateway boasts two international airports, the busiest ports complex in the UK and excellent rail and road infrastructure. It benefits from 1000 ha of development land presenting a strategic development site fronting a deep-water estuary. It is the largest employment land allocation in Yorkshire and Humber[61]. Yorkshire and Humber Regional Economic Strategy's target was to "cut the percentage of local super output areas in the region in the 10 per cent most deprived nationally from 17.4 per cent (in 2004) to 13.7 per cent – halving the gap to the national average" [62] [63]. By 2007 this had decreased to 16.7 per cent.

The regeneration strategy for North East Lincolnshire identifies both Grimsby and Cleethorpes as areas in need of regeneration. The focus in Grimsby is to reinvigorate and revitalise the town centre, develop a new civic quarter and facilitate development at the fish docks and waterfront areas; as well as deliver a number of specific development works. The focus in Cleethorpes is to improve the

---

[60] A Vision for Scarborough (2002) www.scarboroughsfuture.org.uk/downloads/ur_vision_for_scarborough.pdf, Accessed September 2011

[61] www.northlincs.gov.uk/NorthLincs/Business/Invest/SouthHumberGateway.htm, Accessed September 2011

[62] Corporate Plan 2008/11, Yorkshire Forward (2008) www.yorkshire-forward.com/sites/default/files/documents/Corporate%20Plan%202008%20-%202011.pdf, Accessed September 2011

[63] The Regional Economic Strategy for Yorkshire & Humber 2006-15: Progress update 2007

attractiveness of the resort seafront including improvement to market area, gardens and listed buildings[64].

King's Lynn (Norfolk) was designated Growth Point status in May 2008. It is anticipated that up to 2021 the population will grow from 41,500 to 50,000 people[65].

Both Great Yarmouth and Lowestoft have significant deprivation issues. Out of 324 local council areas Great Yarmouth scored 294th and Lowestoft 256th in terms of their economic resilience and ability to withstand and respond to shocks in the external environment[66]. New Anglia Local Enterprise Partnership (NALEP) won approval to develop an enterprise zone in Great Yarmouth and Lowestoft focussing on enhancing the area's market share of activity and income from the energy sector[67]. It is anticipated that over £50 billion of expenditure is expected in renewables, gas exploration, extraction and storage, decommissioning and civil nuclear on or close to the Norfolk and Suffolk coast. Both towns are close to the proposed East Anglia Round 3 offshore wind farm zone. The enterprise zone will commence in April 2012 and cover over 121 hectares of development-ready land. It is expected the enterprise zone will create 9,000 new jobs by 2025

North East Lincolnshire is looking to develop itself as a primary location for environmental technologies[68].

Coastal communities

Fishing

The East inshore and East Offshore plan areas both support significant levels of fishing activity. Fishing is undertaken by both commercial enterprises and for recreation and is mostly concentrated around the coast reflecting the proximity to ports of origin for domestic vessels. The UK fisheries sector, although not a significant contributor to the UK economy as a whole is regionally and locally important in terms of employment for local communities as well as having social and heritage value[69].

There is also an inter-relationship between fishing and tourism which is important in maintaining sustainable coastal communities[70].

[64] New Horizons, A regeneration strategy for North East Lincolnshire 2006-2022, North East Lincolnshire Council
[65] www.west-norfolk.gov.uk/default.aspx?page=23701, Accessed 27 September 2011
[66] Energy for New Anglia, Enterprise Zone Summary
[67] www.waveney.gov.uk/site/scripts/documents_info.php?documentID=707&categoryID=100002
[68] New Horizons, A regeneration strategy for North East Lincolnshire 2006-2022, North East Lincolnshire Council

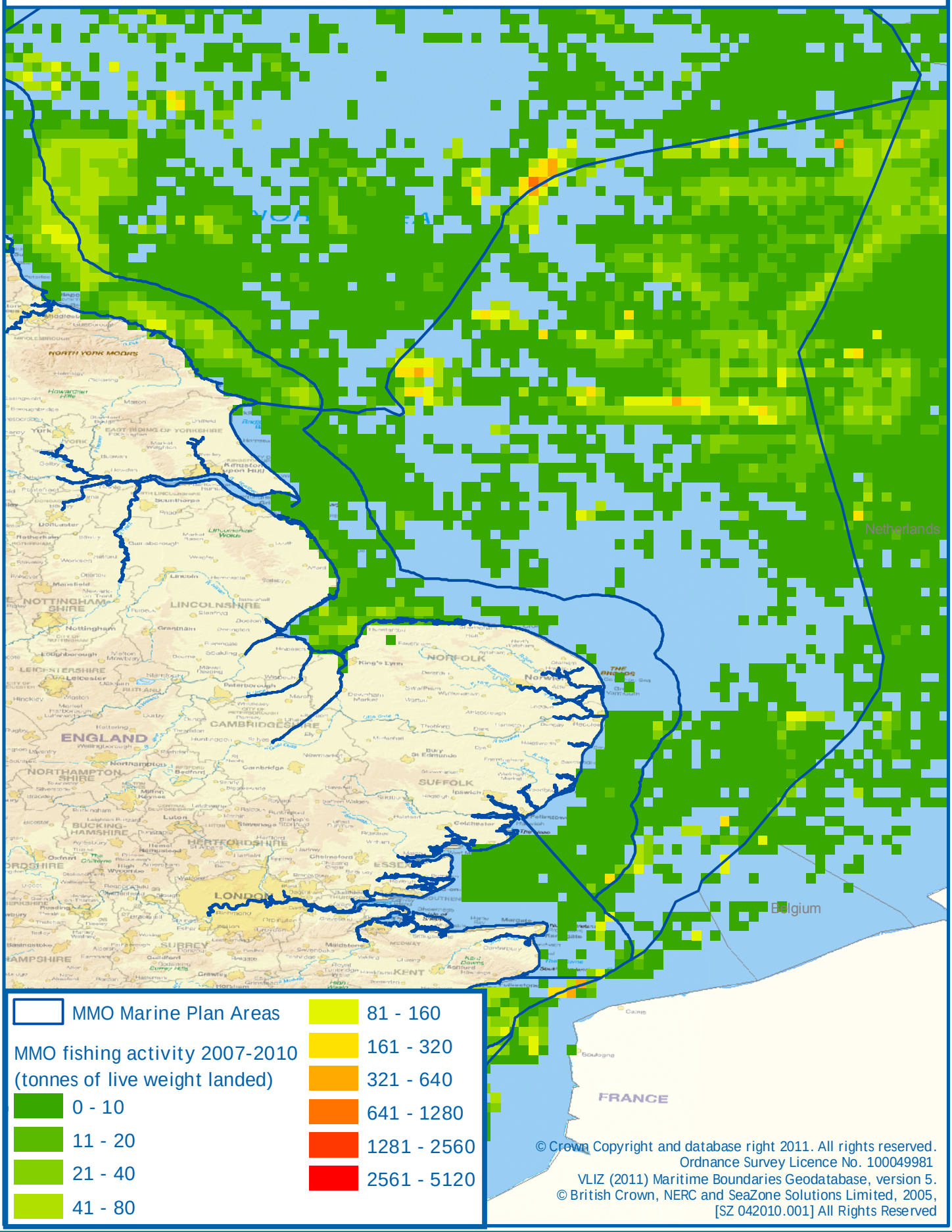
[69] Strategic scoping report for marine planning in England, Draft – April 2011
[70] Maximising the socio-economic benefits of marine planning in the East Marine Area, Roger Tym & partners, July 2011

Figure **6.13**: MMO fishing activity- mobile gears (tonnes of live weight landed from 2007-2010)

marine management organisation

Please note: this map should only be viewed in conjunction with the explantory paragraph of text describing the limitations of the MMO fishing activity data

November 2011. This map has been produced using the ETRS89 Coordinate Reference System



Over the past 30 years, the UK fishing industry has experienced a substantial decline in vessel numbers, due to a number of reasons including introduction of fishing limits and catch possibilities. This has had knock on effects to onshore activity with the combined effect of the relative demise of once important fishing centres including Lowestoft, Grimsby and Hull. These centres also supported ancillary sectors such as supply, maintenance and repair of boats, engines and nets, and consequentially had a significant impact on local communities in these areas[71].

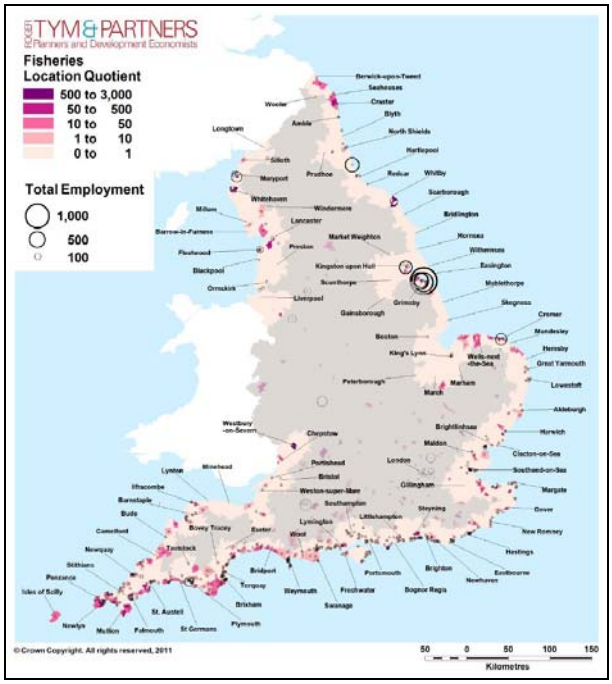


Figure 6.14: Fisheries – Location quotient and employment mapping[72]

Climate change

"Many UK coastal areas already face high deprivation and related socio-economic challenges that make them particularly vulnerable to the impacts of climate change" (JRF 2011[73]).

Climate change effects including an increase in average temperature, severity and frequency of extreme weather events such as storms and sea level rise and rising sea level are anticipated to have a significant impact in the UK in this century. Combined they are anticipated to contribute to the increased likelihood of coastal erosion and flooding along the east coast of England. The impacts of climate change are likely to present significant threats to coastal communities in these areas, in particular, those that rely on the immediate coastal area for economic and social activity, communications and housing[74].

---

[71] Regional Fishing Plan, Final Report, East of England Development Agency, (June 2006) www.insighteast.org.uk/WebDocuments/Public/approved/user_9/East_of_England_Fishing_Plan[1].pdf, Accessed 28 September 2011.
[72] Maximising the socio-economic benefits of marine planning for English coastal communities, Marine Management Organisation, Roger Tym & Partners, Final Report, July 2011
[73] Impacts of climate change on disadvantaged UK coastal communities, Joseph Rowntree Foundation, March 2011

Recent research has identified that large populations of older people living in coastal communities in their retirement may be disproportionately affected by climate change induced extreme weather events. This is likely to impact on health and social care provision.

Coastal erosion in the east of England is expected to increase, partly because of sea level rise. In particular, parts of the coast that are composed of low-lying and soft sediments will be most vulnerable including exposed locations and estuaries. A report on the impacts of climate change on disadvantaged UK coastal communities[75] identified the coastlines of Yorkshire and Lincolnshire and East Anglia as particular "hotspots" where it is expected that future sea level rise will be particularly rapid or have greatest impact.

Over 100,000 hectares of land around the Humber Estuary are at risk of flooding due to storm surge in the North Sea. 15 per cent of this land contains homes for around 400,000 people as well as key infrastructure including ports, power stations and refineries. Hull and Grimsby are identified as particularly vulnerable, as well as, other smaller settlement. Within the Hull and Humber Ports City Region nearly 197,000 properties are at risk from flooding with 32.3 per cent on the north bank and 22.1 per cent on the south bank at a moderate or significant risk of flooding[76]. Plans are in place to ensure effective protection for 99 per cent of the population with the 1 per cent representing people living in sparsely populated areas where protection may not be effective[77].

Across the Hull city region it is anticipated that winter rainfall will increase by around 16 to 17 per cent. The floods in the summer of 2007, which was as a result from heavy rainfall run-off from the land overwhelmed the north bank drainage system and affected 8,600 households[78].

Norfolk is ranked 10th out or 149 lead local flood authority areas (LLFA) for being at risk of flooding. 37,991 properties are at risk of surface water flooding, 15,975 properties at risk of fluvial flooding and 46,121 properties at risk from tidal flooding. Flood management in Norfolk is difficult due to the county's size, the number of dispersed communities and the significant number of areas at risk from both fluvial and tidal flooding. The entire length of North Norfolk's coast line is at risk of either cliff erosion or from tidal flooding. Furthermore, much of the area around the rivers Ant, Bure and Thurne and their associated broads are at risk of either river or tidal flooding.

North Norfolk is at significant risk of flooding along its northern coast between the borough of King's Lynn and West Norfolk and Kelling Hard, on its eastern coast

---

[74] Impacts of climate change on disadvantaged UK coastal communities, Joseph Rowntree Foundation, March 2011
[75] Impacts of climate change on disadvantaged UK coastal communities, Joseph Rowntree Foundation, March 2011
[76] Progress in the Hull and Humber Ports City Region, Statistical Update – March 2010
[77] Hull and Humber Ports City Region, Economic Assessment – March 2010, Humber Economic Partnership
[78] Progress in the Hull and Humber Ports City Region, Statistical Update – March 2010

between Bacton and Walcott and between Cart Gap to its border with Great Yarmouth Borough[79] [80].

Climate change will present both opportunities and threats to communities adjacent to the plan area. Negative impacts may include increased pressure on water resources, increased risk of coastal flooding while positive impacts may include increased demand for leisure and tourism facilities. Uncertain impacts include potential challenges and opportunities for agriculture production[81].

Rural communities

Over 85 per cent of England is classified as rural[82] and over 19 per cent of England's population live in rural areas. Rural areas are often some of the least affordable places to live in the country with the lowest house prices in rural areas around 7.6 times the lowest annual earnings. This compares with 6.7 times in urban areas.

The Coastal Typologies study[83] identifies large concentrations of working countryside settlement types in the Fens including Outwell, Terrington St. Clement and Long Sutton. These working countryside areas are typified by lower skill occupations including manufacturing, construction, and retail. Though they are characterised as having lower average levels of deprivation, they have significantly longer travel times to key services and are particularly reliant on cars for travel. Aldeburgh and Soutwold are identified as "rural chic areas" which, though comparable in other ways to "working countryside areas", differ in their generally greater prosperity levels and lower proportion of people receiving benefits relating to worklessness or ill health.

Data from 2009 identified that 19 per cent of employees living in rural areas were self employed (compared to 12 per cent in urban areas), and are on average older with the average age expected to increase at a higher rate than in urban areas. In 2008 one in three rural households were off the national mains gas network and were reliant on higher cost heating fuels[84].

Many of the areas adjacent to the East Inshore plan are experiencing an aging of the population and outflow of older people from the towns to suburban and rural areas. For example, between 1991 and 2005 the population of Bottesford and Scunthorpe declined by around 8 per cent and now 50 per cent of North Lincolnshire's population lives outside Bottesford and Scunthorpe. Furthermore, the average age of rural communities is increasing at a faster rate than the urban population.

---

[79] www.norfolk.gov.uk/News/NCC094807, Accessed 27 September 2011
[80] North Norfolk District Council Sustainability Appraisal: Scoping Report, www.northnorfolk.org/ldf/documents/Scoping_Report_(Updated_Web_Version).pdf, Accessed 27 September 2011
[81] North Norfolk Core Strategy, http://consult.north-norfolk.gov.uk/portal/planning/cs/adopted_cs?pointId=2423101815681#section-2423101815681, Accessed 27 September 2011
[82] Defined as settlements with fewer than 10,000 people.
[83] Marine Management Organisation Coastal typologies: detailed method and outputs Final Report by Roger Tym & partners July 2011
[84] http://www.defra.gov.uk/rural/communities/

Tourism and recreation

The Yorkshire and Humber, Lincolnshire and East Anglia coastline provide a variety of tourist attractions and facilities. Tourism in North East Lincolnshire is centred around the resort area of Cleethorpes, although this is limited to a short season from April to August[85].

Tourism is also important along the Norfolk coastline. The North Norfolk district council restricts new caravan park developments due to concerns about flooding and rising sea levels[86].

Sea angling is practised along the length of the East of England coast. Around 93,500 households in the East of England are regularly involved in sea angling, each fishing around 16 days per year which is the highest rate within England and Wales. Sea angling is important to the regional economy with an annual value of between £54 million and £109 million, 26 charter boat operators, 660 dependent jobs and substantial expenditure by non residents (£15.8 million)[87].

Equalities

This section identifies baseline data regarding social inequalities, including in relation to protected characteristics.

Deprivation and social inequality are strongly linked, so that people who have lower level qualifications and lower status/worse paid jobs, experience higher rates of social deprivation, in terms of crime, health problems, poor quality local environment, as well as rates of poverty. Social inequalities often also relate strongly to disadvantage experienced in relation to characteristics such as disability, age or race, characteristics protected by equalities legislation.

Equalities legislation sets out to protect against unfair discrimination and to promote equal opportunities and good relations between different communities with respect to defined protected characteristics. An understanding of the social equalities context also needs to recognise social inequalities with respect to people's varying socio-economic circumstances.

Age

Aging is a population trend that is relevant to the coastal communities of the Humber, East of England and East Midlands.

The Coastal Typologies study produced on behalf of the MMO identifies areas in and around Sheringham, Halesworth, North Walsham (suburbs) Bridlington (North and Sewerby) as "silver seaside" areas, which have the highest proportion of people of

---

[85] New Horizons, A regeneration strategy for North East Lincolnshire 2006-2022, North East Lincolnshire Council

[86] Core Strategy (Preferred Options) Consultation Document, http://consult.north-norfolk.gov.uk/portal/planning/cs/cspocd?pointId=section_1323155454283, Accessed 10/10/2011

[87] Regional Fishing Plan, Final Report, June 2006, East of England Development Agency, www.insighteast.org.uk/WebDocuments/Public/approved/user_9/East_of_England_Fishing_Plan[1].pdf, Accessed 29 September 2011

pensionable age of all the typology groups, with approximately 30 per cent of the population of pensionable age on average, compared with 22 per cent across coastal areas as a whole and 20 per cent across England[88].

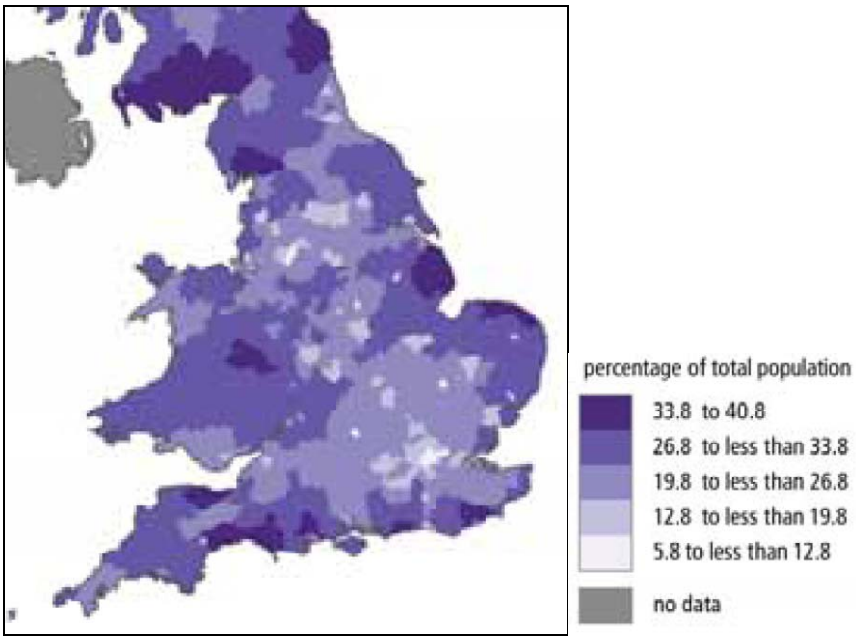


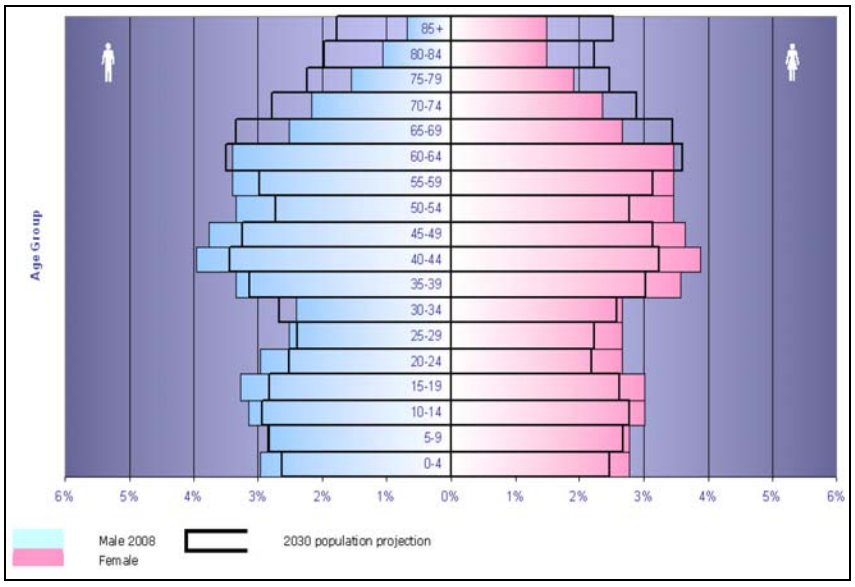
Figure 6.15: The aging of the UK population, 1992 – 2031, by local authority[89]

Aging is a significant factor in the steady population increase of the Hull and Humber Ports City Region (which includes East Riding of Yorkshire, Kingston upon Hull, North Lincolnshire and North East Lincolnshire), with the population expected to grow by 10 per cent by 2020[90]. Elderly people tend to reside in suburban areas around the edge of Kingston-upon-Hull city. Traditionally there has been a trend for older people from South and West Yorkshire choosing to retire to the East Riding of Yorkshire coastline[91].

Similarly people of pensionable age have accounted for nearly all the population growth in North Lincolnshire since 1991. That said, average growth in the area was just over 4 per cent since 1991, compared with 7 per cent on average nationally. Since 1991 the child (under 16) population has declined by 6 per cent, whereas the over 65 or over 60 group has increased by 21 per cent. By 2015 the population is expected to grow by around 7 per cent of which at least half will be by people aged over 50. It is anticipated that there will be nearly a 25 per cent growth in people of pensionable age in the next 25 years. By 2030 it is predicted that 40 per cent of the resident population will be aged over 50.

[88] Marine Management Organisation Coastal typologies: detailed method and outputs Final Report by Roger Tym & Partners July 2011
[89] 4.6.5 Impacts of climate change on disadvantaged UK coastal communities, Joseph Rowntree Foundation, (March 2011)
[90] Progress in Hull and Humber Ports City Region (March 2010), Hwww.yorkshirefutures.com/progress-region/hull-humber-ports-city-regionH, accessed September 2011
[91] Hull and Humber Ports City Region, Economic Assessment – March 2010, Humber Economic Partnership

Table 6.5: Population pyramid for North Lincolnshire 2008 compared to 2030[92]



As in other parts of the region, there is a tendency for residents to move out of the towns to rural areas. In the ten years between 1991 and 2001 the population of the Wolds parishes increased by 10 per cent, while the population of some wards in Grimsby declined by nearly 11 per cent during this time.

It is anticipated that the population of Suffolk will grow by nearly 10 per cent by 2021 of which over 13 per cent is expected in Suffolk Coastal District. The age structure is expected to change with a reduction in the number of children and significant increase in the number of people aged 65 and over[93].

North Norfolk has a high proportion of people of retiring age and above (over 65) making up over 25 per cent of the population compared to 20 per cent in Norfolk and 16 per cent in England and Wales[94].

Great Yarmouth's population is older than that of East of England and England and its mean age is approximately equal to the rest of Norfolk. More than 20 per cent of people in Great Yarmouth are over the age of 65[95].

Another significant trend affecting North East Lincolnshire and North Norfolk is outward migration of young adults. North Norfolk struggles to retain young people or

---

[92] North Lincolnshire Health & Well Being Strategy 2009-2011
[93] Sustainability Appraisal of Core Strategy and Development Management Policies, June 2010
[94] North Norfolk District Council Sustainability appraisal: Scoping Report, www.northnorfolk.org/ldf/documents/Scoping_Report_(Updated_Web_Version).pdf?bcsi_scan_AB11CAA0E2721250=1&bcsi_scan_E956BCBE8ADBC89F=0&bcsi_scan_filename=Scoping_Report_(Updated_Web_Version).pdf, Accessed 27 September 2011
[95] Great Yarmouth Borough Council Local Development Framework Sustainability Appraisal: Scoping Report 2006, www.great-yarmouth.gov.uk/ldf-sa-scoping-report-part1.pdf?bcsi_scan_E956BCBE8ADBC89F=1&bcsi_scan_AB11CAA0E2721250=0&bcsi_scan_filename=ldf-sa-scoping-report-part1.pdf, Accessed 27 September 2011

attract them to the area, with no higher education institutions and limited graduate or vocational opportunities.

Disability

The Index of Deprivation – health and disability provides a measure for identifying geographical areas where illness and disability is a significant factor affecting people's ability to work and their quality of life.

In 2001 nearly 20 per cent of North Lincolnshire residents said they had a long term illness or disability. This is higher than the national average but the population, on average is older[96]. Rates of limiting long term illness increase with age.

Gender reassignment

Limited data is available regarding the numbers of people undergoing gender reassignment at any one time. Numbers are likely to be small, although it is reported by the Equality and Human Rights Commission that the numbers of people who have undergone gender reassignment surgery in the last ten years has increased[97].

Pregnancy and maternity

Health data records identify areas of above average teenage pregnancy rates. The marine plan has some potential to indirectly impact on these rates, by improving economic opportunities and reducing deprivation. However, the marine plan has limited potential to measurably impact on discrimination and equal treatment of pregnant women or breastfeeding mothers.

Race

Equalities legislation addresses equal opportunities, discrimination and relations between different racial and ethnic groups.

Based on Office for National Statistics (ONS) 2001 data, nearly 96 per cent of Suffolk Coastal population was white British compared to the wider Suffolk figure of just under 94 per cent. Less than 0.5 per cent were Asian, 0.25 per cent was Black and 0.35 per cent were Chinese.[98]

Hull and Humber Ports City Region (which includes East Riding of Yorkshire, Kingston upon Hull, North Lincolnshire and North East Lincolnshire) is one of four functional sub-regions in the Yorkshire and Humber region. It has a population of approximately 912,000 (2008) with ethnic minorities of 1.8 per cent in (2001)[99].

In North Lincolnshire the 2001 census identified that 3.96 per cent of the local population was from black and minority ethnic (BME) communities compared to 8 per cent nationally. This is not expected to have altered significantly since the data was collected. These communities were identified to have a younger age profile than the white population and were concentrated in the poorer areas of Scunthorpe. North Lincolnshire also has a significant Eastern European population including Polish,

---

[96] North Lincolnshire Health & Well Being Strategy 2009-2011
[97] www.equalityhumanrights.com, Accessed on 12/04/11
[98] Sustainability Appraisal of Core Strategy and Development Management Policies, June 2010
[99] Progress in the Hull and Humber Ports City Region, Statistical Update – March 2010

Lithuanian and Latvian residents[100]. Higher rates of unemployment affect BME populations as compared with overall unemployment rates.

In North East Lincolnshire BME communities represent less than 2 per cent of the population compared with 7 per cent in the region and 9 per cent across England as a whole[101]. The BME community is diverse and relatively evenly distributed across rural and urban communities. The area also has a large population of white European migrants from Germany and Denmark.

West Norfolk is experiencing an increasing mix of cultures and nationalities and is proving an attractive place from migrant workers[102]. Migrant workers from central and eastern European countries that joined the EU in 2004 (A8 countries) as well as from Bulgaria and Romania that joined the EU in 2007 (A2 countries comprise a significant proportion of the cultural diversity of the East coast population. A8 nationals previously had restrictions on their rights to work and were required to register under the Worker Registration Scheme, but since 1 May 2011 A8 nationals now have the same rights as other workers from the EU and EEA. A2 nationals will continue to face restrictions on their rights to work until January 2012. They face particular vulnerabilities in terms of housing, employment conditions as well as economic and social inclusion. Large numbers of migrants in local communities have also posed challenges for policing and education services, as well as for community cohesion[103].

Ethnic Gypsy and Traveller groups are recognised as racial groups for the purposes of equalities legislation. Accommodation shortages have been identified as at the crux of social exclusion, inequality and deprivation experienced amongst Gypsy and Traveller communities. It has proved difficult to identify and progress sites for new provision, largely due to resistance by local settled communities. The East of England is home to a large number of Gypsies and Travellers, with a caravans of 1,803 in the region. Yorkshire and Humber has a capacity for 1,043 caravans whilst in the East Midlands there is a capacity for 495 pitches, of which 161 are in Lincolnshire[104]. There remains a significant shortfall of authorised accommodation provision for Gypsies and Travellers in the East of England, which has the largest number of caravans on non-authorised sites, despite this region having made the most significant recent increases in provision.

Religion or belief

In North East Lincolnshire the vast majority of residents describe themselves as Christian, however, many other faith communities are represented including Muslims, Jews, Sikhs and Buddhists. It is likely that migrant labours from central and

---

[100] North Lincolnshire Health & Well Being Strategy 2009 – 2011
[101] New Horizons, A regeneration strategy for North East Lincolnshire 2006-2022, North East Lincolnshire Council
[102] West Norfolk's Sustainable Community Strategy, Tackling Important Local Issues 2007-2030, www.west-norfolk.gov.uk/pdf/Community%20Strategy%2017th%20Jan%202008.pdf, accessed 27 September 2011
[103] The UK's new Europeans: Progress and challenges five years after accession 2009 www.equalityhumanrights.com/uploaded_files/new_europeans.pdf, accessed 13/10/2011
[104] www.communities.gov.uk/publications/corporate/statistics/caravancountjan2011, www.guardian.co.uk/news/datablog/2011/jun/29/gypsy-sites-england-local-authority

Eastern Europe, who migrated to the UK after the 2001 Census, contribute to an increased diversity of religions, including increased Catholic numbers.

Sex (gender)

Gender pay differences, segregation within the labour market and the different patterns of working between men and women are important dimensions to consider with respect to equal opportunities for men and women. Gender pay differences identify the percentage difference in median hourly earnings of men and women.

Nationally, there is a difference in the proportion of male and female employees who worked full- and part-time. For male employees, 88 per cent worked full-time and 12 per cent worked part-time, while the comparable figures for female employees were 58 per cent and 42 per cent respectively. This highlights the fact that women work part-time more than men and consequently are more likely to receive lower hourly rates of pay.

For full-time employees, the gender pay difference in the East Midlands was 14.1 per cent, which is the second highest after the South East. In the East the gender pay difference was 12.2 per cent, above the overall UK rate of 10.2 per cent. The full time gender pay gap is less marked at 8.7 per cent in Yorkshire and Humber[105].

The pay gap between part time and full time median hourly earnings is very marked in the East of England (-8.0), whereas in Yorkshire and Humber (-4.5) it is more in line with the national average (-4.0), whilst in the East Midlands, there is a positive pay gap of 0.8.

Sexual orientation

There is no reliable information available nationally on numbers of lesbian, gay and bisexual people[106].

Marriage and civil partnership

Legal protections with regard to marriage and civil partnership status are limited to preventing unfair discrimination on these grounds. It is considered unlikely that the Plans will have a significant impact on existing patterns of marriage and civil partnership or in relation to discrimination experienced on these grounds.

What would the situation be without the plan?

The current economic uncertainty makes it extremely hard to predict changes in the community cohesion, health, social inequality and deprivation, though recent trends of growing unemployment are not encouraging in the short term. Likewise, the introduction and implementation of revised government policy, for example welfare reform may alter the situation.

The social impacts are likely to be closely associated with the economic situation. The economics section envisages growth in the marine economy, though certain

---

[105] ONS 2010: Statistical Bulletin: Annual Survey of Hours and Earnings 2010
[106] www.equalityhumanrights.com/uploaded_files/research/research__37__estimatinglgbpop.pdf, Accessed 12/10/2011

constraints are identified. Economic changes are may have some indirect influence on deprivation, health, equality and community cohesion.

Current trends of growing unemployment noted within certain coastal communities are likely to continue, with slow national growth projected over the short term, although future increased economic growth and a reduction in the national deficit could see a reverse towards increased employment.

Without the plan, economic investment in enterprise zones and other ongoing regeneration projects are likely to give rise to some increases in employment. New employment creation may address existing income and employment deprivation in those areas, depending on the skill levels of newly created jobs and the degree of investment in addressing existing skill gaps in the local population.

Trends of a growing ageing population will continue, placing a potentially increasing burden on health services and making older people living in coastal communities potentially more vulnerable to the consequences of climate change. It is likely that outflows of young people will also continue.

Child poverty rates and wider income deprivation are likely to remain static or potentially worsen as a result of cuts to benefits and services, as well as due to the effects of inflation on cost of living, though certain government measures, such as more targeting of benefits may lessen this.

Improvements in health may be achieved as a result of wider national policy or local projects to address existing health deprivation. However, current forecasts of slow economic growth suggest that these improvements may be slowed or potentially reversed.

The population and situation of A2 and A8 migrant workers is likely to continue to fluctuate according to the economic situation in the UK and the EU. Current uncertainties regarding the Euro make it hard to predict trends in migrant flows. With the ending of restrictions on their right to work in the UK, migrants who continue to reside in the areas adjoining the Plan area are likely to steadily become more integrated into local communities. Accommodation provision for Gypsies and Travellers may increase in the area following implementation of the Localism Bill, which incentivises local authorities to make new provision, although it may prove that the scrapping of targets set in the regional spatial strategies and increased local decision making makes approvals for new sites harder to achieve.

An erosion of 'way of life' associated with declining fishing communities in terms of historic connections and family ties with the fishing industry may be diminishing.

What are the issues and opportunities?

Issues

- Social impacts relate to individuals, households and communities. While area-based deprivation data can provide a useful sense of potential issues, not all people living in the areas will experience the same opportunities or disadvantages.
- A very wide range of other policies and initiatives influence community, health and equality. This makes it difficult to identify and judge the significance of marine plan policy on the existing situation.
- A variety of regeneration initiatives are taking place or are planned within the area, some of which are directly related to expected investment in inshore and offshore waters. The appraisal will need to consider how the Plans will contribute to and reinforce these.
- To enhance the confidence of industry to invest in deprived areas. Lack of clarity in terms of investment conditions has the potential to drive investment to other parts of the world.
- A further consideration will be how effectively this investment is likely to bring about changes that impact on existing unfavourable conditions which shape social and health inequalities.
- Poor health and deprivation are significant factors that the Plan needs to address, both through employment creation. Marine planning may also indirectly influence improvements to the living environment, although land-based policies are likely to be more significant in driving such improvements.
- Existing economic deprivation, including income inequalities, increasing unemployment, low educational attainment and skills levels may hamper efforts to share the potential economic benefits in order to tackle existing social and health inequalities.
- Coastal communities adjacent to the East Inshore plan area include towns which are amongst the 10 per cent most deprived communities in England. The Typology identifies that the area includes many towns and cities that have lost their primary markets and are facing challenges to identify new ones. Amongst these, fishing has declined as a significant contributor to employment and economy, though it retains social and heritage value.
- Many coastal communities comprise sizeable or growing numbers of older people with significant care needs. This places an increased demand on health and social care services. Increasing likelihood of more frequent and more severe extreme weather events and coastal flood risk due to climate change may mean health, social care and emergency services lack the resilience to cope with demands when a major flood or other extreme weather event occurs.
- Tourism and recreation have some existing importance which can be important in contributing to social wellbeing and health, which the plan may be able to enhance.
- While the region has a relatively small BME population, A2 and A8 migrant populations as well as Gypsy and Traveller populations experience particular vulnerabilities which will require consideration, including with respect to employment creation. Local authority decision making about land use with respect to marine plan-related activities may affect opportunities for identifying new sites for Gypsies and Travellers along the coastal strip. land allocations.

- Existing gender pay gaps and part time pay gaps are very wide in the East Midlands and East of England.

Opportunities

- The marine plans provide an opportunity to direct investment towards areas of deprivation, potentially to help improve the quality of the living environment and opportunities, in order to tackle causes of social and health inequality and poor community cohesion.
- Opportunities to create new employment, including jobs at a variety of levels, and to drive an increased emphasis on education, skills and training so that disadvantaged groups living in the area are able to share in the benefits of investment.
- Potential to provide opportunities which enable young people to remain in or be drawn to the region.
- Potential opportunities to strengthen tourism and leisure provision, with benefits for healthy living and community cohesion.
- Potential opportunities to mitigate climate change impacts for coastal communities and enhance resilience of towns with significant ageing populations.
- Potential opportunities to strengthen community involvement in how investment is allocated in cities, towns and other coastal communities near land hubs associated with marine activities.

Are there any data gaps?

There are currently a number of data gaps including:

- Certain equality characteristics due to a lack of available data nationally, particularly for protected characteristics that have only recently gained increased protection (sexual orientation, gender reassignment). Disability indicators also remain somewhat restricted, focusing on Census 2001 limiting long term illness & disability-related benefits claimants, which do not correspond well to a social definition of disability, as is used in The Equality Act 2010.
- Data collected relates to population-level data within spatial areas. However, a wide variety of non-spatial determinants affect the circumstances of individuals and households and it may prove difficult to identify measurable change attributable to spatial plan-led initiatives.

6.3 Cultural heritage

Introduction

The Marine Policy Statement (MPS) states that,

> "The historic environment includes the aspects of the environment resulting from the interaction between people and places through time, including all surviving physical remains of past human activity, whether visible, buried or submerged. Those elements of the historic environment – buildings, monuments, sites or landscapes – that have been positively identified as

holding a degree of significance[107] meriting consideration are called 'heritage assets"[108].

As an island nation, the history of the lands now comprising the UK is inextricably linked with the sea, comprising a range of maritime (such as seafaring) remains and those associated with coastal settlement, as well as remains of former terrestrial landscapes and their inhabitants, submerged following historic sea-level rise. Discovery of archaeological remains improves knowledge and understanding of human and societal development, and of the palaeo-environmental conditions prevailing before, during and after settlement of the British Isles. The East of England marine plan areas have particular interest given their inclusion of continental shelf regions which were once exposed above water between the British Isles and mainland Europe during glacial periods and for being the scene of considerable wartime activity both at sea and in the air.

The marine heritage resource is relatively unknown by comparison with the terrestrial record, but is equally threatened by natural and anthropogenic influences. Development in coastal areas, offshore energy projects, pipelines, dredging and fishing may all have a detrimental impact on the marine and coastal heritage resource.

The principal focus of maritime archaeology in the UK has in the past been that of shipwreck, however the archaeological resource in UK territorial waters (particularly those of the North Sea region) and the wider continental shelf is much more diverse and includes submerged landscapes, settlements of past cultures and military aircraft[109]. The current legislation regarding the protection of archaeological remains comprises of international and national law.

English Heritage is the body responsible for archaeology and the built environment which extends to offshore areas within the 12 nautical mile territorial limit, outside of which UK jurisdiction applies. English Heritage may maintain an interest in, or be asked to offer advice concerning, any matters outside the 12 nautical mile limit.

Cultural heritage is not restricted to physical features but also applies to socio-cultural associations with particular areas that contribute to a sense of place. This can be important for coastal communities which have strong historical connections with, for example, industrial heritage such as fishing, shipbuilding and trade. These connections can be important for promoting tourism or for attracting new investment by capitalising on local knowledge and traditions. This topic is also linked to the population, economy, human health and landscape and seascape topics. Whilst some consideration is given to Heritage Coast in this section, its implications for landscape and seascape are dealt with in section 6.7 of this document.

---

[107] Significance is the value of a heritage asset to this and future generations because of its heritage interests.
[108] Defra (2010). UK Marine Policy Statement. TSO, London.
[109] Roberts P & Trow S (2002). Taking to the Water: English Heritage's Initial Policy for the Management of Maritime Archaeology in England. English Heritage, London, p27.

What is the link between the plan and this topic?

The activities covered in the marine plans may have both direct and indirect effects upon marine cultural heritage. For example, direct effects may include direct loss or disturbance of features through activities such as dredging for example or indirectly through marine development that may affect the setting of coastal heritage features. The marine plans will be drafted in accordance with the provisions of the MPS with regard to the protection of heritage assets.

What is the policy context?

Table 6.6 summarises the key elements of the marine cultural heritage context, from which it becomes possible to gain a better understanding of the issues. Following the table is a short discussion that seeks to highlight some of the most pertinent messages.

Table 6.6 Other relevant plans, initiatives and environmental protection objectives

International
UNESCO Convention Concerning the Protection of the World Cultural and Natural Heritage (1972)
UNESCO Convention on the Protection of Underwater Cultural Heritage 2001
UNCLOS United Nations Convention on the Law of the Sea 1982
Europe
European Convention on the Protection of the Archaeological Heritage 1992
Council of Europe European Landscape Convention 2000
North Sea Prehistory Research and Management Framework 2009
National
Legal instruments
Protection of Wrecks Act 1973
Ancient Monuments and Archaeological Areas Act 1979
Protection of Military Remains Act 1986
Treasure Act 1996
Planning (Listed Buildings and Conservation Areas) Act 1990
National Heritage Act of May 2002
UK Marine and Coastal Access Act 2009
Policy and guidance The Government's Statement On The Historic Environment For England 2010 Marine Policy Statement (Defra 2011)
National Policy Statements on Energy 1-5 and Nuclear Power Generation EN-6 (DECC, 2011)
English Heritage: National Heritage Protection Plan 2011-2015
English Heritage: Climate Change and the Historic Environment (2008)
English Heritage: Conservation Principles, Policies and Guidance for Sustainable Management of the Historic Environment (2008)
English Heritage Coastal Estate Risk Assessment 2011
Planning Circular 07/09: Protection of World Heritage Sites
Maritime and Marine Historic Environment Research Framework – final report to be

published summer 2012.
Scheduled Monuments: Identifying, protecting, conserving and investigating nationally important archaeological sites under the Ancient Monuments and Archaeological Areas Act 1979 (2010)
Planning Policy Statement (PPS) 5: Planning for the Historic Environment **Note that the Draft National Planning Policy Framework is currently out for consultation and would replace PPS5.**
PPS 5 Planning for the Historic Environment: Historic Environment Planning Practice Guide (English Heritage, 2009)
Military Aircraft Crash Sites (English Heritage 2002)
Coastal Defence and the Historic Environment (English Heritage 2003)
Ports: the impact of development on the maritime historic environment (English Heritage 2006)
Shoreline Management Plan review and the historic environment (English Heritage 2006)
Regeneration in Coastal Towns (English Heritage 2007)
Strategic Environmental Assessment, Sustainability Appraisal and the Historic Environment (English Heritage 2010)
Seeing History in the View (English Heritage 2011)
The Setting of Historic Assets (English Heritage 2011)
Local
National Mapping Programme Report for the Yorkshire Coast Rapid Coastal Zone Assessment
National Mapping Programme Report for Lincolnshire
National Mapping Programme Report for the Norfolk Coast and Broads
National Mapping Programme Report for the Suffolk Coast
North York Moors National Park Authority North Yorkshire And Cleveland Heritage Coast Strategy 2008-2013

The **European Convention on the Protection of the Archaeological Heritage**, or **Valetta Convention**, came into force in 2001 and seeks to protect archaeological heritage which includes, "structures, constructions, groups of buildings, developed sites, moveable objects, monuments of other kinds as well as their context, whether situated on land or under water". English Heritage has commissioned a project to examine how best to incorporate the objectives of the convention into marine planning to support the drafting of historic environment policies. The outputs, due in November 2012 will prove useful to the ongoing development of the marine plans. Many of the principles of the document mirror the approach of the **UNESCO Convention on the Protection of Underwater Cultural Heritage**, for example, **in situ** preservation and mandatory reporting of findings. In addition, an integrated approach to planning policies is required to ensure that archaeological concerns are raised during development planning and in environmental impact assessment (Art. 5). The convention also introduces themes of methodical scientific study and information dissemination amongst others.

