Annex D Description at a national scale of sectors impacted on by MCZs

Contents

1 Introduction

D.1 This annex describes each of the UK marine sectors that are likely to be impacted upon by the designation of Marine Conservation Zones (MCZs). A description of each sector as it currently exists, in the absence of designated MCZs, is provided. A summary of anticipated impact upon each sector is provided in the Evidence Base and is not repeated here. Best available figures are provided for each sector's turnover, gross value added (GVA) and employment (if readily available) as well as a description of anticipated future UK trends. These represent direct economic contribution only and are summarised in Table 1.

D.2 The year 2008 is presented as the baseline year to avoid the risk that figures might be skewed by the recent recession. However, 2010/11 updates are given if it is relevant to do so (for example for fisheries). A range of recently published sources are referenced, with particular emphasis upon Charting Progress 2.

Table 1 Summary of direct contribution of marine sectors to UK economy by turnover, GVA and employment (sources are provided in accompanying text)

Sector	UK turnover, £m (date)	UK GVA, £m (date)	Directly employed, estimate	Description of anticipated trend
Oil and gas	39,733 (2008)	36,800 (2008)	290,000	Despite estimations of yet-to-be-recovered UK oil and gas resources in recent seaward licensing rounds, forward projections of oil and gas extraction from the UK Continental Shelf (UKCS) are estimated to continue to decline. Deployment of carbon capture storage is anticipated to provide £3,000–6,500m turnover a year by the late 2020s and create more than 50,000 jobs by 2030.
Ports, harbours and shipping	9,500 (2007)	13,143 (2009)	227,000	Sustained growth of 3–4% a year is anticipated in the container and roll-on/roll-off sectors. In addition, port growth is anticipated in support of offshore renewable energy deployment.
Cables (interconnectors and telecom cables)	Not known	2,700 (2008)	Not known	Steady increase in the number of power cables deployed due to offshore energy generation and UK Supergrid connections. Stable trend anticipated for telecom communications due to changing efficiencies in bandwidth and capacity.
Recreation	27,401	1,290	Not known	Due to disparate nature of the sector, estimate includes value for direct and indirect services of some types of recreation, for different years also. Does not include coastal tourism, accommodation and food retail.
Commercial fisheries	719 (2010) 500–700 (over last ten years)	316 (2010)	12,700	A continued decrease in landings is anticipated (in particular for demersal species) but increase in £/kilo due to increasing demand and restricted supply. Figure represents UK vessel landings only (into UK and abroad). 0.4 used as GVA factor.
National defence	1,796 (expenditure) (2008/9)	300 (2008/9)	43,800	No trend information available.

Table 1 Summary of direct contribution of marine sectors to UK economy by turnover, GVA and employment (sources are provided in accompanying text)

Sector	UK turnover, £m (date)	UK GVA, £m (date)	Directly employed, estimate	Description of anticipated trend
Aquaculture	310 (2008) – 350 (2007)	147 (2008) – 193 (2007)	Not known	UK aquaculture production has increased by nearly 500% over the last 20 years. Continued growth anticipated.
Renewables	165 (2010)	50 (2010)	At least 5,000	Anticipated to be fastest growing UK sector with market sales value expected to increase by 80% between 2007/8 and 2014/5. Employment expected to increase to 23,000–57,000 by 2020.
Aggregate extraction	116 (2008)	54 (2008)	1,140 (2007)	Steady increase, due to anticipated demand for new-build nuclear power stations, offshore wind farms with concrete bases and coastal defence.
Water pollution from land	100–200 (2008)	Not known	Not known	The amount of water abstracted for industrial purposes has remained relatively constant over time and it is likely that the requirement for coastal water abstraction will continue at the same levels.
Flood and coastal erosion risk management	358 (2007, expenditure only)	Not known	Not known	Projections are that current spending on coastal defences will need to double by 2080 in order to mitigate the impacts of sea level rise due to climate change

2 Aggregate extraction

D.3 Marine aggregate is sand and gravel that is used primarily in the construction industry but also for beach replenishment and coastal defence. The marine aggregate industry directly employs approximately 1,140 people in the UK. The industry is a vital supplier to the construction sector and provides 20% of the total sand and gravel supply in England and Wales (British Geological Survey, 2007).

D.4 The UK's marine aggregate industry is one of the largest in Europe (British Geological Survey, 2007). In 2008, the industry landed 19.3m tonnes[2] of primary aggregate giving a value of £116m and £54m in GVA. Secondary values identified were £80m from processing and £303m from sales of concrete products. Marine aggregates are mainly sourced off the eastern and southern coasts of England with smaller amounts off the coast of Wales. There is currently no marine extraction in Scotland and Northern Ireland (UKMMAS, 2010). The Crown Estate also generates income from leasing the sea bed for aggregate extraction which in 2008/9 was £20.3m.[3]

D.5 There are currently around 70 production licences in the UK which produce up to 21m tonnes of material per year[4]. The licences represent about 0.12 per cent of the area of the UK Continental Shelf (UKCS), and of this only about eight per cent was actively dredged during 2010 equating to 106 km[4]. In 2009, the currently consented application areas for marine aggregate extraction in the UKCS were deemed sufficient to maintain the current level of demand for approximately 25 years (The Crown Estate, 2009a). However, the anticipated level of demand could vary considerably depending on the number of new-build nuclear power stations and concrete gravity base foundations required for offshore wind farms. Currently, approximately one third of total UK marine aggregate production is exported to the continent (British Geological Survey, 2007).

