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# Economic Assessment of Short Term Options for Offshore Wind Energy in Scottish Territorial Waters: Costs and Benefits to Other Marine Users and Interests

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# Summary

## Introduction

In 2009, The Crown Estate identified 10 areas where it was prepared to grant commercial leases for offshore wind energy developments. Collectively, these areas could provide a generation capacity of around 6.4GW. Subsequent to this, one of the sites (Bell Rock) proved technically unsuitable for development and the developer has withdrawn from the scheme.

The Scottish Government's draft Offshore Wind Energy Plan provides a strategic overview of where offshore wind development could be progressed including The Crown Estate's 9 short-term options, together with a number of medium and longer-term options. A number of studies have been commissioned by Marine Scotland to support the evaluation of the Plan prior to its adoption. These studies have included a Strategic Environmental Assessment (SEA) (Marine Scotland, 2010a) and a Habitats Regulations Appraisal (ABPmer, 2011) of the short and medium term options in the Draft Plan. In addition, Marine Scotland also commissioned an economic assessment of the short term offshore wind options within the Draft Plan to further inform the finalisation of the OWE Plan and the Post-Adoption Statement. The study has focused on the short term options identified as there is greater certainty about these developments at this point in time.

The project has sought to assess the impact of development in the following broad areas of Scotland specified within the Draft OWE Plan:

- North East: focusing on Beatrice;
- East: Inch Cape, Neart na Gaoithe, Forth Array;
- South West: Solway Firth, Wigtown Bay; and
- West: Argyll Array, Islay, Kintyre.

As no sites in the North or North West areas have been identified among the short term options, no development options from these areas have been considered within the analysis. Information on regional-scale impacts has also been combined to provide an indication of impacts at a national level.

The study has been undertaken by ABPmer in association with economic consultants SQW and Risk & Policy Analysts (RPA) between December 2010 and February 2011. The project has been managed jointly by the Marine Analytical Unit (MAU) and the Marine Renewables and Offshore Wind policy team within Marine Scotland supported by a wider Project Advisory Group involving key stakeholders. The study involved a significant level of consultation with stakeholders to understand potential impacts and develop key assumptions.

The study approach has assessed and compared the costs incurred by, and benefits arising from, different policy options and considered them against a 'do nothing' option (where there is no intervention). The assessment has been prepared in line with the principles with Better Regulation Executive guidance on impact assessment[1] and the Green Book methodology (HM Treasury, 2003) for economic assessment.

[1] Department for Business Innovation and Skills website: http://www.bis.gov.uk/policies/better-regulation/policy/scrutinising-new-regulations/preparing-impact-assessments

The key requirements of the study have been to:

- Provide a comparison of the economic and social benefits associated with the development of the short term options for offshore wind in Scottish Territorial Waters against any potential economic and social costs associated with it;
- Assess the distribution of costs and benefits amongst the public sector, different industries (e.g. fishing, tourism, shipping) and wider society, in order to establish who may bear the benefits and costs associated with the short term options;
- Consider the impact (in terms of Gross Value Added (GVA) and employment) that the short term options may have on the regional economies affected, and on the wider Scottish economy. In particular, it has estimated the net impact resulting from the manufacture, installation, operation and decommissioning of offshore wind sites, from any associated infrastructure development works that are required, and from any impacts on other marine activities; and
- Finally, the impact assessment has involved specific tests to determine the potential impact of policies on small firms and on competition.

This report presents the findings of the assessment of costs and benefits to other marine users and interests.

## Methodology

The study has sought to estimate the costs and benefits to different marine users and interests associated with implementation of the OWE Plan. Two options have been assessed as follows:

- Do nothing (the baseline, which incorporates anticipated changes in the absence of intervention in the form of the Draft Plan); and
- The intervention option (implement the plan for the nine short term options based on the capacities identified in the Draft Plan).