The North Sea Prehistory Research and Management Framework (NSPRMF) 2009, is the first transnational framework designed to instigate large-sale study of the archaeology which lies beneath the southern North Sea. It is intended to facilitate

information gathering and where possible preservation of the marine heritage in the area.

Unless the UN Convention is properly ratified, the protection of shipwrecks in UK territorial waters will continue to be covered by the **Protection of Wrecks Act (PWA) 1973** although this only has remit within territorial waters, administered in England by English Heritage. Wrecks or wreck sites may be considered to merit designation if they contribute to the understanding of the past on account of their historical, archaeological or artistic importance. Restricted areas may include part of the surrounding seabed deemed necessary to secure protection of the wreck. Designation of wrecks and submerged prehistoric sites is also possible under the **Ancient Monuments and Archaeological Areas Act 1979**. The **Marine and Coastal Access Act 2009** provides for consideration of the social consequences of marine conservation zone (MCZ) designation with social consequences defined as inclusive of any sites in that area which are of historic or archaeological interest. **The Marine Policy Statement 2011** identifies that many coastal heritage assets are not afforded statutory protection. However, it states, "The absence of designation for such assets does not necessarily indicate lower significance and the marine plan authority should consider them subject to the same policy principles as designated heritage assets (including those outlined) based on information and advice from the relevant regulator and advisors".

Submerged military sites on or in the seabed may be protected by the **Protection of Military Remains Act (1986)**. The act seeks to designate any vessel or aircraft (as a protected place or designated control area) which appears to have become sunk or stranded while in military service whether before or after the passing of the act. Vessel designations are restricted to those sunk after 4 August 1914, while controlled sites have a maximum age of 200 years. A designation of protected place can be given to any named vessel even if its geographical location is not known. This act has the principal concern of protecting the sanctity of military vessels and aircraft which are military maritime graves. Note, such vessels do not have to be historic per se.

In England, the **National Heritage Act of May 2002** has given English Heritage responsibility for maritime archaeology out to the extent of the 12 nautical mile territorial limit. However, for the area of UK controlled waters adjacent to England, not subject to the responsibility of any devolved administration, English Heritage, when requested, provides advice to competent authorities under EU directives on Strategic Environmental Assessment (2001/42/EC) and Environmental Impact Assessment (85/337/EEC, as amended) both of which require assessment of cultural heritage. In reference to non SEA and EIA developments or other projects, English Heritage through the National Heritage Act 1983 (as amended by the National Heritage Act 2002), may offer advice about foreign monuments, with the term ‘monument’ described as per the Ancient Monument and Archaeological Areas Act 1979. Any advice English Heritage offers, including any marine development licensing procedures (as provided for under the Marine and Coastal Access Act 2009) is spatially limited to the area of UK Controlled Waters adjacent to England.

English Heritage's **National Heritage Protection Plan 2011-2015**, builds on the principle at the heart of **PPS5**, the Plan is focused on understanding and articulating the significance of the historic environment, as the key to its informed and effective protection and management. The plan will identify an integrated and holistic suite of activities, which English Heritage hope will enable joined-up and co-ordinated work across the sector in a way that has not been done before.

The **National Planning Policy Framework (NPPF)** is currently undergoing consultation. This document seeks to greatly simplify the current guidance on planning policy. The Government's objectives for planning for the historic environment[110] are to:

- conserve heritage assets in a manner appropriate to their significance; and
- contribute to our knowledge and understanding of our past by capturing evidence from the historic environment and making this publicly available, particularly where a heritage asset is to be lost.

All of the documents have the overarching objective of protecting, conserving and enhancing the archaeological and cultural heritage resources throughout the UK. The series of European Conventions highlight the importance of protecting such resources for reasons of collective memory but also for historical and scientific study. Across the UK, legislation, planning guidance and more specific heritage-related guidance has been prepared which seeks to ensure that issues related to the protection of the historic environment are appropriately considered in the planning system.

Implications for sustainability appraisal and marine plan

The marine plan will be used by the MMO when considering the potential impacts of development applications, many of which will require to be assessed with regards to their impact on heritage assets. It will be important in the drafting of the marine plan, and at the project level, to account for the degree of change in heritage assets that certain developments may represent. Given the future trajectory for certain industries, the potential future cumulative impacts could also be a consideration of the plan.

What is the baseline situation?

For much of the Pleistocene period (1.8 million to 10,000 years before present (BP)) glaciations made most of the UK uninhabitable. Sea levels were substantially lower during glacial periods, with the North Sea approximately 120 metres lower than at present during the Last Glacial Maximum (LGM) at approximately 18,000 BP, exposing much of the continental shelf to the east, and south of 53°N[111]. This area provided a migration route from continental Europe to the present UK, and land for

[110] The principles and policies set out in this section apply to the heritage-related consent regimes for which planning authorities are responsible under the Planning (Listed Buildings and Conservation Areas) Act 1990, as well as to plan-making and development management decisions.
[111] Flemming NC (2004a). The scope of Strategic Environmental Assessment of North Sea SEA5 in regard to prehistoric archaeological remains. Technical Report to the DTI, p42.

subsistence and settlement for early Hominids – the so called Doggerland[112] [113]. Most finds in UK waters are of late-glacial to early-Holocene age (12 to 11,000 BP). The primary focus of much research has been the Mesolithic to Bronze Age eras, which are relatively recent and may only be covered in shallow Holocene deposits. As sea-levels rose, sites would have been inundated and in many places destroyed depending on local conditions, topography, sedimentary conditions and the energy of the environment.

The strategic importance of the sea, a long history of fishing for food, the importance of maritime trade routes and the treacherous nature of many inshore waters, has lead to a large number of shipwrecks in UK waters, although information on the number, type and location of these is limited. The UK Hydrographic Office maintains a register of wreck locations (the Wrecks Database), containing some 70,000 records, of which approximately 20,000 are named vessels. Few of these sites have had their condition or archaeological provenance assessed. The record for wreck sites is biased towards those from the post-Medieval and later periods, presumably a function of greater traffic and increased reporting associated with the introduction of marine insurance and the Lloyds of London shipping list of casualties in 1741. Information regarding some wrecks may also be related to their historical importance for navigational safety.

In addition, it must be considered that there is the potential for substantial aircraft remains (primarily World War II) to be found on the seabed both within and outside the 12 nautical mile limit (that is within both the East Inshore and East Offshore areas). Although the overwhelming concentration of losses is in the period between 1939 and 1945, aircraft losses at sea span the entire period of aviation history from the early 20th century to very recent losses. The east coast of England was also scene to extensive World War II coastal defence activity. Whilst many features have long-since been removed, important remnants remain within the coastal zone such as pill boxes and anti-tank defences.

The coastal zone also contains a large number of statutory heritage features including listed structures, scheduled ancient monuments and registered historic parks and gardens.

Historic seascape characterisation maps an understanding of the cultural processes shaping the present landscape in coastal and marine areas. It extends principles of historic landscape characterisation to the rich and varied heritage in, on and beneath our seas and along the coast. A nationally-applicable method was finalised in March 2008. That method has now been implemented in a number of locations (see below). It is proposed that the publicly available outputs of this study will be used to inform the SA process and assessment in this and/or the landscape and seascape chapters as appropriate.

---

[112] Coles BJ (1998). Doggerland: a speculative survey. Proceedings of the Prehistoric Society 64: pp45-81.

[113] Gaffney V, Thomson K & Fitch S (2007). Mapping Doggerland: The Mesolithic Landscapes of the Southern North Sea. Institute of Archaeology and Antiquity, University of Birmingham. Archaeopress, Oxford p131.

Coastal features

The intertidal zone within this marine plan area contains a very large number of archaeological sites ranging from Middle Palaeolithic to post-medieval finds. Many of these have become visible due to erosion in the coastal zone. Similarly, sites are also continuing to be lost to erosion in the form of cliff retreat or soft-sediment erosion.

Coastal Palaeolithic sites are relatively rare in England making finds in this area particularly important. Late Upper Palaeolithic occupation sites such as Titchwell[114] are good examples of these. More recent discoveries have also been made in the coastal zone of Norfolk and Suffolk. A number of sites have been discovered and excavated by the British Museum at Happisburgh, Norfolk in recent years[115], revealing glacial and interglacial deposits in addition to human tools and butchered animal bone. Early sites have also been discovered at Pakefield in Suffolk, both as a result of the eroding coastline. These discoveries have suggested the earliest known date of human occupation of Britain and Northwestern Europe at least 200,000 years earlier than previously thought to 700,000 BP. Latest excavations may indicate that this may be pushed back even further to approximately 950,000 BP[116]. Several sites are known at Happisburgh. Site 1 is at least 500,000 years ago, clearly older than the Anglian glaciation. Site 3 is between 700,000 and 950,000 years old, containing the oldest evidence of human occupation of northern Europe at a time when the climate was similar to today[117].

Coastal cliffs in Suffolk have provided significant exposures containing Palaeolithic material, notably the Dunwich cliffs[118]. Other areas of the East Anglian coastline are acknowledged as having significant archaeological potential although little in the way of prehistoric finds have been made (Palaeolithic and Mesolithic age). Submerged forests and coastal peat deposits may contain valuable evidence of later Mesolithic cultures including, for example in the Fenlands and Humber Estuary. Such evidence may be useful in evaluating the transition of these peoples to agriculture[119].

Neolithic material has been recovered from the coastal areas of East Anglia, from The Tweed to Flamborough Head (such as Withow Gap, Skipsea) and the Suffolk coast (such as Freston, Kessingland). A high concentration of Neolithic axes has also been found in the North Norfolk area with further finds at Flamborough head in the form of knives and arrowheads[120]. The highly eroding coastline between Flamborough Head and Spurn Head has revealed a substantial array of prehistoric

---

[114] Fulford M, Champion T & Long A Eds (1997). England's Coastal Heritage: A survey for English Heritage and the RCHME. English Heritage Archaeological Report 15. English Heritage, London p268.
[115] Parfitt et al., 2010. Early Pleistocene human occupation at the edge of the boreal zone in northwest Europe. Nature,466: pp229-233
[116] (http://www.ahobproject.org/Happisburgh.php)
[117] Scoping Response from Norfolk County Council January 2012
[118] Good C & Plouviez J (2007). Archaeological Service Report: The Archaeology of the Suffolk Coast. Suffolk County Council, p74.
[119] Good C & Plouviez J (2007). Archaeological Service Report: The Archaeology of the Suffolk Coast. Suffolk County Council, p74.
[120] Bradley RJ, Fulford MG & Tyson (1997). The archaeological resource: regional review. In: M Fulford, T Champion & A Long Eds. England's Coastal Heritage: A survey for English Heritage and the RCHME. English Heritage Archaeological Report 15. English Heritage, London pp154-178.

artefacts, including a Neolithic polished axe at Grimston Garthe and at Withernsea. Assuming coastal retreat has been the same for millennia, many kilometres of coast will have been lost, and Mesolithic, Neolithic and historic material are presumably scattered on the seabed.

Evidence of Bronze Age cultures are numerous (notably Felixstowe and Shotley peninsulas) although often difficult to date accurately. Many sites survive on the Suffolk coast in sandy areas which remain undisturbed by agriculture. A significant number of finds has been made at Holme Beach near Holme-next-the-sea, Old Hunstanton, Norfolk. Of particular note is a large timber circle surrounding an upturned oak trunk constructed within the saltmarsh. This site, known as Holme I, or Seahenge, has been dated to 2049BC. A further circle, Holme II, exists about 100 metres to the east of Holme I and may have been constructed up to two centuries earlier[121]. Other constructions in the freshwater marshes in this area include five platforms, a corduroy trackway, a post group and a possible timber-lined pit[122]. Later constructions in this area include a complex network of medieval fish traps.

A large amount of Late Iron Age and Roman materials exist including coins and metalwork. The discovery of several possible Roman villas or large farmsteads along the Norfolk coast makes a significant addition to the countywide distribution of this site-type. For the Iron Age and Roman period extensive swathes of field systems, trackways and enclosures have been mapped using aerial photography across vast areas of the north East Anglia coast. On the higher ground of East Anglia, fragments of extensive prehistoric or Roman ditched field systems are visible from photographs as cropmarks.

The post-Roman period (Saxon and Medieval) is relatively poorly represented at the coast although this is not to say that the East of England coastal area was not an area of considerable activity during these periods.

The remains of more than 200 saltern mounds indicate the former presence of a major salt processing complex near King's Lynn. Most of this salt working dates to the Anglo-Saxon and medieval periods, although areas of Romano-British production are also evident. Areas of reclamation in Suffolk have revealed Roman salt production sites and features relating to post-medieval drainage. The National Mapping Programme (NMP) has used aerial photography to identify archaeological features. This means it has been possible to accurately record for the first time some of coastal area's earliest historic landscapes that are visible as cropmarks on the aerial photographs. A considerable amount of new evidence for medieval and post medieval peat extraction was identified in East Anglia. Other identified features including timber structures of varying dates were recorded along with post medieval oyster pits and a wooden fish trap in Holbrook Bay in the Stour Estuary, probably of Saxon origin[123].

---

[121] Brennand and Taylor 2003 'The Survey and Excavation of a Bronze Age Timber Circle at Holme-next-the-Sea, Norfolk, 1998-9', Proceedings of the Prehistoric Society 69, pp1-84
[122] Norfolk Environment and Archaeology Division 2003 Holme-Next-The-Sea Archaeological Project Design, Norfolk Archaeology and Environment Report (unpublished)
[123] Suffolk County Council, Suffolk Coast NMP

During the medieval period, a number of coastal settlements developed as fishing villages. Following the Norman Conquest a number of these expanded rapidly as trading ports and/or major fishing harbours.

In the 13th and 14th centuries Great Yarmouth and King's Lynn were amongst the busiest and most important ports in England. During the 14th century three quarters of all English worsted exports passed through Great Yarmouth. In the Middle Ages Lowestoft also became an increasingly important fishing town. The industry grew quickly and the town grew to challenge its neighbour Great Yarmouth. This trade, particularly fishing for herring, continued to act as the town's main identity until the 20th century. Lowestoft was also a naval base in World War One.

In Yorkshire, Kingston-Upon-Hull has been an historic market town, trading and fishing port since medieval times. It became prosperous as an industrial centre on the back of wool trading, whaling, fishing and also as a military port. Hull remains a significant gateway and industrial base on the east coast despite industrial decline in the 20th century and changes in fishing practices.

In Lincolnshire, Grimbsy has been a major fishing and trading port since medieval times, booming in the late 19th and early 20th centuries. At its peak in the 1950s, Grimbsy laid claim to be the largest fishing port in the world although has declined following the Anglo-Icelandic cod wars of the 1970s and changes in fishing policy and practice which affected the fishing industry UK-wide. Nonetheless, such towns still retain a significant historical, cultural association with fishing.

Felixstowe in Suffolk has been a significant settlement since long before medieval times and since became a stronghold of England's coastal military defences, only becoming a major port in the 1880s. In addition to shipping, the town also became a fashionable tourist resort in Victorian times following the advent of the railways. It is now one of the largest container ports in the UK.

Many east coast towns benefited from the arrival of the railways and places such as Bridlington, Cleethorpes, Skegness, Great Yarmouth and Felixstowe became popular tourist destinations in the 19th and early 20th centuries. Many have since declined as a result of the advent of cheaper foreign holidays and a change in customer preferences but still retain a strong sense of place and character associated with this past.

There are numerous 20th century defence structures on the coast dating to World War I and World War II which include tank traps and pill boxes. The Second World War in particular had a brief but dramatic impact on the Suffolk coast. Following the invasion of France in 1940, extensive coastal anti-invasion defences were rapidly constructed that stretched almost continuously along the coast. On contemporary wartime photographs it is possible to see these defences in great detail, ranging from anti-aircraft gun batteries to barbed wire barriers and individual pillboxes. Most of these defences were quickly removed once the war ended but some remnants remain today.

The East Riding of Yorkshire coastline is rich in the remains of military features from world wars I and II. Amongst the military features recorded were the anti-invasion defences at Sand le Mere near Tunstall Hall and the Easington defence sites that

consisted of anti-tank cubes, pillboxes, infantry trenches and gun emplacements. The Humber Forts are two large fortifications in the mouth of the Humber estuary. Haile Sand and Bull Sand Fort were planned in 1914 to protect the entrance to the estuary and were re-used again in World War II. Bull Sand Fort is Grade II listed.

These relatively recent features also clearly demonstrate the power of coastal erosion on the heritage resource. For example, the aerial photography shows that the gun emplacements of the Godwin Coast Artillery Battery near Kilnsea photographed in 1946 were set well back from the coastline. In 2009, the same emplacements lie fragmented on the current beach[124].

Further information on the development of the coastline during these periods can be obtained from the Historic Seascape Characterisation project work commissioned by English Heritage. To date, the following projects have been completed in the East of England area:

- Withernsea to Skegness[125]
- Newport to Clacton and adjacent waters
- Southwold to Clacton (pilot).

These resources contain a large amount of heritage and seascape data in a variety of formats. It is proposed that these are consulted on an ongoing basis as the SA and marine plans develop.

The terrestrial coastal environment contains a significant number of statutory historic sites including listed buildings, scheduled ancient monuments and registered historic parks and gardens. The locations of such features are identified in Figure 6.16.

[124] Yorkshire Coast and Humber Estuary Rapid Coastal Zone Assessment Survey (RCZAS) NMP
[125] http://archaeologydataservice.ac.uk/archives/view/ehswithern_eh_2009/

Figure 6.16: Location of historic sites at the coast

The English Heritage Coastal Estate Risk Assessment[126] identifies six properties at risk within the East of England Marine Plan areas. Four of the properties have a low or medium flood risk and no coastal erosion risk (due to their location on estuaries). Berney Arms Windmill and Landguard Fort are both at high risk of tidal flooding, as

[126] English Heritage (2011) Coastal Estate Risk Assessment

the entirety of each area of English Heritage responsibility lies within the projected flood zone 3. Despite Landguard's coastal location, the risk from coastal erosion is low, assuming that the present flood defences are maintained and continue to function efficiently. These are illustrated in Figure 6.17 below:

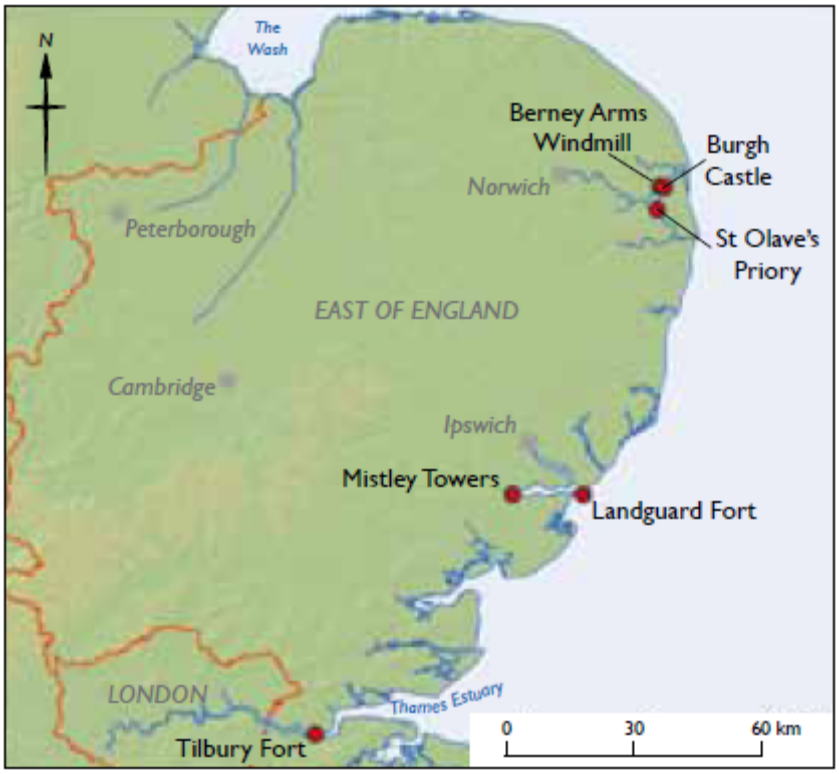


Figure 6.17: Location of English Heritage coastal estate at risk in the East of England Marine Plan Areas (English Heritage 2011)

Offshore features

Little is known about the early Holocene occupation of the southern North Sea due to very few archaeological finds having been made[127]. Figure 6.18 illustrates the hypothetical exposure of continental shelf during the Devensian Late Glacial Maximum, at its maximum extent following ice retreat and during the early Holocene.

[127] Chapman HP & Lillie MC (2002). In: NC Flemming Ed (2004). Submarine Prehistoric Archaeology of the North Sea: Research Priorities and Collaboration with Industry. Council for British Archaeology, York pp65-69.

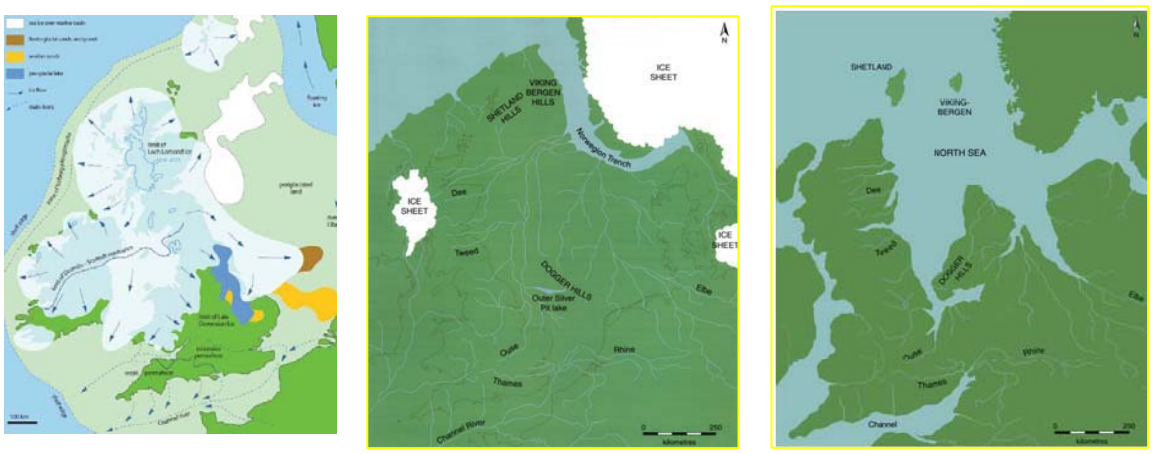


Figure 6.18: The hypothetical exposure of continental shelf during the Devensian Late Glacial Maximum, at its maximum extent following ice retreat and during the early Holocene (Source: Left, Woodcock & Strachan (2000), middle and right, Coles[128], cited in Gaffney et al[129])

Geological surveys have suggested that the subsequently submerged lands between Great Britain and mainland Europe, termed Doggerland by Coles[130], stretched from the east coast of England to the present coast of the Netherlands, western Germany and Denmark. Present sea-level was reached about 6,500 or 6,200 BP. Flints, spear-heads and mammal remains have been dredged from the area known as the Dogger Bank, although the vast relict lagoon that was present to the south between 8000-7000 BP may provide a richer assemblage. No recent fossil bone or artefact finds have been made at this location.

The archaeological potential of the area had first been discussed in the early 20th century, but interest intensified in 1931 when a commercial trawler operating between the sandbanks and shipping hazards known as the Leman Bank and Ower Bank east of the Wash, dragged up an elegant barbed antler point (possibly used as a harpoon or spear) that dated to a time when the area was tundra between 4,000 and 10,000 years ago. The submerged peat landscape at the Lehman and Ower Banks was probably used by Mesolithic people. The peat from this area dates to approximately 8,500 BP.

Vessels have retrieved mammoth and lion remains, among other remains of land animals, as well as small numbers of prehistoric tools and weapons which were used by the region's inhabitants[131]. Thousands of fossil mammal bones have been recovered with evidence of working from Brown Ridge. These date to the early Pleistocene, and later Pleistocene and Devensian, most are from the latter period.

---

[128] Coles BJ (1998). Doggerland: a speculative survey. Proceedings of the Prehistoric Society 64: pp45-81.
[129] Gaffney V, Thomson K & Fitch S (2007). Mapping Doggerland: The Mesolithic landscapes of the southern North Sea. Institute of Archaeology and Antiquity, University of Birmingham. Archaeopress, Oxford p131.
[130] Gaffney V, Thomson K & Fitch S (2007). Mapping Doggerland: The Mesolithic landscapes of the southern North Sea. Institute of Archaeology and Antiquity, University of Birmingham. Archaeopress, Oxford p131.
[131] Louwe Kooijmans, L. P., 1970-71, Mesolithic bone and antler implements from the North Sea and from the Netherlands. Ber Rijksdienst oudheidk. bodemonderz. 20/21, pp27-73

The area is an erosional remnant of freshwater clays overlain by approximately six metres of modern, mobile sand surface. The bones and artefacts are likely confined to the clay (Flemming (2002)[132], (2004a)[133], (2004b)[134]).

Most finds in UK waters are of late-glacial to early-Holocene age (12,000 to 11,000 BP). To date no maritime archaeological artefacts of lower Palaeolithic origin (approximately 500,000 to 300,000 BP) have been recovered from the southern North Sea[135].

Recovery of submerged archaeology occurs as a by-product of dredging or trawler by-catch. This is coarse and produces an archaeological mix of poor spatio-temporal resolution[136] [137]). This method of recovery has however recently uncovered a collection of 28 Neanderthal hand axes from dredged material 13km off the coast of Great Yarmouth which are currently regarded as perhaps the most significant find of Ice-age artefacts from the North Sea to date, and their typology places them at a date of approximately 100kya[138].

Historic sites

The coastal zone contains a large number of statutory heritage features including listed structures, scheduled ancient monuments and registered historic parks and gardens. These may include, for example lighthouses, quaysides, piers or ancient remains. While not all strictly below the mean high water mark, these features may be indirectly affected by activities at sea. Other sites may have benefited from a coastal location but cannot be described as specifically coastal in nature. Numerous Bronze Age barrows have been identified, for example, on Salthouse Heath in Norfolk, while extensive Iron Age to Romano-British rural settlements and field systems have been identified at Snettisham and Heacham[139]. Further details on statutory sites can be added at the next stage of the SA process where applicable.

Wrecks

There are around 7,352 wreck sites listed in the National Monument Record (NMR) which are located in the East of England marine plan areas although some of these

---

[132] Flemming NC (2002). The scope of Strategic Environmental Assessment of North Sea areas SEA3 and SEA2 in regard to prehistoric archaeological remains. Technical Report to the DTI, p51.
[133] Flemming NC (2004a). The scope of Strategic Environmental Assessment of North Sea SEA5 in regard to prehistoric archaeological remains. Technical Report to the DTI, p42.
[134] Flemming NC Ed (2004b). The prehistory of the North Sea floor in the Context of the Continental Shelf archaeology from the Mediterranean to Nova Zemlya. Submarine Archaeology of the North Sea: Research priorities and collaboration with industry. Council for British Archaeology Research Report 141, York pp11-20.

[135] Hosfield R (2007). Terrestrial implications for the maritime geoarchaeological resource: A view from the Lower Palaeolithic. Journal of Marine Archaeology 2: pp4-23.
[136] Glimerveen J, Mol D, Post K, Reumer JWF, van der Plicht H, de Vos J, van Geel B, van Reenen G & Pals JP (2004). In: NC Flemming Ed. Submarine Archaeology of the North Sea: Research priorities and collaboration with industry. Council for British Archaeology Research Report 141, York pp 43-52.
[137] Hosfield R (2007). Terrestrial implications for the maritime geoarchaeological resource: A view from the Lower Palaeolithic. Journal of Marine Archaeology 2: pp4-23.
[138] Wessex Archaeology (2008b). UKCS Offshore Oil and Gas and Wind Energy Strategic Environmental Assessment: Archaeological Baseline. Technical Report prepared for the Department of Energy and Climate Change, Wessex Archaeology, Salisbury, p89.
[139] Norfolk Coast and Broads Rapid Coastal Zone Assessment National Mapping Programme

are located in terrestrial fluvial environments (such as river terraces). It is worth noting that numerous wrecks are thought to exist for which we have no information at all and which would increase the current numbers dramatically. For example, Sole Bay in Suffolk is known to contain over 1,000 wrecks[140]. A breakdown of known maritime sites for each county is provided in Table 6.7.

Table 6.7: Maritime archaeological records categorised as wreck for English counties bordering the marine plan area (DECC Offshore Energy SEA 2 2010 and the NMR Record)

County	Number of sites recorded as wrecks	Summary
East Riding of Yorkshire	1,566	Comprises wrecks, aircraft wrecks and watercraft wrecks. With the exception of unclassified wrecks, none pre-date the medieval period.
City of Kingston upon Hull	22	All wrecks (with the exception of unclassified ones) are from the 20th century.
Lincolnshire	738	Early (Stone-age, Bronze- and Iron-Age) logboats have been recovered but only from terrestrial fluvial environments. Records are relatively few until the Georgian (296), Victorian (222) and modern (158) eras.
Norfolk	3,477	Unlike Lincolnshire, no wreck pre-dates the Anglo-Saxon period, which is represented by a singular, coastal find. Like other regions, records for wrecks increase in the Medieval (35) and post-Medieval (2738) period. Modern finds account for 662 of the records.
Suffolk	1,549	The earliest submerged marine vessels are Medieval in age. Records increase substantially in the Georgian (577), Victorian (380) and modern (402) periods.

There are four historic, protected wrecks in the marine plan area (refer to Table 6.8 and Figure 6.16).

Table 6.8: Protected wrecks within East of England marine plan areas (English Heritage pastscape website)

Wreck name	Date of sinking	Location	Protection status	Other information
Dunwich Bank	Approximately 16th century	52º 15′ 8.4″ N, 01º 38′ 31.8″ E	PWA	Southwold, Suffolk.100 metre exclusion zone
Filey Bay Wreck	-	54º 11.488' N, 00º 13.3774'	PWA	Filey Bay, Yorkshire, 300 metre exclusion zone Potentially the Bonhomme

[140] Scoping response from Waveney District and Suffolk County Councils.

Wreck name	Date of sinking	Location	Protection status	Other information
		E		Richard, sunk 1779 – further examination is required to confirm its identity
HMS Exmoor	1941	n/a	PMRA‡	Off Lowestoft
HMS Vortigern	1942	n/a	PMRA‡	Off Cromer
HMS Umpire	-	-	PMRA	Off Sheringham
HMS Fitzroy	-	-	PMRA	Off Lowestoft
HMS Amphion	-	-	PMRA	Off Dunwich

Notes: PWA=Protection of Wrecks Act 1973; PMRA= Protection of Military Remains Act 1986; ‡=designated as a 'protected site' under the PMRA 1986 – no specific coordinate data.

What would the situation be without the marine plan?

In the absence of actions to protect archaeological resources in the coastal and offshore zones it can be assumed that, in areas other than those experiencing net sediment accretion, they will experience deterioration over time through the action of weather, waves, tides, currents and biological activities. Accidental disturbance to or destruction of individual sites from human activities is also likely to occur on a sporadic basis despite legislative controls and guidance. Pressures on our coasts and seas are increasing rapidly in number and scale, from coastal sea defences, port expansion, new shipping channels, extraction of aggregates, oil and gas, and wind-farm construction amongst many others. These activities contribute to, but also impact on, the historic marine environment.

Remains close to the coast and those comprised of fragile materials are those most likely to be lost but are also those offered statutory protection of some form under the present regime. Statutory designations cover a relatively small proportion of remains, with most sites not benefitting from formal protection. There are just two protected wrecks and five protected military remains in and adjacent to the East of England marine plan areas.

The greatest risk to coastal sites is erosion in the form of cliff retreat or erosion of soft sediments which may result in a significant redistribution of historic artefacts on the seafloor. Cliff lines comprised of loose and unconsolidated deposits may erode at several metres per year. These tend to be situated on the eastern and southern coasts of the UK mainland, also the location of the highest density of archaeological remains in the coastal zone. Erosion, marine aggregates extraction and coastal developments may expose archaeological resources for subsequent examination, but the majority may be lost to the sea. There are also risks associated with coastal regeneration, in that heritage features may be lost through this process.

PPS 5 is designed to give consideration to a broader definition of heritage resources than was required by the previous system of legislation and guidance. This should

result in improved decision-making with regard to heritage issues. However, broader socio-cultural issues associated with coastal communities and their relationship to the marine environment remains less well defined and therefore more easily overlooked. It is therefore likely that environmental, economic and social pressures will continue to force unmanaged change to the historic associations within many coastal communities.

What are the key issues?

The following key issues and opportunities have been identified:

- Knowledge of offshore archaeology is limited by the practical and economic problems involved in searching large areas of the sea floor, however, archaeological research frameworks are published that guide further studies, such as The North Sea Prehistory Research and Management Framework (2009).
- Dredging (including aggregate extraction) and benthic fishing methods may disturb the sea bed and damage exposed sites.
- Developments in the offshore zone have the potential to uncover, disturb or destroy archaeological remains lying on or under the sea bed and any impacts should be taken into account in decision making as informed by SEA and EIA procedures. Of particular concern are major infrastructure developments such as the construction of oil and gas installations, commercial ports and offshore wind farms. Indirect impacts are not always fully appreciated. They include changes to local current patterns, sediment movements and scour from cables and structures.
- The cumulative effects of marine activities upon heritage assets are of particular concern.
- Whilst artificial coastal defence works can help to retain the stability of fast-eroding sections of coastline, they can have adverse impacts downdrift and offshore as sediment movement becomes disrupted. Increased rates of scour may expose or erode deposits of potential archaeological value. The resulting situation is one which requires continual surveying of coastal sites or surveying at a suitable frequency so that the condition of sites might be monitored and any important artefacts recovered. In many cases erosion is geologically controlled, such as at Holderness.
- The visual impacts of developments on the landscape/seascape[141] have the potential to affect the setting of historical features and potential loss of interest and therefore reduced local revenue associated with historic features is also a consideration. These may arise from both offshore developments and their coastal-based infrastructure. Changes may be significant from a heritage perspective, but also affect the potential for income from tourist-related activities.
- Commercial salvage and attrition as a result of recreational diving are localised threats to the shipwreck resource, and it is not clear how much has been

[141] Wessex Archaeology (2007). Historical Environment Guidance for the Offshore Renewable Energy Sector. Published by COWRIE Ltd, UK, 52pp.

salvaged from wrecks on the UK continental shelf, though it is likely that it is under reported[142].

- An erosion of 'way of life' associated with declining fishing communities in which historic connections and family ties with the fishing industry may be diminishing. The same may be true of other industries where pressures to reduce manpower or reform working practices would have an adverse impact on cultural associations. See also sections 6.2 and 6.5 of this document.
- Archaeological sites in offshore areas and north of the Dogger Bank are even less well known than the more intensively studied southern North Sea, though there is a chance that material of Palaeolithic or early Mesolithic provenance exists.
- The co-location of other activities and developments with sites and areas of archaeological interest requires attention to optimise spatial planning and thereby support access and long-term conservation.

Opportunities

- The marine plans provide an opportunity to improve the protection of heritage resources in the coastal and offshore zones.
- Opportunities to gain a greater insight into the marine archaeological resource may be possible if measures are adopted that place new information in the public realm and support access.
- Potential advantages to heritage tourism if coastal sites are protected, discovered or enhanced through appropriate management.

Are there any data gaps?

The following key data gaps have been identified for further investigation as the SA process progresses:

- Lack of spatial detail regarding underwater archaeological sites.
- Due to the nature of maritime heritage largely being submerged, there is considerable uncertainty regarding the extent and detail of undiscovered remains.
- Historic seascape character maps to be obtained from English Heritage where complete for the study area
- Further details on statutory heritage features along the coast can be added at the next stage of SA where applicable

6.4 Marine ecology

Introduction

This section provides a brief overview of the main ecological elements of the coast and sea within the East Inshore and East Offshore marine plan areas. It also outlines elements important for biodiversity or nature conservation beyond those encompassed within marine protected areas and other designated sites that are set

[142] Wessex Archaeology (2008). Wessex Archaeology website (accessed March 2008) http://news.wessexarch.co.uk/2008/03/09/evidence-of-ice-age-hunters-found-below-northsea/

out in Chapter 4.1. Greater detail will be provided in the main environment baseline to the sustainability appraisal (SA), and reference are also made below to wider reports which have recently characterised the broadscale features of the UK coasts and seas, such as Charting Progress 2[143], the UK Offshore Energy Strategic Environmental Assessment 2[144], OSPAR Quality Status Review (OSPAR 2010).

In line with the required SEA topics (see Chapter 3), marine ecology is a consideration of this SA (that is biodiversity, flora and fauna). To provide context to the topic area, and to address Annex I (a) of the SEA directive, that is to consider, "...the contents, main objectives of the plan or programme and relationship with other relevant plans and programmes", a summary table of relevant initiatives (which includes plans, programmes, policy and other relevant items), is shown below, following which there is a discussion of the key objectives and targets of the principal initiatives, as well as the implications of the marine plan with regards to these.

What is the policy context?

Article 3 of the Habitats Directive 92/43/EEC (as amended) provides for the creation of a coherent ecological network of European sites (Natura 2000) made up of special areas of conservation (SACs), which are set up to conserve those species listed in Annex I and habitats listed in Annex II of the directive; and those sites designated as special protection areas (SPAs) for bird species under Annex I (rare or vulnerable) and II (migratory) of the Wild Birds Directive 2009/147/EC. Note that MPAs (and other designated sites) are also specifically addressed in Chapter 4.

Table 6.10: Other relevant plans, initiatives and environmental protection objectives

International
Convention on International Trade in Endangered Species of Wild Fauna and Flora (1973)
Ramsar Convention on Wetlands of International Importance especially as Waterfowl Habitat (1971, 1982)
United Nations Convention on Biodiversity (the Rio Convention, 1992)
The Strategic Plan of the Convention on Biological Diversity – “Aichi” targets
Convention on the Conservation of Migratory Species of Wild Animals (the Bonn Convention, 1979)
The International Council for the Exploration of the Sea (ICES) Code of Practice for the Introduction and Transfer of Marine Organisms
International Convention for the control of ships ballast waters and sediments (adopted 2004, still to enter into force)
Regional
Convention for the Protection of the Marine Environment of the North East Atlantic (the OSPAR convention, 1992)

[143] Defra (2010). Charting Progress 2: An assessment of the state of UK seas. Published by the Department for Environment Food and Rural Affairs on behalf of the UK Marine Monitoring and Assessment Strategy community, London, p194.
[144] DECC (2011). OESEA2 Environmental Report. Future leasing/licensing for offshore renewable energy, offshore oil & gas, hydrocarbon gas and carbon dioxide storage and associated infrastructure. UK Offshore Energy Strategic Environmental Assessment. Report to the Department of Energy and Climate Change.

OSPAR Recommendation 2003/3 on a Network of Marine Protected Areas
OSPAR Agreement 2005/6 on the Agreement on Background Concentrations for Contaminants in Seawater, Biota and Sediment
OSPAR List of Threatened and/or Declining Species and Habitats
Convention for the Conservation of Salmon in the North Atlantic Ocean (1983)
Council of Europe Strategy on Invasive Alien Species (2003)
OSPAR Quality Status Report 2010
Europe
Directive 92/43/EEC, on the Conservation of Natural Habitats and of Wild Fauna and Flora
Directive 2004/35/EC on environmental liability
Water Framework Directive (2000/60/EC)
Marine Strategy Framework Directive 2008/56/EC
Council of Europe Strategy on Invasive Alien Species (2003)
EU Biodiversity Communication (2006)
The Sixth Environment Action Programme of the European Community 2002-2012
Action Plan: halting the loss of biodiversity by 2010 and beyond (2006)
Directive 2009/147/EC, on the Conservation of Wild Birds
EC Council Regulation 1100/2007 on establishing measures for the recovery of the stock of European eel
National
Our Seas – a shared resource. High Level Marine Objectives (2009)
Marine Policy Statement
National Energy Policy Statement (EN1-4, 6)
National Policy Statement for Ports
Note that the Draft National Planning Policy Framework (2011) is subject to ongoing consultation and is set to consolidate and replace all of those planning statements listed below.
Planning Policy Statement 1: Delivering Sustainable Development
Planning Policy Statement 9: Biodiversity and geological Conservation
Consultation paper on a new Planning Policy Statement: Planning for a Natural and Healthy Environment.
Other relevant initiatives
Biodiversity: UK Action Plan (1995, 2005)
UK Government Sustainable Development Strategy: Securing the Future (2005)
Safeguarding our Seas: A Strategy for the conservation and sustainable development of our marine environment (2002)
Invasive non-native species framework strategy for Great Britain
Review of Marine Nature Conservation (DEFRA 1999 onwards) and response, Safeguarding Sea Life (2005)
Charting Progress 2 – An Assessment of the State of UK Seas (2010)
NERC Marine Environmental Mapping Programme (MAREMAP)
Biodiversity 2020: A strategy for England's wildlife and ecosystem services
UK National Ecosystem Assessment (2011)
The Natural Environment White Paper (2011)
Local
Marine Aggregate Levy Sustainability Fund (MALSF) Regional Environmental Characterisations), including the Thames, East Coast and the Humber studies
Natural England and JNCC Marine Conservation (MCZ) Project, *Net Gain*

Local biodiversity action plans
Biodiversity in the East Riding of Yorkshire
Humber Estuary
Lincolnshire
Norfolk
Essex and Suffolk
Suffolk

Statutory measures for biodiversity, conservation and wider environment

The **Conservation of Species and Habitats Regulations 2010** consolidates the Conservation (Natural Habitats, &c.) Regulations 1994 and also implements certain aspects of the Marine and Coastal Access Act 2009. Principally the transfer of certain licensing functions from Natural England to the Marine Management Organisation (MMO), and the recognition of marine enforcement officers to be able to use powers under the Marine and Coastal Access Act 2009 to enforce offences under the Habitats Regulations. The Conservation of Species and Habitats Regulations 2010 transpose the Habitats Directive into legislation in England, Wales and Scotland, including their territorial seas out to 12 nautical miles. Under the Conservation of Species and Habitats Regulations 2010, Regulation 35 (formerly 33 in the 1994 Regulations) requires that Natural England produce advice for relevant authorities on the conservation objectives and activities likely to cause deterioration or disturbance to those habitats and/or species associated with Natura 2000 or Ramsar sites.

The **Wildlife and Countryside Act** (WCA) 1981 (as amended) is one of the principal pieces of legislation relating to nature conservation in Great Britain (such as implementing the Wild Birds Directive). Although protection under the WCA generally includes adjacent territorial waters (12 nautical miles), for certain species, protection is limited to 6 nautical miles from coastal baselines due to the interaction with the Common Fisheries Policy and for the designation of marine nature reserves out to 3 nautical miles. The Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007 (as amended) apply the Habitats Directive and the Birds Directive beyond territorial waters (12 nautical miles). These regulations together provide for the designation and protection of European sites and the protection of European Species in the UK and UK waters. The WCA is supplemented by various other pieces of legislation including the **Countryside and Rights of Way (CRoW) Act** 2000. This legislation provides for the protection of species and the designation of nationally important sites known as sites of special scientific interest (SSSI). Many SSSIs are also designated as European sites. SSSI sites have until recently extended only to mean low water (such as intertidal areas), though the Marine and Coastal Access Act 2009 has allowed for the all new SSSIs to extend below this line.

To date the vast majority of designated conservation sites in the UK have been terrestrial or terrestrial with marine components, with very few being entirely marine in nature. More recently a number of offshore SACs are in the process of being designated and work is underway to identify and extend a number of marine SPAs. These sites, and those sites to arise from the designation of MCZs, are a key step in extending the network of national and European sites into offshore waters and the creation of an ecologically coherent network in the marine environment.

The **Marine Strategy Framework Directive** (MSFD) establishes a framework within which member states must take measures to achieve or maintain good environmental status in the marine environment by the year 2020. Marine planning will need to take into account any relevant targets, indicators or measures aimed at achieving "good environmental status" under the directive covering a number of descriptors such as those to do with biodiversity, the seabed, generation of noise, and impacts on hydrographical conditions[145].