D.6 Overall, demand for UK marine aggregates is increasing due to growing demand from the construction industry, particularly for large projects such as new-build nuclear power stations, offshore wind farms and anticipated coastal defence schemes, coupled with a limited land-based supply of aggregate materials (UKMMAS, 2010). Production was affected by the recession but it is anticipated that the long-term trend for steady and increasing demand will continue over the 20-year period of the Impact Assessment (IA) (BMAPA, pers. comm., 2011). In light of this, The Crown Estate is preparing to launch a new UK licensing round in 2013 for marine aggregate prospecting in new resource areas (The Crown Estate, pers. comm., 2012).

3 Aquaculture

D.7 Aquaculture is the farming or culturing of aquatic organisms (fish, molluscs, crustaceans and plants). 'Enhanced fishery' is the term given more to the cultivation of shellfish beds that occur naturally, in contrast to a purposely set-up farm system with fixed structures (UKMMAS, 2010). Both are considered under this sector heading.

[2] Between 1998 and 2010, this averaged 21.45m tonnes/yr (Marine Aggregate Summary Statistics 1998–2010, www.bmapa.org/issues_area01.php (accessed 19 December 2011)).
[3] The Crown Estate website, April 2010.
[4] The Crown Estate website, June 2012.

D.8 Most (99%) of existing marine-based fin-fish aquaculture activity is located in Scotland although it is increasing in areas of Wales and England. Shellfish production is more evenly spread throughout the UK (mainly mussels, but also pacific oysters, native oysters, cockles and clams). In 2007, the turnover from aquaculture was estimated to be £350m, providing a GVA of £193m. In addition, the processing of fish from aquaculture provided an estimated additional £105m GVA (UKMMAS, 2010). In 2008, the turnover from aquaculture was estimated to be £310m, providing a GVA of £147m (Saunders and others, 2010).

D.9 In 2009, shellfish cultivation (outside of aquaculture) in the UK was worth an estimated £29.6m (2009 data; latest available) (Cefas, 2011)[5] which provided an estimated £16.3m of GVA.[6]

D.10 UK aquaculture production has increased by nearly 500% over the last 20 years. Production from the marine environment has increased in importance over that period, accounting for 94% of total UK production of aquaculture in 2008 compared with 59% in 1998. Development of the industry is closely tied in with changes in wild fisheries, the availability of investment, site availability and what the environment can support (UKMMAS, 2010).

4 Archaeology

D.11 No figures are available to estimate the turnover, GVA and employment of this sector.

5 Cables (interconnectors and telecom cables)

D.12 This sector comprises the transfer of telecommunications (telecom) and interconnectors (power) between the UK and other countries and among the islands of the UK through sub-sea cables. There are some 18,000km of telecom cable and 2,368km of power cable on the UKCS (UKMMAS, 2010). The highest proportion passes through the south-west MCZ project area. The UK has international power cable links with France, Belgium and in development with Ireland (The Crown Estate, pers. comm., 2012). Other cables provide links to the islands from the UK mainland (UKMMAS, 2010).

D.13 The GVA of the cables sector has been estimated to be £2,700m based on the number of international phone calls (Pugh, 2008). However, this figure does not include the value of internet and data capacity which is the primary commodity (UKCPC, pers. comm., 2011). Approximately 95% of international telecom traffic is routed via submarine fibre-optic cables which are both cheaper and faster than satellite (ICPC/UNEP/WCMC, 2009). The true value of telecom cables should incorporate both the value of the traffic which is carried and the significance held by the UK as a key strategic location for international systems looking to reach markets in America, Europe, Africa and Asia (UKCPC, pers. comm., 2011). These are difficult to capture in market value terms but are significant (UKMMAS, 2010).

D.14 The UK telecom sector went through a period of correction from 2002 to 2006 following the growth and downturn associated with the Dotcom bubble, but some major domestic and international systems are now being installed (UKMMAS, 2010).

[5] There is some overlap between published data for farmed and capture shellfish production. However, “the data are nevertheless valuable for giving an overall impression of activity within and value of the industry” (Cefas, 2011).
[6] GVA has been calculated by applying a GVA conversion factor (GVA as a percentage of output) of 0.55 (UKMMAS, 2010) to the value of output data.

D.15 It is likely that more sub-sea cables and interconnectors will be required in the UKCS in the next 20 years, but this is very dependent on improvements in technology and the capacity bandwidth of the network. There is an ongoing trend towards fewer cables with higher capacities. Future growth in demand for sub-sea power cables will be driven by the offshore renewable energy sector as well as the development of the European Supergrid, which is a large-scale strategic programme to create a pan-Europe renewable energy network (UKMMAS, 2010). Possible future cable routes to link offshore renewables developments together are provided in the 2011 Offshore Development Information Statement.[7]

6 Coastal development

D.16 No figures are available to estimate the turnover, GVA and employment of this sector.

7 Commercial fisheries

D.17 The UK marine fisheries sector comprises all economic activities related to the capture of wild marine fish and shellfish, and the subsequent handling and processing of catches. For the purposes of the IA, the sector is defined as just the commercial capture of fish and shellfish. Handling and processing of catch is defined as a secondary activity for the purpose of the IA.

D.18 The UK fleet totalled 6,477 vessels in 2010 (MMO, 2011a). While the substantial rate of decline in the size of the fleet that was apparent during the 1990s has eased (UKMMAS, 2010), the downward trend remains. Since 2001 four key indicators of fleet size – number of vessels, fleet capacity, fleet power and employment – have all shown a decline. The number of registered UK fishing vessels fell by 16%; total fleet capacity (total fleet gross tonnage) and power (total fleet kW) declined by 21% and 17% respectively; and employment fell by 15%, to 12,700 fishermen (MMO, 2011b). Over the past eight years, total fishing effort in demersal fisheries has fallen by around 30% or more in the North Sea, west of Scotland and in the Irish Sea (UKMMAS, 2010). This continued decline has been driven partly by reduced fishing opportunities and partly by decommissioning exercises carried out by UK fisheries administrations (UKMMAS, 2010).