Three separate scenarios have been applied to the intervention option to take account of some of the key uncertainties that will influence the scale of costs and benefits arising from implementation of the Draft Plan. These have been termed ‘low impact’, ‘medium impact’ and ‘high impact’ scenarios.

The evaluation of costs and benefits for other marine users and interests under the three implementation scenarios has been undertaken in a number of steps as follows:

- Identification of sectors potentially affected - this was based on a review of SEA Environmental Report consultation responses, wider information on the effects of offshore wind farm development on other marine users and a spatial analysis in GIS to identify potential interactions between the short term options and other marine users;
- Evaluation of interactions - the nature of the interactions between the short term options and other marine users were evaluated to determine whether specific interactions were likely to have a significant effect on the other marine user. This evaluation took account of stakeholder views and the existing evidence base; and

- Valuation (monetisation) of costs and benefits - where significant interactions were likely to occur, the costs and benefits to other marine users were estimated where possible based on specific scenarios identified in Section 4.

Costs and benefits to other marine users and interests have been presented as both 'long-run' annual costs and discounted costs over a 50 year period 2011-2060. This timescale is comparable to the estimated lifespan of offshore wind developments. An indication of associated job impacts has also been provided using multipliers based on the 2007 Type I multipliers for Scotland.

## Assessment of Costs and Benefits

A number of marine users and interests have been identified as potentially incurring additional costs associated with implementation of the Plan scenarios (Table S1). Specific costs may accrue to the commercial fishing, shipping, recreational boating, recreational angling and tourism sectors.

Developers and operators of offshore wind farms may also incur some additional costs to mitigate some potential impacts on other marine users. It has been assumed that these are included within the costs of offshore wind farm construction and operation and are not, therefore, included here. The scale of such costs relative to the overall investment in offshore wind is estimated to be very small.

While some potential benefits have also been identified, these are likely to be small in terms of value and not significant in the context of the Plan as a whole. The extent to which such benefits might be realised remains very uncertain and it has not been possible to quantify them.

**Table S1. Summary of affected sectors and impacts**

| Sector | Significant Cost Impact to Sector? | Main Economic Impact |
|---|---|---|
| Commercial Fisheries | ✓ | Loss of revenues from displacement of fishing activity |
| Aquaculture | × | |
| Shipping and Ports | ✓ | Increased costs from additional steaming distances |
| Aviation | × | |
| Wave and Tidal Energy Development | × | |
| Cables and Pipelines | × | |
| Recreational Boating | ✓ | Increased costs from additional steaming distances |
| Recreational Angling | ✓ | Loss of expenditure on related activities from displacement or cessation of activity |
| Surfing, Windsurfing and Kayaking | × | |
| Tourism | ✓ | Loss of expenditure from displacement or cessation of activity |
| Social Impacts | ✓ | Not quantified. Negative impacts as a result of impacts to existing economic activities; positive impacts as a result of offshore wind farm supply chain development |

The total discounted costs to other marine users range from £1.4m in the low impact scenario up to £168.7m in the high impact scenario (Table S2). This range reflects the current available evidence base, the uncertainties involved in making assumptions around trends in future marine activities and current uncertainties about the extent of impacts, particularly in advance of detailed project-level assessments.

Under the high impact scenario, the largest costs are estimated to relate to reductions in tourism expenditure, although costs are also borne by the commercial fisheries, shipping and ports, recreational angling and recreational boating sectors. Approximately 61% of the costs are estimated to fall in West Region with relatively low costs associated with the single short-term development option in North-East Region.

While the costs to other marine users may be relatively small at the national and regional levels, they may still be significant at a local level or to individual sectors and stakeholders.