These measures include the establishment of a cohesive network of marine protected areas (MPAs) which is intended to build on the areas already protected as European marine sites under the Birds Directive and Habitats Directive. The Marine and Coastal Access Act 2009 will aid the completion of an ecologically coherent and well-managed network of MPAs, suggested as a contributory measure to achieving good environmental status in the MSFD, and as required in similar commitments regarding MPAs under international conventions such as the Convention on Biological Diversity. These sites will be known as **marine conservation zones** (MCZs). The MCZ project in England and Wales is delivered through four regional projects administered by Natural England and the Joint Nature Conservation Committee (JNCC), with the projects Net Gain and Balanced Seas covering the North Sea and the area relevant to the East Inshore and East Offshore areas. The intention is to have a network of effectively managed sites (European protected and MCZs) by 2020. Details on those draft MCZs identified in the southern North Sea, and which are relevant to the East Inshore and East Offshore plan areas, are given in Chapter 4.

Net Gain and Balanced Seas, along with the other regional MCZ projects, submitted their final recommendations in September 2011. The Science Advisory Panel is now assessing the final recommendations, in terms of how well the report meets the Ecological Network Guidance. Natural England and JNCC will also provide their assessment and advice to government. Following the submission of the final recommendations, the impact assessment (currently ongoing) and the advice from the statutory nature conservation bodies, ministers will consider which sites should be put forward for public consultation and potential designation.

In addition to provisions under the MSFD, **the Water Framework Directive** (WFD) has implications for transitional (that is estuarine) and coastal waters (out to 1 mile), as well as all other terrestrial surface waters, groundwater and terrestrial ecosystems which are dependent on groundwaters. The directive aims to take a holistic approach to water management, preventing deterioration of aquatic ecosystems and restoring surface waters and groundwater to “good status” in terms of ecological and chemical objectives for surface waters. The directive, through the Water Environment (Water Framework Directive) (England and Wales) Regulations 2003, will help to improve the ecological status of coastal and transitional waters during the course of marine plan implementation (see Section 6.8).

[145] See Marine Policy Statement (2.5.9-2.5.11) including list of all 11 ‘descriptors’.

Other non-statutory measures

The UK Biodiversity Action Plan (BAP) provides a national strategy for the conservation of biological diversity and the sustainable use of biological resources as required under Article 6 of the Rio Convention. A number of species (1,150) and habitats (65) have been identified as being priorities for conservation action in the UK, and these include a number of marine components, for instance 28 BAP habitats are marine. Though the plans for these species and habitats have no statutory status, they are given some legal basis in the Countryside and Rights of Way Act 2000 and the Natural Environment and Rural Communities Act 2006 (such as list of species of principal importance designated under Sections 41 and 42 of the act).

In 2010 the EU published **guidance on the development of wind farms in accordance with EU nature legislation**[146], specifically Natura 2000 aimed at (including others) planners, developers and consultants. In addition to planning guidance and policy background, the document identifies potential impacts arising from both onshore and offshore wind farms on birds, bats and aquatic species (such as cetaceans), and how strategic planning can help to avoid or minimise environmental conflicts.

Wider policy

The MPS, published in March 2011, is wide reaching and provides a policy steer for marine decision makers (primarily the MMO but also those involved in NSIPs) in relation to most marine activities. More widely and in relation to all marine activities, high level environmental considerations are provided by reaffirming the conservation responsibilities of the UK Government which are to be taken account of in the preparation of marine plans. This includes the commitment to establishing a UK network of MPAs incorporating the new MCZ designation under the Marine and Coastal Access Act 2009 (see above) and existing and future marine sites including SACs and SPAs.

More generally, the **high level marine objectives** agreed by the UK Government and devolved administrations set out an approach to the sustainable use of UK seas, including the recognition that healthy marine habitats and ecosystems, species and biodiversity should be maintained and where appropriate recovered. The Marine Policy Statement (MPS) builds upon this, stating "As a general principle, development should aim to avoid harm to marine ecology, biodiversity and geological conservation interests (including geological and morphological features), including through location, mitigation and consideration of reasonable alternatives. Where significant harm cannot be avoided, then appropriate compensatory measures should be sought"[147]. The MPS also recognises the importance of statutory designations, and the legal protection afforded to such sites.

National Policy Statements (NPSs) are aimed at providing a policy steer for nationally significant infrastructure projects (NSIPs) as detailed in the Planning Act 2008. Those which are of close relevance to marine planning are:

---

[146] http://ec.europa.eu/environment/nature/natura2000/management/docs/Wind_farms.pdf
[147] Defra (2011) Marine Policy Statement, p18

- Overarching National Policy Statement for Energy (EN-1)
- National Policy Statement for Renewable Energy Infrastructure (EN-3)
- National Policy Statement for Gas Supply Infrastructure and Gas and Pipelines (EN-4)
- National Policy Statement for Ports.

Each NPS was subject to an appraisal of sustainability (AoS) incorporating Strategic Environmental Assessment (SEA) and Habitats Regulations assessment (HRA). The Overarching National Policy Statement for Energy (EN-1) addresses policy in relation to generic biodiversity impacts, whereas the energy specific policy statements contain more detailed considerations, although still at a high policy level. Each NPS contains considerations relevant to potential impacts on the natural environment including birds, marine mammals, fish and intertidal habitats.

Fisheries management

The population status of a number of commercial fish species (fish stocks) is a nature conservation and fisheries concern. An indicator of the proportion of finfish stocks around the UK at full reproductive capacity (see HM Government 2005[148]) has been calculated for 20 fin-fish stocks for which ICES provide quantitative advice on sustainability[149], International Council for the Exploration of the Sea (ICES) website[150] for 2011 advice). These include demersal roundfish (cod, haddock, saithe, hake), flatfish (sole, plaice), and pelagic (mackerel, herring) fisheries. The status of a further 23 finfish stocks harvested in UK waters has not been calculated due to inadequate data and modelling, or new data requiring developmental work, and from 2008, ICES have provided advice on elasmobranchs (sharks and rays) for the North Sea[151]. The present state of the principal UK stocks are shown in UK Sea Fisheries Statistics 2010[152], with trends in stocks referred to in the Fisheries sector section in Chapter 4.

Fisheries are managed under the Common Fisheries Policy (CFP), with total allowable catches (TAC) forming a key part of the policy in relation to fish stock conservation. These are agreed by member states, and based on the ICES advice referred to above. The CFP is currently under reform[153], with the UK's approach to this having been part of a recent consultation exercise. Reformation of the CFP should contribute to sustainable fisheries management, and also nature conservation – for instance achieving good environmental status under the MSFD (such as populations of all commercially exploited fish and shellfish are within safe biological limits, exhibiting a population age and size distribution that is indicative of a healthy

[148] HM Government (2005). Securing the Future. The UK Government Sustainable Development Strategy. Cm 6467, March 2005. p186.
[149] MMO (2010). UK Sea Fisheries Statistics 2010. Marine Management Organisation. 138pp.
[150] ICES website (Accessed: 15 November 2011). www.ices.dk/advice/2011AdviceReleasedates.asp
[151] Defra (2010). Charting Progress 2: An assessment of the state of UK seas. Published by the Department for Environment Food and Rural Affairs on behalf of the UK Marine Monitoring and Assessment Strategy community, London, p194.
[152] MMO (2010). UK Sea Fisheries Statistics 2010. Marine Management Organisation. p138.

[153] European Commission (2009). Green Paper: Reform of the Common Fisheries Policy. COM(2009)163. Brussels, April 2009. p27.

stock). The final regulation is due to be agreed by both the Council of Fisheries Ministers and the European Parliament in time to come into force on 1 January 2013.

In addition to threats posed from marine development and climate change, the marine environment has recently been subject to a number of introduced species which have led to a series of localised changes in community composition. A number of national and international initiatives exist aiming to recommend and introduce safeguards to limit the transport of invasive species, including the GloBallast Partnership Programme and the Invasive Non-native Species Strategy for Great Britain, as well as guidance from the Maritime and Coastguard Agency[154].

Implications for sustainability appraisal and marine plan

The East Inshore area contains numerous conservation designations of national and European importance, and there are a number of MCZ sites likely to be located within the East Inshore area, and also the East Offshore area. In addition, the wider marine environment supports a range of habitats and species for which the impacts of any development should be considered. In order to ensure that the UK meets its conservation objectives at the European and national level, and wider good environmental status under the MSFD, the marine plan will need to consider the location and level of current coastal and marine developments, likely future use of the marine area, and what impacts (including cumulative impacts) may be expected.

The MPS provides an outline of the high level environmental (Paragraph 2.5) and more detailed marine ecology and biodiversity (Paragraph 2.6.1) considerations that must be made by the Marine Planning Authority (that is. MMO) in decision making and in preparation of the marine plans. It is noted that (Paragraph 3.1.6) "Activities or developments that may result in unacceptable adverse impacts on biodiversity should be designed or located to avoid such impacts."

What is the baseline situation?

Plankton

The plankton community may be broadly divided into a plant component (phytoplankton) and an animal component (zooplankton). The ecology of the plankton community is closely coupled with environmental factors. Members of the plankton are key producers and primary consumers in marine ecosystems and so population changes will have impacts on organisms at higher trophic levels, with important environmental and economic consequences.

The plankton community of the southern North Sea primarily consists of neritic and coastal species which are well-suited to the mixed waters of this region. Decapod larvae, along with copepod species such as *Centropages hamatus* and *Calanus helgolandicus*, are commonly found in the southern North Sea. Phytoplankton biomass is greater here than in the northern North Sea, and has been increasing since the 1988 regime shift. Although some localised coastal areas in this region may be affected by eutrophication this is primarily a problem in the Continental region. For the most part changes in plankton in the southern North Sea are driven

[154] Marine Guidance Note 363, The control and Management of Ships' Ballast Water and Sediment. www.dft.gov.uk/mca/mcga-mnotice.htm?textobjid=A0834F4B022176A8

by climatic variability. Over the last few decades, climate warming in the southern North Sea has been noticeably faster than in the northern North Sea. This is reflected in the biological response of planktonic organisms; for example, phenological cycles observed in the southern North Sea have moved further forward in time than in the northern North Sea[155]. A change in the plankton community composition can have a significant effect on organisms at higher trophic levels. The increasing abundance of *C. helgolandicus* at the expense of *C. finmarchicus* may also have had an effect on cod recruitment as the population of *C. helgolandicus*, unlike that of *C. finmarchicus*, peaks too late in the year for cod larvae to feed on it (Helaouet & Beaugrand 2007), and a similar relationship is observed in sandeels. This in turn affects seabird, marine mammal and human predators of these fish.

Benthos

The seabed and benthos is a fundamental part of the marine ecosystem, critical to nutrient cycling and of major importance as a food resource for man, fish, birds and other animals. The seabed is the spawning ground of several commercially important species and is the ultimate sink for discharged and spilled materials. Benthos refers to the seabed and its associated animals and plants. Benthic flora, whether algal or macrophyte (sea grasses) also have an important influence on the productivity and structure of some habitats and communities, for example through sediment stabilisation in the case of eelgrass beds, or spatial complexity and provision of cryptic habitats in the case of kelp forests. Although confined to relatively shallow water depths (because of light attenuation), benthic flora are a major source of the organic detritus which is a key energy source for benthic faunal communities from the intertidal to abyssal depths.

Quantitative studies of the biology of the seabed have been undertaken for the last 100 years, initially in the context of fisheries ecology and biogeographical patterns of species distribution but more recently to meet requirements for periodic, sea-wide assessments of quality status to meet international obligations, such as those under OSPAR, ICES and EU auspices for European waters. For example, the ICES North Sea Benthos Project 2000[156] undertook to integrate macrobenthic infaunal and environmental data (1999–2002) and compare the outcome with that of the ICES North Sea Benthos Survey conducted in 1986, to identify any significant changes and their likely causes. General latitudinal trends of increases in diversity and (less clearly) density from south to north as described for the 1986 data[157] were again seen in 2000. They are at also related to water depths, which typically are shallower in the southern North Sea. Lowest diversities were found in nearshore waters along the whole southern and southeastern North Sea. This may be related not only to the

[155] Defra (2010). Charting Progress 2: An assessment of the state of UK seas. Published by the Department for Environment Food and Rural Affairs on behalf of the UK Marine Monitoring and Assessment Strategy community, London, p194.
[156] Rees H L, Eggleton JD, Rachor E & Vanden Berghe E. (Eds) (2007). Structure and dynamics of the North Sea benthos. ICES Cooperative Research Report 288: p258.

[157] Heip C, Basford D, Craeymeersch JA, Dewarumez J-M, Dörjes J, de Wilde P, Duineveld G, Eleftheriou A, Herman PMJ, Niermann U, Kingston P, Künitzer A, Rachor E, Rumohr H, Soetaert K & Soltwedel T (1992). Trends in biomass, density and diversity of North Sea macrofauna. ICES Journal of Marine Science 49: pp13–22.

reduced salinities there, but also to the high climatic and hydrological variability and disturbing human influences, including pollution and eutrophication[158].

The composition of the seabed fauna of the UK reflects the intersection of four biogeographical zones or provinces, with the North Sea being covered by the Boreal Province. Each Province has a distinguishable series of faunal communities inhabiting specific sediment types, and often these communities extend over wide areas (such as the fine sands of the central North Sea). In addition, there are a number of highly localised habitats and communities, including reefs of long lived horse mussels and cold water corals, some of which are the subject of biodiversity conservation action at an OSPAR, EU or UK level. UKSeaMap 2010 builds on previous work to develop predictive habitat models using Geographic Information Systems (GIS), particularly UKSeaMap 2006 and the MESH project. However, in UKSeaMap 2010 confidence is partly integrated into the model as a way of selecting the most likely habitat to occur at a particular location. This method also allows the production of maps showing confidence in boundaries between habitats. The quality of the data describing the nature of the seabed (type of sediment, rock) has been assessed, since this variable drives many of the habitat predictions. The combination of confidence in boundaries and quality of the seabed substrata data gives an overall confidence map to accompany the predictive habitat map[159].

Broadscale characterisation of seabed habitats and their biological communities within several UK regions has been funded through the Marine Aggregate Levy Sustainability Fund (MALSF). Relevant regional environmental characterisations (RECs) have been produced for the East Coast[160], Humber[161] and the Outer Thames Estuary[162]. These provide integrated broadscale seabed maps in order to support the sustainable management of offshore resources. The basis of the maps was a regional assessment of the physical, biological and archaeological environment. Figure 6.19 below shows some of the habitats of conservation interest in the marine plan areas.

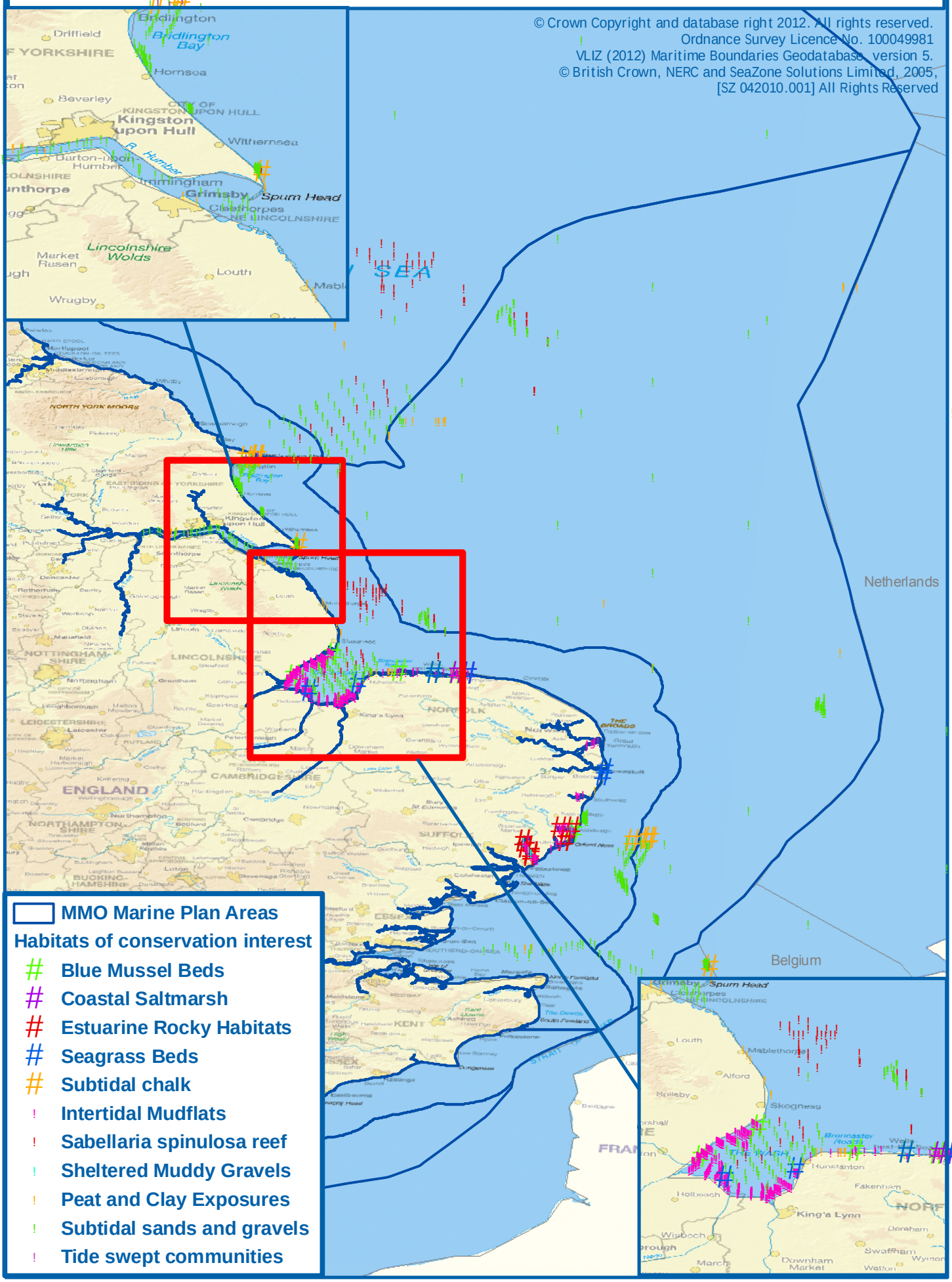
[158] Rachor E, Reiss H, Degraer S, Duineveld GCA, Van Hoey G, Lavaleye M, Willems W & Rees HL (2007). In: HL Rees, JD Eggleton, E Rachor & E Vanden Berghe Eds. (2007). Structure and dynamics of the North Sea benthos. ICES Cooperative Research Report 288: p258.
[159] McBreen F, Askew N, Cameron A, Connor D, Ellwood H & Carter A (2011). UKSeaMap 2010: Predictive mapping of seabed habitats in UK waters. JNCC Report, No. 446.
[160] Limpenny SE, Barrio Froján C, Cotterill C, Foster-Smith RL, Pearce B, Tizzard L, Limpenny DL, Long D, Walmsley S, Kirby S, Baker K, Meadows WJ, Rees J, Hill J, Wilson C, Leivers M, Churchley S, Russell J, Birchenough AC, Green SL & Law RJ (2011). The East Coast Regional Environmental Characterisation. Cefas Open report 08/04. p287.
[161] Tappin DR, Pearce B, Fitch S, Dove D, Geary B, Hill JM, Chambers C, Bates R, Pinnion J, Diaz Doce D, Green M, Gallyot J, Georgiou L, Brutto D, Marzialetti S, Hopla E, Ramsay E & Fielding H (2011). The Humber Regional Environmental Characterisation. British Geological Survey Open Report OR/10/54. p357.
[162] Emu Ltd (2009). Outer Thames Estuary Regional Environmental Characterisation.

Figure **6.19**: Habitats of conservation interest

January 2012

This map has been produced using the ETRS89 Coordinate Reference System

marine management organisation



MMO Marine Plan Areas

Habitats of conservation interest

- Blue Mussel Beds
- Coastal Saltmarsh
- Estuarine Rocky Habitats
- Seagrass Beds
- Subtidal chalk
- Intertidal Mudflats
- Sabellaria spinulosa reef
- Sheltered Muddy Gravels
- Peat and Clay Exposures
- Subtidal sands and gravels
- Tide swept communities

Fish and shellfish

Fish

A number of recent studies have surveyed and defined fish assemblages in the North Sea, similar to the regional study carried out by Callaway et al[163]. Ehrich et al[164] identified five significant and separate assemblages of benthic fish species in the North Sea (Continental Coast, Central North Sea, Channel, Northern North Sea and Northern Atlantic clusters), each associated with water masses and particular habitat features. A community analysis carried out identified 10 main assemblages, with diversity hotspots of demersal fish typically found near inflows of Atlantic water, where immigration from adjacent regions will affect community composition.

Increasing water temperatures have led to changes in the fish community, with colder water species moving northwards and higher numbers of warmer water species being observed in southern regions. This has impacts on higher trophic levels with a well known example being the substitution of hard-to-swallow pipefish for sandeels in the diet of seabird chicks when sandeel abundance is low, which may have lethal consequences. Fishing pressure depresses the stocks of some key commercial species.

Species diversity within the fish community is greater in the southern North Sea than in the central or northern North Sea[165] and within the southern North Sea, fish diversity is greatest in the west[166]. Callaway et al[167] found that the southern North Sea is characterised by a high abundance of small demersal species, typically found closely associated with the seabed, including solenette (*Buglossidium luteum*), dab and common dragonet (*Callionymus lyra*). Of species more loosely associated with the seabed, three distinct assemblages were identified in the region. The two most extensive of these could be characterised by whiting, grey gurnard (*Eutrigla gurnardus*), horse mackerel (*Trachurus trachurus*) and dab. The third assemblage, located in the far south of the region, was characterised by high numbers of horse mackerel and mackerel (*Scomber scombrus*). Corten & van de Kamp[168] identified twelve, "southern" species within the North Sea: poor cod (*Trisopterus minutus*), bib

---

[163] Callaway R, Alsvag J, de Boois I, Cotter J, Ford A, Hinz H, Jennings S, Kroncke I, Lancaster J, Piet G, Prince P & Ehrich S (2002). Diversity and community structure of epibenthic invertebrates and fish in the North Sea. ICES Journal of Marine Science **59**: pp1199-1214.

[164] Ehrich S, Stelzenmüller V & Adlerstein S (2009). Linking spatial pattern of bottom fish assemblages with water masses in the North Sea. Fisheries Oceanography **18**: pp36-50.

[165] Callaway R, Alsvag J, de Boois I, Cotter J, Ford A, Hinz H, Jennings S, Kroncke I, Lancaster J, Piet G, Prince P & Ehrich S (2002). Diversity and community structure of epibenthic invertebrates and fish in the North Sea. ICES Journal of Marine Science **59**: pp1199-1214.

[166] Rogers SI, Rijnsdorp AD, Damm U & Vanhee W (1998). Demersal fish populations in the coastal waters of the UK and continental NW Europe from beam trawl survey data collected from 1990-1995. Journal of Sea Research **39**: pp79-102.

[167] Rogers SI, Rijnsdorp AD, Damm U & Vanhee W (1998). Demersal fish populations in the coastal waters of the UK and continental NW Europe from beam trawl survey data collected from 1990-1995. Journal of Sea Research **39**: pp79-102.

[168] Corten A & van de Kamp G (1996). Variation in the abundance of southern fish species in the southern North Sea in relation to hydrography and wind. ICES Journal of Marine Science **53**: pp1113-1119.

(*Trisopterus luscus*), red mullet (*Mullus surmuletus*), sardine (*Sardina pilchardus*), lesser weever (*Echilichthys vipera*), anchovy (*Engraulis encrasicolus*), tub gurnard (*Chelidonichthys lucerna*), John Dory (*Zeus faber*), bass (*Dicentrarchus labrax*), black sea bream (*Spondyliosoma cantharus*), horse mackerel and mackerel. Other common species in the southern North Sea include pogge or hooknose (*Agonus cataphractus*), flounder (*Platichthys flesus*) and sand gobies (*Pomatoschistus minutus*)[169].

Elasmobranchs

The most abundant sharks found in the southern North Sea are the lesser and greater spotted dogfish, tope and thornback ray. The outer Thames Estuary is an important nursery area for a number of ray species, including thornback rays, adults of which migrate into Thames Estuary waters less than 10 metres deep from the wider Southern North Sea to breed in summer[170]. Sightings of other species, such as the common skate, basking shark and porbeagle are rare in the southern North Sea[171].

Diadromous species

Diadromous species are those which migrate between marine and freshwater as part of their lifecycle. The sea lamprey and river lamprey are rare in the region, although they once comprised an important fishery in the rivers of southeast England. The allis and twaite shad (*Alosa alosa* and *A. fallax*) are rare, herring-like fish, and most abundant around the west coast, though are present in the Thames Estuary. The Atlantic salmon and sea trout are most abundant around the northern and western coasts of the UK, but are also present in the southern North Sea, particularly in the Thames and Stour rivers[172]. Large numbers of sea trout are found off the north coast of Norfolk, feeding on sprat and sandeels, prior to returning to their home rivers in Northeast England. Smelt may be found shoaling in English and Welsh estuaries, travelling upriver to spawn from May to August.

The rivers and estuaries of southeast England provide an important habitat for the European eel (*Anguilla anguilla*). The up-river migration of elvers in the Thames occurs between April and October, with peak movement of eels in May and June[173]. The status of UK eel populations is a major concern and the decline in the European eel population is a matter of international concern. The Environment Agency developed a National Eel Management Strategy in 2001, and has introduced a national package of eel fishing byelaws, with the latest byelaws passed in July 2010.

---

[169] Cefas (2007) Fish and fish assemblages of the British Isles. Report no. C2983. Report to the Department of Trade and Industry.
[170] Walker PA & Hislop JRG (1998). Sensitive skates or resilient rays? Spatial and temporal shifts in ray species composition in the central and north-western North Sea between 1930 and the present day. ICES Journal of Marine Science 55, pp392-402.
[171] Rogers S & Stocks R (2001). North Sea fish and fisheries. Technical report produced by the Centre for Environment, Fisheries and Aquaculture Science for Strategic Environment Assessment - SEA 2.
[172] Aprahamain M & Robson CF (1998). Chapter 5.8. Fish: salmon, sea trout and eels. In: JH Barne, CF Robson, SS Kaznowska, JP Doody, NC Davidson & AL Buck Eds. Coasts and seas of the United Kingdom. Region 7 South-east England: Lowestoft to Dungeness (Coastal Directory Series). Joint Nature Conservation Committee, Peterborough pp126-127.
[173] Naismith IA & Knights B (1988). Migration of elvers and juvenile European eels, Anguilla anguilla L. in the River Thames. Journal of Fish Biology 33, pp161-175.

The National Eel Management Strategy has since been replaced by 15 eel management plans for each of the river basin districts (two of which encompass the East Inshore area) in England, Wales, Scotland and Northern Ireland were submitted by the UK to the European Commission and these were approved in March 2010. The Eels (England and Wales) Regulations 2009 implement the measures set out in the management plans and these came into force in January 2010. The regulation of eel fisheries regulations was addressed by the Marine and Coastal Access Act 2009. The use of eel nets is authorised by the Environment Agency (rather than licensed, as previously), a process that also extends to smelt, lamprey, non-native crayfish and mitten crab fisheries.

Spawning and nursery grounds

At spawning and nursery grounds, fish aggregate in large numbers and therefore are particularly vulnerable to disturbance. Spawning may take place in well defined locations and at specific times around the UK and throughout the year. Maps, displaying approximate spawning and nursery grounds for key species in UK waters were produced by Coull et al[174].

Shellfish

Nephrops is a commercially important species, which in the marine plans area is mainly found in silty sediments to the south of the Dogger Bank, while pink (*Pandalus montaguii*) and brown (*Crangon crangon*) shrimp are abundant in the Wash and the Thames and Humber Estuaries. The east coast of England is a site of particularly intense spawning by brown crab (*Cancer pagurus*) (Rogers and Stocks 2001) but they are found throughout the region. Cockles (*Cerastoderma edule*), mussels (*Mytilus edulis*) and razor clams (*Ensis spp.,* including the introduced *E. directus*) are abundant in the Wash, as are wild and cultivated oysters along the Essex and Kent coast[175]. Whelks (*Buccinum undatum*) and periwinkles are also widespread in the region.

Figure 6.20 shows species of conservation interest in the marine plan areas.

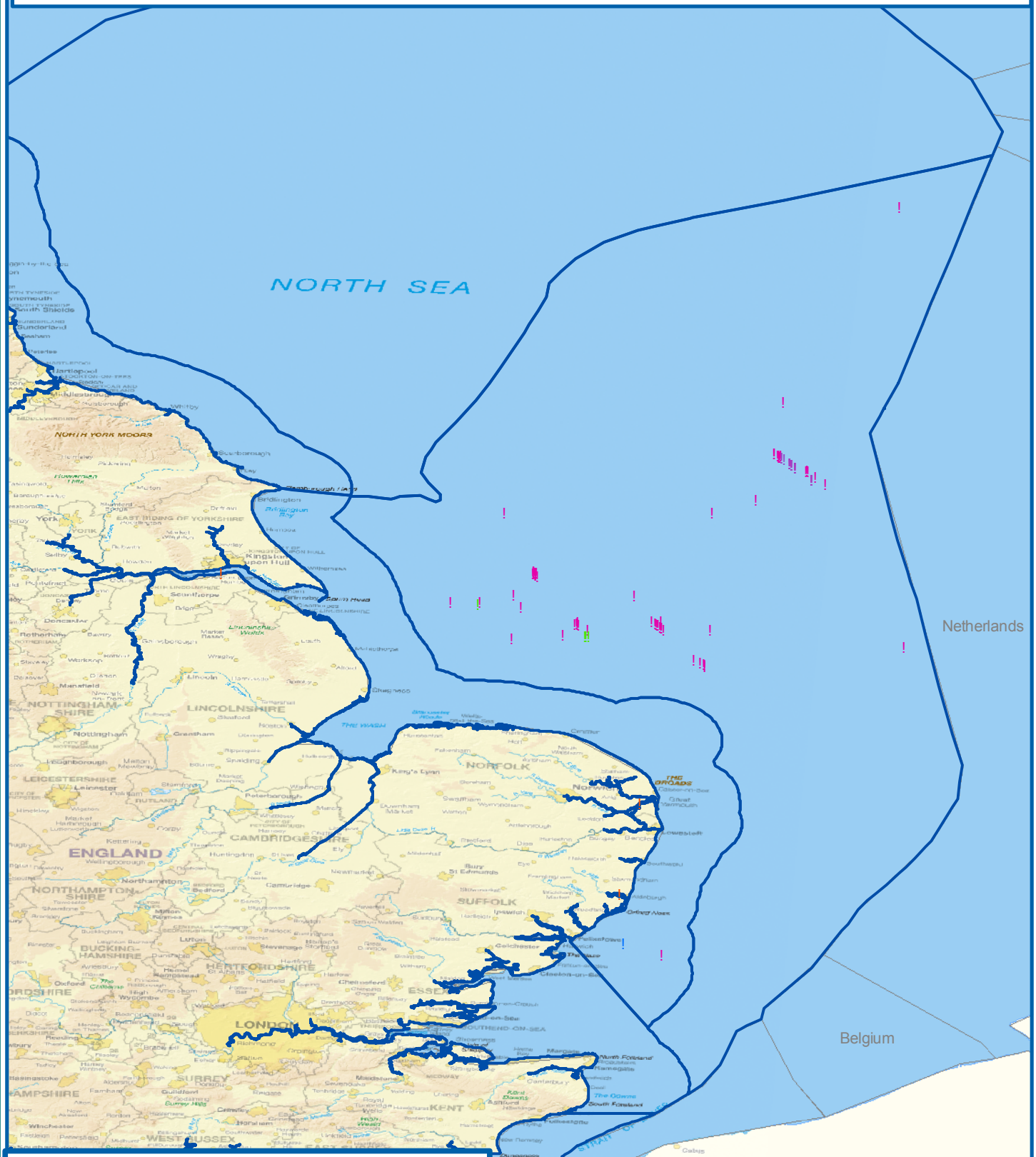
[174] Coull KA, Johnstone R & Rogers SI (1998). Fisheries sensitivity maps in British waters. Report to United Kingdom Offshore Operators Association, Aberdeen.
[175] Rogers S & Stocks R (2001). North Sea fish and fisheries. Technical report produced by the Centre for Environment, Fisheries and Aquaculture Science for Strategic Environment Assessment - SEA 2

Figure 6.20: Species of conservation interest

January 2012

This map has been produced using the ETRS89 Coordinate Reference System

marine management organisation



MMO Marine Plan Areas

Species of conservation interest

- Alkmaria romijni (tentacled lagoon worm)
- Arctica islandica (ocean quahog)
- Gitanopsis bispinosa (amphipod shrimp)
- Ostrea Edulis (native oyster)
- Thyasira gouldi (northern hatchet shell)

Cephalopods

Cephalopods are a class of mollusc, including the squids, octopuses, cuttlefish and bobtail squids (sepiolids). The only species that is regularly found in the area in large numbers is the European common squid *Alloteuthis subulata*, which typically migrates into the southern North Sea in the summer. Among the other frequently recorded species are: the long-finned squids, *Loligo forbesii* and *Loligo vulgaris*; the short finned squid, *Todaropsis eblanae*; the bobtail squids, *Sepiola atlantica*, *Sepietta oweniana* and *Rossia macrosoma*; the cuttlefish, *Sepia officinalis*; the octopus, *Eledone cirrhosa*. These nine species, along with *Onychoteuthis banksii*, are the only cephalopods to have been encountered in the southern North Sea during International Bottom Trawl Surveys and International Beam Trawl Surveys between 1996 and 2003[176].

Birds

The North Sea coast contains breeding populations of all seabirds that are known to breed in the UK, although the Mediterranean gull (*Larus melanocephalus*) does not breed in the northern North Sea, and the Manx shearwater, storm petrel (*Hydrobates pelagicus*), Leach's petrel (*Oceanodroma leucorhoa*), Arctic skua (*Stercorarius parasiticus*), great skua and black guillemot (*Cepphus grylle*) do not breed in the southern North Sea[177]. Breeding seabirds, kittiwakes (*Rissa tridactyla*), guillemots (*Uria aalge*) and razorbill (*Alca torda*) commute offshore to feed and moult. Flamborough Head/Bempton Cliffs support 300,000 individual birds respectively, including puffin (*Fratercula arctica*), razorbill, guillemot, herring gull, gannet and kittiwake. Birds at these colonies feed at sites including the frontal system off the coast of Flamborough Head, outer silver pit and Brown Ridge. A DECC SEA funded Royal Society for the Protection of Birds (RSPB) study has tagged gannets from Bempton cliffs which will help identify important foraging areas for gannets from the Bempton and Flamborough SPA. Fourteen breeding adult gannets, tracked via satellite from Bempton Cliffs, yielded information about their foraging ranges during chick-rearing, and the extent of overlap of their foraging trips with potential development zones for offshore wind energy generation in the North Sea. Most foraging trips were within 100 kilometres of Bempton Cliffs, and considerable overlap was noted in particular with the Hornsea Round 3 development zone for offshore wind energy generation[178]. Further south, a lack of suitable cliff habitats means there are fewer nesting colonies of seabirds other than terns and gulls. Following the breeding season, seabirds will leave colonies and move to sea. Consequently, numbers of seabirds at sea are greatest during the winter months. Trends in various bird numbers (including breeding seabirds and wintering waterbirds) are given regularly through the collaboratively produced State of the UK's Birds series[179]. The

---

[176] De Heij A & Baayen RP (2005). Seasonal distribution of cephalopod species living in the central and southern North Sea. Basteria 69: pp4-6.
[177] Mitchell PI, Newton SF, Ratcliffe N & Dunn TE (2004). Seabird populations of Britain and Ireland. Results of the Seabird 2000 Census (1998-2002). T&AD Poyser, London.
[178] Langston RHW & Boggio S (2011). Foraging ranges of northern gannets Morus bassanus in relation to proposed offshore wind farms in the UK. RSPB Report to DECC.

latest report indicates mixed fortunes for various bird groups and species, generally without defined cause and effect.

Waterbirds, characteristic of wet grassland, shingle, sand dune and dry coastal grasslands can be found throughout this region. The southern North Sea coast supports particularly high densities of waders, with notable wetland species including bittern (*Botaurus stellaris*) and avocet (*Recurvirostra avosetta*). It is also a particularly important coastline for wintering and passage waterbirds, as it lies on a principal migratory pathway. At peak times in winter, the region is estimated to hold at least a quarter of the English total of wintering waterfowl. Four of the six principal sites monitored by the Wetland Bird Survey are on the southern North Sea coastline: the Wash, the North Norfolk Coast, the Humber Estuary and the Thames Estuary.

Marine mammals

Cetaceans

There are more than twenty cetacean species recorded in UK waters. Of these, the species found in the East Inshore and East Offshore areas are harbour porpoise (*Phocoena phocoena*), white-beaked dolphin (*Lagenorhynchus albirostris*), Atlantic white-sided dolphin (*Lagenorhynchus acutus*), and minke whale (*Balaenoptera acutorostrata*). The most comprehensive study of cetacean distribution and abundance is the SCANS and SCANS-II programmes (Small Cetacean Abundance in the European Atlantic and North Sea) from the summers 1994 and 2005 respectively[180]. These surveys were a combination of ship-based (sightings and acoustic data) and aerial surveys. Other monitoring surveys conducted in UK waters are the Cetacean Offshore Distribution and Abundance in the European Atlantic survey (CODA) in July 2007, UK Cetaceans Strandings Investigation Programme (UK CSIP) (an obligation under ASCOBANS[181]).

The harbour porpoise is the most common cetacean, widely distributed throughout UK waters, both coastally and offshore. They typically occur in groups of 1-3 animals although there are reports of larger aggregations[182]. The SCANS project in 1994 suggested high densities of animals north of Scotland and in the western central and northern North Sea. Repeat surveys for SCANS-II showed considerable differences in distribution[183]. In 2005, harbour porpoise were observed in relatively high densities throughout much of the UK southern North Sea, an area from which they were largely absent in 1994. Lower densities were shown for the central North Sea and Moray Firth in 2005 compared to those of 1994. Within the southern Central

---

[179] Eaton MA, Balmer DE, Cuthbert R, Grice PV, Hall J, Hearn RD, Holt CA, Musgrove AJ, Noble DG, Parsons M, Risely K, Stroud DA & Wotton S (2011). The state of the UK's birds 2011. RSPB, BTO, WWT, CCW, JNCC, NE, NIEA and SNH, Sandy, Bedfordshire

[180] SCANS-II (2008). Small cetaceans in the European Atlantic and North Sea. Final Report to the European Commission under project LIFE04NAT/GB/000245. Available from Sea Mammal Research Unit, University of St. Andrews, p54.

[181] Agreement on the Conservation of Small Cetaceans of the Baltic, North East Atlantic, Irish and North Seas.

[182] Reid J, Evans PGH & Northridge S (2003). An atlas of cetacean distribution in North-West European waters. Joint Nature Conservation Committee, Peterborough, UK, p77.

[183] Reid J, Evans PGH & Northridge S (2003). An atlas of cetacean distribution in North-West European waters. Joint Nature Conservation Committee, Peterborough, UK, p77.

North Sea (SCANS-II survey strata U) the estimated abundance was 88,143 with a density of 0.562 individuals per square kilometre[184].

The white-beaked dolphin is the second most common cetacean in UK shelf waters, with group sizes typically being less than 10, although larger schools (up to 500) have been reported[185]. Sightings occur throughout the year, and are more frequent in summer and early autumn. In the southern Central North Sea (SCANS-II survey strata U), estimated abundance was 493 and a density of 0.0031 dolphins per square kilometre was recorded in the summer 2005 survey[186].

Atlantic white-sided dolphins share most of their range with the white-beaked dolphin, and during surveys it is often difficult to distinguish between the two, therefore they are collectively recorded as *Lagenorhynchus* spp. In the southern Central North Sea. their estimated abundance was low compared to other cetaceans, with the SCANS-II estimated abundance of 405 and a density of 0.0026 dolphins per square kilometre[187].

Minke whales are a seasonal visitor to UK waters, appearing to move into the North Sea at the beginning of May and remaining present until October. They are widely distributed, occurring in coastal and offshore shelf waters. In the summer of 2005, the SCANS-II survey found the southern Central North Sea to have a higher estimated abundance (3,519) and density (0.0224 whales per square kilometre) than most other UK waters[188].

Seals

Two species of seals live and breed around the UK, the grey seal (*Halichoerus grypus*) and the harbour seal (*Phoca vitulina*). Reviews of seal distribution, ecology and sensitivities are undertaken by the Sea Mammal Research Unit (SMRU), University of St. Andrews and formal advice is given annually based on the latest scientific information provided to the Special Committee on Seals (SCOS) by the SMRU. The latest advice paper was published in 2010.

Approximately 40 per cent of the northeast Atlantic (including Baltic Sea) grey seal population occur in the UK[189]. SCOS estimates the UK population size at the start of the 2009 breeding season to be 106,200[190]. Notable breeding colonies in the East Inshore area occur at Donna Nook at the mouth of the Humber, Blakeney Point and

---

[184] Reid J, Evans PGH & Northridge S (2003). An atlas of cetacean distribution in North-West European waters. Joint Nature Conservation Committee, Peterborough, UK, p77.
[185] Reid J, Evans PGH & Northridge S (2003). An atlas of cetacean distribution in North-West European waters. Joint Nature Conservation Committee, Peterborough, UK, p77.
[186] Reid J, Evans PGH & Northridge S (2003). An atlas of cetacean distribution in North-West European waters. Joint Nature Conservation Committee, Peterborough, UK, p77.
[187] Reid J, Evans PGH & Northridge S (2003). An atlas of cetacean distribution in North-West European waters. Joint Nature Conservation Committee, Peterborough, UK, p77.
[188] SCANS-II (2008). Small cetaceans in the European Atlantic and North Sea. Final Report to the European Commission under project LIFE04NAT/GB/000245. Available from Sea Mammal Research Unit, University of St. Andrews, p54.
[189] SCOS (2007). Scientific advice on matters related to the management of seal populations: 2007. Special Committee on Seals, p93.
[190] SCOS (2010). Scientific advice on matters related to the management of seal populations: 2010. Special Committee on Seals, pp115.

Horsey. These colonies, collectively classed by SCOS[191] as Donna Nook + East Anglia, are monitored annually. Pup production in 2009 at these colonies was 2,240, with a 14.9 per cent increase from 2008, and an average annual change from 2004 to 2009 of +15.8 per cent.

Grey seals forage in the open sea and return regularly to haul-out on land where they rest, moult and breed. They may range widely to forage and frequently travel over 100 kilometres between haul-out sites. Compared with other times of the year, grey seals in the UK spend longer hauled-out during their annual moult (between December and April) and during their breeding season (between August and December). Tracking of individual seals has shown that they can feed up to several hundred kilometres offshore although most foraging probably occurs within 100 kilometres of a haul-out site. Individual grey seals based at a specific haul-out site often make repeated trips to the same region offshore, but will occasionally move to a new haul-out site and begin foraging in a new region[192]. At-sea usage based on 110 tagged seals over the period 1991 to 1999[193] [194] identified an area of moderate usage just north of the Humber estuary in the vicinity of Flamborough Head.

Harbour seals are one of the most widespread pinniped species, with approximately 33 per cent of the word population of the European sub-species (*P. vitulina vitulina*) occurring in the UK[195]. In the East Inshore area, notable haul-out sites occur at The Wash, Blakeney Point, Donna Nook and Scroby Sands and are monitored annually. Current estimates of harbour seals (2007-2009) at the four haul-out sites are 3,633 compared to 3,133 in 2005. The population in the East Inshore area has experienced extensive fluctuations due to two epidemics of phocine distemper virus (PDV) occurring in 1988 and again in 2002. The population recorded declines of 52 per cent in 1998 and 22 per cent in 2002, and recovery was not observed in subsequent annual counts until 2009 where a large increase was observed. Despite this large increase the population is still less than 7 per cent lower than pre-epidemic count in 2002.

Harbour seals pupping season is June and July and their annual moult occurs primarily in August, extending into September. Therefore the at-sea population is less during those months. Modelled at-sea usage using data from satellite tagging data has shown an area within The Wash, and extending seaward and northerly towards Flamborough Head showed higher marine usage by the seals[196].