D.19 Landings (in volume terms) by the UK fleet[8] have declined, in line with the reduction in fleet size, falling by 18% since 2001 to 606,300 tonnes in 2010 (MMO, 2011b). Landings into UK ports accounted for 68% of total UK fleet landings. Fish prices have generally increased, with the Landed Price Index[9] showing an increase in the price of first-sale fish of 47% between 2001 and 2010 (MMO, 2011b). As a result, the value of UK fleet landings has increased, despite the fall in volumes. The total value of landings by the fleet was £719m in 2010, up 25% since 2001 (MMO, 2011b). The sector is estimated to have generated £316m GVA in 2010.[10]

D.20 Over the last ten years (2001 to 2010 inclusive), landings by UK-registered fishing vessels have varied between 580,000 and 740,000 tonnes of fish and £510m and £720m at first sale (MMO fisheries statistics). Shellfish and demersal fish species currently contribute around 40%

[7] www.nationalgrid.com/uk/Electricity/OffshoreTransmission/ODIS/CurrentStatement/
[8] Including landings into UK and non-UK ports.
[9] The Landed Price Index measures the average change in the price of fish landed by UK vessels into the UK at first sale. It provides a measure of domestic inflation in the price of fish landed by UK vessels into the UK.
[10] The GVA estimate has been calculated by applying a GVA ratio of 0.44 to the value of UK fleet landings. The GVA ratio is based on a crude average of the fleet segment GVA ratios provided in Annex H7, which are derived from data published in Curtis (2009). For comparison, a GVA ratio of 0.40 (based on data from 2006) is used by Pugh (2008) and UKMASS (2010) to calculate the GVA of the commercial fishing sector.

each to the total market value of the catch, with the remaining 20% comprising pelagic species such as mackerel and herring. The composition of UK fleet landings has changed over the last decade. Landings of demersal species have declined significantly since 2001, with the volume and value of landings down 38% and 2% respectively, which has resulted in a relative increase in the proportion of sector output provided by shellfish and pelagic species. The decline in landings of demersal species is thought to be a result of EU controls on Total Allowable Catch and effort as well as the decommissioning of vessels (UKMMAS, 2010).

D.21 Secondary activities can be equally important with fish processing from sea fisheries contributing a further £385m GVA in 2007 (UKMMAS, 2010).

D.22 The North-East Atlantic mackerel stock currently supports the most valuable fin-fish fishery in UK waters, operating mainly from Scotland. In Northern Ireland, Wales and the Channel Islands' coastal waters, the most valuable fisheries are for shellfish, reflecting the relatively higher incidence of inshore fishing for crabs, lobsters and other shellfish such as cockles in these areas. The demersal fisheries in the North Sea, west of Scotland and in the Irish Sea have shifted away from fin-fish species towards the very valuable Norway lobster (*Nephrops norvegicus*). This shift has followed the long-term decrease in many fin-fish stocks, associated fishing restrictions (e.g. cod recovery programme) and the perceived increase in economic opportunities in shellfish and mixed-demersal fisheries (UKMMAS, 2010).

D.23 The most profitable fleet segments in the UK operate in the North Sea and off the west of Scotland. Profitability has varied widely in the UK catching sector since 2000 because of a reduction in catch-per-unit effort, escalating fuel prices, an increase in quota trading, and increases in first-sale prices following the introduction of Buyers and Sellers regulations in 2006 (UKMMAS, 2010).

D.24 Commercial fishing is a particularly important socio-economic activity in remote coastal regions in Scotland, and in coastal regions in Wales, Northern Ireland and the south-west of England. Although it makes a relatively low contribution to overall GDP, it can be the principal local economic contributor, particularly in terms of employment. The dependency of jobs on fishing can be as high as 20% or more in some coastal communities (UKMMAS, 2010).

D.25 Overall, the large majority of scientifically assessed stocks continue to be fished at rates well above the levels expected to provide the highest long-term yield. The European Commission is developing management plans to recover depleted stocks, and to manage stocks sustainably. They seek to restrict fishing mortality rates to the maximum sustainable yield by 2015, as required by the World Summit on Sustainable Development in Johannesburg in 2002. Such management plans were initially focused on cod recovery, but have now been extended to a range of other species (UKMMAS, 2010).

D.26 The sea fisheries industry is heavily influenced by the Common Fisheries Policy (CFP) and its associated quota restrictions. This makes projections of the future state of the industry particularly difficult. The CFP is currently under review which is due to be completed in 2013. This may have significant impacts on the capacity and performance of the sector.

8 Education and research

D.27 No figures are available to estimate the turnover, GVA and employment of this sector.

9 Flood and coastal erosion risk management

D.28 This sector includes coastal defence measures used to prevent or reduce flood risk and coastal erosion. Defences may involve hard structures such as concrete seawalls, and soft engineering such as beach replenishment and managed realignment. Around 44% of the England and Wales coastline is defended and 6% of Scotland's coastline. The investment in coastal defence and flood protection in 2007 was £358m. The investment in beach replenishment in England and Wales in 2007/8 was £11m (part of this figure will be duplicated in the aggregate extraction sector). Ancillary market values include £60m (2007/8) for construction of defences in England and Wales. Data for Scotland and Northern Ireland are difficult to source as responsibility lies with several different departments and agencies (UKMMAS, 2010).

D.29 The investment and hence activity within this sector in England and Wales has doubled over the past ten years due to the vulnerability of the coast to potential flooding and coastal erosion associated with climate change and sea level rise. However, investment and employment figures alone do not capture the entire value to the economy of coastal defences, as there are significant indirect social and economic benefits that are difficult to quantify (UKMMAS, 2010).