**Table S2. Estimated range of total costs to other marine users, between low and high impact scenarios (£m, discounted over 50 years)**

| | North East | East | South West | West | Total |
|---|---|---|---|---|---|
| Commercial Fisheries | £0.3m-£2.6m | £0.7m-£15.4m | £0.1m-£1.1m | £0.3m-£14.4m | £1.4m-£33.5m |
| Aquaculture | - | - | - | - | - |
| Shipping and Ports | - | £0m-£31.4m | £0m-£0.2m | £0m-£0.6m | £0m-£32.2m |
| Aviation | - | - | - | - | - |
| Wave and Tidal Energy Development | - | - | - | - | - |
| Cables and Pipelines | - | - | - | - | - |
| Recreational Boating | £0m-£0.1m | £0m-£0.3m | £0m-£0.2m | £0m-£0.2m | £0m-£0.8m |
| Recreational Angling | - | - | £0m-£7.9m | £0m-£16.6m | £0m-£24.5m |
| Surfing, Windsurfing and Kayaking | - | - | - | - | - |
| Tourism | - | - | £0m-£6.9m | £0m-£70.8m | £0m-£77.7m |
| Social Impacts | Not quantified | Not quantified | Not quantified | Not quantified | - |
| **Total Quantified Costs** | **£0.3m-£2.7m** | **£0.7m-£47.1m** | **£0.1m -£16.3m** | **£0.3m-£102.6m** | **£1.4m-£168.7m** |

These costs may also result in some employment opportunities being lost in the affected marine sectors. When the costs are isolated and applied to simple economic multipliers, it is estimated that between 4-140 jobs per annum in the fisheries, recreational angling and tourism sectors may no longer be supported compared to what would have happened in the absence of development (Table S3). In the high impact scenario, approximately 70% of the affected jobs are in tourism, and 14% are in commercial fisheries. Around 80% of employment impacts per annum are estimated to occur in West Region. These impacts are substantially lower in the medium and low impact scenarios. The reduction in the number of jobs supported is predicted to reach maximum levels in around year 6 and to remain at this level over the operating life of the wind farms.

**Table S3. Estimated national employment impacts on commercial fisheries, recreational angling and tourism sectors**

| Scenario | Maximum Gross No. Jobs Lost/Not Supported | |
|---|---|---|
| | Number | Year |
| High Impact | 140 | 6 |
| Medium Impact | 26 | 8 |
| Low Impact | 4 | 6 |

This reduction in employment opportunity can be compared with data on the total number of employees in these sectors, from Section 3 of this report. This indicates a total of around 5,000 people employed

in fishing in Scotland, just over 3,000 in sea angling and over 200,000 in tourism as a whole, with around 4,400 of these in marine and coastal wildlife tourism. The numbers of jobs indicated in Table S3 are a small proportion of these totals, but could still be significant locally.

There may be scope within the design of individual projects to avoid or mitigate impacts to many of the other marine interests. Such measures effectively transfer the cost impacts to the developer. Where costs of mitigation measures may fall to developers, these have been assumed to be included within the capital cost of offshore wind farm construction.

**Social Costs and Benefits**

Implementation of the short-term options also has the potential to give rise to a range of social impacts. Positive impacts would be associated with job creation in the offshore wind farm supply chain. Other social impacts may arise as a result of impacts to visual amenity. There are also stakeholder concerns that the scale of development overall would undermine some of the essential qualities of these Regions, including their wild and isolated character. Other specific concerns identified through the consultation on the SEA Environmental Report relate to possible impacts associated with shadow flicker, impacts on TV reception, infrastructure provision, health impacts and the effects on property prices and housing availability. These potential impacts have not been quantified or monetised within the analysis.