---

[191] SCOS (2010). Scientific advice on matters related to the management of seal populations: 2010. Special Committee on Seals, p115.
[192] SCOS (2010). Scientific advice on matters related to the management of seal populations: 2010. Special Committee on Seals, p115.
[193] McConnell BJ, Fedak MA, Lovell P & Hammond PS (1999). Movements and foraging of grey seals in the North Sea. Journal of Applied Ecology **36**: pp573-590.
[194] Matthiopoulos J, McConnell B, Duck C & Fedack M (2004). Using satellite telemetry and aerial counts to estimate space use by grey seals around the British Isles. Journal of Applied Ecology 41: pp476-491.
[195] SCOS (2007). Scientific advice on matters related to the management of seal populations: 2007. Special Committee on Seals, p93.

Movements at sea by harbour seals are constrained by the need to return periodically to land. They do sometimes undertake rapid, long distanced journeys, venturing to other haul-outs. Goodman[197] identified, via genetic analyses, that during the breeding season however there is very little movement of seals between distinct haul-out site regions.

Otter

The European otter (*Lutra lutra*) population experienced catastrophic declines in 1950s to 1970s in much of the UK and Europe meaning that the population was effectively negligible from central and southeastern counties in England by 1980s (BAP website). Population numbers are recovering however, with The Wash and north Norfolk coast representing major coastal habitats for otters.

What would the situation be without the plan?

In the absence of marine planning, a number of existing processes would continue to provide protection to the habitats and species of the coast and offshore area. Specifically, a number of habitats and species are already afforded statutory protection, for instance being listed as Annex I species or Annex II habitats under the Habitats Directive, and the designation of sites which have such qualifying features is ongoing. The MCZ process described in this section, though also implemented as part of the Marine and Coastal Access Act 2009, is independent of the marine plan process and therefore will, along with Natura 2000 sites, contribute to the achievement of creating a coherent network of offshore sites which could contribute to achieving good environmental status in relation to the MSFD. Generally, a number of initiatives including those associated with the WFD and MSFD will contribute to improving the physical and chemical status of estuarine, coastal and offshore waters, and by association these should help to reduce the impacts of certain anthropogenic activities.

What are the key issues?

The trajectory of individual receptors covered by the biodiversity, habitats, flora and fauna topic has been outlined in Charting Progress 2[198]. A number of key environmental issues which affect these receptors, and which are also of particular relevance to the East Inshore and East Offshore marine plan areas are listed below:

- Climate change: rising global air and sea temperatures and associated sea-level rise has implications for all receptors considered in the marine ecology chapter, for instance the loss of intertidal habitat (such as used by waterbirds and waders) through coastal squeeze. More direct changes include a change in the plankton growing season and the distribution of certain fish species (such as the coldwater monkfish *Lophius piscatorius has progressively moved northwards*) which may

[196] Sharples RJ, Matthiopoulos J & Hammond PS (2008). Distribution and movements of harbour seals around the coast of Britain. Report to the Department of Energy and Climate Change (DECC). Sea Mammal Research Unit, St. Andrews, UK, p65.
[197] Goodman SJ (1998). Patterns of extensive genetic differentiation and variation among European harbour seals (Phoca vitulina vitulina) revealed using microsatellite DNA polymorphisms. Molecular Biology and Evolution 15: pp104-118.
[198] Defra (2010). Charting Progress 2: An assessment of the state of UK seas. Published by the Department for Environment Food and Rural Affairs on behalf of the UK Marine Monitoring and Assessment Strategy community, London, p194.

also be prey species for other animals such as seals. Ocean acidification, through the uptake of CO_2 from the atmosphere, is predicted to have future negative impacts on calcifying organisms, including numerous plankton taxa, molluscs, echinoderms and molluscs, which will resonate at higher trophic levels.

- Habitat loss and disturbance: fishing impacts include the potential depletion of commercial fish stocks (see Chapter 4), impacts on benthic habitats and bycatch of non-target fish species, seabirds, marine reptiles and cetaceans. Habitat damage resulting from the harvesting of shellfish (such as scallop dredging) can also cause changes to marine ecosystems, for instance leading to mortality of benthic organisms and the reduction in food availability for waterbirds or marine mammals. On a smaller scale, direct impacts on benthic habitats arise from aggregate extraction, wind farm installation and other offshore subsea installation.
- Marine litter: ingestion of or entanglement in marine litter by fish, mammals, reptiles and birds can result in mortality.
- Marine noise: anthropogenic activities in the East Inshore and East Offshore areas which generate marine noise include shipping, oil and gas exploration and production (which may include the acquisition of seismic data) and wind farm installation (presently largely reliant on pile driving). Marine mammals are of principal concern, though fish and cephalopods may also be subject to disturbance by noise.
- Pollution: estuarine fish species are still subject to pressure from inputs of pollutants and coastal developments, though a number of initiatives (including those associated with the Water Framework Directive) are helping to improve the physical and chemical quality of rivers and estuaries.
- Non-native species: the spread of non-native species may be accentuated by climate change (above). Their appearance in a number of habitats around the UK, including intertidal and shallow subtidal environments, is being addressed through a number of national and international initiatives aiming to recommend and introduce safeguards to limit the transport of invasive species, including the GloBallast Partnership Programme and the Invasive Non-native Species Strategy for Great Britain.

Opportunities

- The marine plans will help to ensure that targets associated with, for instance, the implementation of the MSFD in the UK are met, though should ensure relevant high level marine objectives for the wider marine environment are also considered, such as: a halting and, if possible, a reversal of biodiversity loss with species and habitats operating as a part of healthy, functioning ecosystems, and the general acceptance of biodiversity's essential 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.
- The MMO should maximise the opportunities for integrating policy outcomes when drafting the marine plans (such as developments building-in beneficial features for marine ecology as part of good design).

Are there any data gaps?

OESEA2[199] and Charting Progress 2[200] have identified a number of data gaps with respect to marine ecology some of which are relevant to marine planning:

- Recent information on the distribution of fish eggs and larvae, and variability in space and time.
- There is a general lack of modern data on waterbirds in offshore areas. Adequate data on waterbird distribution and abundance is a prerequisite to effective environmental management of activities, for example, in timing of operations to avoid periods of particular sensitivity.
- Detail of bird migration patterns, and variability in space and time including flight heights in different weather conditions.
- Further understanding of the marine areas routinely used by breeding birds for foraging, in particular those adjacent to or supporting colony SPAs.
- Better understanding of the ecology of most marine mammal species and in particular important areas for breeding, foraging and resting.
- Understanding of variations in ambient noise, and other anthropogenic noise sources, must be improved to assess likely effects of additional noise.
- Data are required on the spatial scale at which marine mammals and their prey respond to well characterised noise sources, and whether this varies according to individual characteristics, behavioural state or other environmental variables.
- Greater knowledge is required concerning the potential impact of future climate change (including ocean acidification), the risks posed by introduced and potentially invasive species, and the consequences of "new" pressures such as offshore wind farms, which look set to expand dramatically in the next few years.

6.5 Economy

What is the link between the plan and this topic?

Although plan objectives are still in development, it is understood that the marine plan will prioritise between marine activities and within marine activities. Some prioritisation will be spatially targeted, while other prioritisation will be less so (that is a policy approach will apply across the plan area). This chapter seeks to understand those issues that should be a focus of prioritisation, from an economic sustainability perspective. Issues fall into two broad categories:

- Those to be addressed in order to maximise economic growth.
- Those to be addressed in order to address existing poor economic performance.

The SEA Directive provides a clear rationale for taking an equity perspective, with Annex 1(d) requiring a particular focus on existing problems. Further rationale for taking this perspective comes from the policy context (see below).

---

[199] DECC (2011). UK Offshore Energy Strategic Environmental Assessment 2. Department of Energy and Climate Change.

[200] Defra (2010). Charting Progress 2: An assessment of the state of UK seas. Published by the Department for Environment Food and Rural Affairs on behalf of the UK Marine Monitoring and Assessment Strategy community, London.

There is also a need for this chapter to give particular consideration to those issues that need to be addressed in order for economic benefits to be realised locally – that is along the coastline of the East plan areas. The SA should focus on this whilst acknowledging the potential for the marine plan to maximise benefits to the wider economy.

What is the policy context?

This section draws out key messages from the policy context with a view to better understanding those issues that should be a focus of the appraisal. This section:

- Firstly explores those priorities for the national economy established by the Treasury and the Department for Business, Innovation and Skills that are of relevance for the East marine plan areas.
- Secondly considers the potential for each of the marine activities identified within the UK MPS to result in economic benefits.
- Thirdly presents economic priorities (of relevance to marine spatial planning) identified at the local level along the East plan area coastline.

The national policy context

The UK Plan for Growth (2011)[201]

Of the 16 "ambitions and measurable benchmarks2 for the UK set out within 'The Plan for Growth', it is suggested that the following are particularly relevant to marine planning:

- To encourage investment and exports as a route to a more balanced economy.
- Ensure the UK remains one of the top destinations for foreign direct investment (FDI).
- An increase in exports to key target markets.
- An increase in private sector employment, especially in regions outside London and the South East.
- Increased investment in low carbon technologies.
- Supporting more apprenticeships than any previous government.

Local growth: realising every place's potential (2010) [202]

Government interventions should support investment that will have a long term impact on growth, working with markets rather than seeking to create artificial and unsustainable growth. In some cases this means focusing investment at areas with long term growth challenges so that these areas can undergo transition to an economy that responds to a local demand. Places that are currently successful may also wish to prioritise activity to maximise further growth by removing barriers, such as infrastructure constraints. However, the White paper also emphasises that:

---

[201] HM Treasury (2001) The UK Plan for Growth [online] available at www.hm-treasury.gov.uk/ukecon_growth_index.htm, Accessed 10/11

[202] Department for Business, Innovation and Skills (2010) Local Growth: Realising Every Place's Potential [online] available at www.bis.gov.uk/policies/economic-development/local-growth-white-paper, Accessed 10/11

"This does not mean that every place will grow at the same rate or that everywhere will, or will want to, become an economic powerhouse. Long term economic trends make differences in economic performance inevitable and these can and do change over time."

Specific examples of areas where it makes sense for government intervention to tackle market failures include:

- investment in infrastructure
- tackling barriers such as transport congestion and poor connections;
- other support to areas facing long term growth challenges where this can help them manage their transition to growth industries
- strategic intervention where it can stimulate private sector investment in new green technology in strategic locations
- encouraging foreign investment and indigenous companies to export, especially where we have a comparative advantage.

Finally, the White Paper identifies that economic policy should be judged on the degree to which it delivers strong, sustainable and balanced growth of income and employment over the long-term. More specifically, growth should be: broad-based industrially and geographically, ensuring everyone has access, including future generations, to the opportunities that growth brings; whilst also focused on businesses that compete with the best internationally.

The Regional Growth Fund

The Local Growth White Paper also introduced the Regional Growth Fund, as a new mechanism for levering private sector investment, creating private sector jobs and rebalancing economies in places currently over-reliant upon the public sector. Figure 6.19 shows the location of projects allocated funding through the first round of the Regional Growth Fund and the area over which the projects are expected to have an impact. It can be seen that, along the East plan area coastline, it is only the northern area that has been a priority for funding. The one project that did receive funding will involve the development of 1,475 homes in Hull. The explicit aim is for quality new housing to support major growth in local renewable energy industries.

On 31 October 2011, the Government announced the successful bids for Round 2 of the Regional Growth Fund. Again, the focus is very much on directing funds to the Midlands and North of England.

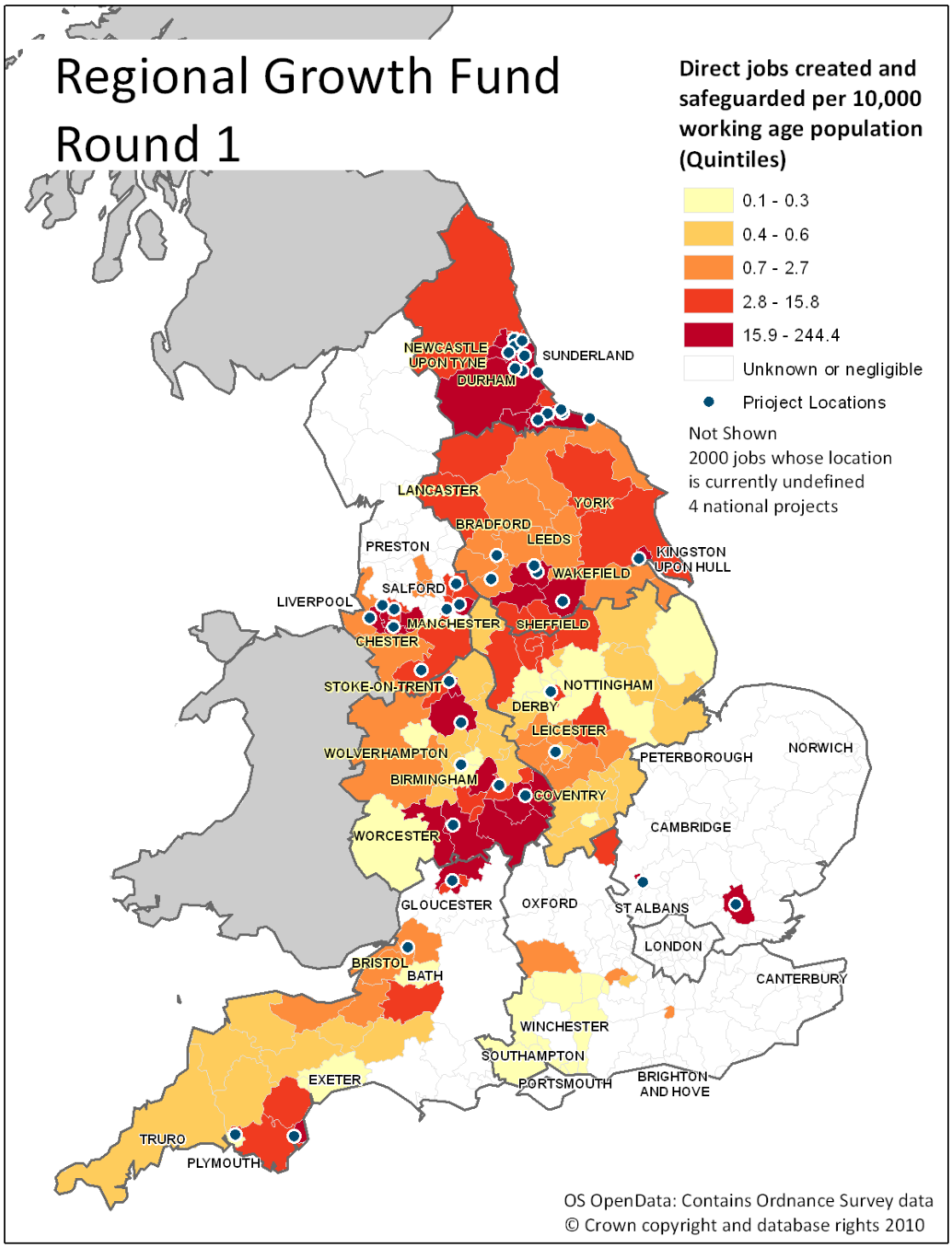


Figure 6.21: Regional Growth Fund Round 1 project locations and predicted employment impact[203]

[203] Employment impact is based on the numbers of direct created and safeguarded jobs given by applicants in proportion to the areas where they said these impacts would be felt. Figures have been given in relation to the size of the working age population (per 10,000 head of working age population). Resulting values have been grouped by quintile for local authorities where some employment impact would be felt. This has the advantage of representing the entire distribution evenly and minimising the effect of outliers. However, it does mean that the category sizes are not equal.

The Marine Policy Statement (2011)[204]

Box 1 of the MPS presents high level marine objectives. One of the five headline objectives is the need to 'achieve a sustainable marine economy'. Underneath this sits the following four detailed objectives:

- Infrastructure is in place to support and promote safe, profitable and efficient marine businesses.
- The marine environment and its resources are used to maximise sustainable activity, prosperity and opportunities for all, now and in the future.
- Marine businesses are taking long-term strategic decisions and managing risks effectively. They are competitive and operating efficiently.
- Marine businesses are acting in a way which respects environmental limits and is socially responsible. This is rewarded in the marketplace.

In terms of this scoping section, perhaps the most important messages come from the first two bullets, that is there is a need for marine plans to support business and enterprise; and there is a need to ensure that decisions taken enable "prosperity and opportunities for all, now and in the future". The point made by the second bullet is reinforced by Paragraph 2.5.5, which identifies the need for marine planning to contribute to securing sustainable economic growth both "in regeneration areas and areas that already benefit from strong local economies", promoting "economic growth and [sustaining] local jobs". This does not detract from the importance of the other two bullets, which need to be addressed through marine planning and the SA.

Section 2.5 of the MPS lists some key marine industries. It differentiates between long established industries (such as fishing, marine transport, port-related storage and processing, oil and gas production) and new and developing industries such as the renewable energy sector and associated offshore electricity transmission.

Chapter 3 then sets out policy objectives for key industries and activities. From this Chapter it is possible to understand more about those activities that should be a priority from an economic perspective, and why.

Energy production and infrastructure development

In general, there must be a focus on "oil and gas sectors which supply the major part of our current energy needs, and a growing contribution from renewable energy and from other forms of low carbon energy supply".

In terms of oil and gas, the MPS emphasises that economic development is significant in terms of national prosperity, and that:

- oil and gas can only be exploited where they are found, and that it usually **should** be exploited where it is found "to achieve the objective of maximum economic recovery"
- looking ahead, the recovery of remaining oil and gas reserves will require additional investment in both money and expertise

---

[204] HM Government (2011). UK Marine Policy Statement [online] available at www.defra.gov.uk/publications/files/pb3654-marine-policy-statement-110316.pdf, Accessed 10/11

- a range of offshore infrastructure is required to increase the UK's gas storage capacity.

In terms of renewable and low carbon energy supply, the MPS similarly emphasises that renewable energy resources can only be developed where the resource exists and where economically feasible. Decisions should recognise:

"The potential impact of inward investment in offshore wind, wave, tidal stream and tidal range energy related manufacturing and deployment activity; as well as the impact of associated employment opportunities on the regeneration of local and national economies… [in particular] Expansion of the offshore wind supply is likely to require significant investment in new high-value manufacturing capability with potential to regenerate local and national economies and provide employment."

In addition, in terms of energy production and infrastructure development, the MPS emphasises:

- It has been estimated that the carbon capture and storage (CCS) sector could be worth up to £3 billion a year by 2030, sustaining up to 100,000 jobs[205] but currently CCS is not commercially proven and the UK Government's intention is to support commercial scale demonstration projects[206].
- There will be a need to ensure the development of any necessary on-shore infrastructure, including: sub-stations, new gas and electricity import infrastructure, appropriately developed and placed ports and harbours.
- There are obvious economic benefits from increasing the capacity of offshore electricity networks, most notably through facilitation of offshore renewable energy. The UK Government has established a new offshore transmission regime to help ensure that the substantial investment required to connect offshore generation projects to the onshore grid is delivered in a cost effective manner.

Ports and shipping

Ports and shipping are an essential part of the UK economy, providing the major conduit for the country's imports and exports. According to 2011 Oxford Economics figures, the maritime sector, including ports, shipping and maritime services, contributes around £26.5 billion annually to UK GDP while supporting 531,000 jobs and providing £7.8 billion in tax revenues.

Ports are also very important for local economies. Despite continuing advances in efficiency, ports remain substantial employers and they facilitate geographically dispersed economic activity in trade-related sectors. In addition, they are essential to support emerging industries such as renewable energy development. The operation

---

[205] Clean Coal: an industrial strategy for the development of carbon capture and storage across the UK, DECC, 2010

[206] On 12 March 2010, the Government awarded funding to both E.ON UK and the ScottishPower CCS Consortium to carry out Front-End Engineering and Design (FEED) studies as part of the procurement process for the UK's first commercial-scale Carbon Capture and Storage (CCS) demonstration project. It has recently been announced that a deal could not be reached on the ScottishPower CCS Consortium project at Longannet. Government state that 'a selection process for further CCS projects will be published as soon as possible.'

of ports and marinas is enabled through the creation, maintenance and development of channels, berths and docks. Shipping is also an essential and valuable economic activity for the UK. Water transport is supported by a diverse range of ancillary activities including shipbuilding and repair, the construction of ports and marinas and activities associated with navigation including dredging.

The importance of ports to the national economy and local economies is a message that comes through clearly in the recently published National Planning Policy Statement for Ports - see Table 6.11.

Table 6.11: Key messages from the National Policy Statement for Ports[207]

1. The UK ports sector is the largest in Europe, in terms of tonnage handled. The private sector operates 15 of the largest 20 ports by tonnage and around two-thirds of the UK's port traffic. Much of the tonnage handled is concentrated in a small number of ports, with the top 15 ports accounting for almost 80 per cent of the UK's total traffic.
2. Recent consents for container developments have been in or near deepwater ports in the main coastal estuarial locations. But it is not possible to anticipate future commercial opportunities. New shipping routes and technologies may emerge. The needs of trading partners may change as their economic circumstances develop. So capacity needs to be provided at a wide range of facilities and locations, to provide the flexibility to match the changing demands of the market, possibly with traffic moving from existing ports to new facilities generating surplus capacity.
3. The Government believes that there is a compelling need for substantial additional port capacity over the next 20 to 30 years, to be met by a combination of development already consented and development for which applications have yet to be received. Excluding the possibility of providing additional capacity for the movement of goods and commodities through new port development would be to accept limits on economic growth and on the price, choice and availability of goods imported into the UK and available to consumers. It would also limit the local and regional economic benefits that new developments might bring. Such an outcome would be strongly against the public interest.
4. At regional and local level, economic benefits from port developments include regeneration and employment opportunities. As commercial developments, ports can also generate agglomeration effects by bringing together businesses, with varying degrees of mutual interaction, and producing economic benefits over and above those reflected in the value of transactions among those businesses. Ports can contribute to the enhancement of people's skills and of technology, as embodied in equipment used by ports and port-related activities, with wider longer-term benefits to the economy.
Ports and energy
5. Ports 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. Port handling needs for energy can be expected to change as the mix of our energy supplies changes and particularly as renewables play an increasingly important part

[207] DfT (2011) National Policy Statement for Ports [online] available at www.dft.gov.uk/publications/national-policy-statement-for-ports, Accessed 11/11

as an energy source. Because of the Government's renewables targets and in light of the policies set out in the Renewable Energy NPS, there is a strong public interest in enabling ports to service these developments.
6. The UK Renewable Energy Roadmap (2011) indicates that, in its central scenario, up to 18 GW of new offshore wind capacity could be deployed by 2020, with a high potential for further deployment by 2030. The manufacturing and assembly of large-scale equipment to serve the offshore energy sector within port sites in the UK is set to see significant increase in demand as a result. This is in addition to port capacity needed to provide installation, operation and maintenance facilities for this scale of deployment. To some extent, capacity provided for by container terminal consents may help to contribute, on an interim basis, to meeting demand.

Tourism

To quote directly from the MPS:

"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. Tourism is one of the top three growth sectors of the economy and supports 1.5 million jobs and contributed nearly £90 billion to the economy in 2009[208]. Seaside tourism makes an important contribution. It supports some 21,000 jobs and contributes £3.6 billion to the economy. The economic, social and environmental factors relating to tourism therefore need to be carefully considered in developing marine plans. A similar picture exists for recreation where, for example, the estimated economic contribution of recreational boating to the UK economy was £1.042 billion in 2009/10 and employed nearly 35,000 in this sector[209]."

Other marine activities

Marine aggregates make a crucial contribution to meeting the nation's demand for construction aggregate materials, essential for the development of our built environment. Marine aggregates also contribute to energy security and economic development through provision of fill for major coastal infrastructure projects, for example ports, renewable energy and nuclear energy projects.

'The Charting Progress 2 Report identifies that **oil and gas and maritime transport** activities in the East marine area both result in greater than £1 billion Gross Value Added (GVA) per annum. This is considerably higher than the GVA that results from any individual activity within the marine area, with: telecoms and leisure or recreation both resulting in £100 to 500 million GVA; mineral extraction and water extraction both resulting in £10 to 100 million GVA; and fisheries, aquaculture and defence all resulting in less than £10 million GVA[210].

[208] Tourism Contribution to the Economy & Tourism Employment (TSA). Employment figures are for 2008.
[209] Defra (2011) UK Marine Policy Statement. p46
[210] http://chartingprogress.defra.gov.uk/productive-seas#productive-table

Submarine cables are part of the backbone of the world's power, information and international telecommunications infrastructure, and socially and economically crucial to the UK.

Fishing is important from a perspective of maintaining a prosperous and efficient fishing industry and provide social, cultural and economic benefits to often fragile coastal communities. The dependence of jobs on fishing can be as high as 20 per cent or more in some communities. Marine plan authorities should have regard to the economic impacts of displacement and whether it is possible for vessels to relocate to other fishing grounds.

Shellfish **aquaculture** is evenly spread throughout the UK, where as finfish aquaculture is focused overwhelmingly in Scotland. Shellfish farming is an expanding activity. In 2008 the estimated value of farmed shellfish was £33 million, from just over 38.6 thousand tonnes; this is an increase of about 40 per cent over the level of production in 2007.

A Description of the Marine Planning System for England (2011) [211]

This document supplements the MPS by clarifying the procedural approach that will be taken to marine spatial planning in England. This document does not focus on supplementing the substantive messages set out within the MPS, although it does helpfully suggest the following as a priority:

> "Marine planning has the potential where appropriate, to contribute to the transformation of coastal towns from geographically peripheral areas to hubs for sustainable economic growth based on the shared terrestrial and marine evidence base."

The potential for marine activities to increase local economic output

The Roger Tym & Partners / OCSI report: Maximising the socio-economic benefits of marine planning for English coastal communities (2011)[212] identifies that when considering the potential for an activity to improve the economic performance of an area there is a need to have a particular focus on the potential for the activity to increase:

- labour quantity
- labour skills
- competition
- innovation
- investment
- enterprise.

Broadly, the first two drivers are about increasing labour utilisation, while the second four relate to increasing labour productivity. The Roger Tym & Partners / OCSI report

---

[211] Defra (March 2011) A Description of the Marine Planning System for England. www.defra.gov.uk/environment/marine/protect/planning/

[212] Roger Tym and Partners / OSCI (2001) Maximising the socio-economic benefits of marine planning for English coastal communities [online] available @ www.marinemanagement.org.uk/marineplanning/documents/se_national.pdf, Accessed 10/11

looks at labour utilisation and labour productivity in turn, and considers how the benefits can be maximised through marine planning, given the particular activities that will be a focus. Set out below is a summary of some headline findings.

The potential for activities to affect labour utilisation:

- Geographical proximity to an energy production site will not guarantee benefits. Rather, effects on local labour utilisation depend on the extent to which support industries (such as construction, maintenance and operations industries) are able to establish.
- By way of an example, the development, construction and initial five years operation of the Scroby Sands offshore wind farm resulted in a total expenditure of £80 million, but only £38.8 million (48 per cent) was contracted to UK companies and only £12.8 million (16 per cent) contracted to companies from within the East of England. Evidence suggests that this level of leakage is relatively low. Having said this, the sheer scale of investment in some Round 3 projects, and the consequent local jobs growth effects, may mean that certain towns which are successful in capturing activity do see a significant economic boost.
- Ports and shipping activity can have high local effects as labour catchments tend to be relatively local, and there is demand for lower skilled labour, so creating jobs that are accessible for less well skilled workers who find themselves at increased risk of unemployment (although lower skilled jobs make a smaller contribution to productivity growth).
- While the total number of individuals employed in fisheries has fallen in past decades, making this activity one of less economic significance in many local areas, it is the case that changes in levels of fisheries activity will still have significant impacts in some labour markets (particularly those which are more peripheral, and lack alternative occupations). On the positive side, this means that they are available to individuals who are at greater risk of unemployment, but lower skilled jobs make a smaller contribution to productivity growth.
- Jobs created in tourism are also low skilled in nature. Tourism jobs tend to be seasonal and are frequently part time, which is not good from a local productivity perspective.
- Manufacture of telecommunications cabling is an example of an activity that will have minimal impact on labour utilisation. Manufacturing takes place at a small number of sites, and cable laying contractors are international. Jobs created are likely to be highly specialised and consequently inaccessible to deprived people.

The potential for activities to affect labour **productivity**:

- The renewables industry in particular will be the beneficiary of very high levels of capital investment over coming years, and as a result per capita output can be expected to be significantly higher than average.
- Round 3 wind farm licensing is one of the largest investment programmes undertaken in the UK, ever, but it is also footloose in a way that other big investment programmes (such as railways, or the conversion from coal gas to natural gas) have not been, given that manufacture and some maintenance and operations activities could locate abroad unless these industries find an accommodating home.

- Port activities can have major impacts on local infrastructure. In the largest projects, there can be positive connectivity spin-offs for local economies resulting from these impacts, as upgraded road infrastructure may be available to other business users, and so improve linkages to labour and product markets. Equally, many areas are looking to move port areas away from traditional port activity, and instead use waterfront areas to bolster urban environments.
- Fisheries pay is below average, with intermittently high wage being eroded by factors such as seasonality and weather. As with other primary/extractive industries, the fishing industry is not likely to drive forward local productivity (although it is important to note that there may be exceptions)
- It is important to note, though, that the presence of fisheries does tend to play a role in terms of supporting local distinctiveness, which in turn can boost productivity in the tourism industry. There is a difficulty in quantifying the extent of this influence.
- Tourism typically results in minimal benefits to local labour productivity, although there is evidence that speciality tourism and a refreshed tourist offer might work to raise productivity. Local connectivity may be enhanced by the travel demand created by tourism. Conversely, tourism may negatively affect local transport connectivity.

Priorities identified at the local level

Local enterprise partnership priorities

Local enterprise partnerships (LEPs) are joint local authority/business bodies that reflect genuine economic areas to promote local economic development – see Figure 6.22. The Local Growth White Paper set out the diverse roles the local enterprise partnerships can play. These could include ensuring that planning and infrastructure investment support business needs, and working with Government to support enterprise, innovation, global trade and inward investment. LEPs are a key mechanism for achieving the Government's aim of achieving a more evenly balanced economy across the country and between industries, and one that is more driven by private sector growth.

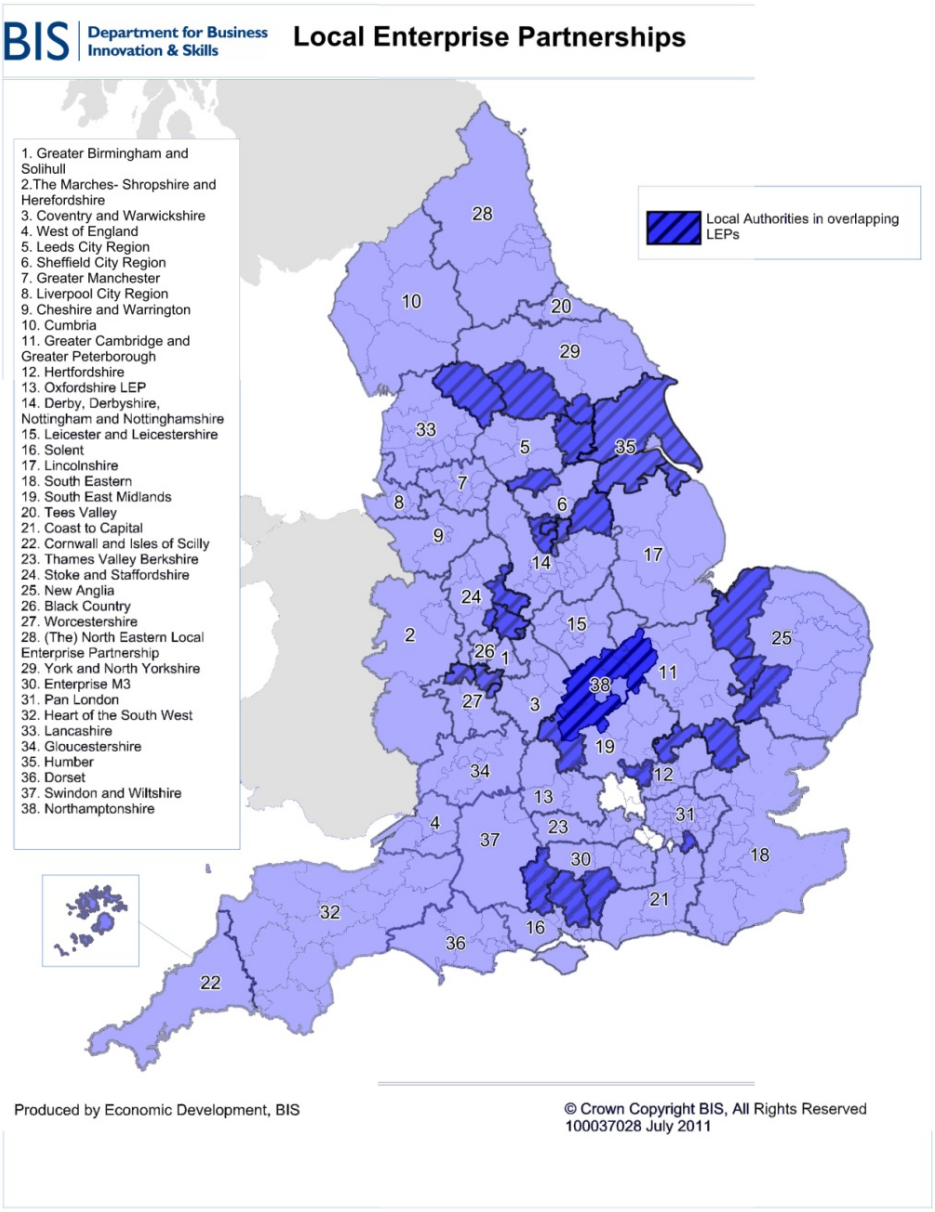


Figure 6.22: Local enterprise partnerships in England

The East plan areas coastline falls primarily within the LEPs for The Humber, Greater Lincolnshire, and New Anglia. Understanding of priorities established through the South Eastern LEP are also of relevance to the East marine plan areas.

The Humber LEP

The four unitary Humber authorities are working with Associated British Ports and other private sector partners to establish the estuary as a major energy corridor, building on its existing role in non-renewables such as the import of coal and North Sea gas terminals. The ports complex of Immingham, Hull, Grimsby and Goole is well established, and plans are in place to develop adjacent sites. However, there are multiple issues – for example, Habitats Regulations, maintaining the deep water channels of the Humber, the level of Tolls across the Humber Bridge, and the need

to develop the indigenous skills base – which require support from Government at a national level[213].

In August 2011 Government announced that the Humber Estuary Renewable Energy Super Cluster would be one of the 22 national enterprise zones. The Humber Estuary Renewable Energy Super Cluster Enterprise Zone covers the proposed 2,000-acre energy park earmarked near Killingholme on the south bank and the Green Port initiative in Hull. It is predicted that this Enterprise Zone will support the creation of up to 4,850 jobs by 2015 and save businesses up to £7.9 million in forgone business rates[214].

Greater Lincolnshire LEP [215]

Along with King's Lynn/West Norfold area, a major economic priority within the coastal area of Lincolnshire relates to continued support for the agri-food sectors. To the north of Lincolnshire, Grimsby and Immingham form the fourth largest port in Northern Europe, handling 65.3 million tonnes of cargo in 2008. In addition to import/export related activities (which include the chemicals sector), the port underpins the agri-food sector for the north of Greater Lincolnshire.

New Anglia LEP [216]

The goal is to capitalise on strengths including:

- The UK's premier energy coast (gas, renewables, nuclear and biofuels/biomass) including major centres at Great Yarmouth, Lowestoft and Harwich in Essex
- Shipping, ports and logistics.
- There is the major international container port at Felixstowe and important facilities at Harwich, Ipswich, Great Yarmouth, Lowestoft, and King's Lynn. Suffolk handles 40 per cent of all UK container trade and is therefore a key economic driver and an asset of major strategic importance.

The LEP will focus on addressing and overcoming existing problems, including in relation to:

- below average skill levels
- an infrastructure deficit on the road and rail network
- inadequate utilities infrastructure, which is actively hindering private sector investment
- significant areas of deprivation in urban, rural and coastal areas
- high levels of public sector job dependency.

In August 2011 Government announced that Great Yarmouth and Lowestoft would become one of the 22 national enterprise zones. The Great Yarmouth and Lowestoft

---

[213] Roger Tym & Partners / OCSI (2011). The East Marine Plan area: maximising the socio-economic benefits of marine planning [online] available at www.marinemanagement.org.uk/marineplanning/documents/se_east.pdf, Accessed 10/11

[214] www.thisisgrimsby.co.uk/Humber-region-enterprise-zone-gets-ahead/story-13148427-detail/story.html, Accessed 10/11

[215] See microsites.lincolnshire.gov.uk/GLLEP, Accessed 10/11

[216] See www.newanglia.co.uk/Downloads/Norfolk-Suffolk-LEP.pdf, Accessed 10/11

Enterprise Zone will focus on the regeneration and growth potential within the two towns offered by the energy sector. The focus will be on new jobs in the ports, logistics and engineering sectors as well as the services which support those. A central element of the strategy is to plan for economic growth within the two towns in an integrated manner, with 121 hectares of land identified across the two towns. By 2015 it is envisaged that there will be around 80 businesses in the enterprise zone, of which 60 will be as a result of expansion and 20 inward investors. Longer term the enterprise zone is expected to be home to between 150 and 200 businesses. It is forecast that 9,000 new jobs will be created in the enterprise zone areas by 2025 (1,380 by 2015) and a further 4,500 (690) indirect jobs[217].

The Essex, Kent, Medway, Thurrock and Southend Local Economic Partnership[218]

Suffolk Coastal District, on the southern fringe of the East plan area, is one of the most complex areas on the East coast, with the major ports of Felixstowe, Harwich and Ipswich in the vicinity and considerable estuarine coastline. Although the major ports themselves are outside the East plan area (whilst Felixstowe town is in the marine plan area, the port of Felixstowe is not), shipping must sail through the plan area to access the ports. There are strong dependencies and relationships between Suffolk and Essex marine activities that will need careful management. In particular, it will be important that issues on the Stour and Orwell are picked up.

Centres for Offshore Renewable Engineering

Government has identified five English locations with strong local enterprise partnerships (LEPs), where there is a combination of commercial interest, and traditional or developing industrial strengths in maritime and offshore engineering, and designated these areas as CORES (Centres for Offshore Renewable Engineering). CORES include Humber (North & South bank) and New Anglia (Great Yarmouth & Lowestoft). These areas offer the right infrastructure for offshore wind manufacturing, access to a skilled workforce, an experienced local supply chain and committed local leadership[219].

The local policy context

Work has been undertaken by Roger Tym and Partners / OSCI[220] to review the local policy context established by local authorities along the East plan area coastline, with a view to better understanding policy priorities that should be picked up by the marine plan. This work has included: a detailed review of adopted and emerging planning policy documents; and consultation with local planning authorities through telephone interviews.

---

[217] www.newanglia.co.uk/Downloads/EZOverview.pdf, Accessed 10/11

[218] Roger Tym & Partners / OCSI (2011). The East Marine Plan area: maximising the socio-economic benefits of marine planning [online] available at www.marinemanagement.org.uk/marineplanning/documents/se_east.pdf, Accessed 10/11

[219] More information is available at www.bis.gov.uk/assets/biscore/business-sectors/docs/c/11-1393-centres-for-offshore-renewable-engineering, Accessed 01/12

[220] Roger Tym & Partners / OCSI (2011). The East Marine Plan area: maximising the socio-economic benefits of marine planning [online] available at www.marinemanagement.org.uk/marineplanning/documents/se_east.pdf, Accessed 10/11

Set out below are the headline messages gleaned from the Roger Tym and Partners / OSCI analysis of consultation responses[221]. Messages have been edited down considerably, but read together help to develop our understanding of the appropriate scope of the SA. This should not be taken as a comprehensive list of issues to inform the SA. Depending on the scope of plan issues and options, there may be a need for further local evidence gathering.

East Riding of Yorkshire

- Suggest that the marine plan should support ports in the north of England, given that this could help take the pressure off ports in the South East. However, there are practical barriers to developing the Humber ports to this level, including congested road and rail connections.
- There is ongoing work to develop a sustainable economic niche for the shellfish fishing fleet working out of communities along the coast from Flamborough down to Easington including Hornsea and Withernsea.
- There are opportunities to diversify the tourism offer, for example through diving, yachting, or angling; through securing the renaissance of the traditional resorts of Bridlington, Hornsea and Withernsea, and through developing the rural tourism offer, visitors encouraged to coastal caravan parks.
- Through the Humber LEP, East Riding is working on tourism development (along an 80 mile stretch of coastline).

Kingston upon Hull

- The Green Port Hull proposal, which includes the Siemens/ABP proposals for Alexandra Dock, is a major push to secure green jobs which needs active marine planning support. The council believes that Hull's economic difficulties (associated with structural change and peripherality) on the one hand, and its strong position for participation in North Sea power generation activities on the other, suggest that there is a good case for marine planning support.
- Ports are a major industry for Hull, and seen as central to the economic rationale of the city. These are seen as part of a wider logistics offer: the city looks out to Rotterdam and Zeebrugge for many of its economic connections, and is linked to Leeds, Manchester and Liverpool by the M62. The City Council will seek to expand Hull's port activities (wherever possible).
- The city and other neighbouring authorities are seeking to broaden the city's economic base. Amongst other initiatives, this involves tourism and changes of land use to encourage a higher city centre population. There are sites within the port and on the waterfront outside the port which may come up for redevelopment. These could be used for mixed use developments.

North Lincolnshire

- The Able Marine Energy Park in North Killingholme is a project of strategic significance. Together with the related Logistics Park (which encircles the Marine Energy Park itself) the local authority suggests that this is one of the biggest

[221] The Roger Tym and Partners / OSCI report emphasises that the issues and considerations presented are those suggested by interviewees through workshops and interviews, subject to editing, amendment and selection by the consultant team. These considerations are not binding and do not represent a corporate local authority view.

development opportunities in the north of England for the past two to three decades. A proactive approach is required to progress the scheme, given that proposals will necessitate significant investment in local transport infrastructure. The energy proposals in North Lincolnshire complement other proposals in Hull (where Siemens have options on a site adjacent to the docks). There are also possible implications for Goole, where local industry could form an important part of the Energy Park supply chain.

- The Humber is an internationally important estuary for nature conservation, with significant eco-tourism potential. The landscape of North Lincolnshire is also varied and offers a wealth of green tourism opportunities based around its intrinsic values.

North East Lincolnshire

- Wind energy maintenance and operations represents a major opportunity for the area. Centrica and Siemens already service the Lynn and Inner Dowsing Wind Farm from Grimsby. This is a relatively small Round 1 development of 54 turbines, and is small in scale compared to proposals in Round 2 and Round 3. It is North East Lincolnshire's aspiration that Grimsby will be the main operations and maintenance hub for the East Coast wind farms. Officers say that they expect six blue chip names at Grimsby dock within the next 10 years.
- Grimsby is struggling with a range of structural economic changes, and so there are sound equity reasons for ensuring that Grimsby is able to take advantage of this significant industrial opportunity. North East Lincolnshire wish to see quick, pro-development decisions taken that reflect what is seen as a strategic opportunity for the local economy. The anxiety is that delay will mean that competitor ports in Germany and Denmark will pick up maintenance and operations work that otherwise would have stayed in the UK.
- Proposals for a £130 million biomass-fuelled power plant at Immingham Docks are going to consultation in July 2011.
- Officers in North East Lincolnshire are concerned regarding the potential for delays to investment in wind energy that might be caused due to a lack of on-shore grid connections.
- The fisheries industry is no longer a major employer, but Grimsby remains a very important part in the fisheries supply chain (5,000 local jobs are in food processing, of which fish processing represents the largest share).
- Cleethorpes is a traditional seaside resort, and tourism and recreation forms a significant part of the local economy.

East Lindsey

- There is a concern within East Lindsey Council regarding the potential for onshore implications from offshore marine activities to adversely impact on the tourism sector, which in turn depends extensively on the quality of the natural environment.
- The Lincshore project, which started in 1994, pumps sand from licensed offshore sites onto 20 kilometres of beach between Skegness and Mablethorpe both as a flood defence mechanism and in support of tourism. East Lindsey District Council wish to work with strategic partners to maintain the project.
- The council is developing regeneration proposals for Skegness.