D.30 Flood and coastal erosion risk management projects often have substantial impacts on the coastal environment, for example from construction, physical footprint, changes in geomorphology, loss of the intertidal area, coastal erosion, as well as other forms of habitat degradation and loss. All schemes are therefore subject to appraisal by the relevant regulatory authorities and agencies which take account of the social, economic and environmental impacts as part of the consenting and funding processes (UKMMAS, 2010).

D.31 Projections are that current spending on coastal defences will need to double by 2080. The use of managed realignment (a measure often undertaken as a compensatory measure for coastal works that may provide additional soft flood and coastal defence benefits) and other forms of soft coastal defence measures are likely to increase (UKMMAS, 2010).

10 Water pollution from land

D.32 The income generated through licensing of discharges and disposal at sea can be used to indicate investment and therefore the economic value of this sector. Income from licensing includes about £0.3m for waste disposal (2007 data) and £9.1m for water discharges (2007/8 data). The Crown Estate's income from foreshore leases for outfall pipes and permissions is in the region of £1m a year (UKMMAS, 2010).

D.33 It is difficult to calculate the contribution to the economy associated with saline abstractions, although it is clear that they are fundamental to sustaining several major economic activities. The annual market value of electricity sales from coastal power stations is in the region of £5,000m to £10,000m. Coastal power stations with 'once through' cooling water systems have an energy efficiency advantage over air-cooled power stations of the order of 2%. On this basis it could be argued that the specific value to the economy of coastal power generation is of the order of £100m to £200m a year. The amount of water abstracted for industrial purposes has remained relatively

constant over time and it is likely that the requirement for coastal water abstraction will continue at the same levels. While many coastal power stations are due to be decommissioned over the next two decades, a series of new coastal nuclear power stations may be developed (UKMMAS, 2010).

11 National defence

D.34 UK military defence spending is the third largest area of public expenditure. In 2008/9, UK military defence spending totalled £45,500m. It can be estimated that expenditure for the operation of marine activities was £1,796m with a GVA of £300m (Saunders and others, 2010). Activities and hence the location of the value to the economy are mainly related to the location of naval bases and exercise areas. The Royal Navy employs 38,600 service men and women and 5,200 civilians, and local economies also benefit from activities associated with the naval bases (UKMMAS, 2010).

12 Oil and gas (including carbon capture and storage)

D.35 The oil and gas sector includes activities relating to oil and gas exploration and production, gas transportation, gas storage, and carbon capture and storage.

12.1 Oil and gas production

D.36 Oil and gas resources are extracted offshore in the North Sea, Irish Sea and Atlantic Margin west of Shetland. Up until the end of 2009, the UK's total production to date of onshore and offshore gas was 2,423,387m m^3 and 3,196m tonnes for onshore and offshore crude oil (DECC website, accessed 2011). UK oil production peaked in 1999 and gas production in 2000. Since then, UK production has declined.

D.37 The domestic oil and gas extraction industry's turnover was £40,000m in 2008 and accounted for £37,000m in GVA, and is one of the largest contributors to UK GDP (Saunders and others, 2010). The value of oil and gas is driven by their sale price and the level of production. For example, price per barrel of oil is strongly influenced by volatile energy markets owing to a complicated range of supply and demand issues (UKMMAS, 2010).

D.38 The extraction of oil and gas is supported by highly specialised supply chain activities and also supports a large downstream manufacturing sector (oil refining: net trade surplus £1,000m; petrochemicals: turnover £50,000m; trade surplus £5,000m), although these use a mix of UK and imported production (UKMMAS, 2010).

D.39 Approximately 290,000 people are directly employed in the oil and gas industry in the UK, and a further 90,000 jobs are indirectly supported (Oil & Gas UK, 2006).

D.40 Domestic resources satisfied about two thirds of UK primary energy demand in 2008 (94% of oil demand and 74% of gas demand) and are projected to satisfy about half of the UK's oil and gas demand in 2020 (UKMMAS, 2010). In December 2009, imports of gas exceeded gross UK production for the first time since 1967 (DECC, 2010a). Despite estimations of yet-to-be-recovered UK oil and gas resources in recent seaward licensing rounds, forward projections of oil and gas extraction from the UKCS are estimated to continue to decline (DECC, 2010a).

12.2 Gas storage

D.41 Gas may be stored underground in (part-) depleted hydrocarbon fields, in caverns leached out of salt structures or in aquifers. To date there is only one offshore storage facility, the Rough Field off the Yorkshire coast. But there are plans for conversion to gas storage of other offshore fields in the Southern Basin and Irish Sea and also for the creation of salt cavity storage facilities off southern England and in the Irish Sea. Gas is injected into such facilities at times of low demand and withdrawn at times of high demand. Forecasts of natural gas storage capacity required by 2020 to ensure security of gas supply during peak demand winter months vary widely, but a value of about four times current developed capacity is not unreasonable (Deloittes, 2010; Ofgem, 2010).

D.42 Extreme uncertainty currently surrounds the outlook for the natural gas storage sector in the UK due to an oversupply in international natural gas and liquid natural gas (LNG) markets. Furthermore, the markets of the Atlantic Basin (North America and Europe) and those of Asia/Pacific (India, China and Japan) are becoming increasingly coupled due to the mobility of LNG cargoes, with the consequence that gas prices and the sourcing of UK imports will impact on natural gas storage needs and economics. Nevertheless, by 2015 required storage capacity is forecast to be about twice present capacity (The Energy Contract Company, 2009).