## Abbreviations

| | |
|---|---|
| £bn | £billion |
| £k | £thousand(s) |
| € | Euro |
| ABP | Associated British Ports |
| ABPmer | ABP Marine Environmental Research Ltd |
| ACES | Aberdeen Centre for Environmental Sustainability |
| AFMEC | Alternative Futures for Marine Ecosystems |
| AIFC | Aviation Investment Fund Company Ltd |
| AIS | Automatic Identification System |
| AONB | Areas of Outstanding of Natural Beauty |
| ASACS | Air Surveillance and Control System |
| ASP | Association of Surfing Professionals |
| ATC | Air Traffic Control |
| BAA | British Airport Authority |
| BAP | Biodiversity Action Plan |
| BERR | The department for Business, Enterprise and Regulatory Reform |
| BMF | British Marine Federation |
| BWEA | British Wind Energy Association |
| CAA | Civil Aviation Authority |
| Capex | Capital Expenditure |
| CCGT | Combined Cycle Gas Turbine |
| CCS | Carbon Capture and Storage |
| Cefas | Centre for Environment, Fisheries and Aquaculture Science |
| CO2 | Carbon Dioxide |
| CoSLA | Convention of Scottish Local Authorities |
| DECC | Department of Energy and Climate Change |
| Defra | Department for Environment, Food and Rural Affairs |
| DfT | Department for Transport |
| DWT | Deadweight Tonnage |
| EBA | European Boating Association |
| EC | European Commission |
| eftec | Economics for the Environment Consultancy |
| EIA | Environmental Impact Assessment |
| EM | Electromagnetic |
| EMEC | European Marine Energy Centre |
| EMF | Electromagnetic Fields |
| EMR | Electricity Market Reform |
| ER | Environmental Report |
| ERDF | European Regional Development Fund |
| ERM | Environmental Resources Management |
| ETSU | Energy Technology Support Unit |
| EU | European Union |
| FTE | Full Time Equivalent |
| GB | Great Britain |

| | |
|---|---|
| GBS | Gravity Base Structure |
| GHG | Greenhouse Gas |
| GIS | Geographical Information System |
| GVA | Gross Value Added |
| GW | Gigawatt |
| GWh | Gigawatt hour |
| HIAL | Highlands and Islands Airports Ltd. |
| HIE | Highlands and Islands Enterprise |
| HMS | Her Majesty's Ship |
| HRA | Habitats Regulations Appraisal |
| HSE | Health & Safety Executive |
| HVDC | High Voltage Direct Current |
| IA | Impact Assessment |
| IALA | International Association of Marine Aids to Navigation and Lighthouse Authorities |
| ICES | International Council for Exploration of the Seas |
| ICZM | Integrated Coastal Zone Management |
| IDBR | Inter Departmental Business Register |
| IMO | International Maritime Organization |
| IPA | IPA Energy + Water Economics |
| IPC | Infrastructure Planning Commission |
| IPS | International Passenger Survey |
| JNCC | Joint Nature Conservation Committee |
| km | kilometre |
| Limpet | Land Installed Marine Powered Energy Transformer |
| m | metres |
| MAHP | Major Accident Hazard Pipeline |
| MAU | Marine Analytical Unit |
| MCA | Maritime and Coastguard Agency |
| META | Marine Ecotourisum for the Atlantic Area |
| MMO | Marine Management Organisation |
| MOD | Ministry of Defence |
| mppa | million passengers per annum |
| MW | Megawatt |
| MWh | Megawatt hour |
| NATS | National Air Traffic Service |
| NERL | NATS En Route |
| nm | nautical miles |
| NPV | Net Present Value |
| NRIP | National Renewables Infrastructure Plan |
| NSA | National Scenic Areas |
| NSP | Navigation Service Providers |
| O&M | Operation and maintenance |
| ONS | Office of National Statistics |
| Opex | Operating Expenditure |
| OWE | Offshore Wind Energy |
| OWF | Offshore Wind Farm |
| p.a. | per annum |