- There are some specific coastal project proposals being discussed locally, for example, development of a private sector wind farm assembly proposal at Wainwright.

Boston

- The local authority believes that the tourism potential of the borough could be further developed.
- A potential concern about routeing of onshore cables and pylons is noted given the potential for landscape conflicts.
- Flood risk will have serious implications for how development within coastal communities can be achieved in the longer term and could be a very practical curb on economic development locally.

South Holland

- There are opportunities to develop the tourism product in Lincolnshire, developing niche markets which could include marine related tourism. Ideas are in development through the Lincolnshire Coast project (covering East Lindsey, Boston and South Holland districts). This will link to ongoing research to survey coastal businesses about issues and aspirations with a view to modelling future scenarios in relation to flood risk and the economic impact that this might have.
- Sutton Bridge has a small port facility which deals with bulky goods such as peat and timber. The local authority would like to see better use made of this facility (this issue was previously raised by the regional spatial strategy).

King's Lynn and West Norfolk

- Marina proposals exist for King's Lynn. The council believes there is a strong socio-economic case for a positive enabling approach given the existing barriers to investment faced by the town. The marina plans are currently at a halt due to adverse economic conditions.
- Current port activity in the area has consolidated at the main port. The port has not attracted significant amounts of maintenance activity resulting from offshore wind developments. This has been focused at Wells, which is in the neighbouring local authority of North Norfolk. The council wishes to retain activity at the main port, and grow it if possible. The port borders an area of high deprivation, and tends to create jobs accessible to the local population.
- Whilst very important to a number of individuals, fisheries cannot be said to be central to the local economy. Under the EU Objective 2 Programme, on the North Norfolk coast there have historically been small amounts of investment in improving facilities. King's Lynn's socio-economic status suggests a rationale for further action.
- Hunstanton is peripherally located, and suffers from poor transport connections. The Hunstanton regeneration masterplan focuses on better quality year-round employment, predominantly in tourism. Marine activities form an important part of Hunstanton's tourist offer.

North Norfolk

- There is a need to maintain the Cromer crab fisheries as it contributes to both economic activity directly and also supports the tourism appeal of Cromer.

Great Yarmouth

- See discussion of the Great Yarmouth and Lowestoft Enterprise Zone above
- Proposals for a third river crossing in Great Yarmouth, which had been developed and costed, are currently in abeyance due to lack of funding but would benefit the harbour if carried through.
- Key areas to support tourism, which is important to Great Yarmouth, include maintaining water quality and beaches.
- The outer harbour is able to take most sizes of vessels and a new aggregates berth has been created. More expansion may be proposed in the outer harbour.

Waveney

- Energy is seen as having a strategic importance to Lowestoft's future economy, given Lowestoft's relatively deprived status, and the fact that other strategic economic drivers for the town are difficult to see given issues of peripherality and structural economic change. Lowestoft does not aim to provide manufacturing space for turbines. Instead, there are aspirations to increase activity through the turbine maintenance and related activities. The Area Action Plan focusing on the Lowestoft outer harbour and Lake Lothing area contains an employment allocation in the outer harbour called the Power Park, and considerable local work has been undertaken to prepare Lowestoft as a centre of excellence for offshore wind transmission.
- See discussion of the Great Yarmouth and Lowestoft Enterprise Zone above.
- Lowestoft and Great Yarmouth are areas with significant socio-economic difficulties. They have been the subject of numerous regeneration initiatives over the years. There is a strong equity rationale for strategic investment directed at new turbine maintenance industries in these towns.
- Lowestoft has aspirations for large amounts of waterfront housing, although some development is currently in abeyance. Given local structural economic weaknesses, there are significant merits in seeing housing-led regeneration when economic conditions improve.
- Although industries are smaller than previously, fisheries employment in Lowestoft and Southwold remains. Plans for fishing are more about protecting existing character of the area, whilst supporting existing fisheries businesses where possible.

Suffolk Coastal

- Local communities are aware that new power transmission cabling resulting from offshore power generation has little local economic and social benefit, and considerable local environmental disbenefits.
- The expected Sizewell C nuclear power station will have a very wide range of impacts, for example, aggregates extraction for construction and implications for coastal processes.
- The Felixstowe port extension (not in the East plan area) is currently around two-thirds of the way to completion. The project will secure Felixstowe's position as a major European hub and one of the few ports able to dock the new generation superships. New port facilities at Bathside Bay (not in the East plan area) may be developed during the plan period. Socio-economic impacts of port growth on the East plan area (to the north of the Estuary) are likely to be relatively limited, given

that the geography of the estuary makes labour markets relatively distinct between Harwich and Felixstowe.
- The Suffolk estuaries are a very important component for Suffolk's tourism offer as a whole, and local tourism has largely coastal focus. In particular, the area running from Aldeburgh to south of Colchester is one of the most concentrated recreational sailing areas in the country. Sailing contributes to sense of place at local coastal towns, and supports significant employment.
- Fisheries are no longer seen as a major economic driver; however, they are an important animator of ports, have an important tourism value and supply local restaurants and beachside fish stalls.

Ipswich

- Ipswich port undertakes some boat building (yachts), and the port deals with non-containerised cargoes (often in aggregates and timber). The town has seen a significant amount of housing redevelopment of redundant port sites in recent years, and there are still sites on the fringes of the port area which lend themselves to housing. The county believes that the Ipswich housing market is likely to recover sooner than that of Lowestoft, given its closer proximity to London.
- The borough council is keen to support the wider Haven Gateway partnership as employment growth could support regeneration and benefit residents of deprived parts of Ipswich.

Scarborough Borough

- The coastal environment is central to Scarborough's tourism offer, and so is seen as an important economic as well as environmental asset. The council intends to develop a Coastal Zone Management Policy as part of the Core Strategy which will set how assets can be maintained into the long term.

Tendring

- Both the port of Harwich and Brightlingsea have developed support services and supply chain activity in relation to offshore wind farm developments, with the opportunity to build this role as further wind farm development is carried forward (such as London Array). Longer term, there is already planning permission for the development of additional container port facilities at Bathside Bay, Harwich.
- In the longer term, higher quality tourism could be a route to assist regeneration of more deprived communities in, for example, Clacton and Jaywick. There is opportunity for marine related tourism and recreation through the East marine plan to support the district council's aspirations (albeit that Tendring is an adjacent authority).

A visual summary of the most important marine issues for particular areas

From analysis of evidence gathered through consultation with local authorities, the Roger Tym and Partners / OSCI report[222] suggests the three big marine issues as being: tourism, energy, and ports (in that order). Fishing is considered by local

[222] Roger Tym & Partners / OCSI (2011). The East Marine Plan area: maximising the socio-economic benefits of marine planning [online] available at www.marinemanagement.org.uk/marineplanning/documents/se_east.pdf, Accessed 10/11

authorities to be the fourth most important issue. The distribution of local authorities' perceptions of the key issues is shown in the map below.

Figure 6.23: Local authorities' perception of the main marine issues in the East plan area (based on RTP analysis of interviews)

What's the baseline situation?

Introduction to the baseline review

Figure 6.24 presents the activity count map for the East plan areas. From the perspective of this scoping chapter, Figure 6.24 is helpful in that it gives an impression of those areas that are particularly important for marine businesses. However, there is clearly also a need to break this down further, and understand where particular activities are concentrated, given that the marine plan will look to prioritise. The other headline limitation of Figure 6.24 is that it gives no indication of where marine related activates are focused onshore.

This aspect of baseline review – that is establishing what happens where – is not the focus of this chapter. Rather, the focus of this chapter is on developing an understanding of the current economic performance of coastal areas associated with the East marine plan. It is this baseline understanding that will be particularly useful when it comes to predicting and evaluating the sustainability implications of the plan and plan alternatives. More generally, reviewing baseline conditions is helpful in the sense that – in the same as reviewing the policy context – it helps to identify issues that should be a focus of appraisal. Any further fuller description of the baseline will include consideration of relevant aspects of the "Productive Seas" component of Charting Progress 2 [223].

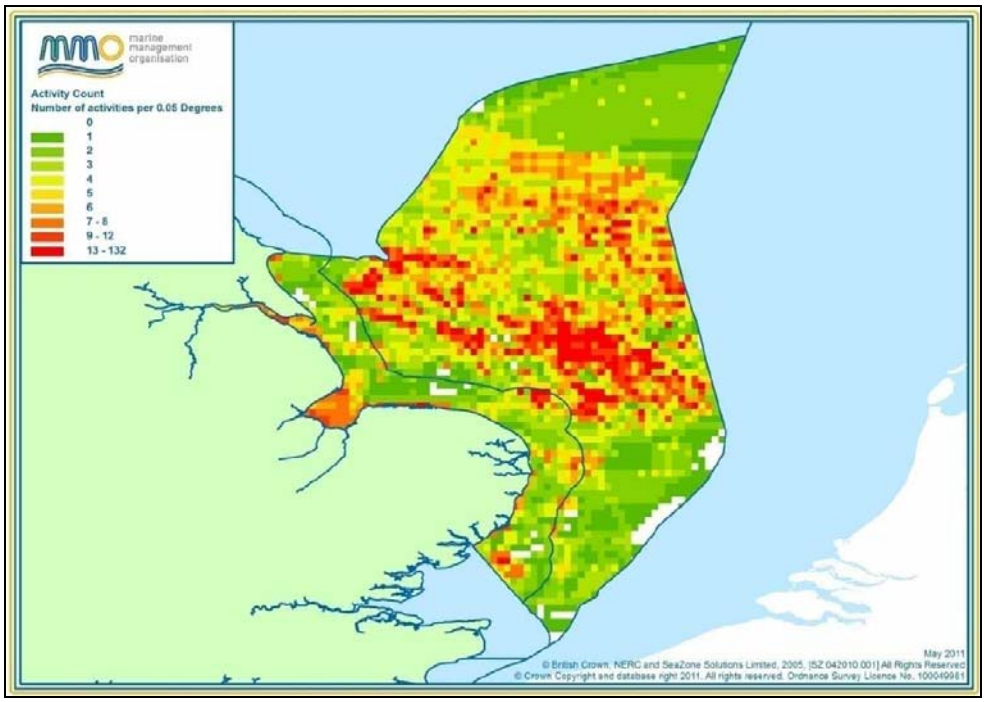


Figure 6.24: Marine 'activity count' within the East Onshore and East Offshore areas

Economic performance of coastal areas

Work by Roger Tym & Partners / OCSI[224] identifies labour utilisation and labour productivity as key headline indicators of local economic performance.

The report considers the situation for coastal areas of **England** in terms of both headline indicators. In terms of labour utilisation, the report highlights that:

- educational attainment and workforce skills in coastal areas are not generally worse than the English average, but this hides pockets of real problems

[223] Defra (2010). Charting Progress 2: An assessment of the state of UK seas. Published by the Department for Environment Food and Rural Affairs on behalf of the UK Marine Monitoring and Assessment Strategy community, London, p194.
[224] Roger Tym and Partners / OSCI (2001) Maximising the socio-economic benefits of marine planning for English coastal communities [online] available at www.marinemanagement.org.uk/marineplanning/documents/se_national.pdf, Accessed 10/11

- a number of seaside towns have a very low proportion of workers with high-level qualifications
- employment growth in coastal towns has been better than average, and labour resources in coastal areas have been boosted by in-migration by people of working age
- coastal areas with strong environments may be well positioned to attract highly skilled workers – some may be loosely termed lifestyle shifters
- employment rates are slightly below the English average, and claimant rates for the three main benefits for the non-employed is above average
- the amount of paid work done in coastal communities is depressed by seasonality and part-time working and in some areas high concentrations of older people reduce per capita productivity levels.

In terms of labour productivity, the report highlights that:

- 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 do not embrace structural change and innovation.
- Some coastal industries – including fisheries, tourism, shipbuilding and port activities – have been subject to profound structural change in the last half century. A number of coastal areas have struggled to respond by moving their economies to other, more productive activities. There is a theory[225] that the economic future of places rests to a certain extent on its historic economic path. Places become path dependent when firms and consumers are locked-into repetitive patterns of production and consumption, and this limits the opportunity for new products and services to make it to the market.
- Places can move through the path dependence phase into the path decay phase. The Roger Tym & Partners / OCSI Report suggests that, just as with industrial cities, it is this process of path decay that can threaten some coastal areas.
- Firms in poorer and more remote regions can face less competition, and hence reduced incentives to cut costs and innovate.
- Business stock and start-up rates in coastal communities are slightly below average.
- Regarding the investment productivity driver, some coastal areas are up against formidable natural obstacles.
- Frequently, coastal status means that coastal areas are peripherally located, which makes it difficult to compete successfully in labour and product markets, so reducing the level of investment the market is willing to make.
- The lack of a 360-degree economic hinterland means that coastal towns may experience difficulties in attracting investment and remaining competitive.
- The tourism industry in some coastal resorts suffers from particular problems with regard to reinvesting on the scale required to keep up with customer expectations.
- Distinctiveness and irregularity is central to much of the coast's appeal (with Aldeburgh being a good example).

---

[225] Simmie et al (2008) History matters: Path dependence and innovation in British city-regions

Economic performance of coastal areas in the East of England

A separate report by Roger Tym & Partners / OCSI (2011)[226] categorises all coastal areas along the East plan area using a nationally developed[227] typology (see Figure 6.25, Table 6.12 and Figure 6.26), before then undertaking analysis to better understand the prevalence of each area 'type' along the coastline of the East plan area.

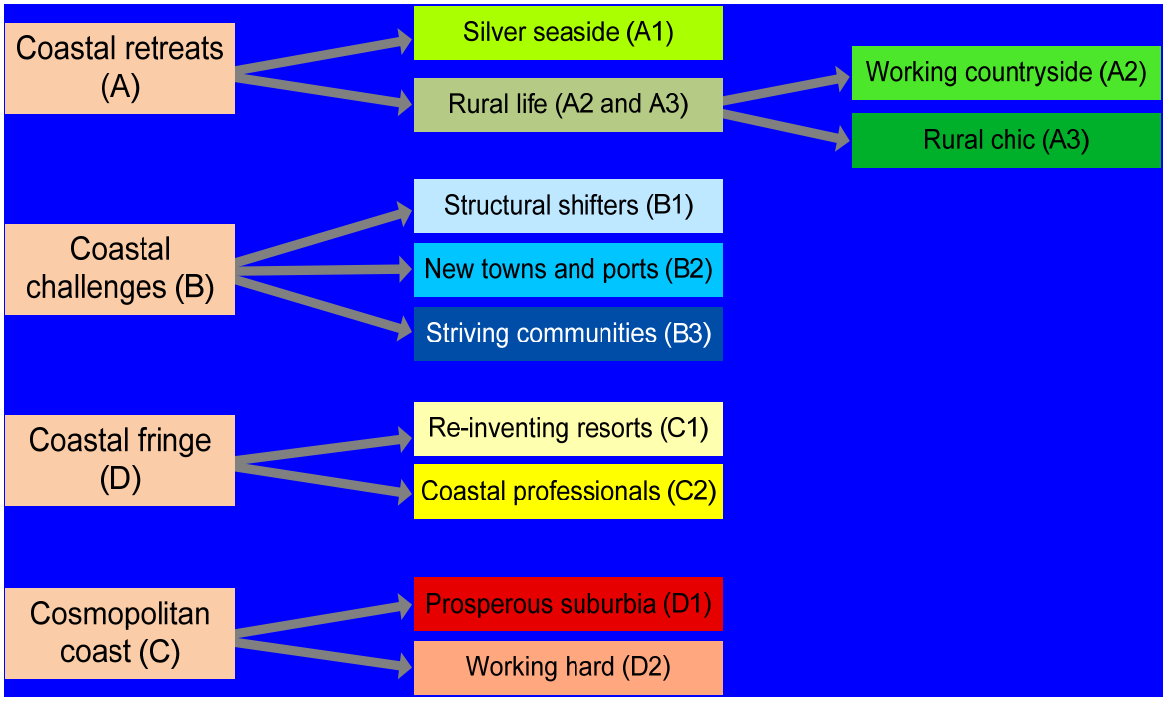


Figure 6.25: The Roger Tym & Partners / OCSI typology of coastal areas in England[228]

Table 6.12: Explanation of the Roger Tym & Partners / OCSI typology of coastal areas[229]

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	• People receiving Jobseekers Allowance • People

[226] Roger Tym & Partners / OCSI (2011). The East Marine Plan area: maximising the socio-economic benefits of marine planning [online] available at www.marinemanagement.org.uk/marineplanning/documents/se_east.pdf, Accessed 10/11

[227] That is this typology was developed to capture the characteristics of all coastal areas nationally, it was not developed specifically to reflect the range of coastal areas within along the coastline of the East Plan area.

[228] Roger Tym and Partners / OSCI (2001) Maximising the socio-economic benefits of marine planning for English coastal communities [online] available at www.marinemanagement.org.uk/marineplanning/documents/se_national.pdf, Accessed 10/11

[229] Roger Tym and Partners / OSCI (2001) Maximising the socio-economic benefits of marine planning for English coastal communities [online] available at www.marinemanagement.org.uk/marineplanning/documents/se_national.pdf, Accessed 10/11

Typology category	Overview	Above the coastal average	Below the coastal average
		• Self employment • People employed in tourism	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
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	Challenges relating to poor skills and high levels of worklessness,	• Jobs growth • Child and	• People qualified to degree level

Typology category	Overview	Above the coastal average	Below the coastal average
and ports	but counterbalanced by relatively strong economy and often located close to areas of economic growth	pensioner poverty • Jobseekers Allowance claimants • Incapacity Benefit claimants	
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
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 40km to work	• People living in houses • Owner occupied • Overall employment rate • Part time employees

Typology category	Overview	Above the coastal average	Below the coastal average
		• People living in flats • ID 2010 crime domain	
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 40km to work • Private rented housing • ID 2010 Crime domain • People living in flats	• People of pensionable age • Part time employees • People living in houses
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

Typology category	Overview	Above the coastal average	Below the coastal average
			claimants (unemployment benefit) • People receiving workless benefits due to poor health • Self-employed people • Social rented housing

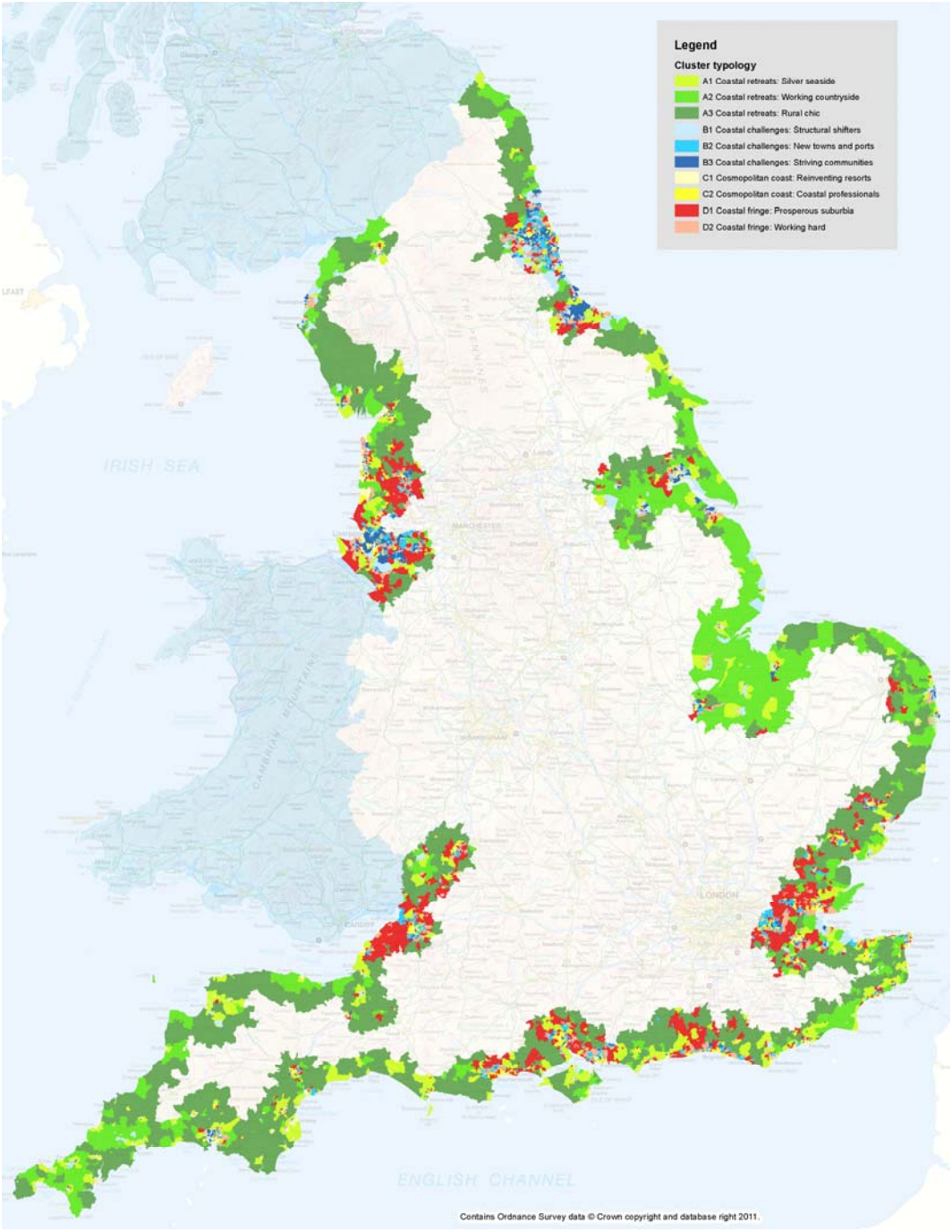


Figure 6.26: Coastal typologies within England[230]

[230] Roger Tym and Partners / OSCI (2001) Maximising the socio-economic benefits of marine planning for English coastal communities [online] available at www.marinemanagement.org.uk/marineplanning/documents/se_national.pdf, Accessed 10/11. It is important to note that the typology has been applied to 'Lower Super Output Areas' (SOAs). The size of SOAs is correlated to population, i.e. rural LSOAs are larger than urban LSOAs. Hence, the map should be taken to be a useful reflection of the area of land falling under each typology, but not population.

Set out below is a brief description of the prevalence of each coastal type along the East plan area coastline.

Coastal retreats – Silver seaside

By land area, this typology is somewhat prevalent along the coastline of the East plan area, although it is considerably more prevalent along the coastlines of the South East and South West regions. In the East, this typology is distributed quite widely, but with particular areas of focus in North Norfolk, Scarborough and Tendring districts. Towns associated with this typology include Sheringham, Halesworth, North Walsham, Scarborough and Bridlington.

It is worth emphasising that silver seaside areas are associated with:

- the highest proportion of people of pensionable age of all the typology groups
- a higher proportion of jobs in the areas are connected with tourist industries than across other typology groups, with fewer jobs in knowledge industries
- levels of part-time employment greater than across coastal areas as a whole
- proportions of people receiving benefits lower than the seaside and coastal average (benefit claimants are also more likely to be older, with 41 per cent of working age people receiving benefits aged over 50)
- Higher travel times to employment centres than the coastal average.

Coastal retreats – Working countryside and rural chic

By land area, these typologies are very prevalent along the coastline of the East plan area. Having said this, the rural chic typology is more prevalent along the coastlines of the South East and South West regions.

Working countryside is focused in the Fens including Outwell, Terrington St. Clement, Long Sutton, as well as along the Lincolnshire coastline and around the Humber Estuary or Holderness.

Rural chic areas are prevalent along the Suffolk coastline, including Southwold and Aldeburgh, as well as parts of the North Norfolk and around the Humber. Particularly associated with historic towns and villages. Two thirds of settlements have populations of less than 1,500.

Rural chic areas are generally more prosperous, with a lower proportion of people receiving benefits relating to worklessness or ill health and higher levels of skills and a significantly higher proportion of adults qualified to degree level. In rural chic areas a higher proportion of people are employed in high skilled sectors such as knowledge industries, education and business. Working countryside areas are typified by lower skill occupations including manufacturing, construction, and retail.

It is worth emphasising that:

- travel times to key services are significantly further than across other groups and car ownership is relatively high
- deprivation levels are below average, with below average levels of people receiving benefits, and the lowest levels of crime (on average) of all the typology groups

- there is a higher proportion of households living in caravans than across other typology groups (although caravans make up a small proportion of the total housing).

Coastal challenges – Structural shifters

By land area, this typology is somewhat prevalent along the East plan area coastline, although it is considerably more prevalent along the coastlines of the North East and North West regions, and also more prevalent along the South West coastline. About a third of the lower super output areas (LSOAs) of Hull, Northeast Lincolnshire and Waveney Districts can be placed in this category. Particular focal points include deprived agricultural centres such as Wisbech, Gainsborough, Boston, and the seaside/port towns of Great Yarmouth, Lowestoft, Grimsby/Cleethorpes and Skegness.

These are areas that have lost their primary markets, and are facing the challenge to find new ones. This group can include a range of single industry coastal towns, including seaside resorts, industrial heartlands and former agricultural centres.

These areas are characterised by a low proportion of people with degree level qualifications and a high proportion of people involved in blue collar activities – manufacturing, construction, transport storage and communication. By contrast there are lower proportions of people involved in knowledge industries and financial and business services. These sectors have been struggling in recent years and jobs growth has been lower on average in these areas than across coastal areas and England as a whole.

Deprivation levels are relatively high with a high proportion of people on all main benefit types (with high levels of seasonal unemployment). However, home ownership levels are higher than across other coastal challenges groups with relatively low levels of social housing.

Coastal challenges – New towns and ports

Compared to other parts of the country, this typology is not prevalent along the East plan area coastline. There are no major concentrations (such as is the case around the Thames Gateway, to the south). Peterborough is the main area of focus, although this town is not characteristically coastal. Small pockets exist in Hull, Great Yarmouth and Ipswich.

These are areas that face challenges relating to poor skills and high levels of worklessness, but with this counterbalanced by a relatively strong economy. These areas are often located close to areas of economic growth.

These areas have higher than average levels of people receiving out of work benefit; however, employment rates are high compared to areas with similar levels of worklessness. A high proportion of people are involved in manufacturing, construction and activities associated with ports including marine transport, storage and communication. The proportion of people with degree level qualifications is below the coastal and national average; however, there is a strong presence of knowledge industry jobs in these areas. This apparent contradiction suggests that skilled people commute into these areas to work from outside, with the areas

attractive for businesses (for example with relatively cheap accessible land for development), but less attractive for residents.

Coastal challenges – Striving communities

By land area, this typology is somewhat prevalent along the East plan area coastline, although it is considerably more prevalent along the coastlines of the North East and North West regions. This typology best typifies much of Hull, as well as parts of Bridlington, Scunthorpe, Immingham, Grimsby, King's Lynn, Great Yarmouth and Lowestoft.

These are areas with high levels of deprivation across all indicators, and a very high proportion of people living in social rented accommodation. Just under half of the population in these areas live in social rented housing (approximately three times the average across coastal areas). There are higher proportion of people living in terraced housing and purpose built flats and a lower proportion of other housing types. These areas have very high levels of deprivation on many measures, including in relation to education and employment (which includes part time working and seasonality). In terms of the structure of the economy, these areas had the lowest levels of jobs growth between 2001 and 2008, and have the highest proportion of people employed in the public sector (which can be taken to be 'vulnerable'.

Cosmopolitan coast – Reinventing resorts

By land area, this typology is not prevalent along the East plan area coastline. It is considerably more prevalent along the coastlines of the North East, North West and South West regions. In the East, this typology is focused at smaller resorts (compared to the national picture) including Cromer and Sheringham, as well as parts of Great Yarmouth and Lowestoft. Central Ipswich also falls under this category. Scarborough, to the north, is associated strongly with this typology.

These are primarily tourist economies with high levels of deprivation, but diversifying to attract a more highly skilled population. A high proportion of people in this group are involved in tourist activities including hotels and catering. By contrast there are fewer people employed in industrial occupations. Despite relatively high levels of deprivation, skill levels are above average for coastal areas. There is also evidence of entrepreneurship with relatively high levels of home working and self employment, suggesting that despite the relatively weak economy, professionals may be 'downshifting' to these areas for lifestyle and environmental considerations rather than economic reasons.

Cosmopolitan coast – Coastal professionals

This typology is somewhat prevalent, although it is more prevalent along the coastlines of the South East and South West regions. Ipswich is the primary example, along with pockets within Hull.

These are city and market town service centres with highly skilled populations and dynamic economies. In these areas, there is a high proportion of people qualified to degree level and a high proportion of people working in high skilled sectors including knowledge economy activities, real estate, renting and business activities and education. Employment is less likely to be part time then across other typology

groups. There has been a high level of jobs growth in recent years in these areas compared with other coastal groups. Deprivation levels are generally lower than the coastal average but higher than the average across the coastal fringe and coastal retreat groups.

Coastal fringe – Prosperous suburbia

This typology is somewhat prevalent, although it is more prevalent along the coastlines of the South East, South West and North West regions. This typology is found in small pockets along the suburban edges of several coastal towns, with particular concentrations across Broadland District and around Hull and Ipswich. These are city and market town service centres with highly skilled populations and dynamic economies. These areas are characterised by low levels of deprivation on most measures. Employment in these areas is largely concentrated in service sectors. Self-employment and long-distance commuting are both common. There is the highest proportion of people with degree level qualifications.

Coastal fringe – Working hard

This typology is somewhat prevalent, but less so than for several other areas of coastline around the country. In the East, this typology is notable in and around Scunthorpe, Grimsby, Whittlesey, Spalding, Claydon, Great Yarmouth, Lowestoft and Felixstowe.

These are towns characterised by high levels of employment typically in industrial sectors, and a stable population. These areas have a more stable population than any of the other typology groups with fewer people moving in or out of the area in a given year. The areas have a strong economy with a higher overall employment rate than all of the other groups. In general, employment is more concentrated in manufacturing and port activities than average across coastal areas. Deprivation levels are generally lower than the coastal and national average. However, a lower proportion of working age people are qualified to degree level than the average across England.

Change over time in unemployment claimant levels

The Roger Tym and Partners / OSCI report[231] also examines the trend over time for unemployment claimant levels for each of the coastal area types – see Figure 6.27. There has been a significant increase in the proportion of people receiving Jobseekers Allowance (JSA), as would be expected following the recession in 2008. Coastal areas have generally been hit harder than non-coastal areas, with nine of the ten coastal types experiencing a larger percentage increase in JSA claimants than the average across non coastal areas between 2004 and 2011. The Working Hard (D2) cluster group has seen the largest increase in relative claimant rate; whilst the Reinventing Resorts (C1) group has experienced the smallest relative increase. Reinventing resorts are the only typology cluster to out-perform the average across non-coastal areas over the period. In addition, the chart shows the impact of seasonal fluctuation in many areas, with peaks in the claimant count in February showing up strongly for the coastal retreats groups.

---

[231] Roger Tym and Partners / OSCI (2001) Maximising the socio-economic benefits of marine planning for English coastal communities [online] available at www.marinemanagement.org.uk/marineplanning/documents/se_national.pdf, Accessed 10/11

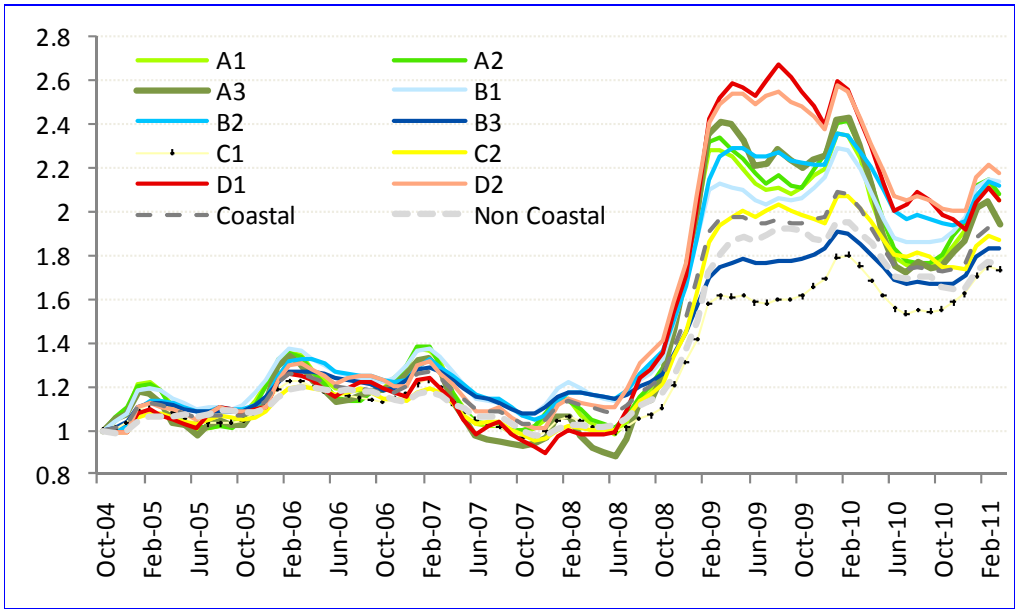


Figure 6.27: Change over time in unemployment claimant levels

Change over time in deprivation levels

Finally, the Roger Tym and Partners / OSCI report[232] examines change over time for Multiple Deprivation, as indicated by analysis of the 2004, 2007 and 2010 Indices of Multiple Deprivation. There is evidence of improvement in new towns and ports (B2) and Coastal professionals (C2), with the numbers of LSOAs ranked as deprived lower in 2010 than in 2004 and 2007. By contrast, the number of LSOAs ranked among the most deprived in Coastal challenges: Structural shifters (B1) is higher in 2010 than 2004 and 2007.

What would the situation be without the plan?

In-line with the requirements of the SEA Directive (see Table 3.1) there is a need to describe 'the likely evolution thereof without implementation of the plan or programme'. This chapter meets this requirement by summarising the likely 'situation without the plan' in terms of a range of sustainability considerations.

The marine economy is expected to grow. In particular, the low-carbon energy industry is developing rapidly in response to a range of policy and financial mechanisms. However, this will inevitably lead to more conflicts between activities, and there is the potential for this to stifle growth.

In terms of wind energy, improvements in the turbine manufacture supply line in UK can be expected to bring significant economic benefits. There are key components within turbines that are now seeing a supply shortfall. The most significant are bearings, gearboxes and blades. Supply chain demand is growing and the key major components can have lead-times of up to three years. Expansion within these sub-

[232] Roger Tym and Partners / OSCI (2001) Maximising the socio-economic benefits of marine planning for English coastal communities [online] available at www.marinemanagement.org.uk/marineplanning/documents/se_national.pdf, Accessed 10/11

component companies is ongoing but most are not currently managing to meet the present high demand[233].

However, a 2010 report carried out for The Crown Estate is suggested that a number of improvements were required in the offshore wind farm supply chain if the industry was to supply 33 gigawatts (GW) of power by 2020[234]. Constraints were indentified in the UK supply chain for offshore turbines, sub-sea cables, and installation vessels.

Precisely what the effect of economic growth within marine sectors will be for labour utilisation and labour productivity within the region and specific areas within the region is much more difficult to say. It is likely that a considerable proportion of the benefits associated with growth will not be felt locally to begin with, although the benefits of growth felt locally can be expected to grow over time, particularly as young people gain the education and skills needed to access employment within the new industries.

What are the key issues?

In-line with the requirements of the SEA Directive (see Table 3.1) there is a need to describe 'any existing environmental problems which are relevant to the plan or programme including, in particular, those relating to any areas of a particular environmental importance'. This chapter meets this requirement by summarising key issues in terms of a range of sustainability considerations relating to the economy.

- Perhaps the key issue identified through scoping is the need to encourage private sector investment and enterprise, particularly in those localities currently underperforming and/or reliant on government jobs and investment. This should help to ensure that growth is sustainable in the longer-term.
- At the same time, there is a need to recognise that not all places and all sectors will wish to focus on becoming more competitive. Keeping things as they are in some instances can help to secure a diverse economic base and support local distinctiveness. There is a need to support long established industries as well as those that are emerging and developing.
- In terms of addressing economic barriers associated with localities, there is a particular need to support investment in infrastructure, including, where possible, transport infrastructure that helps to address the problem of geographic peripherality.
- There is a need to support the Humber area and the Great Yarmouth/Lowestoft area as they seek to develop a competitive advantage in relation to energy and green technologies.
- There is a need to create private sector certainty through planning for the offshore and onshore infrastructure needed to enable development of an offshore

[233] Roger Tym and Partners / OSCI (2001) Maximising the socio-economic benefits of marine planning for English coastal communities [online] available at www.marinemanagement.org.uk/marineplanning/documents/se_national.pdf, Accessed 10/11

[234] BVG Associates for the Crown Estate Towards Round 3: Building the Offshore Wind Supply Chain. Referenced in Roger Tym and Partners / OSCI (2001) Maximising the socio-economic benefits of marine planning for English coastal communities [online] available at www.marinemanagement.org.uk/marineplanning/documents/se_national.pdf, Accessed 10/11

renewable energy transmission network (as well as possible on and offshore CCS transport and storage).

- Given that some new activities will be specialised/capital intensive activities that demand highly specialised labour or capital equipment from regional, national and even international markets, there is a need to support industries that can minimise leakage, including through supporting local skills development. A goal is to increase average wages amongst the local population, which will lead to an increase in the value of goods and services created per head.
- In the shorter-term, there is also a need to support activities that will lead to employment with high local effects on labour utilisation, that is where labour catchments are relatively local, and there is demand for lower skilled labour, so creating jobs that are accessible for less well skilled workers who find themselves at increased risk of unemployment. Full-time jobs should be supported so that there is a move away from seasonal or part time work particularly in areas that focus on the tourist economy.
- There is a need to support industries that can capitalise on the stewardship of the natural and historic environment, given the importance to tourism and investment more generally along this coastline.

Are there any data gaps?

This 'Scoping Consultation Draft' of the Economy Chapter has highlighted a number of sectoral and spatial priorities that should be a focus of marine spatial planning, in order to maximise the benefits of marine spatial planning to local economies along the East plan area coastline. However, there is a need to refine this understanding of the broad scope through consultation. Furthermore, there will be a need for ongoing evidence-gathering as plan-making progresses, and there emerges a clearer picture of the issues and options 'on the table'. In particular, once there is further understanding of the potential reach of the marine plan it will be important to gather further information regarding economic priorities associated with particular localities along the coastline.

6.6 Geology, geomorphology and coastal processes

Introduction

The submarine landscape of the United Kingdom Continental Shelf (UKCS) and adjoining coast, and that of the East Inshore marine plan area, is a product of deep geological strata which define the principal topographic relief. Mobile and moribund bedforms of surficial sediments provide further topography, habitats for marine fauna and flora, and potentially useable economic resources. Notable marine habitats are starting to be recognised in offshore and inshore conservation designations (see section 6.4 in this chapter and section 4.1 in Chapter 4), often associated with qualifying geological or geomorphological features, and marine conservation zones (MCZs) now provide a means of designating sites for purely geological or geomorphologic attributes.

The hydrocarbon reservoirs of the UKCS have been a substantial source of oil and gas resources since their discovery in the 1960s. In some areas sediments provide suitable grades of aggregate which are extracted and used in construction, and more recently marine renewables present a new spatial use of the seabed. All of these

activities have potential impacts for geology and substrates, whether it is physical disturbance and associated habitat loss, or contamination. Seabed sediments, like terrestrial soils, are also potential stores of cultural material (see section 6.3 in this Chapter).

What is the link between the plan and this topic?

Geology and geomorphology (including coastal processes) is a consideration of this sustainability appraisal (SA), in line with those environmental topics listed in Annex I(x) of the SEA Directive, to be given consideration in any assessment. To provide context to the topic area, and to address section Annex I (a) of the SEA directive, i.e. to consider "the contents, main objectives of the plan or programme and relationship with other relevant plans and programmes", a summary table of relevant initiatives (which includes plans, programmes, policy and other relevant items), is shown below, following which there is a brief discussion of the key objectives and targets of the principal initiatives, as well as the implications of the marine plans with regards to these. See also Chapter 2 section 2.6 in relation to Shoreline Management Plans.

What is the policy context?

The East Inshore marine plan area has a geologically diverse coastline recognised by a number of Geological Conservation Review (GCR) and earth science SSSI sites (for instance North Norfolk Coast GCR, Gibraltar Point GCR, Withow Gap SSSI and its offshore area comprises a similarly diverse geomorphological character, as well as having a number of commercially viable resources (such as aggregates, hydrocarbons), in addition to geological strata which may be the focus of carbon capture and storage demonstration.

Table 6.13: Relevant plans, initiatives and environmental protection objectives

International
The Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972 (the London convention) and 1996 Protocol Thereto (amendment on the storage of CO2 in geological formations came into force 10 February 2007)
OSPAR recommendation 2003/3 on a Network of Marine Protected Areas
OSPAR Agreement 2005/6 on the Agreement on Background Concentrations for Contaminants in Seawater, Biota and Sediment
OSPAR recommendation 2005/6 on a management regime for offshore cuttings piles
OSPAR Decision 2007/2 on the storage of Carbon Dioxide Streams in Geological Formations
Europe
Directive 2007/60/EC on the assessment and management of flood risks (2007)
EC Habitats Directive 92/43/EEC (1992)
Water Framework Directive (2000/60/EC)
The Floods Directive (2007/60/EC)
Marine Strategy Framework Directive 2008/56/EC
Communication from the Commission Report to the European Parliament and the Council: An evaluation of Integrated Coastal Zone Management (ICZM) in Europe 2007. COM (2007) 308 final Directive 2009/31/EC for the European Parliament and of the Council of 23 April 2009 on the geological storage of carbon dioxide.
National

Planning Policy Statements
Marine Policy Statement
Note that the Draft National Planning Policy Framework (2011) is subject to ongoing consultation and is set to consolidate and replace all of those planning/minerals statements and guidance documents listed below.
Planning Policy Statement 9: Biodiversity and Geological Conservation
Planning Policy Statement 5: Planning for the Historic Environment
Consultation paper on a new Planning Policy Statement: Planning for a Natural and Healthy Environment
Planning Policy Guidance 20: Coastal Planning (England) – note that PPS25 supplement replaces the policy on managing the impacts of coastal erosion to development set out in PPG20, which is cancelled with the exception of paragraphs 2.9, 2.10 and 3.9. PPG20 was due to be cancelled following introduction of the new Planning Policy Statement; Planning for a Natural and Healthy Environment.
Minerals Policy Statement 1: Planning and Minerals
Marine Minerals Guidance Note 1: Guidance on the Extraction of Sand, Gravel and Other Minerals from the English Seabed.
Other relevant initiatives
Geological Conservation Review (GCR)
Marine Conservation Zones (and equivalent designations under the devolved administrations)
Defra's Consultation on Coastal Change Policy (2009)
Making Space for Water: National Coastal Erosion Risk Mapping Project (ongoing)
The Framework for the Development of Clean Coal (FDCC)
Cleaner Coasts healthier Seas, Working for a better marine environment, Our strategy for 2005-2011 (Environment Agency)
A Strategy for Promoting an Integrated Approach to the Management of Coastal Areas in England
MCA Civil Hydrography Programme
Local
Shoreline management plans
Flamborough Head to Gibraltar Point
Gibraltar Point to Hunstanton (The Wash)
Hunstanton to Kelling Hard (North Norfolk)
Kelling Hard to Lowestoft
Lowestoft to Felixstowe (Suffolk)
Essex and South Suffolk
River basin management plans
Anglian RBMP
Humber RBMP
The Humber Flood Risk Management Strategy
Regionally important Geological and Geomorphological Sites (RIGS)
Marine Aggregate Levy Sustainability Fund (MALSF) Regional Environmental Characterisation
East Coast REC
Humber REC
Outer Thames REC

There is presently a paucity of inshore or offshore designations for which geological or geomorphological features represent qualifying features, though certain features are gaining protection through designations for which they are a qualifying habitat feature (such as SACs designated under the Conservation of Habitats and Species Regulations 2010 and Offshore Marine Conservation (Natural Habitats, &c.) (Amendment) Regulations 2010). The Marine and Coastal Access Act (MCAA) 2009 provides for the conservation of specific "features of geological and geomorphological interest" through the designation of MCZs. In addition, the Marine and Coastal Access Act amends the Wildlife and Countryside Act 1981 in such a way that SSSI notifications can be made in England below the mean low water mark (MLWM) under certain statutory conditions set out in the act (such as the flora, fauna or features leading to the notification of the SSSI are also present in the sub-tidal area to which SSSI protection is to extend). The act also provides powers to remove SSSI notifications where they coincide with new MCZs. In the terrestrial environment, the Geological Conservation Review (GCR), launched in 1977, identifies the most important (nationally and internationally) terrestrial geological sites in Britain. GCR sites are chosen such that they satisfy the legal requirements of SSSI designations for geology and physiography, and therefore they often geographically coincide with notified earth science-SSSIs or those which are awaiting notification. Important sites are also locally recognised through the regionally important geological and geomorphological sites (RIGS) programme, though only SSSI features have any form of statutory protection.