12.3 Carbon capture and storage

D.43 Carbon capture and storage (CCS) is the process by which CO_2 that is released from power generation and industrial processes is stored in underground depleted hydrocarbon fields or aquifers. CCS has the potential to be one of the most cost-effective ways to manage the UK's CO_2 emissions and to diversify the UK's electricity supply (UKMMAS, 2010).

D.44 Worldwide up to $40,000m has been committed by governments to support CCS projects (GCCSI, 2011). UK-based firms are anticipated to benefit by between £3,000m and £6,500m a year by the late 2020s (AEA, 2010) and create more than 50,000 jobs by 2030 (CCSA, 2011). Teesside, Merseyside, Humberside and Scotland could benefit from the CCS industry. In particular, CCS could provide replacement jobs for those currently employed in the oil and gas sector as production continues to decline in the North Sea and Irish Sea oil and gas fields.

D.45 However, CCS development is at an early stage and as such there is considerable uncertainty surrounding future rates of deployment and where it will take place (UKMMAS, 2010). In April 2012, the Government launched a £1,000m programme to support the design, construction and operation of CCS. Its aim is to support market delivery of CCS-equipped fossil-fuel power stations in the UK.[11]

13 Ports, harbours, shipping and disposal sites

D.46 The UK ports, harbours and shipping sector is the largest in Europe in terms of tonnage handled. It is also responsible for 95% of all UK trade (in volume) (DfT, 2009). In 2007, the turnover of UK shipping (freight, passenger and charter services) was £9,500m (UKMMAS, 2010). Ports, harbours and shipping (including port businesses) are estimated to support 227,000 people in direct employment in the UK and provide £13,700m GVA to the UK economy (Oxford

[11] www.decc.gov.uk/en/content/cms/emissions/ccs/demo_prog/demo_prog.aspx

Economics, 2011). No turnover estimate is provided. A further 300,000 people are estimated to be supported indirectly in employment, providing a further £13,300m GVA (Oxford Economics, 2011).

D.47 The Crown Estate generates an income for HM Treasury from leases for ports and harbours of approximately £2.6m a year (The Crown Estate, pers. comm., 2011).

D.48 Nowadays, most cargo is shipped by trucks that roll on and roll off (RO-RO) or in large containers. Over recent years, liquid bulks have decreased largely due to the decline in landings of North Sea oil. However, this still makes up the largest proportion of all port traffic (DfT, 2011). The global recession has had a significant impact on the short-term performance of the sector with many ships operating below capacity or being laid up in storage. However, the long-term trend is for sustained growth of 3–4% on average a year in the container and RO-RO sectors (UKMMAS, 2010). The Government forecasts a 182% increase in container traffic and 101% increase in RO-RO traffic by 2030 (from 2005 levels). In addition, considerable port growth is anticipated in support of offshore renewable energy deployment (DfT, 2011).

D.49 The size of the UK fleet (UK-owned) is currently well below levels seen in the 1970s. However, since 2000 the fleet has grown, particularly when measured by deadweight tonnage (DWT). The number of ships has grown less markedly, with an increase in the average size boosting DWT capacity. As of 2009, the UK Chamber of Shipping estimated there to be 110 UK shipping companies, together owning around 1,000 ships with a DWT of 20m (Chamber of Shipping, pers. comm., 2010).

14 Recreation

D.50 The sector is estimated to be worth £3,326m (Pugh, 2008) in terms of GVA, and is the fourth largest marine-related sector in the UK. Many different leisure and recreational activities in the UK make use of the marine environment. It is difficult to capture the direct market value obtained from recreational and leisure activities because some activities, such as swimming, do not result in a marketable good or paid-for service. Although this sector is likely to have a high value of economic activity, uncovering the economic contribution is hampered by the number of activities, their wide distribution and the lack of centrally available statistics (UKMMAS, 2010).

D.51 Some indications of the market value of ancillary activities include a turnover of £1,840m for the small commercial marine industry in 2006/7; surfing industry turnover of £200m in 2001; and total expenditure from recreational fishing of £538m for England and Wales in 2003 and £141m for Scotland in 2008 (UKMMAS, 2010).

D.52 These sources provide a total turnover of £2,740m and £1,290m GVA. Expenditure on secondary activities such as coastal tourism, accommodation and food can also be significant with an estimated market value for coastal towns of £4,800m in 2005 (GVA £2,260m). Other benefits that are potentially substantial include employment and cultural values (UKMMAS, 2010). In 2009, 12.9m people participated in watersports (Watersports and Leisure Omnibus Survey, 2009).

D.53 Overall, participation in most marine leisure and recreational activities has stayed relatively stable or increased in recent years. The growth and stability of the marine leisure and recreation market is heavily dependent on the general health of the UK economy, which determines whether people have time and money for leisure pursuits (UKMMAS, 2010).

15 Renewable energy

15.1 Wind farms

D.54 Renewables currently account for 5.5% of electricity use (DECC, 2009b), and about 3% of energy consumption (EC, 2009). The UK has committed to sourcing 15% of its total energy (across the sectors of transport, electricity and heat) from renewable sources by 2020. Targets are much higher in some parts of the UK, with Scotland aiming for 20% by 2020 and Northern Ireland 40% by 2025. The Welsh Government's energy policy statement details the potential to produce more than twice as much renewable electricity as Wales consumes as a nation today by 2025. Projections suggest that by 2020 about 30% or more of our electricity generation – both centralised and small-scale – could come from renewable sources, compared with 6.7% in 2009 (DECC, 2011).

D.55 The estimated direct turnover for the offshore renewables industry from current generating capacity is £165m and GVA is £50m with additional indirect turnover from manufacturing and installation. The extraction of energy from renewable sources lessens UK dependence on fossil fuel energy, which has much higher associated CO_2 emissions, and improves energy security by increasing the diversity of electricity supply (UKMMAS, 2010).