| | |
|---|---|
| PAG | Project Advisory Group |
| PAR | Precision Approach Radar |
| PCA | Process Chain Analysis |
| pers. comm. | personal communication |
| PEXA | Practice and Exercise Area |
| PSR | Primary Surveillance Radar |
| R1/R2/R3 | Round 1/Round 2/Round 3 OWF development |
| RAF | Royal Air Force |
| ROC | Renewables Obligation Certificates |
| Ro-Ro | Roll on Roll off |
| ROV | Remotely Operated Vehicle |
| RPA | Risk & Policy Analysts Ltd. |
| RSPB | Royal Society for the Protection of Birds |
| RYA | Royal Yachting Association |
| SAC | Special Areas of Conservation |
| SAS | Surfers Against Sewage |
| SBA | Scottish Boating Alliance |
| SDI | Scottish Development International |
| SE | Scottish Enterprise |
| SEA | Strategic Environmental Assessment |
| SEB | Scottish Enterprise Borders |
| SEERAD | Scottish Executive Environment and Rural Affairs Department |
| SFF | Scottish Fishermen's Federation |
| SIC | Standard Industrial Classification |
| SMA | Scotland's Marine Atlas: Information for The National Marine Plan |
| SNH | Scottish Natural Heritage |
| SPS | Significant Peripheral Structure |
| SSACN | Scottish Sea Angling Conservation Network |
| SSE | Scottish and Southern Energy |
| SSPO | Scottish Salmon Producers Organisation |
| STW | Scottish Territorial Waters |
| TCE | The Crown Estate |
| teu | Twenty Foot Equivalent Unit |
| TSO | Treasury Solicitor's Office |
| TV | Television |
| UK | United Kingdom |
| UKCES | UK Commission for Employment and Skills |
| UKCPC | UK Cable Protection Committee |
| UKERC | UK Energy Research Centre |
| UKMMAS | UK Marine Monitoring and Assessment Strategy |
| UKTS | United Kingdom Tourism Survey |
| USD | US Dollars |
| VMS | Vessel Monitoring System |
| WAG | Welsh Assembly Government |
| WDCS | Whale & Dolphin Conservation Society |
| WQS | World Qualifying Series |

# Economic Assessment of Short Term Options for Offshore Wind Energy in Scottish Territorial Waters: Costs and Benefits to Other Marine Users and Interests

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# 1. Introduction

In 2009, The Crown Estate identified 10 areas where it was prepared to grant commercial leases for offshore wind energy developments (Appendix A, Figure A1). Collectively, these areas have a generation capacity of around 6.4GW (Table 1). Marine Scotland subsequently progressed a Strategic Environmental Assessment (SEA) of offshore wind in territorial waters which led to the publication of the Draft Plan for Offshore Wind Energy (OWE), and an SEA Environmental Report in May 2010 (Marine Scotland, 2010a).

The Draft OWE Plan provides a strategic overview of where offshore wind development could be progressed in the short, medium and long term. The Crown Estate's initial 10 options were included in the Draft OWE Plan, but subsequent to this one of the sites (Bell Rock) proved technically unsuitable for development and the developer has withdrawn from the scheme. The Draft OWE Plan identified a further 25 medium term options that were considered to be potentially acceptable in environmental terms.

**Table 1. Indicative capacity and size of short term OWF options in Scottish Territorial Waters**

| Short term Sites | Size (MW) | Area (km$^2$) |
|---|---|---|
| Solway Firth | 300 | 61 |
| Wigtown Bay | 280 | 51 |
| Kintyre | 378 | 69 |
| Islay | 680 | 94 |
| Argyll Array | 1500 | 361 |
| Beatrice | 920 | 121 |
| Inch Cape | 905 | 150 |
| Bell Rock | 700 | 93 |
| Neart na Gaoithe | 360 | 105 |
| Forth Array | 415 | 128 |

Consultation on the Draft OWE Plan and SEA Environmental Report began in May 2010 and concluded on 27 September 2010. The consultation included a series of regional and sectoral meetings. Over 800 consultation responses were received. The feedback received through this process has consistently emphasised the importance of considering social and economic factors when developing the OWE Plan, particularly around the potential impact of offshore wind on other marine industries and users.