At the coast, natural denudation processes are leading to shoreline retreat (exemplified along the Holderness Coast, though this is an extreme example) and increased flood risk in many cases, which may be accentuated by projected climate and associated environmental change, and this may include increased storminess and sea-level rise[235]. Integrated coastal zone management (ICZM) and appropriate planning policy aims to help manage and mitigate the problems associated with, amongst other things, coastal erosion and flood risk. The Flood and Water Management Act 2010 makes provisions for the creation of a National Flood and Coastal Erosion Risk Management (FCERM) Strategy, which was published in May 2011. In addition to the above, planning policy (such as PPS20 and PPS25) and related guidance outlines how developers and authorities should manage development at the coast. This includes considering, amongst other things, impacts that may arise from a development (such as to whether it may enhance flood risk elsewhere), whether the development is itself flood resilient, whether it may be more appropriately located elsewhere, and whether it is sustainable in the long-term (e.g. in the face of rising sea-levels) – see paragraphs 148 to 162 of the draft National Planning Policy Framework, and corresponding detail in section 2.6.8 of the Marine Policy Statement (MPS).

In line with a consideration of future sea-level change, shoreline management plans (SMP) are taking a longer term view by identifying sustainable management approaches of relevance for up to the next 100 years. Each SMP (or revised SMP2) provides policy recommendations for coastal areas which may advise holding the

[235] Lowe JA, Howard TP, Pardaens A, Tinker J, Holt J, Wakelin S, Milne G, Leake J, Wolf J, Horsburgh K, Reeder T, Jenkins G, Ridley J, Dye S, Bradley S (2009). UK Climate Projections science report: Marine and coastal projections. Met Office Hadley Centre, Exeter, UK.

line (HTL) through the maintenance of present defences or where monitoring and assessment provide evidence that new defences would be beneficial, no active intervention (NAI), here defences are not maintained, and managed realignment (MR) or retreat (R) where defences are removed and/or moved inland to allow for natural coastal denudation. Policies are provided in each SMP over three epochs, 2009 to 2025, 2025 to 2055 and 2055 to 2105.

The Water Framework Directive (WFD) seeks to achieve good ecological status (such as biological or chemical quality) or good ecological potential (such as for heavily modified water bodies) for coastal and estuarine water bodies. River basin management plans (RBMPs) now completed for England are one of the principal means that the WFD has been implemented in the UK and will be used in combination with other plans including SMPs to achieve a fully integrated approach to coastal management (such as in relation to the improvement of morphological status (see key issues, below) and with regards to coastal flooding). RBMPs identify relevant morphological and hydrodynamic issues and the measures to manage these. Similarly, the Marine Strategy Framework Directive (MSFD) seeks to achieve good environmental status, which incorporates geological conditions, in the marine environment.

The Floods Directive seeks to manage the risks posed to human health, the environment, cultural heritage and economic activity by flooding. The programme includes the production of a Preliminary Flood Risk Assessment showing the impact of historic flooding by 2011, and the generation of flood risk maps showing a range of hazard variables (water depth, extent and probability) by 2013. By 2015, management plans should have been produced which should be coordinated with river basin management plans. The Environment Agency has completed a number of Catchment Flood Management Plans (CFMPs) relevant to the East Marine Plan area (e.g. those for Yorkshire & North East, Anglian and South East). The CFMPs aim to understand the causes of flooding and recommend ways of managing flooding over the next 50 to 100 years for each catchment. The Environment Agency has also published a National Flood Risk Assessment, which indicate the way in which flood risk should be reduced and mitigated, through physical or policy measures. Additionally, the Environment Agency has produced a flood risk map for England, which includes consideration of flooding from both terrestrial and marine sources (also see Section 6.8).

The storage of carbon dioxide in geological formations is likely to take place in the UK, and most likely in the UKCS, within the next 10 years, at least at a demonstrator level. Suitable formations may consist of saline aquifers, halite deposits or depleted hydrocarbon reservoirs. UK Government will provide up to £1 billion towards the first UK CCS demonstration project, with up to another three potentially being partly funded through general taxation (funding through the electricity supply levy mechanism (under the Energy Act 2010) is not being pursued by the current Government). It is expected that after 2020 the technology will be economically and technologically feasible. In preparation for this, all new fossil fuel power stations must be designed so as to be carbon capture ready (initially for approximately 25 per cent of their capacity or 400 megawatts (MW)), and all coal plants must be retrofitted within five years of CCS being proven. CCS demonstrator projects are likely to be located in areas of high CO_2 emissions (such as Thames Estuary, Humberside,

Merseyside, the Firth of Forth, Teesside and Tyneside), and the UK Government plans to promote their co-location. The Energy Act 2011 makes a number of amendments to the Energy Act 2008 with regards to the conversion of installations and pipelines for CCS demonstration along with a number of other provisions, including details relating to compulsory acquisition for CCS pipelines over land.

Internationally, the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972 (the London Convention) and 1996 protocol provide environmental law for the permanent storage of CO_2 in geological formations. The amendments to the 1996 protocol, which entered into force on 10 February 2007, state that "carbon dioxide streams may only be considered for dumping, if: disposal is into a sub-seabed geological formation; they consist overwhelmingly of carbon dioxide (they may contain incidental associated substances derived from the source material and the capture and sequestration processes used); and no wastes or other matter are added for the purpose of disposing of them." OSPAR Decision 2007/02 on the Storage of Carbon Dioxide Streams in Geological Formations, states that all contracting parties should not allow storage of CO_2 in geological formations without authorisation or regulation from their competent authorities. The decision also indicates what any permit or approval should, at least, contain. Directive 2009/31/EC establishes a European level legal framework for the environmentally safe storage of CO_2 by member states in their Exclusive Economic Zone and Continental Shelf. The basis for this directive is that CCS can provide a bridging technology whereby carbon emissions can be attenuated while renewable technologies and associated technologies provide a more sustainable energy source. The directive also sets out a number of requirements of member states in the selection of geological stores and a permitting and monitoring regime. At the UK level, the Energy Act 2008 provides a legislative basis permitting carbon storage on the UKCS, implemented by the Secretary of State for Energy and Climate Change, or Scottish Ministers in their Territorial Waters. In August 2010 the UK Government set out a response to the proposed licensing regime for offshore carbon dioxide storage forming part of the transposition of EU Directive 2009/31/EC (see above), implemented by the Storage of Carbon Dioxide (Licensing etc.) Regulations 2010.

Implications for sustainability appraisal and marine plans

The marine plan will need to consider both the implications of any offshore or coastal development within its remit on coastal processes in relation to coastal erosion and flood risk, and also what implications such erosion and flood risk have for a given development within its lifetime (incorporating the implications of projected sea-level rise). The marine plan will be informed by both the MPS and terrestrial planning policy in relation to flood risk and coastal erosion, and will also need to have regard to established initiatives which have already identified suitable management practices at the coast (such as SMPS, RBMPs, the National Flood and Coastal Erosion Risk Management (FCERM) Strategy) – see Section 2.6.8 of the MPS.

With regards to developments further offshore, the marine plan should have regard to the potential impacts from activities on geology and substrates (such as pipelay which may be associated with offshore hydrocarbons or CCS development, aggregate extraction and offshore renewables). The locations of existing and proposed developments will also need to be considered in the context of any MCZs

(or Natura 2000 sites) for which geological or geomorphological features are deemed to qualify for protection either in their own right, or as supporting habitats.

What is the baseline situation?

Though some aspects of the environmental baseline are exclusively covered by either the East Inshore (such as coastal processes) or East Offshore areas, in certain instances such as hydrocarbon prospectivity, viable geological formations are found throughout the southern North Sea, and no reasonable division can be made.

Seabed substrates and topography

The present distribution of geological strata in the UKCS, including that of the East Inshore and East Offshore areas is determined by past geological and geomorphological processes. The present location of sediments and certain topographic features is a function of the underlying geology and millennia of aeolian, fluvial and glacial activity both in the marine and terrestrial environment. The distribution of sediments is generally well characterised across the UKCS and the deep geological structure of the UKCS, and the North Sea in particular, is quite well known, particularly in areas of mature oil and gas production. Certain topographic features are important for the quality of habitat they provide, and these are bound by hard geology or sediment type and process (such as North Norfolk sandbanks), though others may be formed by marine organisms themselves (such as biogenic reef). A range of notable topographic features are found in the East Inshore and Offshore areas, and a number of candidate SACs are currently being considered. There are also a number of SACs with marine components which have qualifying features that can be described as geological or geomorphological, such as **sandbanks which are slightly covered by seawater all the time, reefs and submerged or partially submerged sea caves**.

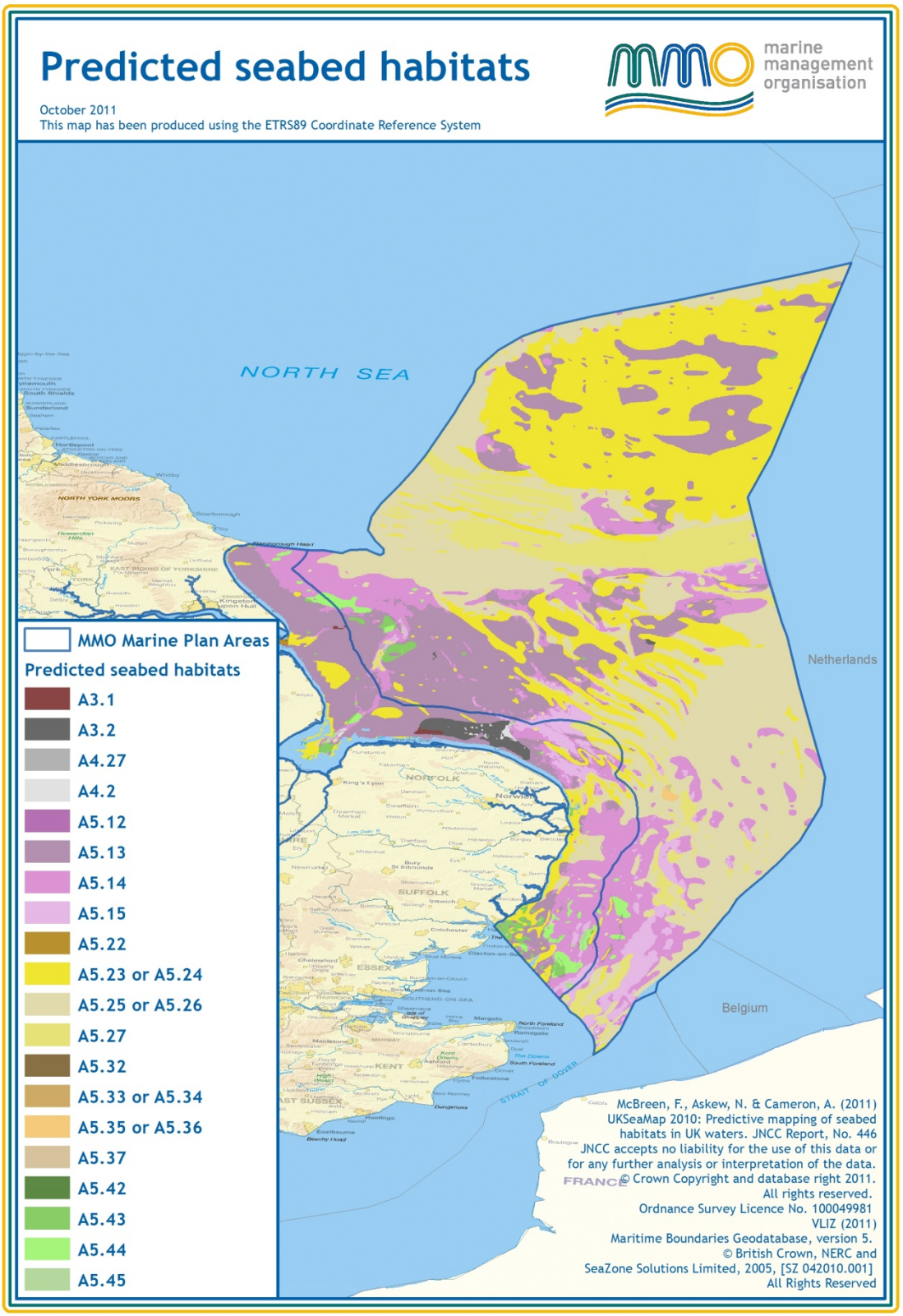


Figure 6.28: Predicted seabed habitats in the East Inshore and East Offshore areas

At a local level, the distribution of sediments and sediment bedforms, for instance sand waves and sand ripples, is largely a result of bottom currents and wave action which are tied into large scale oceanographic (see section 6.8) and climatic processes, and in some cases structures are part of relict bedforms dating back to the last glaciation, or are more recent structures formed by leaking gasses/fluids (such as pockmarks), though there is no evidence of the latter in the East Inshore or East Offshore area.

Seabed sediments in the East Inshore area range from mud and sandy muds in the intertidal areas of the Wash, Humber and off Orfordness, to coarser sand and gravel further offshore, towards and beyond 12 nautical miles, which is the subject of licensed gravel extraction. Seawards, in the East Offshore area, sediments tend to fine towards sand and gravelly sand with isolated patches of muddy sediments, such as that found in the Outer Silver Pit. As stated above, the distribution of these sediments is a function of past geological events and ongoing reworking of materials from the coast (see below) and at the seabed since the last marine transgression.

The topography of the East Inshore area is generally shallow, ranging from the intertidal to depths typically up to 40m, though with a number of notable areas of sandbanks, some of which are designated partly for the feature, **sandbanks slightly covered by seawater all the time** and occasional deeps (such as the Silver Pit and Sole Pit). Sandbanks include those in the Inner Dowsing, Race Bank and North Ridge cSAC (incorporating the Inner Dowsing sandbank) and Haisborough, Hammond and Winterton cSAC. The sites are located off the Wash and Norfolk coasts respectively and encompass a number of charted sandbank features including Haisborough Sand, Haisborough Tail, Hammond Knoll and Winterton Ridge.

The North Norfolk Sandbanks, which now form part of the North Norfolk Sandbanks and Saturn Reef cSAC, are located within the East Offshore area. The banks have a north-west to south-east orientation and are thought to be gradually elongating in a north-easterly direction[236]. Cameron et al[237] noted that the banks seemed to comprise a nearshore parabolic group with sandwaves on their flanks, and a linear, comparatively stable offshore group of probably older derivation. The designated sandbanks include the Leman, Ower, Well, Swarte and Broken Banks, as well as the Indefatigable Banks. The largest designation in the East Offshore area which incorporates the Annex I sandbanks category is the Dogger Bank cSAC. Dogger Bank largely a relict feature of lacustrine clays generated during the last glacial recession which began c. 18,000 years BP[238]. The deposit is up to 42 metres in height above the seabed, making water depths in the region shallow to as little as 20 metres. This feature gives its name to the wider Doggerland environment[239, 240, 241],

---

[236] Cooper WS, Townend IH & Balson PS (2008). A synthesis of current knowledge on the genesis of the Great Yarmouth and Norfolk Bank Systems. Marine Estate Research report, The Crown Estate
[237] Cameron TDJ, Crosby A, Balson PS, Jeffrey DH, Lott GK, Bulat J & Harrison DJ (1992). United Kingdom Offshore Regional Report: the geology of the southern North Sea. HMSO for the British Geological Survey, London, p152.
[238] Jones LA, Coyle MD, Evans D, Gilliland PM & Murray AR (2004). Southern North Sea Marine Natural Area Profile: A contribution to regional planning and management of the seas around England. English Nature, Peterborough, UK

which was water and ice free during the successive glaciations during the Pleistocene, and which was the subject of human occupation (see section 6.3). Evidence of former coastal environments around Dogger Bank come in the form of saltmarsh peat beds[242] and clays containing intertidal molluscs[243].

Hydrocarbon prospectivity and suitable formations for gas storage/CCS

The underlying geology of the Southern North Sea provides both topographic relief and hydrocarbon resources at depth. The southern North Sea is a gas province, with the majority of offshore installations being in the East Offshore marine plan area, though a number of pipelines traverse the East Inshore area, connecting with terminals at Easington, Theddlethorpe and Bacton. The southern North Sea also provides prospective geological formations for the storage of carbon dioxide, both in the form of saline aquifers (such as the Lower Triassic Bunter Sandstone), and in the future, depleted hydrocarbon reservoirs. The proximity of the Humber Estuary and its hinterland, a key east coast emitter of CO_2, could lead to this area being one of the first to demonstrate CCS.

Coastal features and processes

The modern coastline of the East Inshore area, as with the topography and substrates of the UKCS, is a culmination of its geological origins and subsequent geomorphological reworking by oceanographic (wave, current, tidal) and climatic influences (which include past glacial episodes). Geology controls coastal topography and the spatial variation (local and regional) in erosional resistance. Regionally in the UK, there is a tendency for rocks of greatest resistance to erosion (and age) to feature on the north and west and those of least resistance to feature on the south and east. Locally, variations in erosional resistance, the bedding and fault characteristics of hard-rock coasts and the dominant energy environment, may lead to beach, bay, stack and cave formations[244]. Sediment derived from coastal erosion and riverine inputs may be redistributed offshore and redeposited, contributing to shelf substrates, or be coastally redistributed where it may help to maintain beach systems in wave dominated environments or contribute to estuarine infilling, tidal flat and salt marsh in tidally dominated energy environments.

At the most northerly point of the East Inshore area, the chalk cliffs of Flamborough Head are capped with glacial till material and have the most diverse array of active erosional landforms of any chalk coastline in England[245]. Coastal topography is

---

[239] Coles BJ (1998). Doggerland: a speculative survey. Proceedings of the Prehistoric Society **64**: pp45-81.
[240] Gaffney V, Fitch S & Smith D (2009). Europe's lost world: The rediscovery of Doggerland. Council for British Archaeology Research Report 160, p202.
[241] Gaffney V, Thomson K & Fitch S (2007). Mapping Doggerland: The Mesolithic landscapes of the southern North Sea. Institute of Archaeology and Antiquity, University of Birmingham. Archaeopress, Oxford p131.
[242] Oele E (1969). The Quaternary geology of the Dutch part of the North Sea, north of the Frisian Islands. Geologie en Mijnbouw **48**: pp467-480.
[243] Balson P, Butcher A, Holmes R, Johnson H, Lewis M, Musson R (2002). North Sea geology. Technical report produced for Strategic Environmental Assessment – SEA2 & SEA3. British Geological Society. Report to the DTI, p49.
[244] May VJ & Hansom JD (2003). Coastal Geomorphology of Great Britain, Geological Conservation Review Series, No. 28. Joint Nature Conservation Committee

highly variable and cliffs range in elevation from between less than 5 metres and up to 36 metres. The sediments of Holderness consist largely of Holocene sands overlying a number of layers of glacial till, and are generally easily erodible, with average retreat rates of 1.3 to 1.5 metres a year. The eroded material provides substantial inputs of sediment which are moved south by massive longshore transport[246], with some of the material contributing to the extensive Spurn Head shingle spit at the entrance to the Humber Estuary and much of the material contributing to sediment input to the Humber Estuary itself[247], the North Lincolnshire Coast and the Wash[248]. Extensive erosion is also a feature of the Suffolk coast with rates of retreat estimated at between 0.9 to 3.5 metres a year for sections of the coast from Benacre to Southwold, and Dunwich to Minsmere[249].

In areas with coastal erosion and flooding problems, the imposition of coastal defences may be advantageous to the immediate coastline, though sedimentary coastlines in the longshore direction are likely to be affected. Sediment may be caught up in groyne fields, some of which can unintentionally have a sediment trapping efficiency of close to 100 per cent [250], and in some cases have aided the offshore movement of material which is then lost from the coastal system[251, 252].

Sediment flows, erosion rates and coastal landforms are greatly influenced by the tidal and wave environment which meets the coast, and these are described in Section 6.8, Water Environment. Current sea-level and historic sea-level change has influenced the character of much of the UK coastline. During the last glacial maximum (approximately 20,000 before present (BP)), global sea-levels were around 135 metres lower than present[253], exposing much of the UK continental shelf. During the last marine transgression, sea-levels rose as ice retreated, with eustatic sea-levels reaching those roughly equivalent to today by 4,000 BP[254]. Relative sea-level is not only controlled by eustatic alterations (which have most recently been associated with climate change), but also regional isostatic change. In the UK such readjustment is the result of Holocene deglaciation, resulting in a

---

[245] May VJ (2003a). Chapter 3: Hard-rock cliffs – GCR site reports. In: VJ May & JD Hansom Eds. Coastal Geomorphology of Great Britain. Geological Conservation Review Series: No. 28. Joint Nature Conservation Committee

[246] May VJ (2003a). Chapter 3: Hard-rock cliffs – GCR site reports. In: VJ May & JD Hansom Eds. Coastal Geomorphology of Great Britain. Geological Conservation Review Series: No. 28. Joint Nature Conservation Committee

[247] Long AJ, Innes JB, Kirkby JR, Lloyd JM, Rutherford MM, Shennan I & Tooley MJ (1998). Holocene sea-level change and coastal evolution in the Humber estuary, eastern England: an assessment of rapid coastal change. The Holocene **8**: pp229-247.

[248] English Heritage (2008). Bridlington to Skegness Maritime Natural Area Profile. Natural Area 101, p57.

[249] Brooks D & Spencer T (2010). Temporal and spatial variations in recession rates and sediment release from soft rock cliffs, Suffolk coast, UK. Geomorphology **124: pp**26-41.

[250] Masselink G & Hughes M (2003). An Introduction to coastal processes and geomorphology. Hodder Education

[251] Masselink G & Hughes M (2003). An Introduction to coastal processes and geomorphology. Hodder Education

[252] May VJ & Hansom JD (2003). Coastal Geomorphology of Great Britain, Geological Conservation Review Series, No. 28. Joint Nature Conservation Committee.

[253] Yokoyama Y, Lambeck K, De Deckker P, Johnston P, & Fifield LK (2000). Timing of the Last Glacial Maximum from observed sea level minima. Nature **406**:pp713-716.

[254] May VJ & Hansom JD (2003). Coastal Geomorphology of Great Britain, Geological Conservation Review Series, No. 28. Joint Nature Conservation Committee.

generally negative adjustment in the East Inshore area (see Figure 6.29) of between -0.4 to -0.7 mm a year[255] [256].

Anthropogenically augmented climate change has been linked to a global eustatic change in sea-levels in the order of 3.1 mm a^{-1} between 1993 and 2003[257] (IPCC 2007), primarily through the reduction in the size of valley glaciers and ice caps, and the thermal expansion of the ocean associated with increased global temperatures. Sea-level is expected to increase (in absolute terms) by 12 to 76 cm over the next 100 years[258, 259], outpacing even the highest positive isostatic uplift figures for the UK. The resulting relative sea-level rise (such as range 21 to 68 cm for London and 7 to 54 cm for Edinburgh – see Figure 6.29 will lead to a greater risk of coastal flooding and erosion, though an increased frequency in storms and storm surges (including an increase in wave height), remains unproven in the most recent probabilistic projections for the UK[260, 261]. Integrated coastal zone management (ICZM) has been highlighted by the IPCC[262] as a means to deal with the threat of sea-level rise, and the principles of this form of coastal zone management are being adopted in the UK, for instance through SMPs (see above), and there is increasing recognition in planning policy that a long-term view of coastal development needs to be taken in this regard.

[255] Shennan I & Horton B (2002). Holocene land- and sea-level changes in Great Britain. Journal of Quaternary Science **17**: pp511-526.
[256] Shennan I, Milne G & Bradley S (2009). Late Holocene relative land- and sea-level changes: Providing information for stakeholders. GSA Today **19**: pp52-53.
[257] IPCC (2007). Climate Change 2007: The Physical Science Basis. In: S Solomon, D Qin, M Manning, Z Chen, M Marquis, KB Averyt, M Tignor & HL Miller Eds. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, United Kingdom.
[258] The range derived from estimates based on the 5th percentile (low emissions scenario) and 95th percentile (high emissions scenario).
[259] Lowe JA, Howard TP, Pardaens A, Tinker J, Holt J, Wakelin S, Milne G, Leake J, Wolf J, Horsburgh K, Reeder T, Jenkins G, Ridley J, Dye S, Bradley S (2009). UK Climate Projections science report: Marine and coastal projections. Met Office Hadley Centre, Exeter, UK.
[260] Horsburgh K & Lowe J (2010). Mean Sea Level and Sea Level Extremes in MCCIP Annual Report Card 2010-11, MCCIP Science Review.
[261] Lowe JA, Howard TP, Pardaens A, Tinker J, Holt J, Wakelin S, Milne G, Leake J, Wolf J, Horsburgh K, Reeder T, Jenkins G, Ridley J, Dye S, Bradley S (2009). UK Climate Projections science report: Marine and coastal projections. Met Office Hadley Centre, Exeter, UK.
[262] Nicholls RJ, Wong PP, Burkett VR, Codignotto JO, Hay JE, McLean RF, Ragoonaden S & Woodroffe CD (2007). Coastal systems and low-lying areas. Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Parry ML, Canziani OF, Palutikof JP, van der Linden PJ & Hanson CE (Eds.), Cambridge University Press, Cambridge, UK

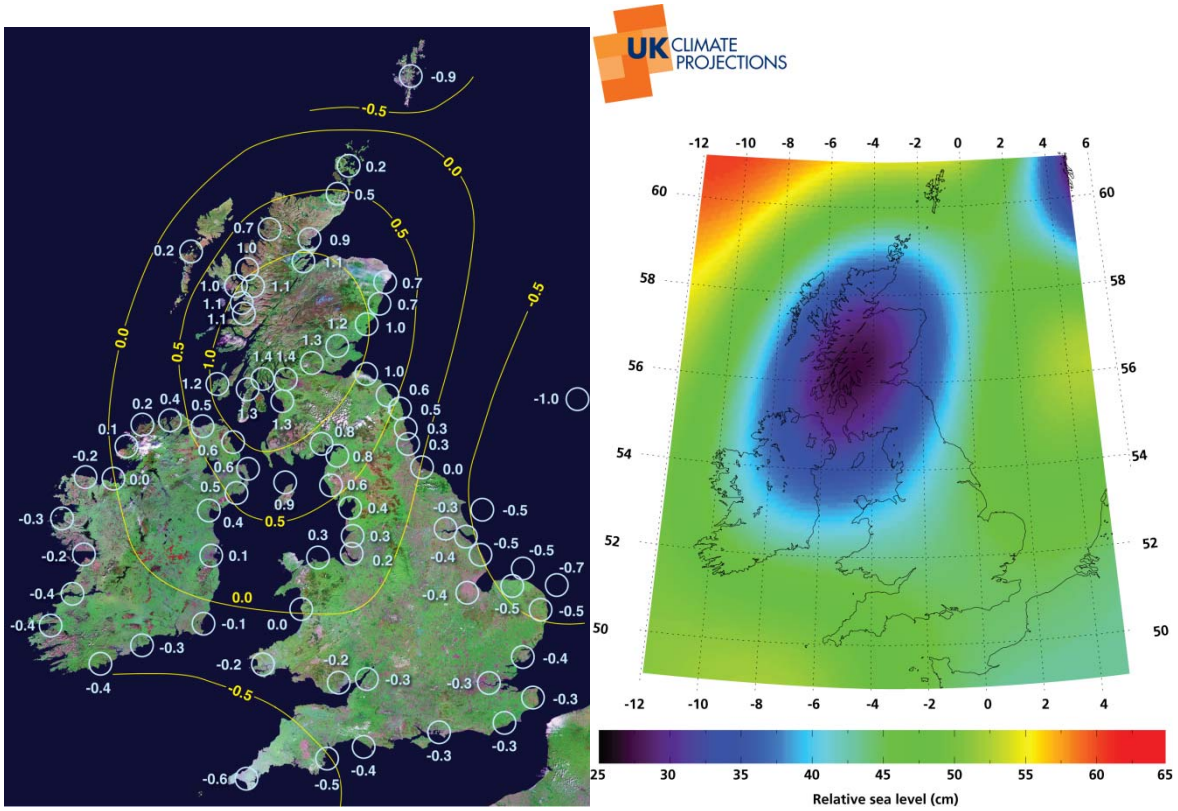


Figure 6.29: Isostatic adjustment (mm/yr) and relative sea-level rise (cm) for 2095 (Source: Shennan et al[263]; UKCP09, after Bradley et al[264]. Note: Relative sea-level rise based on a central estimate of the medium emissions scenario (see Section 6.1, for details)).

JNCC[265] list 11 principal coastal physiographic features which are located in the East Inshore area. These update and reclassify a number of previous works[266] and include estuaries, bays and lagoons (Figure 6.30). The importance of such features in coastal processes and as supporting habitats is recognised in statutory designations, for instance as Annex I habitats of the Habitats Directive.

Since 1998 the joint Defra/Environment Agency Estuaries Research Programme has facilitated study in UK estuary morphology and process, including the modelling and simulation of estuarine processes and morphological change for the purposes of estuarine management. The studies provide models suitable for use in order to determine the morphological characteristics and processes and predict change based on a number of natural and anthropogenic variables. The reports and models are largely disseminated through the Defra Research Programme webpages and the estuary-guide.net website.

[263] Shennan I, Milne G & Bradley S (2009). Late Holocene relative land- and sea-level changes: Providing information for stakeholders. GSA Today 19: pp52-53.
[264] Bradley S, Milne GA, Teferle FN, Bingley RM & Orliac EJ (2009). Glacial isostatic adjustment of the British Isles: New constraints from GPS measurements of crustal motion. Geophysical Journal International. 178: pp14-22.
[265] McBreen F, Askew N, Cameron A, Connor D, Ellwood H & Carter A (2011). UKSeaMap 2010: Predictive mapping of seabed habitats in UK waters. JNCC Report, No. 446.
[266] Davidson NC & Buck AL (1997). An Inventory of UK Estuaries: Introduction and Methodology. Joint Nature Conservation Committee.

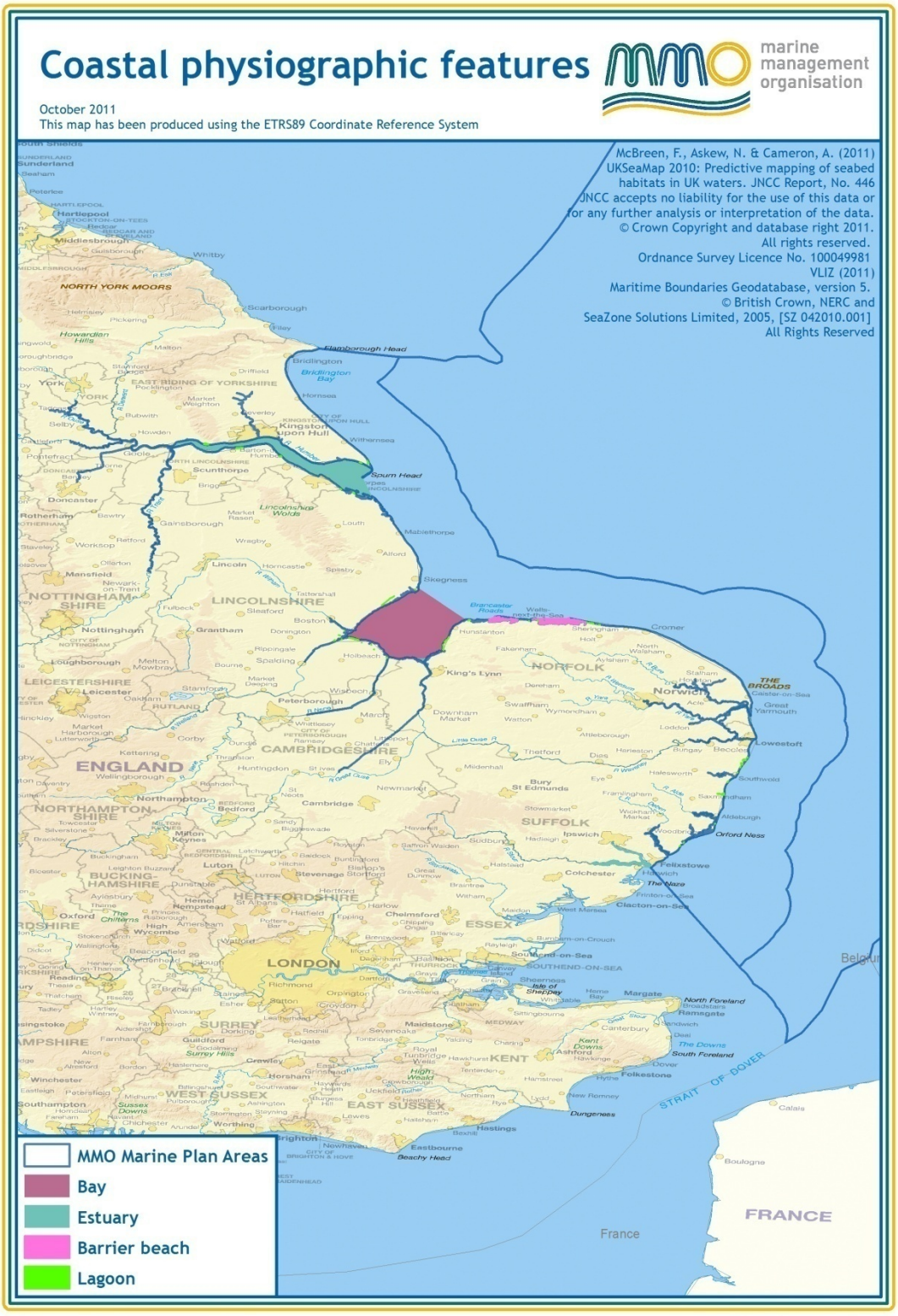


Figure 6.30: Coastal physiographic features in the East Inshore area

What would the situation be without the plan?

In the absence of the marine plan, a number of existing planning policies and initiatives (such as SMPs, RBMPs, the **National Flood and Coastal Erosion Risk**

Management Strategy) would provide an assessment of relative risk at the coast of the East Inshore area to erosion and coastal flooding, as well as management strategies to mitigate the risk. In addition, the MPS would provide some detail for consideration when deciding on planning applications which may have implications for coastal processes. Ongoing SAC designation and the possibility of a future array of geology or geomorphology based MCZs should provide adequate statutory protection to notable sites.

What are the key issues?

The environmental baseline is likely to evolve slowly in the absence of anthropogenic influences. At present there are no anthropogenic activities which are likely to cause significant regional scale changes to geology and sediments, though a number of key issues are outlined below:

- Trawling and dredging activities can generate localised scour and associated habitat damage and loss, and sediment plumes.
- Impacts at the coast have wider environmental and social implications, and are derived from both the natural denudation process, and anthropogenic impacts including coastal defence and other coastal infrastructure (such as cable and pipe landfall, new port infrastructure) and sea-level change.
- As coastal erosion and inundation in some areas may be uneconomic or undesirable to halt through engineering, the realignment of some coastal infrastructure and housing may be expected.
- The loss of some of the coastal archaeological resource that cannot be studied prior to inundation and erosion may also be expected.
- Many of the coastal and estuarine environments in the East Inshore area are defined as heavily modified due to the incidence of land reclamation, coastal and flooding defences, aggregate extraction, use for marine fisheries, and navigation and port activity. Heavily modified water bodies (HMWB) include those sites which have had their character or physical form greatly altered by anthropogenic activities, or which are designated as such under Article 4(3) of the WFD. Work is underway in order to try and achieve good ecological potential (GEP) in such areas. In order to achieve GEP, mitigation measures set out for each water body by the Environment Agency need to be put in place.

The marine planning process also raises a number of opportunities for the topic of geology, substrates and coastal processes, which include:

- Making the most of the requirement to consider a number of other relevant plans including RBMPs, SMPs, flood risk management and other existing coastal policies and initiatives (such as coastal change management areas), in planning decisions and in drafting the marine plans.
- The consideration of the resilience of proposed developments given present projections with regards to sea-level change, and their potential impact on sediment dynamics.

Are there any data gaps?

The following data gaps have been identified for this topic area, which are of relevant to the East Inshore and East Offshore marine plan areas:

- The BGS sediment map for the UKCS is highlighted in Charting Progress 2[267] as being of insufficient detail to define the UK's marine resources and habitats, evidenced by the level of detail provided by new multibeam, Olex data and digital single-beam bathymetry studies which presently only cover a limited extent of the UKCS. BGS are presently working on a revised seabed map for the UKCS, though coverage is limited at present.
- Bathymetry studies such as the UK Civil Hydrography Programme continue to add to the increasing multibeam dataset for the UKCS. Commercial programmes also collect data which may be of wider use, but the lack of coordination in efforts in this area means that separate studies are not contributing to a single national dataset (though this is being identified through the NERC Marine Environment Mapping Programme, MAREMAP).
- The wave and tidal energy industry is due to expand in the coming years as devices become commercially viable. The resources, particularly for tidal devices, tend to be in proximity to the coast, and the majority of these devices are likely to be deployed in territorial waters. At present there is little empirical data on the impacts of such technologies on coastal processes, for instance the array scale effects of energy removal.
- The MCCIP[268] note that the regional variability of sea-level changes are poorly addressed at the current resolution of GCMs used for climate projections. Connected with this is future scope for improvements in probabilistic projections[269], and other resolution issues which may be resolved by future enhances in computing power.

6.7 Landscape and seascape

Introduction

Landscapes with views of the coast or sea, or more specifically seascapes, can be defined as "An area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors" (from Article 1 of the European Landscape Convention), though was defined in the MPS as "landscapes with views of the coast or seas, and coasts and the adjacent marine environment with cultural, historical and archaeological links with each other" (MPS Paragraph 2.6.5.1).

Issues concerning landscape and seascape change are important but potentially emotive and subjective, based around the individual perceptions of residents, visitors or tourists. Any potential development in the marine environment which is inter-visible with the coast (or coastal developments themselves) may influence views in different ways depending on structure type, size, number, type of movement and orientation, coastal form, lighting, aspect and scale, settlement pattern and type.

---

[267] Defra (2010). Charting Progress 2: An assessment of the state of UK seas. Published by the Department for Environment Food and Rural Affairs on behalf of the UK Marine Monitoring and Assessment Strategy community, London, p194.

[268] [268] Horsburgh K & Lowe J (2010). Mean Sea Level and Sea Level Extremes in MCCIP Annual Report Card 2010-11, MCCIP Science Review.

[269] The “mathematical and statistical approaches to climate modelling and prediction” programme being undertaken at the Isaac Newton Institute is given as an example of ongoing research which seeks to improve the statistical probabilistic projections by Horsburgh & Lowe (2010).

Attitudes of people observing the change and the resultant development typically also vary widely.

What is the link between the plan and this topic?

Consistent with those issues to be considered when developing marine plans as outlined in the MPS, the plan and therefore the SA, will consider the potential visual, cultural, historical and archaeological impacts for both designated and non-designated areas. Additionally, the assessment will consider any wider social and economic impacts of a development or activity on coastal landscapes and seascapes (see Section 2.5.5 of the MPS), for impacts on tourism (see Section 6.5) and the context of heritage assets (see Section 6.3).

In line with the required SEA topics (see Chapter 3), landscape (and by association seascape) is a consideration of this SA. To provide context to the topic area, and to address section Annex I (a) of the SEA directive, that is to consider "the contents, main objectives of the plan or programme and relationship with other relevant plans and programmes", a summary table of relevant initiatives (which includes plans, programmes, policy and other relevant items), is shown below, following which there is a brief discussion of the key objectives and targets of the principal initiatives, as well as the implications of the marine plan with regards to these.

What is the policy context?

Landscape and seascape character varies throughout the UK and in the marine plan areas, and the perceived quality of some seascapes and their adjoining landscapes has traditionally been valued more than others which have been recognised in landscape designations (illustrated in Figure 6.31, below). The coastline of the East Inshore marine plan area has a number of often overlapping, statutory (such as areas of outstanding natural beauty, national park) and non-statutory (such as heritage coasts) landscape orientated designations, which have been attained due to the intrinsic natural (or more often semi-natural) and anthropogenic attributes of a particular area. Each of these designations has slightly varying objectives, not all of which relate purely to landscape.

Table 6.14: Relevant plans, initiatives and environmental protection objectives

International
World Heritage Convention 1972
Europe
Council of Europe Landscape Convention 2000
National
Planning Policy Statements
National Policy Statements foe Energy (EN 1-6)
Marine Policy Statement
Note that the draft National Planning Policy Framework (2011) is subject to ongoing consultation and is set to consolidate and replace all of those planning statements listed below
Planning Policy Statement 1: delivering Sustainable development
Planning Policy Statement 7: Sustainable development in rural areas
Planning Policy Statement 5: Planning for the Historic Environment
Other relevant initiatives
Natural England's Landscape {Policy 2008 and detailed policies on designated

landscapes, future landscapes and historic landscapes
Natural England's European Landscape Convention A: Framework for implementation (2007)
European Landscape Convention: Natural England's 2009/2010 Action Plan
The European Landscape Convention – The English Heritage Action Plan for Implementation (2009)
Coastal Access: An audit of coastal paths in England (2008-09)
Coastal Access: natural England's Scheme (2010)
The National Character Areas of England
Local
English Heritage Historic Landscape and Seascape Characterisation programme
Withernsea to Skegness Historic Seascape Characterisation
Clacton to Southwold Historic Seascape Characterisation
Newport to Clacton and Adjacent Waters Historic Seascape Characterisation
North Yorkshire Historic Landscape Characterisation
Lincolnshire Historic Landscape Characterisation Project
Essex Historic Landscape Character Assessments
Norfolk Historic Landscape Character Assessments
Suffolk Historic Landscape Characterisation
Landscape character assessment
East Riding Landscape Character Assessment (2009)
North Yorkshire Landscape Character Assessment
North East Lincolnshire Landscape Character Assessment (2010)
Lincolnshire Landscape Character Assessment (in progress)
Landscape Character Assessment of North Norfolk (2009)
Great Yarmouth Landscape Character Assessment (2008)
Suffolk Landscape Character Assessment (2008)
Waveney District Landscape Character Assessment (2008)
Local plans and local development frameworks for relevant district councils

Areas of outstanding natural beauty (AONBs) are principally concerned with landscape conservation, though also can also make provision to preserve traditional agriculture, forestry and industry. The promotion of recreation is not an objective of these designations unless they are consistent with the principal objectives of AONBs, which contrasts with national parks which, in addition to their primary purpose of preserving and enhance the landscape, wildlife and cultural heritage is to promote public enjoyment. Heritage coasts are designated for areas considered to be of exceptional scenic value and largely undeveloped, and are made to help protect the coast and its heritage features which may be architectural or archaeological.

Landscape designations, and historic monuments and their settings, are dealt with in numerous terrestrial planning policy statements and guidance in England, including PPS1: Delivering Sustainable Development, PPS 7: Sustainable Development in Rural Areas, and PPS 5: Planning and the Historic Environment. It should be noted that there is a consultation underway to replace these with a consolidated National Planning Policy Framework. Most recently, the energy National Policy Statements (EN1-6) present a view consistent with the present PPS7 (and largely in keeping with

the draft National Planning Policy Framework), that the highest protection status is afforded to statutory landscape designations (such as AONBs, national parks), within which proposed developments may be exceptionally granted consent where it is demonstrated to be in the public interest.