D.56 There are currently 14 offshore wind farms operating 487 turbines with a total installed capacity of 1,524MW of electricity. A further 6 offshore wind farms are under construction (2,054MW); an additional 7 offshore wind farms have been consented but are yet to be built (1,862MW) and 22 further offshore wind farms including Round 3[12] areas of search (41,709MW) are in planning (Renewables UK website, accessed 12 January 2012).

D.57 A 2008 report identified that the wind industry provided 5,000 jobs in the UK (prior to Round 3) (Bain and Company, 2008). Looking forward, the wind energy sector is expected to be one of the fastest growing of the LCEGS[13] sectors over the period to 2015 (BIS, 2012). It is estimated that by 2020 the number of jobs in the sector will increase to between 23,000 and 57,000 (Bain and Company, 2008) and between 67,000 and 316,000 by 2050 (Offshore Valuation Group, 2010).

15.2 Wave and tidal

D.58 The UK has some of the best wave and tidal resources in the world, including the world's second highest tidal range in the Severn Estuary (DECC, 2010c). The full extent of the wave and tidal stream/range resource that can be exploited for energy generation is dependent on many factors (e.g. turbine interactions, device spacing and cumulative impact) and as technologies develop, understanding of the available resource will improve. Larger-scale deployment than is currently seen is envisaged in the period beyond 2020 (DECC, 2010c).

D.59 The world's first commercial competition for wave and tidal energy sites resulted in awards to ten companies in 2010 with sites leased in Penland Firth and Orkney. Approximately 1.2GW of

[12] http://www.decc.gov.uk/en/content/cms/meeting_energy/wind/offshore/leasing/leasing.aspx
[13] LCEGS – Low Carbon Environmental Goods and Services, defined as including the environmental sector, the renewable energy sector and the emerging low carbon sector.

power is expected to be produced.[14] The European Marine Energy Centre in Orkney is providing some of the main sites for testing wave and tidal stream demonstrator devices. The Wave Hub is currently being developed off the coast of Cornwall to test devices for generating electricity from wave energy. A single wave energy device, Limpet, has been installed and been operational since 2000 in Islay, Scotland. Technology to generate electricity from tidal streams is also being trialled in Strangford Lough in Northern Ireland.

D.60 Research cited by the Department of Energy and Climate Change (DECC, 2010c) estimates that the practical resource level for UK wave energy is in the order of 50TWh/year (equivalent to the annual electricity demand of 11m UK households) and that the total UK tidal stream potential is in the order of 17TWh/year (equivalent to the annual electricity demand of 4m UK households). A Strategic Environmental Assessment (SEA) for Wave and Tidal Energy in English and Welsh waters as part of the UK Offshore Energy 2 SEA was launched in March 2010. The Marine Energy Action Plan 2010 (DECC, 2010b) recommends that, subject to the marine energy SEA for the relevant areas being undertaken, The Crown Estate will look at opportunities for commercial leasing in England and Wales.

16 Environmental Baseline (UKMMAS, 2010)

16.1 Ocean processes

D.61 Sea-surface temperatures around the UK have risen by between 0.5 °C and 1 °C from 1870 to 2007, with much of this change having occurred since the mid-1980s. There is extensive coastal erosion around parts of the UK and a decrease in the intertidal area (known as 'coastal squeeze'). This in turn is causing loss of land, property and coastal habitat, particularly salt marshes and mud flats, which are also bird feeding grounds.

D.62 Over the 20th century, mean and extreme sea levels rose by about 14cm. Sea level rise increases the risk of flooding, and infusion of land with salt. It also allows larger waves to approach the shore, leading to more erosion, damage and risk to coastal structures.

D.63 UK seawater is probably becoming more acidic, mirroring the global pattern. This could affect many marine species. Acidification also decreases the ability of the oceans to take up human emissions of CO_2, which may affect the rate of global warming.

D.64 The Atlantic Meridional Overturning Circulation, which is partly responsible for the temperate UK climate, is extremely variable, and it is not clear whether it has yet shown the longer-term decline suggested by most climate models. It continues to contribute to the UK's temperate climate. (UKMMAS, 2010).

16.2 Healthy and biologically diverse seas

D.65 Rising seawater temperatures are affecting species composition in the English Channel and Celtic Sea. Many seabed sedimentary habitats in large areas of the North Sea, the Western Channel and Celtic Sea, and the Irish Sea have been adversely affected, particularly by mobile fishing gears.

[14] The Crown Estate website, Press Release (16 March 2010) – World's First Wave and Tidal Energy Leasing Round to Power up to Three Quarters of a Million Homes, accessed 19 April 2010 at www.thecrownestate.co.uk/newscontent/92-pentland-firth-developers.htm.

D.66 Although there is some way to go before the exploitation of the majority of commercial fish stocks is at safe levels, there have been some improvements, probably because of a reduction in fishing effort. However, a number of species are suffering sharp declines, particularly sharks and rays, which are especially vulnerable to fishing pressure. Overall, the situation is still considerably worse than historical levels. For estuaries, there have been improvements in certain species, but eel recruitment has declined in some regions, reflecting an Atlantic-wide downturn in the numbers of elvers returning to rivers.

D.67 Harbour seal numbers in some areas have declined dramatically since 2001. There have been improvements in waterbird communities, but the numbers of some seabird species have been falling since the mid-1990s. Certain seabird species (e.g. kittiwakes) have suffered poor breeding success in recent years. There is strong evidence of a rapid change in the wintering distribution of estuarine birds in response to global warming during recent years. (UKMMAS, 2010).