Reflecting best practice in SEA, the environmental assessment was frontloaded and used to define the content of the Draft OWE Plan. However, environmental impact is just one of a number of considerations to be taken into account since SEA legislation requires plan making bodies to consider the impact of plans on material assets.

Marine Scotland therefore commissioned this study to undertake an economic assessment of the short term offshore wind options within the Draft OWE Plan to inform the finalisation of the OWE Plan and the Post-Adoption Statement. The study has focused on the short term options identified as there is greater certainty about these developments at this point in time.

The project has assessed the impact of development in the following broad areas of Scotland specified within the Draft OWE Plan (Appendix A, Figure A1):

- North East: focusing on Beatrice;
- East: Inch Cape, Neart na Gaoithe, Forth Array;
- South West: Solway Firth, Wigtown Bay; and
- West: Argyll Array, Islay, Kintyre.

As no sites in the North or North West areas have been identified among the short term options, no development options from these areas have been considered within the analysis. Information on regional-scale impacts has also been combined to provide an indication of impacts at a national level.

The study has been undertaken by ABPmer in association with economic consultants SQW and Risk & Policy Analysts (RPA) between December 2010 and February 2011. The project has been managed jointly by the Marine Analytical Unit (MAU) and the Marine Renewables and Offshore Wind policy team within Marine Scotland supported by a wider Project Advisory Group (see Appendix B for list of membership).

## 1.1 Scope of Study

The study approach has assessed and compared the costs incurred by, and benefits arising from, different policy options and considered them against a 'do nothing' option (where there is no intervention). The assessment been prepared in accordance with Better Regulation Executive guidance on impact assessment[2] and the Green Book methodology (HM Treasury, 2003) for economic assessment.

The key requirements of the study have been to:

- Provide a comparison of the economic and social benefits associated with the development of the short term options for offshore wind in Scottish Territorial Waters against any potential economic and social costs associated with it;
- Assess the distribution of costs and benefits amongst the public sector, different industries (e.g. fishing, tourism, shipping) and wider society, in order to establish who may bear the benefits and costs associated with the short term options;
- Consider the impact (in terms of Gross Value Added (GVA) and employment) that the short term options will have on the regional economies affected, and on the wider Scottish economy. In particular, the study has sought to estimate the net impact on regional economies resulting from the manufacture, installation, operation and decommissioning of offshore wind sites, from any associated infrastructure development works that are required, and from any impacts on other marine activities; and
- Finally, through specific tests within an impact assessment, to determine the potential impact of policies on small firms and on competition.

2 http://www.bis.gov.uk/policies/better-regulation/policy/scrutinising-new-regulations/preparing-impact-assessments

This report focuses on the costs and benefits to other marine users and interests.

The potential environmental impacts and impacts on visual amenity associated with the short term options have been considered as part of the SEA. Although any impacts that have emerged from the SEA have been noted, valuation of these impacts was outwith the scope of this project, given the challenges of adequately valuing ecosystem services and the limited time for the study. Consideration of different approaches for distributing revenues from the short term options was also considered out of scope.

## 1.2 Report Structure

The report has been structured as follows:

- Section 1 - Introduction: this section;
- Section 2 - Methodology - describes the general approach to the impact assessment, the options assessed and the various scenarios and sensitivity tests that have been applied;
- Section 3 - Baseline - describes the current levels of activity and economic value within the four OWE Plan Regions for relevant interests and likely projections for the future (in the absence of the plan);
- Section 4 - Assessment of Impacts - estimates the impacts that may be experienced by relevant sectors as a result of Plan implementation;
- Section 5 – Assessment of Costs and Benefits to Other Marine Users;
- Section 6 - Conclusions; and
- Section 7 - References.

Further information is provided in the Appendices, including detailed maps (Appendix A), Stakeholder and Project Advisory Group engagement (Appendices B, C, F) and sources of information (Appendices D and E).