The European Landscape Convention (ELC) and associated initiatives are presently targeting a move away from focussing on aesthetically "outstanding" areas to adopt a general focus which looks at the quality and sustainability of all landscapes. This is reflected in the national character area network in England, more local landscape or historic character assessment, and organisation policy statements (such as Natural England's framework for implementation, and ELC action plan, the English Heritage Action Plan for Implementation[270]). Moreover, the MPS states that, all coastal landscapes should be considered when developing marine plans, not just those which are protected through designations, which is broadly complementary to the tenets of the ELC. The ELC requires "landscape to be integrated into regional and town planning policies and in cultural, environmental, agricultural, social and economic policies, as well as any other policies with possible direct or indirect impacts on landscape" (Article 5 (d)), and Natural England has prepared a range of guidance on how to integrate the principles of the ELC into plans, policies and strategies. The ELC also raises a number of specific measures (Article 6) including: awareness raising, promotion in the training of landscape specialists, and the identification/assessment of landscapes along with the setting of landscape quality objectives.

The MPS and Marine and Coastal Access Act provide a policy and legal framework for the implementation of a new national coastal trail in England which will also have amenity land associated with it which the public is free to use. The scheme for the implementation of this part of the act in England and its methodology has been drawn up by Natural England (2010), with work having begun on six stretches of coastline, with Norfolk being the only one of these six to reside in the East Inshore area, stretching between Weybourne and Sea Palling with completion expected in 2014. This path augments part of an existing National Trail (Peddars Way/North Norfolk Coast Path) from where it ends at Cromer, south to Sea Palling. The coastal access audit conducted by Natural England in 2009-2010 indicated that the Yorkshire & Humber, East Midlands and East of England areas (those which have coastline in the East Inshore plan area), already have satisfactory and legally secure paths along 67 per cent, 61 per cent and 67 per cent of their coastline respectively. Though perhaps not directly affecting landscape, the initiative may encourage a greater number of visitors to the coast and is likely to increase the number of people experiencing and interacting with seascapes.

Implications for sustainability appraisal and marine plans

The marine plan will be used by the MMO when considering the potential impacts of development applications, many of which will require to be assessed with regards to their impact on landscape and seascape, whether that is on designated sites, or how they influence the wider landscape/seascape character. It will be important in the drafting of the marine plan, and at the project level, to account for the degree of

[270] English Heritage (2010). The setting of heritage assets: English Heritage guidance. Consultation draft.

change in visual character that certain developments may represent, how this varies with regard to seascape and landscape character of the plan area, and any areas outside of the plan area which are within viewable distance of such activities. Given the future trajectory for certain industries (such as offshore renewable, see Chapter 5), the potential future cumulative impacts could also be a consideration of the plan.

What is the baseline situation?

The East Inshore marine plan area has been subject to a number of landscape character assessments (including historic landscape and seascape assessment), as well as having been considered by a number of other initiatives of relevance to landscape such as the Natural England Natural Character Areas Programme, and the Countryside Quality Counts project[271]. These projects provide a baseline of information which may be used to generate a consideration of landscape character in the East Inshore area which is not isolated to designated landscapes (though these are outlined below). It should be noted, that though landscape designations occur exclusively within the East Inshore area, activities taking place further offshore may also be impacted by developments – such as wind farms located in or close to indicative Royal Yachting Association (RYA) cruising routes and ferry lanes – or change how the inshore area is perceived – such as increased shipping traffic.

Statutory and non-statutory landscape designations

There are presently four statutory and three non-statutory landscape designations in the East Inshore marine plan area. In addition to these designations which are indicated in Figure 6.31 and Table 6.15 below, the setting of heritage assets[272], defined in the MPS (paragraph 2.6.6.1) as "buildings, monuments, sites or landscapes – that have been positively identified as holding a degree of significance meriting consideration", should also be a landscape/seascape consideration[273]. These may include, among other things, scheduled monuments, listed buildings and parks and gardens of special historic interest. These features are considered separately in Section 6.3, Cultural Heritage.

[271] Haines-Young RH (2007). Tracking Change in the Character of the English Landscape, 1999-2003. Natural England, Catalogue Number NE42

[272] The setting, or surroundings in which a heritage asset is experienced, is an underlying consideration of Planning Policy Statement 5: Planning for the Historic Environment, and is also considered in the draft National Planning Policy Framework (see paragraphs 180,181 and 188).

[273] See also, English Heritage (2010) guidance on the setting of heritage assets: Consultation draft, July 2010.

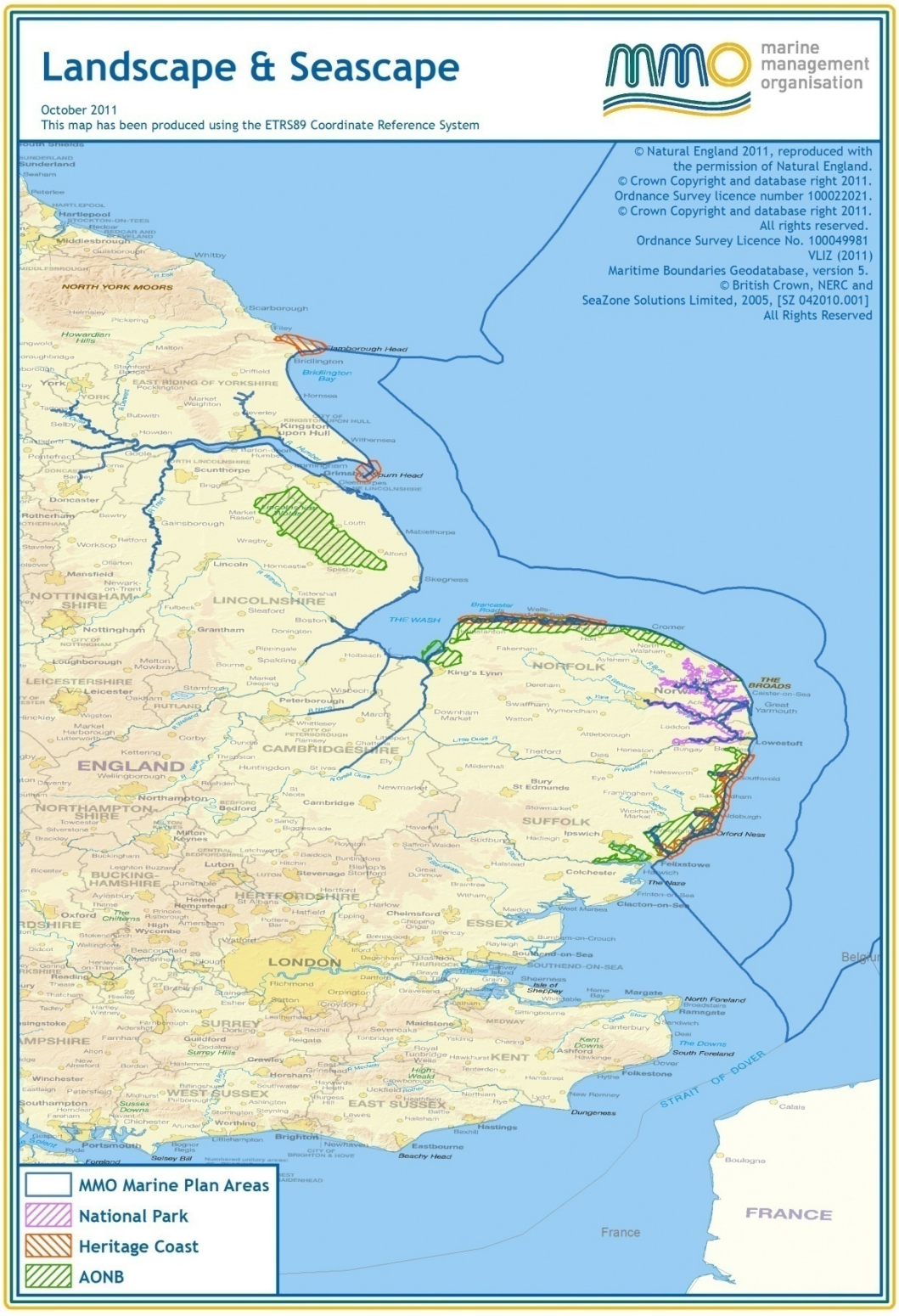


Figure 6.31: Statutory and non-statutory landscape designations intervisible with the coast

Table 6.15: Principal landscape designations in the East Inshore area

Site name	Designation	Summary
Lincolnshire Wolds	AONB	A dissected chalk tableland sloping gently to the east, the abandoned chalk pits and grasslands provide areas for rare plants and insects. Mixed managed woodland includes oak, ash and coppiced hazel.
Norfolk Coast	AONB, HC	Consists of sand and mud flats, dunes, shingle, saltmarsh, reedbeds and grazing marsh in addition to soft, eroding cliffs of glacial sands and gravels east of Weybourne and the farmland, estates and woodland of the coastal hinterland, with important areas of heathland.
Suffolk Coast and Heaths	AONB, HC	A mosaic of different habitats: farmland, heathland, ancient woodland, commercial forestry, reed beds, estuaries, grazing marsh, small towns and villages, low crumbling cliffs and shingle beaches.
Flamborough Headland	HC	A line of chalk cliffs rising at Bempton to 130 metres. Clay and chalk geology are home to a distinct flora and a mainland gannet colony (see section 6.4).
Spurn		This area comprises the curving hook of shingle and sand which makes up the tip of the eastern part of the mouth of the Humber and is home to many migratory bird species in spring and autumn.
Broads	NP	This area was designated under its own Act of Parliament in 1989. The broads consist of peat-pits dug in the medieval period, connected to interior lakes by dykes, allowing lock-free navigation. Fen and carr woodland and drained marshland are characteristic of the area.

Key: AONB=Area of outstanding natural beauty, HC=Heritage coast, NP=National park

Landscape and seascape assessment

Visual impacts may arise from developments which are built directly at the coast (such as harbours) or at some distance from the coast, such as offshore wind turbines and oil and gas installations. With regards to the latter, the visual impact of offshore developments which have surface infrastructure above sea level is generally a function of their visibility from the coast which is dependent on their distance from any given viewpoint, and the atmospheric conditions (such as contrast and haze) prevailing at the time of viewing[274], [275]. The limit of any impact from

[274] Bishop ID & Miller DR (2007). Visual assessment of off-shore wind turbines: the influence of distance, contrast, movement and social variables. Renewable Energy 32: pp814-831.

coastal viewpoints is controlled by the viewable distance over the horizon, ultimately defined by structure height (dipping height), any viewable portion of a development being diminished (or enhanced) by the chromatic contrast of structures and their surroundings (that is the sea and sky) and the arrangement/complexity of structures and how they interact with coastal form (such as scale, complexity, settlement pattern). Though with fewer visual receptors, viewpoints at sea (such as from ferries, yachts) may also be affected.

A number of studies have recently been undertaken to assess the likely impact of offshore renewables on the seascapes of the UK, mainly stemming from the uptake of offshore wind, which has until recently taken place largely within 12 nautical miles of the coast, and therefore largely within viewable distance of the coast. These have taken the form of strategic level seascape studies, which have sought to characterise the coastline of the UK and its sensitivity to offshore developments. Studies for Scotland[276] and Wales[277] have thus far been completed for offshore wind and a wider suite of offshore renewables respectively, adopting an almost uniform methodology of characterisation, based around the use of regional seascape units as devised by Hill et al[278].

Seascape units are contiguous segments of adjoining coast and sea, spatially delimited by the changing visual and geographic constraints of the coast, and do not follow any regional or local authority boundaries (see Figure 6.30). 125 regional seascape units have been identified for the English coast[279], 14 of which are in the East Inshore area, though the characterisation of these units and their relative sensitivity to any particular scenario is not yet complete (see data gaps, below). A characterisation of these seascape units following their identification is usually completed without any reference to a development scenario and so could be used to inform seascape studies for a range of marine developments, or indeed a seascape study for the wider marine plan area.

[275] Hill M, Briggs J, Minto P, Bagnall D, Foley K and Williams A (2001). Guide to Best Practice in Seascape Assessment. INTERREG Programme
[276] Scott KE, Anderson C, Dunsford H, Benson JF & MacFarlane R (2005). An assessment of the sensitivity and capacity of the Scottish seascape in relation to offshore windfarms. Scottish Natural Heritage Commissioned Report No.103
[277] [277] White S & Briggs J. (2009). Welsh seascapes and their sensitivity to offshore developments. Countryside Council for Wales.
[278] Hill M, Briggs J, Minto P, Bagnall D, Foley K and Williams A (2001). Guide to Best Practice in Seascape Assessment. INTERREG Programme
[279] White S & Briggs J. (2009). Welsh seascapes and their sensitivity to offshore developments. Countryside Council for Wales.

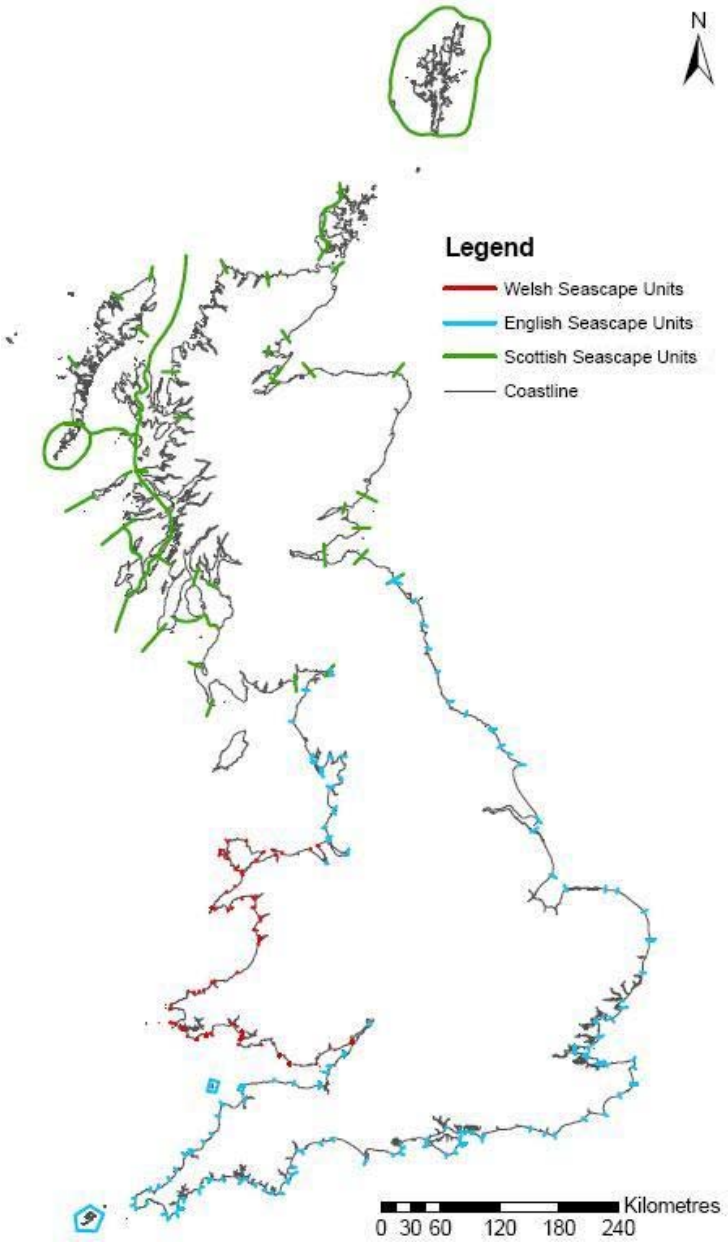


Figure 6.32: Regional seascape units presently defined for the UK[280]

What would the situation be without the Marine Plan?

In the absence of the marine plan, landscapes would continue to be protected through statutory mechanisms (such as under the National Parks and Access to the Countryside Act 1949 (as amended)) and considered in the planning process through the various terrestrial/national policy statements and the MPS. Recognition of the principles of the European Landscape Convention will provide for a consideration of landscapes outside of those with statutory designations (for instance as recognised in the wording of the MPS and other initiatives including, among other things, the respective ELC action plans of English Heritage[281] and Natural England).

---

[280] White S & Briggs J. (2009). Welsh seascapes and their sensitivity to offshore developments. Countryside Council for Wales.

Despite the present level of protection afforded to landscape and seascape, there are a number of key issues and data gaps (below) which the marine plan process may help to address at the local and regional level.

What are the key issues?

Key issues with regards to seascape (both in the East Inshore and East Offshore marine plan areas) are centred on any future increase in offshore activity, particularly offshore renewables development, and its association with the terrestrial landscape. Specific Issues include:

- The present and future leasing rounds of offshore wind are likely to see high numbers of larger turbines built in UK waters. Though the majority of the Round 3 wind zones are outside of territorial waters and therefore developments are unlikely to be greatly visible from the coast, views at sea and associated ancillary development (which may include additional port infrastructure and cable landfalls) for these wind farms and other marine renewables is likely in the coming years.
- The Southern North Sea is also a prospective area for carbon capture and storage (CCS) and continuing gas field development, both of which will result in ongoing or incremental offshore and potentially also coastal development.
- The Government believes that there is a compelling need for substantial additional port capacity over the next 20 to 30 years (see Section 6.5), which would be associated with a similar increase in vessel traffic

The marine plans also provide a number of opportunities with regards to landscape and seascape which include:

- The opportunity to consider landscape and seascape in offshore development consent both for individual developments and as part of cumulative assessments, and to implement landscape character assessment in the consideration of such impacts where appropriate (see MPS paragraph 2.6.5.3).
- The ability to, where necessary, liaise with terrestrial planning authorities on seascape issues.

Are there any data gaps?

- With regards to a consideration of the "existing character and quality [of the seascape], how highly it is valued and its capacity to accommodate change specific to any development" (MPS Section 2.5.5), a seascape character assessment following on from work conducted for the DECC Offshore Strategic Environmental Assessment (OESEA)[282] to identify relevant seascape units for England consistent with those for Scotland[283] and Wales[284] with regards to offshore renewable energy is yet to be conducted.

---

[281] English Heritage (2010). The setting of heritage assets: English Heritage guidance. Consultation draft.
[282] DECC (2009). UK offshore energy Strategic Environmental Assessment: Future leasing for offshore wind farms and licensing for offshore oil & gas and gas storage. Department of Energy and Climate Change.
[283] Scott KE, Anderson C, Dunsford H, Benson JF & MacFarlane R (2005). An assessment of the sensitivity and capacity of the Scottish seascape in relation to offshore windfarms. Scottish Natural Heritage Commissioned Report No.103

- Consistent with the above information gap, a number of non-governmental organisations (such as The National Trust, the Campaign to Protect Rural England) have contributed to the paper 'A manifesto for coasts and seascapes', stemming from the publication 'Coastal Protected Landscapes and Marine Planning' [285]. The former paper, addressed to UK Government, highlights some concerns held by non-governmental organisations with regards to how the new marine planning system will consider seascapes, for instance:
    - the concept and relevance of seascapes, there being no statutory basis for identifying and protecting them
    - the significance of and the role that coastal protected landscapes play in the coordinated management of extensive lengths of the UK coast and adjacent inshore waters designated as AONB or National Park and defined as Heritage coast.

6.8 Water environment

Introduction

The East of England marine water environment is highly varied with the offshore areas comprising shallow water depths being well mixed by tides and wind and the inshore areas comprising extensive areas of intertidal muds, sands and soft cliffs. The area is also subject to significant anthropogenic pressure being heavily used for shipping and energy production.

Marine water quality is a function of both riverine and aeolian terrestrial inputs of pollutants, and those derived from marine activities including shipping and oil and gas exploration and production. Emissions from terrestrial and marine sources to the atmosphere (covered in section 6.1, Air Quality) lead to deposition on the sea surface, and these include acidifying components as well as heavy metals. This section covers the following issues:

- water masses and circulation
- wave environment
- sea-level change and flood risk (see also section 6.1, Air and climate and 6.6 Geology, geomorphology and coastal processes)
- temperature and salinity
- marine pollution/water quality (note, also, Chapter 4 Section 4.10).

What is the link between the plan and this topic?

Developments and activities at the coast and sea can have adverse effects on the water environment. For example, during all phases of development there may be increased demand for water, discharges to water and adverse effects on ecological resources as a result of physical modifications to the water environment. Therefore, there is the potential for activities covered in marine plans to have both direct and

---

[284] White S & Briggs J. (2009). Welsh seascapes and their sensitivity to offshore developments. Countryside Council for Wales.
[285] Europarc Atlantic Isles (2010). Coastal protected landscapes and marine planning system. A report from a workshop held at Losehill Hall, May 2010

indirect cumulative effects upon the water environment. Effects may also be beneficial if there is improved management of coastal and marine resources and a more holistic approach to planning.

What is the policy context?

Table 6.16 summarises the key elements of the marine water environment context, from which it becomes possible to gain a better understanding of the issues. Following the table is a short discussion that seeks to highlight some of the most pertinent messages.

Table 6.16: Other relevant plans, initiatives and environmental protection objectives

International
Convention for the Protection of the Marine Environment of the North East Atlantic (the OSPAR Convention 1992)
IMO International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 (MARPOL 73/78)
International Convention for the Control and Management of Ships' Ballast Water and Sediments (IMO 2003)
OSPAR Decision 2007/1 to Prohibit the Storage of Carbon Dioxide Streams in the Water Column or on the Sea-bed
International Convention on Oil Pollution Preparedness, Response and Co-operation (1990)
Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (1972, as amended) 1996 protocol - revision to convention (2006) and amendments to 1996 protocol
OSPAR Strategy to Combat Eutrophication (2003)
OSPAR Biological Diversity and Ecosystems Strategy
OSPAR Hazardous Substances Strategy
OSPAR Offshore Oil and Gas Strategy
OSPAR Radioactive Substances Strategy
OSPAR Recommendation 2003/1 on the Strategy for the Joint Assessment and Monitoring Programme
OSPAR Decision 2000/3 on the use of organic-phase drilling fluids (OPF) and the discharge of OPF-contaminated cuttings OSPAR Decision 2000/2 on a harmonised mandatory control system for the use and reduction of the discharge of offshore chemicals (as amended by decision 2005/1)
OSPAR Decision 2007/1 to Prohibit the Storage of Carbon Dioxide Streams in the Water Column or on the Sea-bed
OSPAR Decision 2007/2 on the Storage of Carbon Dioxide Streams in Geological Formations
OSPAR Recommendation 2000/5 on a Harmonised Offshore Chemical Notification Format (HOCNF), as amended by OSPAR Recommendation 2005/3 and 2008/2
OSPAR Recommendation 2005/2 on Environmental Goals for the Discharge by the Offshore Industry of Chemicals that are, or Contain Added Substances, Listed in the OSPAR 2004 List of Chemicals for Priority Action

OSPAR Recommendation 2006/3 on Environmental Goals for the Discharge by the Offshore Industry of Chemicals that are, or which Contain Substances Identified as Candidates for Substitution
OSPAR Recommendation 2001/1 for the Management of Produced Water from Offshore Installations as amended by Recommendation 2006/4
OSPAR Co-ordinated Environmental Monitoring Programme (CEMP)
Regional OSPAR (2010) Quality Status Reports (QSRs) of the North Atlantic and its sub-regions
Europe
Water Framework Directive (2000/60/EC) and daughter directives: the Groundwater Directive (2006/118/EC) and Priority Substances Directive (2008/105/EC)
Bathing Waters Directive (2006/7/EC)
Shellfish Waters Directive (2006/44/EC)
Urban Wastewater Treatment Directive (91/217/EC)
Nitrates Directive (91/676/EC)
Priority Substances Directive (2008/105/EC)
Marine Strategy Framework Directive (June 2008)
Integrated Pollution Prevention Control Directive (2008/1/EC)
Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)
Directive 2004/35/EC on environmental liability with regard to the prevention and remedying of environmental damage
Directive 2009/28/EC on the promotion of the use of energy from renewable sources
National
Marine and Coastal Access Act 2009
Safeguarding our seas: A strategy for the conservation and sustainable development of our marine environment (Defra, 2002)
Cleaner Coasts Healthier Seas, Working for a better marine environment, Our strategy for 2005-2011 (Environment Agency)
A strategy for promoting an integrated approach to the management of coastal areas in England (2008)
Our Seas – a shared resource. High level marine objectives (2009)
Draft National Policy Statement for Wastewater (Defra, 2010)
Draft National Policy Statement for Ports (DfT, 2009)(England and Wales)
National Policy Statements for Energy (EN-1-5) and National Policy Statement for Nuclear Power Generation (EN-6) (DECC, 2011)
Marine Policy Statement (Defra 2011)
Water Resources Act 1991 UK
Working for a better marine environment, Our strategy for 2005-2011 (Environment Agency, England and Wales)
The Water Environment (Water Framework Directive) (England and Wales) Regulations 2003
Flooding in England: A National Assessment of Flood Risk
Shoreline Management Plans (SMP2) (England and Wales)

Defra's Charting Progress II (2010)
Marine Strategy Framework Directive - putting in place the legal framework for implementation The Marine Strategy Regulations 2010
Planning Policy Statement (PPS) 20 Coastal Planning
PPS25 Development and Flood Risk **Note that the Draft National Planning Policy Framework is currently out for consultation and would replace these PPSs**
Local
Environment Agency Bathing Water Profiles for Anglian Region and Yorkshire North East Regions.
Shoreline Management Plans for: Flamborough Head to Gibraltar Point, Gibraltar Point to Hunstanton (The Wash), Hunstanton to Kelling Hard (North Norfolk), Kelling Hard to Lowestoft, Lowestoft to Felixstowe (Suffolk), Essex and South Suffolk (Environment Agency).
Anglian River Basin Management Plan (Environment Agency 2009)
Humber River Basin Management Plan (Environment Agency 2009)
The Humber Flood Risk Management Strategy (Environment Agency 2008)

The Convention for the Protection of the Marine Environment of the North East Atlantic (the OSPAR Convention) was signed in Paris in 1992 with the aim of preventing and eliminating pollution and to protect the maritime area against the adverse effects of human activities. Currently five annexes are in force:

1. Prevention and elimination of pollution from land-based sources
2. Prevention and elimination of pollution by dumping or incineration
3. Prevention and elimination of pollution from offshore sources;
4. Assessment of the quality of the marine environment
5. Protection and conservation of the ecosystem.

A range of further OSPAR decisions have also been made which have relevance to the water quality of the East of England marine plan areas.

The OSPAR Quality Status Report (QSR) published in September 2010 evaluated the implementation of the OSPAR strategies and their effectiveness in improving the quality of the marine environment. Key aspects of the QSR cover biodiversity, eutrophication, hazardous substances, offshore oil and gas industry and radioactive substances.

The MARPOL Convention is the main international convention covering prevention of pollution of the marine environment by ships from operational or accidental causes. It is a combination of two treaties adopted in 1973 and 1978 respectively and also includes the Protocol of 1997 (Annex VI). It has been updated by amendments through the years.

The Water Framework Directive (WFD) is the most substantial piece of European water legislation to date and is designed to improve and integrate the way water bodies are managed throughout Europe. In the UK, much of the implementation work will be undertaken by competent authorities. It came into force on 22 December 2000, and was transposed into UK law in 2003 **(The Water Environment (WFD)**

(England and Wales) Regulations 2003). The Directive aims to take a holistic approach to water management, preventing deterioration of aquatic ecosystems and restoring surface waters (which includes rivers, lakes, estuarine and other transitional waters, and coastal waters out to 1 nautical mile) and groundwater to good status in terms of ecological and chemical objectives for surface waters and quantitative and chemical objectives for groundwater by 2015. The status of transitional and coastal waters is measured not only in relation to the presence or absence of pollutants, but also risk factors including introduced non-native species. The Directive also aims to ensure that protected areas such as bathing waters and drinking waters achieve their objectives. Two daughter directives accompany the WFD: **the Groundwater Directive (2006/118/EC)** and the **Priority Substances Directive (2008/105/EC)**. This legislation underpins the requirements of the WFD with regard to groundwater and surface water pollution. The latter will not only contribute to the decline in the emission of priority substances, but also the cessation of their discharge by 2020.

The Bathing Water Directive sets the microbial standards for water quality at popular beaches and inland bathing sites that have been designated as bathing waters because they attract large numbers of bathers. Note that the forthcoming revisions to the Bathing Water Directive will have tighter standards than the current Directive. This comes into force in 2015, but the Environment Agency will begin monitoring bathing waters under the revised Directive from 2012. The **Shellfish Waters Directive** protects or improves shellfish waters in order to support shellfish life and growth, therefore contributing to the high quality of shellfish products directly edible by man. It sets physical, chemical and microbiological water quality requirements that designated shellfish waters must either comply with (mandatory standards) or endeavour to meet (guideline standards).

The Marine Strategy Regulations 2010 transpose the **EU Marine Strategy Framework Directive** (MSFD) into UK law and require the development of the five elements of the marine strategy:

1. The assessment of marine waters
2. The determination of the characteristics of good environmental status for those waters
3. The establishment of environmental targets and indicators
4. the establishment of a monitoring programme
5. The publication of a programme of measures.

Qualitative descriptors for determining good environmental status are listed in Annex I of the MSFD and those of relevance to the water environment include:

- human-induced eutrophication is minimised, especially adverse effects thereof, such as losses in biodiversity, ecosystem degradation, harmful algae blooms and oxygen deficiency in bottom waters.

The Marine and Coastal Access Act was enacted in 2009. The act aims to help the UK achieve clean, healthy, safe, productive and biologically diverse oceans and seas. It seeks to provide better protection for the marine environment; sustainable use of marine resources; an integrated planning system for managing UK seas,

coasts and estuaries; a robust legal framework for decision-making; streamlined regulation and enforcement; and access to the coast. A key output of the act was the requirement to produce a **Marine Policy Statement** (MPS) and marine plans. The MPS was adopted in 2011 and seeks to enable an appropriate and consistent approach to marine planning across UK waters, and ensure the sustainable use of marine resources and strategic management of marine activities from renewable energy to nature conservation, fishing, recreation and tourism. The MPS is underpinned by a series of objectives detailed in, **Our Seas – a shared resource. High level marine objectives** (2009).

Safeguarding our seas: A strategy for the conservation and sustainable development of our marine environment was published by Defra in 2002. This report sets out the UK Government's vision for the marine environment - clean, healthy, safe, productive and biologically diverse oceans and seas. It is underpinned by the principles of sustainable development, integrated management, the conservation of biological diversity, robust science, the precautionary principle and stakeholder involvement. It outlines how Government seeks to adopt an ecosystem-based approach to marine management to better integrate marine protection objectives with sustainable social and economic goals. It covers the broad spectrum of policies that affect the marine environment including water quality.

Charting Progress 2 was published in 2010 and provides an updated assessment of the state of UK seas since Charting Progress was published in 2005. Supporting technical reports on healthy and biologically diverse seas, ocean processes, clean and safe seas, and productive seas provide relevant information on the current baseline and issues affecting the water environment.

The **Flood and Water Management Act 2010** makes provisions for the creation of a National Flood and Coastal Erosion Risk Management (FCERM) Strategy, which was published in May 2011. In addition to the above, planning policy (e.g. PPS20 and PPS25) and related guidance outlines how developers and authorities should manage development at the coast. This includes considering, amongst other things, impacts that may arise from a development (e.g. as to whether it may enhance flood risk elsewhere), whether the development is itself flood resilient, whether it may be more appropriately located elsewhere, and whether it is sustainable in the long-term (e.g. in the face of rising sea-levels).

River basin management plans (RBMPs) now completed for England are one of the principal means that the WFD has been implemented in the UK and will be used in combination with other plans including shoreline management plans (SMPs) to achieve a fully integrated approach to coastal management. RBMPs have been produced for the Anglian and Humber regions in the East of England. Similarly, the second tranche of **Shoreline Management Plans** (SMP2) are being consulted on or have been finalised for England and Wales. These are non-statutory policy documents for coastal flood and erosion risk management planning. Six SMPs exist in the East of England marine plan area.

Implications for sustainability appraisal and marine plan
The marine plan will be used by the MMO when considering the potential impacts of development applications, many of which will require to be assessed with regards to

their impact on water quality, circulation and coastal flooding. It will be important in the drafting of the marine plan, and at the project level, to account for the degree of risk to the water environment (or indeed from the water environment, such as flood risk to new development) that certain developments may represent. Given the future trajectory for certain industries, the potential future cumulative impacts could also be a consideration of the plan.

What is the baseline situation?

The baseline hydrographic and chemical conditions of the UK shelf seas are summarised in the Offshore Energy SEA 2[286], the OSPAR Quality Status Reports[287], the English Nature Marine Natural Area series[288], Defra's Charting Progress 2[289], as well as in numerous more specific peer reviewed publications in journals. The following is largely a synthesis of the baseline presented in the Offshore Energy SEA 2[290], modified and updated where appropriate for the East of England Marine Plan areas.

Water masses and circulation

The major water masses in the wider North Sea can be summarised as consisting of Atlantic water, Scottish coastal water, North Sea water, Norwegian coastal water, central North Sea water, south North Sea water, Jutland coastal water and Channel water[291] (Figure 6.33). The main inflow to the North Sea occurs along the western slopes of the Norwegian Trench, with minor inflows from the Channel and Baltic. The generalised pattern of water movement in the North Sea can be strongly influenced by short-medium term weather conditions, resulting in considerable seasonal and interannual variability.

Fronts or frontal zones mark boundaries between water masses, including tidally-mixed and stratified areas, and are numerous on the European continental shelf, including UK waters. Density stratification is well developed in the summer months of most years in the central and northern North Sea, with the relative strength of the thermocline determined by solar heat input and turbulence generated by wind and tides.

The shallow parts of the southern North Sea remain well mixed throughout the year due to tidal action[292], and the density stratification in the central and northern North Sea breaks down after September due to increasing frequency and severity of

---

[286] DECC (2011). UK Offshore Energy Strategic Environmental Assessment 2. Department of Energy and Climate Change.
[287] OSPAR (2010) Quality Status Report 2010, United Kingdom.
[288] Jones LA, Coyle MD, Evans D, Gilliland PM & Murray AR (2004). Southern North Sea Marine Natural Area Profile: A contribution to regional planning and management of the seas around England. English Nature, Peterborough, UK
[289] Defra (2010). Charting Progress 2: An assessment of the state of UK seas. Published by the Department for Environment Food and Rural Affairs on behalf of the UK Marine Monitoring and Assessment Strategy community, London, 194pp.
[290] DECC (2011). UK Offshore Energy Strategic Environmental Assessment 2. Department of Energy and Climate Change.
[291] Turrell WR, Henderson EW, Slessor G, Payne R & Adams RD (1992). Seasonal changes in the circulation of the northern North Sea. Continental Shelf Research. **12**: pp257-286.

[292] OSPAR (2000). Quality Status Report 2000. OSPAR Commission, London.

storms and seasonal cooling at the surface. Temperature and salinity patterns are more complex within semi-enclosed firths and estuaries.

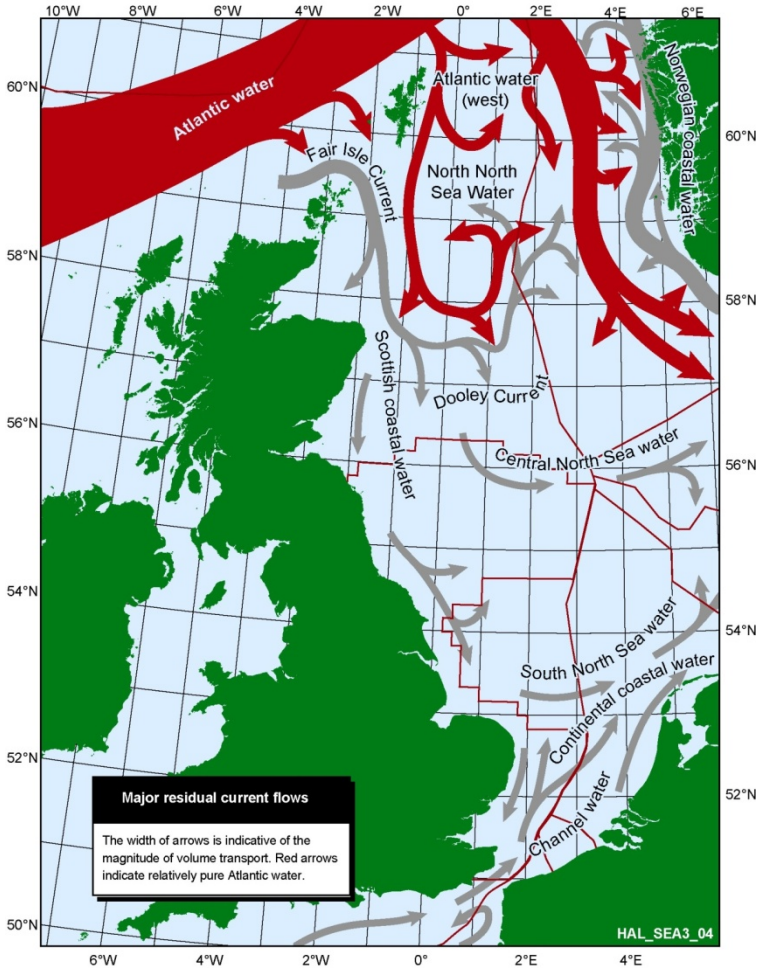


Figure 6.33: Major water masses and residual circulation in the North Sea Source: after Turrell et al[293]

The UKSeaMap project[294] developed maps to represent the seasonal ecological character of the water column, using surface salinity, surface to bed temperature difference and frontal probability (that is the number of days the horizontal temperature difference between neighbouring modelled locations exceeds 0.5 degrees Celsius, divided by the number of days in this season over the 10-year run). This analysis emphasized the importance of the Flamborough Front; and also frontal development around the Dogger Bank within the East of England Marine Plan areas.

The Flamborough Head frontal system has been the subject of significant research since the 1980s. A range of studies have investigated resuspension processes, the southern North Sea sandwave system, the fluxes and transformations of materials (sediments, nutrients, contaminants) into and out of the coastal zone, river

[293] Turrell WR, Henderson EW, Slessor G, Payne R & Adams RD (1992). Seasonal changes in the circulation of the northern North Sea. Continental Shelf Research. **12**: pp257-286.
[294] Connor DW, Gilliland PM, Golding N, Robinson P, Todd D & Verling E (2006). UKSeaMap: the mapping of seabed and water column features of UK seas. Joint Nature Conservation Committee, Peterborough, UK.

catchments, estuaries and coastal seas, riverine, atmospheric, estuarine, coastal and shelf processes[295], [296], [297].

Observations of the physical structure of the region between the Northumberland coast and north Dogger Bank were made in 1996 using towed undulating CTD and satellite-tracked drifting buoys, to test for the presence of a summer cold pool system and associated jet circulation in this area[298]. A more detailed survey of the coast from the Forth to Flamborough Head was also carried out in 1997[299]. Strong bottom fronts were observed to bound a cold pool isolated beneath the thermocline, extending continuously for 500 kilometres along the 40 metres contour, from the Firth of Forth to the eastern end of the Dogger Bank. Persistent and narrow (10 to 15 kilometres) cores of cyclonic nearsurface flow were also observed with velocities in excess of 0.1 metres per second. Peak tidal current velocities are shown in Figure 6.32. In general, maximum velocities are below 1.0m/s except in the vicinity of major headlands (Flamborough Head and Spurn Point) where peak velocities may reach 2.0 metres per second. Significant local variations in patterns of semi-diurnal tidal and residual circulation occur in the vicinity of sandbanks. Bedforms and current meter measurements around the Leman and Well Banks, Smith's Knoll and Hewett Ridges have demonstrated residual near-bed currents to be strongest towards the bank crestline and in opposing directions on either side of the bank[300] [301] [302]. Current records on each side of Well Bank also demonstrated a clockwise near-bed residual circulation around the bank[303] [304], with maximum semi-diurnal amplitude around 0.75 metres per second. This residual circulation pattern is considered to be important in the formation and maintenance of linear sandbanks and will also influence the dispersion of soluble and particulate contaminants.

---

[295] Lwiza KMM, Bowers DG & Simpson JH (1991). Residual and tidal flow at a mixing front in the North
sea. Continental Shelf Research **11**: pp1379-1395.
[296] Gmitrowicz EM & Brown (1993). The variability and forcing of currents within a frontal region off the northeast coast of England. Continental Shelf Research **13**: pp836-890.
[297] Prandle D & Matthews JP (1990). The dynamics of near-shore surface currents generated by tides,
wind and horizontal density gradients. Continental Shelf Research **10**: pp665-681.
[298] Brown J, Hill AE, Fernand L & Horsburgh KJ (1999). Observations of a seasonal jet-like circulation at the central North Sea cold pool margin. Estuarine and Coastal Shelf Science **48**: pp343-355.
[299] Brown J, Fernand L, Horsburgh KJ, Hill AE & Read JW (2001). Paralytic shellfish poisoning on the east coast of the UK in relation to seasonal density-driven circulation. Journal of Plankton Research**23**: pp105-116.
[300] Caston VND & Stride AH (1970). Tidal sand movement between some linear sand banks in the North Sea off northeast Norfolk. Marine Geology **9**: pp38-42.
[301] Caston VND (1972). Linear sandbanks in the southern North Sea. Sedimentology **18**: pp63-78.
[302] Huthnance JM (1973). Tidal current asymmetries over the Norfolk sandbanks. Estuarine and Coastal
Marine Science **1**: pp89-99.
[303] Collins MA, Burnell GM & Rodhouse PG (1995). Distribution and demography of Loligo forbesii in the Irish Sea. Biology and Environment: Proceedings of the Royal Irish Academy B **95**: pp49-57.
[304] Howarth MJ & Huthnance JM (1984). Tidal and residual currents around a Norfolk sandbank. Estuarine and Coastal Shelf Science **19**: pp105-117

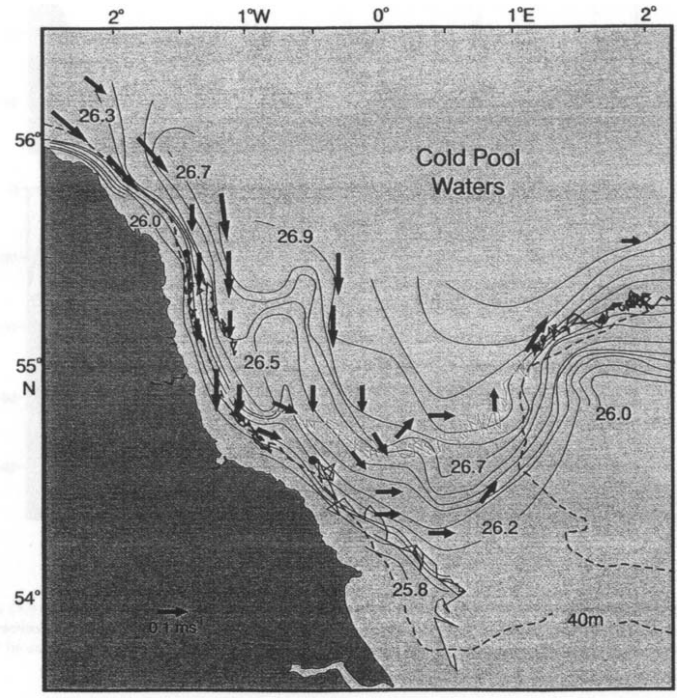


Figure 6.34: The Flamborough Front[305]

Temperature and salinity

In the East of England marine plan areas, significant freshwater input from rivers makes the southern North Sea less saline than the northern North Sea[306] except in the far south where water of North Atlantic origin enters via the Dover Straits. Major differences in Atlantic water inflow from year to year, caused by atmospheric forcing, explain some of the observed large scale differences in salinity between years[307].
In the East of England marine plan areas, winter sea surface temperatures are prevented from dropping below approximately 5 degrees Celsius in the south by a wedge of warm water extending from the English Channel, though further north, temperatures are some of lowest in the UK. In August, temperatures again increase progressively to the south (from 14 to 16.5 degrees Celsius), reflecting increased proximity to the warm European landmass. The waters here are also well mixed at that time of year and show no stratification, whereas in the north bottom temperatures are 2 to 3 degrees Celsius lower than the surface temperatures.