16.3 Clean and safe seas

D.68 A range of persistent chemicals appear in deep-sea fish and marine mammals off UK coasts, and litter has been found at depths of 1,000m. Key points regarding contamination of UK seas are as follows:

- Seven small harbours and estuaries have eutrophication, which is when the sea becomes enriched with excess nutrients that causes algal blooms to occur which block out light and limit the growth of other fauna.
- Polychlorinated biphenyls (PCBs) are present at levels that affect harbour porpoises around the UK, probably by suppressing their immune systems and making them more prone to death from infectious diseases.
- Some ‘legacy’ contaminants are present at high concentrations in estuaries historically contaminated by industrial processes.
- Levels of oil in produced water discharged by the offshore oil and gas industry are falling in response to regulatory controls.
- Doses of radioactivity received by people and wildlife continue to be well within regulatory limits. Work is under way at Sellafield and Dounreay to retrieve radioactive particles from the beaches; the levels are not high enough for the beaches to be closed, but harvesting of seafood around Dounreay is currently banned.
- Microbiological contamination of coastal waters is evident in some localised areas in both bathing waters and shellfish growing waters.

16.4 Climate change

D.69 The world is getting warmer. Global average air and sea temperatures have risen markedly since the mid-20th century and human activities are very probably responsible for much of this. In the mid-to-late-1980s rising sea temperatures were at least partly responsible for a sudden shift in plankton species in UK waters which affected the marine ecosystem. Distributions of some exploited and non-exploited North Sea fish species have responded to increases in sea temperature by moving northward and to deeper waters over the past three decades.

D.70 Warmer sea temperatures since the 1980s have increased the length of the marine growing season. In some areas of the North-East Atlantic, there are more reports of harmful algal blooms, especially since the mid-1980s. Recent studies in the offshore North Sea show that low oxygen events in these areas are more likely to be due to climate change than to nutrient enrichment from human sources.

D.71 Concerns over climate change impacts on the coast have already increased activity and spending on coastal defences, which will need to double again by 2080. (UKMMAS, 2010).

References

ABPmer 2007. *Cost Impact of Marine Biodiversity Policies on Business – The Marine Bill.* London: Defra.

AEA 2010. *Future Value of Carbon Abatement Technologies in Coal and Gas Power Generation to UK Industry*.

AEA Technology 2009. *Future Value of Coal Carbon Abatement Technologies to UK Industry.* London: DECC.

Ager, O. 2004. *Marine Life Topic Note. Aquaculture.* Marine Biological Association of the United Kingdom.

AQUAFACT International Services Ltd 2009. *Assessment of Impacts of Mariculture.* Ospar Commission. ISBC 978-1-906840-82-2.

Bain and Company 2008. *Employment Opportunities and Challenges in the Context of Rapid Industry Growth.* London: British Wind Energy Association.

Bannister, C. 2006. *Towards a National Development Strategy for Shellfish in England.* Seafish.

bdrc 2009. *Visitor Attractions Trends in England 2008. Annual Report.* VisitEngland.

BIS. 2012. Low Carbon Environmental Goods and Services (LCEGS). Report for 2010/11. London. Department for Business, Innovation and Skills.

BMAPA and The Crown Estate 2008. *Marine Aggregate Dredging 1998–2007 A Ten-Year Review.* London: British Marine Aggregate Producers Association and The Crown Estate.

BMAPA 2009. *Strength from Depths – Third Sustainable Development Report for the British Marine Aggregate Industry.* London: British Marine Aggregate Producers Association.

BMAPA 2010a. *Dredging*. Retrieved 12 April 2010 from British Marine Aggregate Producers Association: www.bmapa.org/what_dredge01.php

BMAPA 2010b. *Key Facts*. Retrieved 10 April 2010 from British Marine Aggregate Producers Association: www.bmapa.org/who_key01.php

British Geological Survey 2007. *The Strategic Importance of the Marine Aggregate Industry to the UK*.

Carter, L.B.-M. 2009. *Submarine Cables and the Oceans – Connecting the World.* UNEP-WCMC Biodiversity Series No. 31. ICPC/UNEP/UNEP-WCMC.

CCSA 2011. *A Strategy for CCS in the UK and beyond*.

Cefas 2011. *Shellfish News. Number 31, Spring/Summer 2011.* Weymouth: Cefas.

CPNI 2006. *An Overview of the Use of Submarine Cable Technology by UK Plc.* Centre for the Protection of National Infrastructure.

Curtis, H.M. 2009. *2007 Economic Survey of the UK Fish Fleet.* Edinburgh: Sea Fish.

DECC 2009a. *A Framework for the Development of Clean Coal. Consultation Response.* London: HM Government.

DECC 2009b. *Energy in Brief*.

DECC 2010a. *Energy Trends – September 2010*.

DECC 2010b. *Marine Energy Action Plan 2010 – Executive Summary and Recommendations*.

DECC 2010c. *Marine Energy Action Plan 2010.* London: HM Government.

DECC 2011. *EN1 – National Planning Statement for Energy*.

Defra 2010a. *Aquaculture*. Retrieved 24 June 2010, from Defra: www.defra.gov.uk/foodfarm/fisheries/farm-health/aquaculture.htm

Defra 2010b. *Charting Progress 2: State of the UK Seas. Oil & Gas Feeder Report.*

Deloittes 2010. *UK Gas Storage.*

DfT 2007. *MDS Transmodal – Update 2007*.

DfT 2009. *National Policy Statement for Ports*. London: Department for Transport.

DfT 2010a. *National Policy Statement for Ports.* London: Department for Transport.

DfT 2010b. *Seafarer Statistics 2009.* London: Department for Transport.