Sea surface temperatures (SST) in the north east Atlantic and UK coastal waters have been rising since the 1980s, most rapidly in the southern North Sea and the English Channel[308]. In the southern North Sea, atmospheric forcing is the dominant

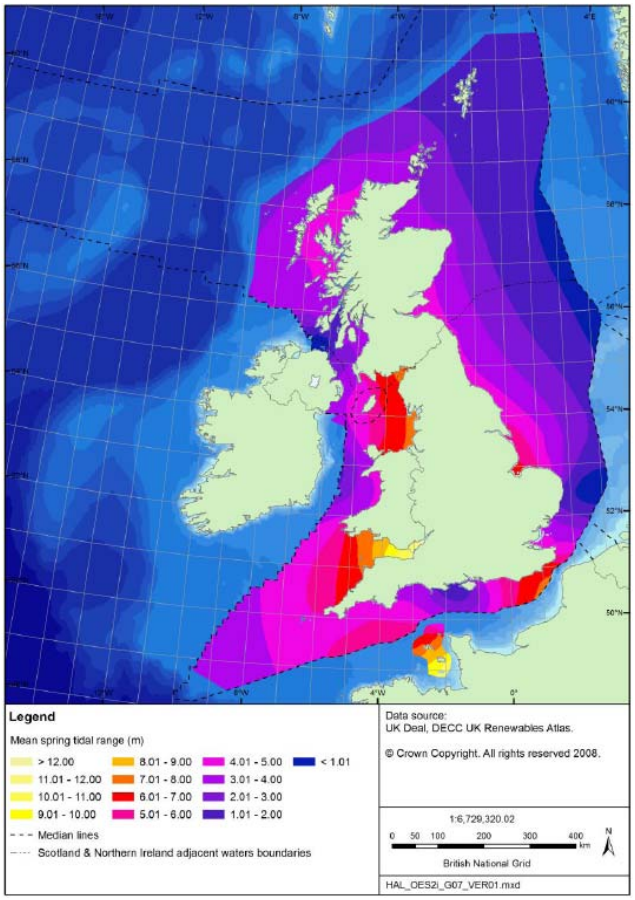
[305] Brown J, Fernand L, Horsburgh KJ, Hill AE & Read JW (2001). Paralytic shellfish poisoning on the east coast of the UK in relation to seasonal density-driven circulation. Journal of Plankton Research23: pp105-116.
[306] Defra (2004). Charting Progress – an Integrated Assessment of the State of the UK Seas. Department for Environment, Food and Rural Affairs on behalf of the UK Government and Devolved Administrations in March 2005.
[307] OSPAR (2000). Quality Status Report 2000. OSPAR Commission, London.

influence, with temperatures being generally cool from 1970 to 1987 when a switch to warm conditions occurred.

Tentative results from UKCP09[309] on possible alterations to hydrography and circulation resulting from climate change indicate that seasonal sea-surface temperatures are likely to substantially warmer by the 2080s the 2080s (2070-2098) for their medium emissions scenario. Temperature rises of approximately 2.5 to 4 degree Celsius are predicted in the southern North Sea.

Wave and tidal environment

The following information relating to UK tides and waves is primarily derived from the Atlas of UK Marine Renewable Energy Resources. Mean spring tidal range generally varies between 1 and 4 metres around the UK, increasing to 5 and 6.5 metres on England's east coast as water tends to be forced against the land by the earth's rotation. Where water travels down estuaries and narrow channels the range tends to increase. For instance tidal range increases in the Eastern English Channel and in the macrotidal estuarine environments of the East Inshore area (see Figure 6.35 below), with the Humber and Wash Estuaries having ranges of 6 metres and 6.5 metres respectively (www.estuary-guide.net).



[308] Holliday NP, Kennedy J, Kent EC, Marsh R, Hughes S, Sherwin T & Berry DI (2007). MCCIP Annual Report Card: Sea Temperature Supporting Evidence. Marine Climate Change Impacts Partnership.

[309] Lowe JA, Howard TP, Pardaens A, Tinker J, Holt J, Wakelin S, Milne G, Leake J, Wolf J, Horsburgh K, Reeder T, Jenkins G, Ridley J, Dye S, Bradley S (2009). UK Climate Projections science report: Marine and coastal projections. Met Office Hadley Centre, Exeter, UK.

Figure 6.35: Peak flow for mean spring tide[310]

Wind generated storm-surges and changes in atmospheric pressure (such as sea-level will generally rise 1 cm for each 1 mb fall in air pressure) may randomly influence the tidal regime[311]. Tidal current speeds are also highly variable and are influenced by nearshore bathymetry and coastal form. Maximum tidal currents at mean spring tides around the UK generally vary between 0.5 and 1.5 metres per second, locally increasing around constrictions or headlands.

The wave environment is less predictable than tidal range and current, though it is strongly seasonal with mean wave heights peaking in January. Extreme waves may be encountered at other times of the year, most notably between October and March. The eastern coast has a lower wave energy environment than the west due to a lower exposure and smaller fetch. In the east, mean heights tend to be less than 1 metre at the coast (refer to Figure 6.36). How these waves are expressed at the coast (such as breaking or reflected waves) and how their energy is dissipated is also spatially variable, and depends on nearshore and coastal bathymetry and topography.

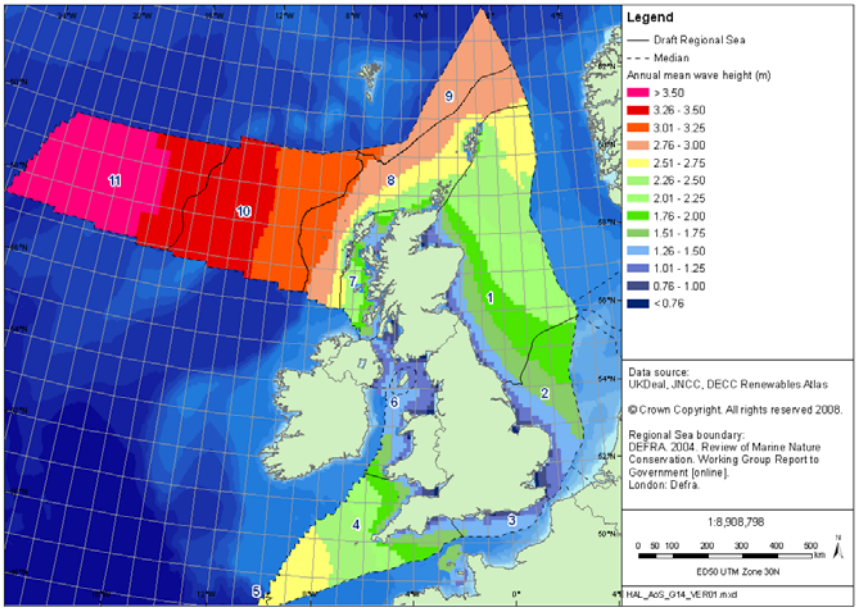


Figure 6.36: Annual mean significant wave height

In the East Offshore marine plan area, the wave climate is relatively low compared to other areas, with the lowest being in eastern coastal waters. Lowe et al[312] project

[310] ABPmer (2008). Review of Round 1 sediment process monitoring data - lessons learnt. Report on behalf of DECC and Defra.
[311] Masselink G & Hughes M (2003). An Introduction to coastal processes and geomorphology. Hodder Education

[312] Lowe JA, Howard TP, Pardaens A, Tinker J, Holt J, Wakelin S, Milne G, Leake J, Wolf J, Horsburgh K, Reeder T, Jenkins G, Ridley J, Dye S, Bradley S (2009). UK Climate Projections science report: Marine and coastal projections. Met Office Hadley Centre, Exeter, UK.

some changes in the UK wave environment as a result of climate change as part of the UKCP09 project. Seasonal mean and extreme wave heights are generally projected to experience negligible change in the North Sea (Figure 6.37).

Changes in the coastal wave climate, as a result of climate change, may have an effect on susceptible coastal regions, especially in conjunction with storm surges and sea level rise. Adverse effects may include damage to the coastline, as well as sea defences.

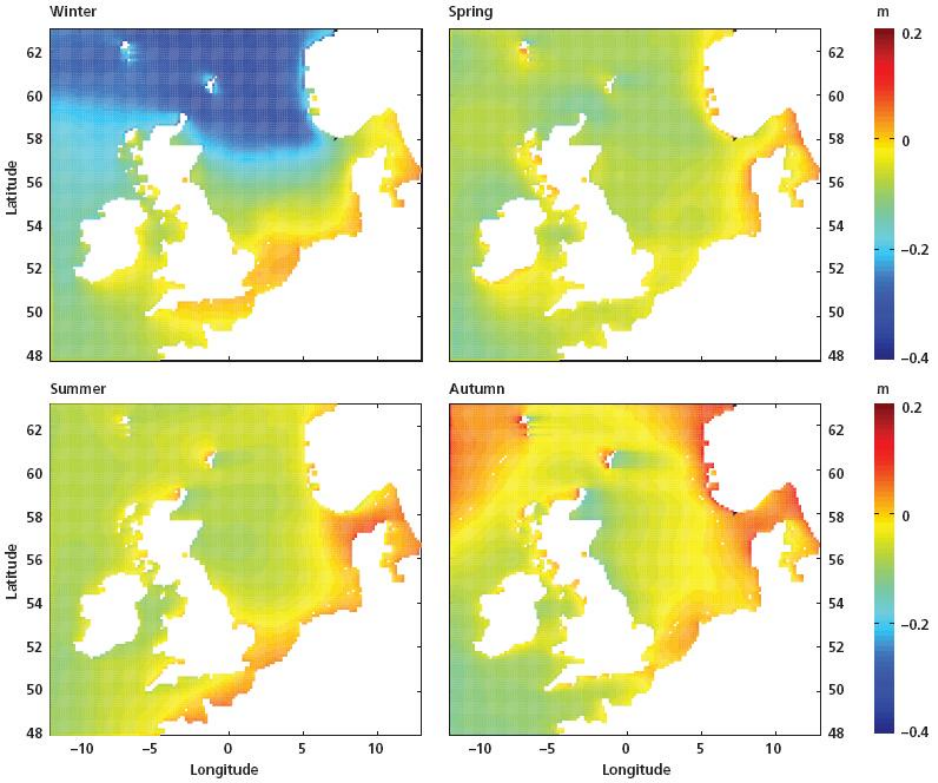


Figure 6.37: Changes in seasonal means of significant wave height (in metres) from 1960 to 1990 to 2070 to 2100 (Source: Lowe et al[313], Note: Top left is winter (December, January, February), top right is spring (March, April, May), bottom left is summer (June, July, August), and bottom right is autumn (September, October, November))

Sea-level change and flood risk

Chapter 6.6, Geology, Geomorphology and Coastal Processes, provides details of historic, current and predicted sea-level change.

The predicted sea-level rise will lead to a greater risk of coastal flooding and erosion, which may be exacerbated by an increased frequency and severity of storms. Lowe et al[314] discuss the possible range of climate-driven changes in surge levels that

[313] Lowe JA, Howard TP, Pardaens A, Tinker J, Holt J, Wakelin S, Milne G, Leake J, Wolf J, Horsburgh K, Reeder T, Jenkins G, Ridley J, Dye S, Bradley S (2009). UK Climate Projections science report: Marine and coastal projections. Met Office Hadley Centre, Exeter, UK.
[314] ibid

may occur around the UK. The significance of these is considered small though is more significant when combined with predictions for relative sea-level rise.

Where flooding occurs at the coast, managers have a number of options although engineered coastal defences have traditionally been used. Other options usually involve a variation of maintaining or implementing defences, accommodating change through adaptation, no active intervention where appropriate, and managed realignment. In line with a consideration of future sea-level change, SMPs have been developed that take a long-term view of the sustainable management approaches that could be used over the next 100 years. Each SMP provides policy recommendations for coastal areas and the relevant SMPs for these Marine Plans are: Flamborough Head to Gibraltar Point, Gibraltar Point to Hunstanton (The Wash), Hunstanton to Kelling Hard (North Norfolk), Kelling Hard to Lowestoft, Lowestoft to Felixstowe (Suffolk), Essex and South Suffolk.

A map of coastal flood risk will be included in the next stage of the SA process, building on the Environment Agency flood risk map..

Marine pollution

Overview

About 80 per cent of marine pollution comes from a variety of land-based activities[315], mostly delivered to the marine environment through effluent discharge or river outflow and from shipping and port activity. Inshore, coastal and particularly estuarine areas are therefore more at risk of being exposed to enhanced pollution levels, though the chemical and ecological quality of waters has improved in recent decades and will be further enhanced by the implementation of management plans (in the form of river basin districts RBDs)) associated with the WFD, which will therefore make a significant contribution to the condition of marine waters.
The current condition of waters (including coastal waters) and pressures in each of the RBDs was highlighted as part of a consultation on the implementation of river basin management plans for each district in 2009 and are available through the Environment Agency's website.

In addition to direct fluvial inputs to the marine environment, deposition from atmospheric pollution can constitute an important and in some cases significant source of contamination to the marine environment depending on the type of pollutant. For instance some heavy metals, persistent organic substances and nitrogen compounds may be derived from deposited sources[316]. Deposited pollutants may be transboundary in nature, though their residence times in the atmosphere are mostly only a few days, being deposited as a rainout component or through sedimentation. There are exceptions, such as polychlorinated biphenyls (PCBs) which have a much longer residence time in the atmosphere and truly represent a transboundary pollutant. The contaminant loading of deposited pollutants

[315] Defra (2002). Safeguarding our seas: A strategy for the Conservation and Sustainable Development of our Marine Environment. Department for Environment, Food and Rural Affairs, London, UK.
[316] OSPAR (2000). Quality Status Report 2000. OSPAR Commission, London.

has been estimated by OSPAR[317] [318] from data derived from the Comprehensive Atmospheric Monitoring Programme.

The OSPAR Quality Status Report (QSR)[319] provides a comprehensive overview of chemical contamination of the North East Atlantic, with those reports detailing OSPAR region II (Greater North Sea) being of relevance to this project. These reports have recently been updated to produce OSPAR QSR2010[320].

Eutrophication

Nutrient inputs (such as nitrogen and phosphorus) may be derived from diffuse land-based sources such as agricultural land, point sources including sewerage outflows, from the deposition of food and faecal matter in fish farming, congregations of wildlife (such as wild fowl) and from atmospheric deposition of eutrophying components (such as reduced and oxidised nitrogen). Riverine discharges of these pollutants reach coastal and offshore marine areas and can contribute to the growth of phytoplankton, macroalgae and aquatic plants, which may result in eutrophication if the balance of organisms is disturbed and various adverse effects, such as deoxygenation, occur. In recent years, direct nitrogen and phosphorus inputs have declined by 35 and 50 per cent respectively on 1990 levels, though riverine inputs, which may alter depending on episodic events including high rainfall and flood, have not shown significant change[321]. The reduction in direct inputs (that is not diffuse sources) of nitrogen and phosphorous to the Northern North Sea have reduced by around 60 per cent since 1990, contrasting with a negligible fall in inputs in the Southern North Sea due to high population densities and intensive agricultural activity. This change reflects better sewerage treatment and industrial discharges due to the implementation of the Urban Wastewater Treatment Directive[322]. Discharges and the impact of nutrients in the marine environment are likely to improve both through the implementation of the WFD and the Marine Strategy Framework Directive (MSFD).

Despite the level of nutrient enrichment in some UK waters, there is evidence that undesirable effects have not occurred. Following a study of coastal and transitional waters in England and Wales (and the risk of them failing to achieve WFD objectives by 2015), the majority of transitional and coastal waters were found not to be, or probably not to be, at risk from failing to achieve WFD objectives due to contamination from diffuse source nitrogen by 2015.

[317] OSPAR (2005). Assessment of trends in atmospheric concentration and deposition of hazardous pollutants to the OSPAR maritime area. Evaluation of the CAMP network. OSPAR Commission, London.
[318] OSPAR (2007). Comprehensive Atmospheric Monitoring Programme: Pollutant deposits and air quality around the North Sea and the North-East Atlantic in 2005. Monitoring and Assessment Series. OSPAR Commission, London.

[319] OSPAR (2000). Quality Status Report 2000. OSPAR Commission, London.
[320] OSPAR (2010) Quality Status Report 2010, United Kingdom.
[321] Defra (2005a). Charting Progress: An Integrated Assessment of the State of UK Seas. Department for Environment, Food and Rural Affairs, p119.
[322] Defra (2005b). Marine Environment Quality. The first of 5 reports produced to support Charting Progress: an Integrated Assessment of the State of UK Seas. Marine Environment Monitoring Group.

The general objective of the Water Framework Directive is to achieve good ecological status for all surface waters by 2015, including coastal and transitional (estuarine) water bodies. The WFD classification scheme for water quality includes five status classes: high, good, moderate, poor and bad. Annex V of the WFD provides a general definition of good status for rivers, lakes, transitional waters and coastal waters: "The values of the biological quality elements for the surface water body type show low levels of distortion resulting from human activity, but deviate only slightly from those normally associated with the surface water body type under undisturbed conditions.

Details of relevant RBDs and the extent and status of estuarine and coastal waters are provided in Table 6.17 below.

Table 6.17: Current extent and status of estuarine and coastal water bodies[323]

River basin district	Number of water bodies in RBD		Percentage of water bodies at good overall status	
	Estuarine	Coastal	Estuarine	Coastal
Humber	8	1	14 per cent	86 per cent
Anglian	18	11	0 per cent	27 per cent

Metals

Metals, including barium, cadmium, copper, iron, lead, mercury, nickel and zinc, are naturally present in seawater and marine sediments, in a range of forms and concentrations. In excessive concentrations, metals can exhibit toxicity and result in significant environmental effects; with cadmium, lead and mercury generally regarded as the elements of greatest concern[324] in North East Atlantic waters. Inputs of heavy metals have reduced in the past 25 years, with direct riverine inputs falling between 20 and 70 per cent and atmospheric deposition decreasing by between 50 and 95 per cent [325].

Some metals are extremely particle-reactive, tending to be adsorbed onto suspended particles, with a consequent reduction in the dissolved phase concentration. The concentrations of trace metals, like other contaminants, tend to be much higher in estuarine sediments than offshore, and sediment characteristics play a significant role in the preferential accumulation of metals. Metals are retained in the fine grained estuarine sediments which act as a sink for contaminants, with this effect decreasing offshore[326]. Chelation by dissolved organic compounds is also a significant factor. A significant proportion of these metals are also likely to end up being redistributed in sea shelf sediments[327], and therefore provide a key source of offshore metal pollutants to the North Sea.

---

[323] Environment Agency website – http://www.environment-agency.gov.uk/research/planning/33106.aspx
[324] OSPAR (2000). Quality Status Report 2000. OSPAR Commission, London.
[325] Defra (2005a). Charting Progress: An Integrated Assessment of the State of UK Seas. Department for Environment, Food and Rural Affairs.
[326] Lee S & Cundy A (2001). Heavy Metal Contamination and Mixing Processes in Sediments from the Humber Estuary, Eastern England. Estuarine, Coastal and Shelf Science **53**: pp619-636.
[327] Ridgeway J & Shimmield G (2002). Estuaries as Repositories of Historical Contamination and their Impact on Shelf Seas. Estuarine, Coastal and Shelf Science **55**: pp903-928.

Charting Progress 2 provides a range of summary data for marine pollution. It identifies that inputs and concentrations of the most commonly monitored contaminants in seawater have fallen since Charting Progress (2005) as a result of earlier controls placed upon their use and are generally below UK Environmental Quality Standard (EQS) limits[328]. Virtually no toxicological hazard from metals was found in water samples analysed for the EU Directives on Dangerous Substances (mainly in estuarine waters) and Shellfish Waters (mainly in coastal waters); nearly 99 per cent of metal concentrations were below the UK EQS values in 2007, although 6 per cent of copper concentrations exceeded the EQS (e.g. see Figure 6.38). This includes an exceedance at Heacham south of Hunstanton. Heacham North beach bathing water quality can sometimes affected by the Heacham River, which outflows close to the beach. The Heacham river and its tributaries flow through a largely rural catchment before passing through the urban area of Heacham. Here there are several holiday home and caravan parks. Within the urban area there are a number of surface water drainage systems that enter the Heacham river.

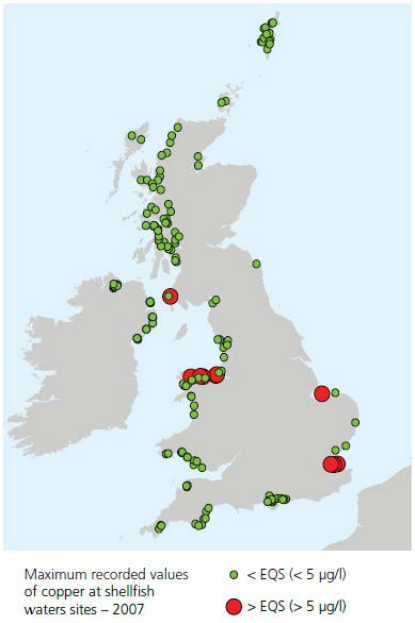


Figure 6.38: Copper concentrations in filtered water samples relative to the UK EQS[329]

Analysis of contaminants in sediments reveals more clearly where there are problems, particularly in estuaries that have been heavily industrialised over time. Figure 6.39 illustrates that concentrations of mercury are above the effects-range median (ERM) in the Wash and have shown an upward trend. Concentrations of PAH are also above the ERM in the Humber Estuary[330].

[328] Defra (2010) Charting Progress 2 - An assessment of the state of UK seas. London.

[329] Defra (2010) Charting Progress 2 - An assessment of the state of UK seas. London.
[330] Defra (2010) Charting Progress 2 - An assessment of the state of UK seas. London.

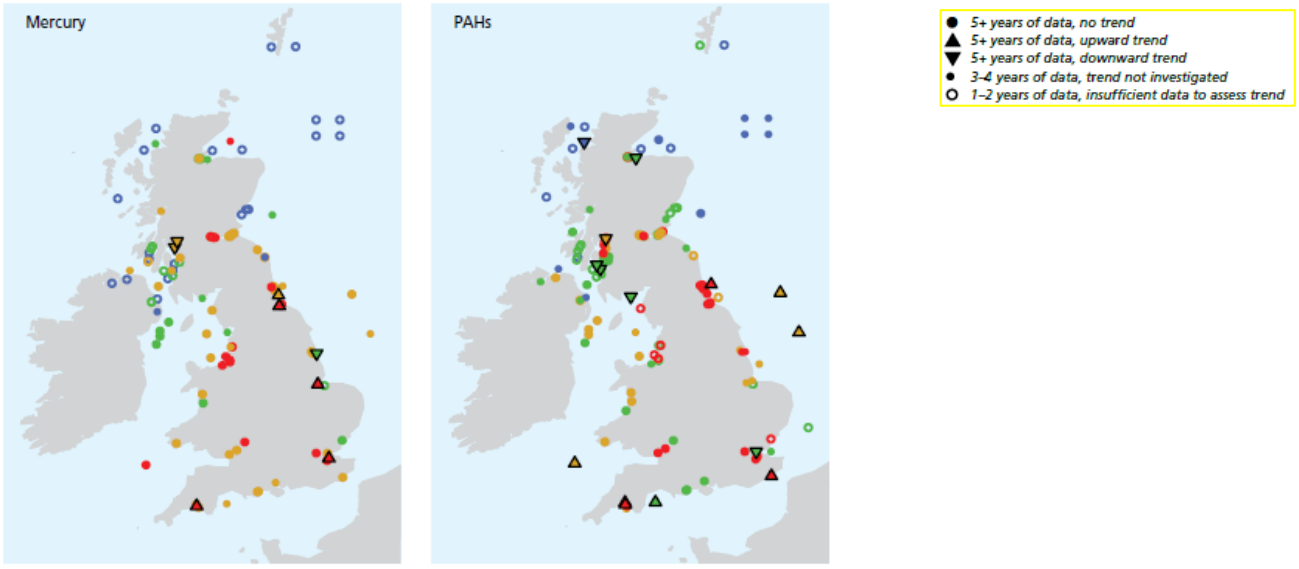


Figure 6.39: Normalised mercury and PAH concentrations in sediment[331] (Blue, green and amber symbols indicate concentrations below the background assessment concentrations (BAC), effects-range low (ERL) and ERM concentrations respectively. Red symbols indicate concentrations above the ERM.)

Concentrations of PCBs, were also determined in surface sediments. They are present in the environment as a result of widespread historical use of these products, mainly in electrical transformers. Although a ban on new uses of PCBs was put in place in 1981, these compounds are very persistent in the environment. Figure 6.40 indicates concentrations of the most toxic congener CB118 (can affect neurological, immunological and reproductive processes in biota and humans) are above the environmental assessment criteria (EAC) in the Humber Estuary[332].

[331] Defra (2010) Charting Progress 2 - An assessment of the state of UK seas. London.
[332] Defra (2010) Charting Progress 2 - An assessment of the state of UK seas. London.

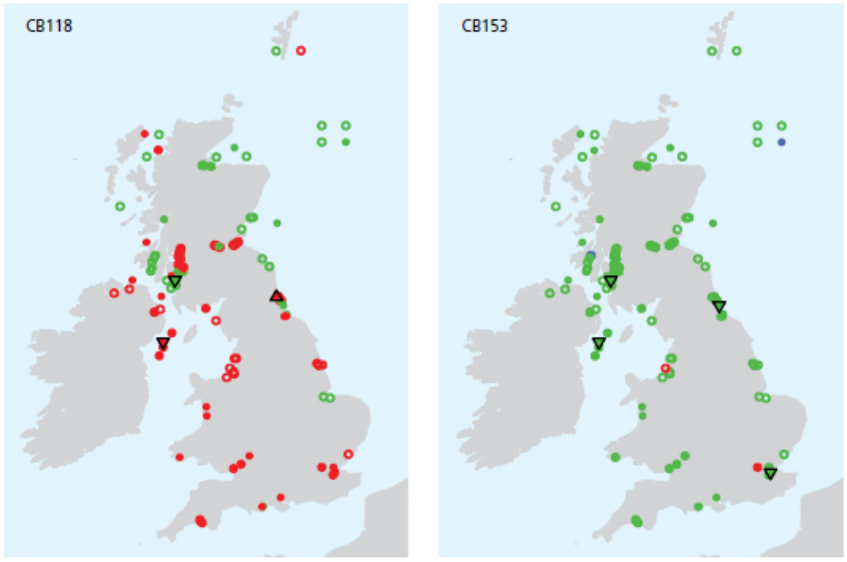


Figure 6.40: Normalised CB118 and CB153 concentrations in sediment[333]. (Blue and green symbols indicate concentrations below the BAC or EAC respectively. Red symbols indicate concentrations above the EAC.)

In fish and shellfish, the highest concentrations of contaminants were found in industrialised estuaries. Cadmium, mercury and lead concentrations were slightly elevated in mussels in the Humber. Figure 6.41 illustrates that concentrations of CB118 in fish liver are above the EAC in a number of areas in the East Inshore and East Offshore marine plan areas. High levels of ethoxyresorufin-O-deethylase (EROD) enzyme activity were found in fish liver, which reflects exposure to contaminants such as dioxins, furans, planar CBs and PAHs, at sites in the North Sea[334].

[333] Defra (2010) Charting Progress 2 - An assessment of the state of UK seas. London.
[334] Defra (2010) Charting Progress 2 - An assessment of the state of UK seas. London.

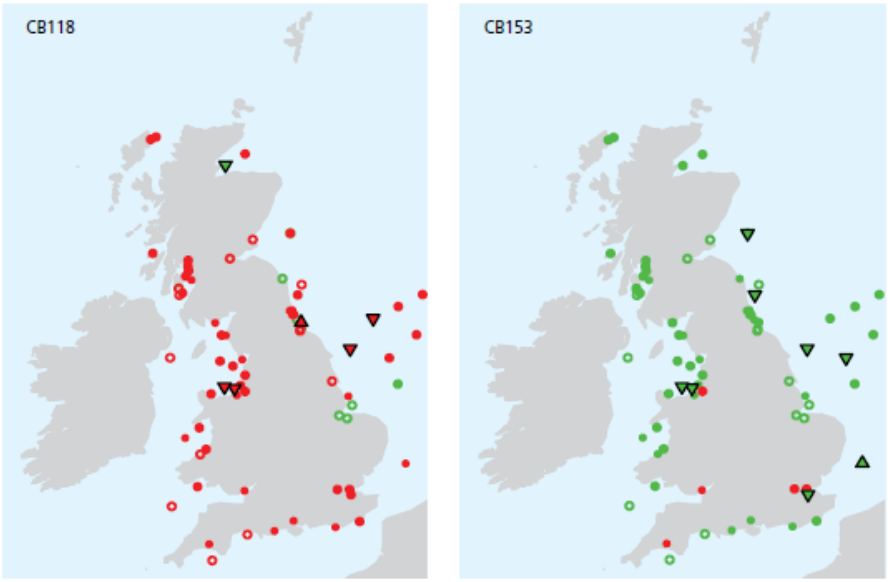


Figure 6.41: Normalised CB118 and CB153 concentrations in fish liver[335]. (Green symbols indicate concentrations below the EACpassive. Red symbols indicate concentrations above the EACpassive.)

Another indicator of poor health in marine biota is imposex – the imposition of male characteristics on female organisms caused by exposure to tributyltin (TBT) or hybrid male/female conditions caused by a wider range of chemicals. Figure 6.42 illustrates that samples of Dogwhelks from south of Flamborough Head show high levels of imposex.

[335] Defra (2010) Charting Progress 2 - An assessment of the state of UK seas. London.

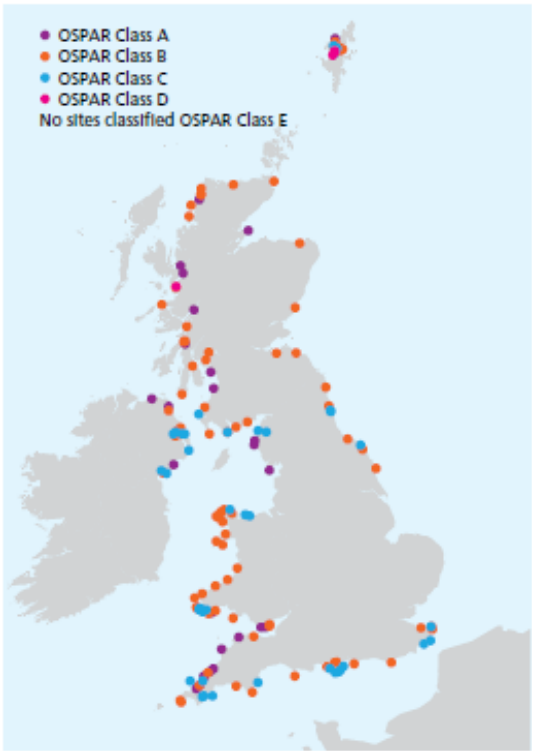


Figure 6.42: OSPAR classification of dogwhelks from UK sampling sites in relation to imposex, 2007[336]. (OSPAR classifications go from A (no incidence of imposex) to E (populations unable to reproduce).)

Radioactivity

Radioactivity occurs both naturally in the marine environment and from man-made sources. In general radioactive discharges are strictly controlled and it is the aim of the OSPAR Radioactive Substances Strategy to reduce such discharges so that concentrations of radiation in the marine environment will be close to background levels for naturally occurring substances and close to zero for man-made radionuclides. Figure 6.43 illustrates the presence of Sizewell nuclear power station within the East Inshore marine plan area and Bradwell nuclear power station located in Essex to the south. The National Policy Statement for Nuclear Power Generation[337] has identified that Sizewell and Bradwell are both locations suitable for the deployment of new nuclear power stations before the end of 2025.

[336] Defra (2010) Charting Progress 2 - An assessment of the state of UK seas. London.
[337] DECC (2011b) National Policy Statement for Nuclear Power Generation (EN-6)

Figure 6.43: Licensed nuclear sites discharging radioactive material into the marine environment[338]

Litter and debris

The overall amount of coastal and marine debris which includes litter deposited by visitors and tourists, and that washed-up from sewerage outflow, shipping litter and lost fishing gear, remains consistently high within the OSPAR area and is not reducing despite recent efforts[339]. Marine litter and debris is aesthetically unpleasant and can have environmental, health and economic impacts, and as it consists of a high degree of plastics, is highly persistent in the marine environment. Entanglement and ingestion of marine litter by marine mammals, fish and birds can cause mortality[340]. MARPOL controls waste from shipping, and terrestrial sources of litter are controlled through the Environment Act, 1990 (England, Scotland and Wales). Litter is one of the 11 qualitative descriptors for assessment of good ecological status under the EU Marine Strategy Framework Directive. Figure 6.44 illustrates the trends in beach litter across all the UK regions.

[338] Defra (2010) Charting Progress 2 - An assessment of the state of UK seas, London.
[339] OSPAR (2009). Marine litter in the North-East Atlantic Region: Assessment and priorities for response. London, United Kingdom.
[340] Defra (2005b). Marine Environment Quality. The first of five reports produced to support Charting Progress: an Integrated Assessment of the State of UK Seas. Marine Environment Monitoring Group.

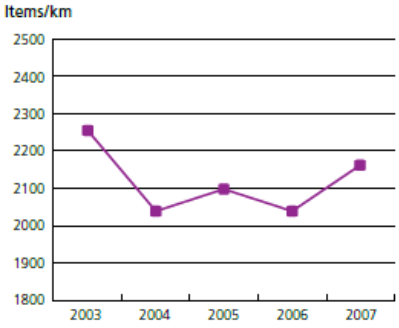


Figure 6.44: Beach litter items (all types) per kilometre surveyed in all UK regions, 2003-2007[341]

Acidification

The pH of the oceans surrounding the UK, and globally, has fallen by an average of 0.1 units as a result of the uptake of anthropogenically produced carbon dioxide since around 1750, and is predicted to fall another 0.3 to 0.4 units by 2100 – this uptake is effectively buffering more serious climate change[342]. Thomas et al[343] calculated the North Sea to be a highly efficient continental shelf pump exporting approximately 93 per cent of atmospheric CO_2 taken up in the coastal waters off the North West European Shelf into the deep waters of the North Atlantic. Measurements are ongoing that will help to understand the complex nature of coastal CO_2 uptake, as part of the CARBON-OPS, Defra-pH and CarboOcean monitoring programmes in the UK and north-western European sectors[344]. Acidification of ocean waters has potential implications for marine biota, including cold-water corals[345] and the ability of organisms such as foraminifera and some benthic invertebrates to produce calcareous skeletal structures[346]. Oceanic uptake of CO_2 may also be reduced by increased ocean acidification which may lead to an increase in atmospheric CO_2 and therefore feedbacks relating to climate change[347].

Bathing waters

In 2007, 96 per cent of bathing waters met at least the imperative (compulsory) standard and 76 per cent met the 'guideline' (desirable) standard under the EU Bathing Waters Directive[348]. Figure 6.45 illustrates compliance at bathing water sampling points in the UK.

---

[341] Defra (2010) Charting Progress 2 - An assessment of the state of UK seas, London.
[342] Turley CM, Roberts JM & Guinotte JM (2007). Corals in deep-water: will the unseen hand of ocean acidification destroy cold-water ecosystems? Coral Reefs. **26**: pp445-448.
[343] Thomas H, Bozec Y, Elkalay K & De Baar HJW (2004). Enhanced open ocean storage of CO_2 from Shelf Sea pumping. Science **304**: pp1005-1008.
[344] Hardman-Mountford N, Litt E, Mangi S, Dye S, Schuster U, Bakker D & Watson A. (2009). Ocean uptake of carbon dioxide (CO_2), MCCIP Briefing Notes. www.mccip.org.uk
[345] Turley CM, Roberts JM & Guinotte JM (2007). Corals in deep-water: will the unseen hand of ocean acidification destroy cold-water ecosystems? Coral Reefs. **26**: pp445-448.
[346] Fabry VJ, Seibel BA, Freely RA & Orr J (2008). Impacts of ocean acidification on marine fauna and ecosystem processes. ICES Journal of Marine Science. **65**: pp414–432.
[347] MCCIP (2008). Marine Climate Change Impacts Annual Report Card 2007-2008. Baxter JM, Buckley PJ & Wallace CJ (Eds.). MCCIP, Lowestoft, Summary Report.
[348] Defra (2010) Charting Progress 2 - An assessment of the state of UK seas. London.

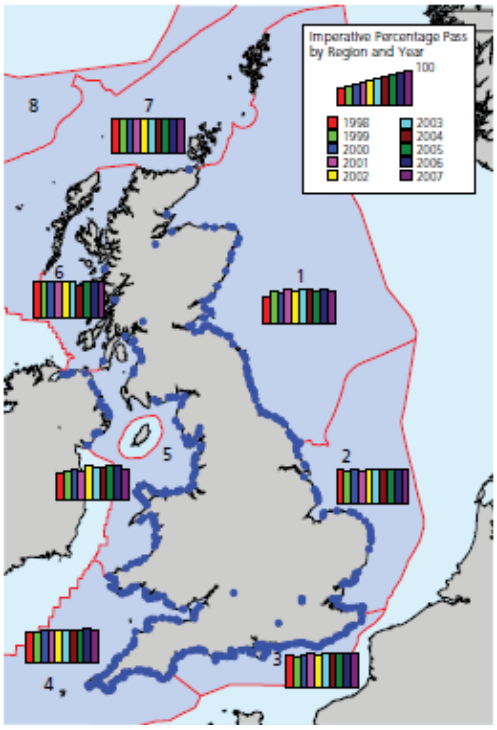


Figure 6.45: Location of UK identified bathing waters in 2007 (•) and regional compliance with the imperative bathing waters standard in UK bathing waters, 1998–2007. Sampling areas include a small number of inland bathing waters[349].

The Environment Agency currently monitors nearly 500 bathing waters during the bathing water season (May to September) and assesses whether they comply with the standards of the Bathing Water Directive. Each bathing water site receives an annual water quality classification for every season. This classification is calculated from 20 samples taken during the season. The number of certain types of bacteria are counted which may indicate the presence of pollution, mainly from sewage or livestock waste. Total coliforms (TC), faecal coliforms (FC) and faecal streptococci (FS) are bacteria that are not directly harmful but indicate the presence of pollution. For September 2011, all of the sampling points within the East of England Inshore Marine Plan area were classified as meeting the stricter UK guideline standards of the Directive apart from Heacham in Norfolk, Southwold, The Denes and Southwold, the Pier[350] in Suffolk. These three locations meet the imperative standard which means that at least 95 per cent of the samples meet the mandatory standards of the Directive[351].

[349] Defra (2010) Charting Progress 2 - An assessment of the state of UK seas. London.
[350] In 2011, Southwold, The Pier was awarded Blue Flag status.
[351] http://maps.environment-agency.gov.uk/wiyby/wiybyController?x=357683.0&y=355134.0&scale=1&layerGroups=default&ep=map&textonly=off&lang=_e&topic=coastalwaters, Accessed 13-10-2011

What would the situation be without the marine plan?

The environmental baseline is likely to be affected by large scale climatic and oceanographic processes, some of which are at present not well resolved. Variations have been observed in North Atlantic and North Sea circulation patterns in the past few decades which are likely to influence sea surface temperatures. Increased wave heights have been observed in the northern North Sea and are known to respond strongly and systematically to the North Atlantic Oscillation[352] [353]. Around the UK, sea temperatures and seasonal stratification strengths are predicted to increase, while salinity is projected to decrease over the 21st century. At a local level, topography often interacts with these principal forces, focusing currents and leading to the generation of amplified current flow or eddies. At present there are no local anthropogenic activities within the UKCS area that are likely to change significantly the physical properties of the water environment, though the pH of the world's oceans has been declining due to CO_2 uptake from anthropogenic sources.

There is, at present, a low confidence in the ability of climate science to accurately resolve the likely changes in ocean currents over the next century resulting from anthropogenically augmented climate change[354] [355]. For the medium emissions scenario used in UKCP09 (equivalent to IPCC SRES A1b[356]), Lowe et al[357] predict little qualitative change in the circulation pattern across the majority of the UK shelf. They also observe a decrease of ≈20 per cent in the flow of water from East Anglia along the continental coast to the German Bight. It is noted that there is considerable uncertainty in these predictions as these changes are likely affected by errors associated with model boundaries. The continuity of the Atlantic Meridional Overturning Circulation (MOC), largely responsible for the UK's mild climate, in response to predicted climate change has been questioned[358]. Despite the low confidence in predictions for this aspect of climate change, MCCIP[359] indicate that it is likely that the MOC will weaken this century, but is unlikely (less than 10 per cent chance) to fail completely.

With regard to both of the above issues, it is unclear whether the development of the marine plans could have a significant impact upon these trends. The marine plans

---

[352] Woolf DK, Challenor PG & Cotton PD (2002). The variability and predictability of North Atlantic wave climate. Journal of Geophysical Research. **107**: pp31-45.
[353] Woolf DK, Cotton PD & Challenor PG (2003). Measurements of the offshore wave climate around the British Isles by satellite altimeter. Philosophical Transactions: Mathematical, Physical and Engineering Sciences. **361**: pp27-31.
[354] Lowe JA, Howard TP, Pardaens A, Tinker J, Holt J, Wakelin S, Milne G, Leake J, Wolf J, Horsburgh K, Reeder T, Jenkins G, Ridley J, Dye S, Bradley S (2009). UK Climate Projections science report: Marine and coastal projections. Met Office Hadley Centre, Exeter, UK.
[355] MCCIP (2008). Marine Climate Change Impacts Annual Report Card 2007-2008. Baxter JM, Buckley PJ & Wallace CJ (Eds.). MCCIP, Lowestoft, Summary Report.
[356] Nakićenović N and Swart R (Eds.) (2000). IPCC Special Report on Emissions Scenarios. A Special Report of IPCC Working Group III. Cambridge University Press.
[357] Lowe JA, Howard TP, Pardaens A, Tinker J, Holt J, Wakelin S, Milne G, Leake J, Wolf J, Horsburgh K, Reeder T, Jenkins G, Ridley J, Dye S, Bradley S (2009). UK Climate Projections science report: Marine and coastal projections. Met Office Hadley Centre, Exeter, UK.
[358] Bryden HL, Longworth HR & Cunningham SA (2005). Slowing of the Atlantic Meridional Overturning Circulation at 25°N. Nature. **438**: pp655-657.
[359] MCCIP (2008). Marine Climate Change Impacts Annual Report Card 2007-2008. Baxter JM, Buckley PJ & Wallace CJ (Eds.). MCCIP, Lowestoft, Summary Report.

would not be able to affect the rate of sea level rise although there may be opportunities to contribute to a more holistic approach to planning in the marine/coastal zone to reduce the risk of coastal flooding to property and infrastructure.

Marine pollution is decreasing in the marine plan area but there is still a legacy of substances from industrialised areas. A series of stringent controls are in place to ensure marine pollution is reduced. The growing traffic in heavy fuel oils through the region raises the risk of accidental spillages occurring although international efforts to improve the quality of ships and crews are likely to have the most significant benefit to this. There may be scope for the marine plans to help minimise this risk further. Similarly, the predicted expansion of nuclear power stations in the region may result in further radioactive discharges to the marine environment, although, as discussed above, the OSPAR Radioactive Substances Strategy and UK Strategy for radioactive discharges is already in place to help achieve reductions in emissions and the new generation of reactors may also lessen the impact on the marine environment.

What are the key issues?

- The potential effects of climate change on coastal flooding and erosion. A large portion of the east coast is vulnerable to flooding and erosion.
- The effects of climate change on sea temperatures and ecology. An increase in sea temperature reduces the ability of oceans to absorb CO_2 affecting certain species thereby causing them to migrate or adapt.
- The likely effects of ocean acidification on ecosystems and marine species.
- Marine pollution derived from riverine, coastal and marine sources, and atmospheric emissions and subsequent deposition (such as metals, acidifying and eutrophying components from sewage and agricultural run-off) and pollutant legacies such as oil based cutting piles, munitions dumping and dredging disposal sites. While these issues are decreasing, there is a persistent legacy of some substances in industrial estuaries.
- Temporary effects in the water column from dredging and other activities which cause turbidity.
- Coastal and marine litter and debris (such as from beach visitors, shipping litter and fishing related debris) is an aesthetic, ecological and economic problem.
- A key driver for change is the WFD requirement (and forthcoming MSFD) to attain good ecological status in coastal waters (0 to 1) and chemical status within territorial waters (0 to 12).

Opportunities

- The Marine and Coastal Access Act and the Marine Strategy Framework Directive provide new means by which important marine sites and ecosystem functions can be protected. The marine plans should carry this forward into regionally specific proposals.

Are there any data gaps?

The following data gap has been identified:

- Further data will be obtained relating to coastal flood mapping.