DfT 2011. *National Planning Statement for Ports*. London: Department for Transport.

Drew Associates 2004. *Research into the Economic Contribution of Sea Angling.* London: Defra.

EC 2009. *National Renewable Energy Action Plan for the United Kingdom: Article 4 of the Renewable Energy Directive 2009/28/EC*.

Element Energy 2010. *One North Sea – A Study into North Sea Cross-border CO_2 Transport and Storage.* North Sea Basin Taskforce.

Experience Marketing Research 2009. *Profile of Potential Visitors, 2009.* South West Tourism.

GCCSI 2011. *The Global Status of CCS: 2010*.

Gubbay, S. 2005. *A Review of Marine Aggregate Extraction in England and Wales 1970–2005.* London: The Crown Estate.

Highley, D.H. 2007. *The Strategic Importance of the Marine Aggregate Industry to the UK.* Research Report OR/07/019. London: British Geological Survey.

ICPC/UNEP/WCMC 2009. *Submarine Cables and the Oceans: Connecting the World*.

James, M.S. 2009. *A Strategic Review of the Potential for Aquaculture to Contribute to the Future Security of Food and Non-food Products and Services in the UK and Specifically England.* Defra.

MMO 2008. *United Kingdom Sea Fisheries Statistics.* Newcastle: Marine Management Organisation.

MMO 2010. *Telecommunications Act 1984*. Retrieved 14 June 2010 from Marine Management Organisation: www.marinemanagement.org.uk/works/licensing/ta.htm

MMO 2011a. *IFISH Database.* Newcastle: Marine Management Organisation.

MMO 2011b. *UK Sea Fisheries Statistics 2010.* Newcastle: Marine Management Organisation.

NWDA 2009. *North West Ports Economic Trends and Land Use Study*.

Offshore Valuation Group 2010. *The Offshore Valuation. A Valuation of the UK's Offshore Renewables Energy Resource.* Machynlleth: Public Interest Research Centre.

Ofgem 2010. *Project Discovery*. Retrieved 20 October 20 2010, from Ofgem: www.ofgem.gov.uk/Markets/WhlMkts/Discovery/Pages/ProjectDiscovery.aspx

Oil & Gas UK 2006.

Oxford Economics 2009. *Economic Contribution of the UK Shipping Industry.* British Ports Association and United Kingdom Major Ports Group.

Oxford Economics 2011. *The Economic Impact of the UK's Maritime Services Sector*.

Posford Haskoning Ltd 2004. *A Development Plan for Marine Aggregate Extraction in England – A Scoping Study.* London: Office of the Deputy Prime Minister.

Pugh, D. 2008. *Socio-economic Indicators of Marine Related Activities in the UK.* London: The Crown Estate.

RYA 2005. *RYA and a Proposed Marine Bill. Opportunities and Concerns as Seen by the RYA.* Royal Yachting Association.

RYA 2010. *Watersports and Leisure Participation Survey 2009.* British Marine Federation, Maritime and Coastguard Agency, Royal National Lifeboat Institution, Royal Yachting Association.

Saunders, J., Tinch, R., Ozdemiroglu, E. and Hull, S. 2010. *Valuing the Marine Estate and UK Seas: Initial Static Baseline Assessment*. ISBN: 978-1-906410-17-9. The Crown Estate.

Scottish Centre for Carbon Storage 2009. *Opportunities for CO_2 Storage around Scotland.* Edinburgh: University of Edinburgh.

South West Coast Path Partnership (date unknown). *South West Coast Path National Trail. A Framework for Action 2007–2012.* National Trails.

South West Tourism 2005. *South West Bathing Waters Study.* South West Tourism.

South West Tourism 2006. *Community Attitudes Survey.* South West Tourism.

South West Tourism 2010a. *South West Visitors Survey 2009.* South West Tourism.

South West Tourism 2010b. *The Value of Tourism to the South West Economy.* South West Tourism.

The Crown Estate (date unknown). *A Briefing Note – Supporting Information Relating to the Announcement of Round 3.* London: The Crown Estate.

The Crown Estate 2008. *Socio-economic Indicators of Marine Related Activity in the UK Economy.*

The Crown Estate 2009a. *Marine Aggregate Reserves 2008.* London: The Crown Estate.

The Crown Estate 2009b. *Marine Aggregates – The Crown Estate Licences – Summary of Statistics 2008.* London: The Crown Estate.

The Crown Estate 2010a. *Offshore Wind Energy – Round 1 and Round 2 Lease Area Extension*. Retrieved 7 April 2010 from The Crown Estate: www.thecrownestate.co.uk/our_portfolio/marine/offshore_wind_energy/r1-r2-lease-area-extensions.htm

The Crown Estate 2010b. *Offshore Wind Energy – Rounds 1 and 2*. Retrieved 7 April 2010 from The Crown Estate: www.thecrownestate.co.uk/our_portfolio/marine/offshore_wind_energy/rounds-one-two.htm

The Crown Estate 2010c. *Round 3 – Round 3 Developers*. Retrieved 7 April 2010 from The Crown Estate: www.thecrownestate.co.uk/our_portfolio/marine/offshore_wind_energy/round3/r3-developers.htm

The Energy Contract Company 2009. *The UK Gas Market Review.*

The Institute of Materials, Minerals and Mining 2003. *The Institute of Materials, Minerals and Mining.* Referenced in: The Crown Estate 2009a.

UKMMAS 2010. *Charting Progress 2. Feeder Report: Productive Seas.* London: Defra.

Watersports and Leisure Omnibus Survey 2009. *Watersports and Leisure Omnibus Survey*.

Yorkshire Forward 2009. *A Carbon Capture and Storage Network for Yorkshire and Humber.*