# 2. Methodology

## 2.1 Introduction

This report seeks to estimate the costs and benefits to other marine users and interests as a result of implementation of the OWE Plan.

There are a number of key assumptions and uncertainties that need to be addressed in projecting costs and benefits, for example: the scale of offshore wind development under the OWE Plan; the compatibility of the offshore wind developments with other marine users (following incorporation of appropriate mitigation measures); and the potential costs of any displacement of existing activities. These uncertainties have been used to define the particular options and scenarios that have been assessed.

## 2.2 Options Assessed

For this study, two options were assessed as follows:

- Do nothing (the baseline, which incorporates anticipated changes in the absence of intervention in the form of the Draft Plan); and
- The intervention option (implement the plan for the nine short term options based on the capacities identified in the Draft Plan).

## 2.3 Approach to Scenarios

Three different scenarios have been applied to the intervention option to take account of uncertainties in the potential significance and impact of interactions between the short term options and other marine users. These factors can potentially influence the costs and benefits to marine users and interests. The scenarios have been termed 'low', 'medium' and 'high' impact reflecting combinations of different scales of impact on other marine users. .

As a result of the relative lack of direct precedent for offshore wind development on such a scale, there are inherent uncertainties about the extent of sectoral incompatibility and consequential impacts. Although assumptions underpinning the scenarios vary according to marine sector, in general terms, the 'high', 'medium' and 'low' impact scenarios have sought to reflect these uncertainties as follows

- The high impact scenario generally assumes that sectors' activities are incompatible with the short term options in the areas where they interact and, therefore, do not take place;
- The medium impact scenario generally assumes that aspects of the sectors' activities are compatible with the short term options, or that appropriate mitigation measures are put in places, which would allow some aspects of the sectors' activities to continue; and

- The low impact scenario generally assumes that the short term options would have a limited significant impact on other marine sectors' activities. This may be as a result of activities being naturally compatible, through use of mitigation measures, or through reduced scale of development of short term options.

The bases for estimating the cost and benefit consequences for each sector and for each scenario are described in detail in Section 4.

## 2.4 Information Sources

A wide range of information has been accessed to inform this study. This has included published and unpublished data and reports (see Appendix D), spatial data layers (Appendix E) and other specific information provided through stakeholder engagement. Sector specific sources of information are identified in Sections 3 and 4.

## 2.5 Stakeholder Engagement

Notwithstanding the short time scales within which the study has been progressed, a high level of engagement has been sought with relevant stakeholder organisations. An initial list of stakeholders was contacted at the start of the study to inform them of the purpose and nature of the work (see letter in Appendix F), to identify how they wished to be engaged and to seek to identify additional relevant evidence that they might be able to contribute to the study. A complete list of stakeholders contacted through this study is presented in Appendix C.

The study has been overseen by a Project Advisory Group (PAG) comprising the most relevant stakeholder groups at national and regional levels and chaired by Marine Scotland. The PAG met twice, in December 2010 and January 2011, where the members reviewed and commented on the methodology and draft findings of the study. In addition, a brief presentation of the study objectives was made at five regional stakeholder events organised by Marine Scotland in January 2011 (Campbeltown, Tiree, Islay, Dumfries and Wigtown). These stakeholder events were primarily to inform stakeholders about progress with the draft OWE Plan and to discuss comments received in relation to the consultation on the draft SEA Environmental Report. However, the events provided a useful opportunity to engage directly with stakeholders and to discuss potential socio-economic concerns.

## 2.6 Establishing a Baseline

The definition of the baseline is an important step in any impact assessment as it provides the initial starting point against which to assess the implementation scenarios, and the changes that will arise in any case under the do nothing option, going forward. The baseline has been focused on those topic areas where changes in costs and benefits can reasonably be expected to be impacted by the proposed intervention (with reasons provided where other topic areas are excluded).

As with all socio-economic assessments, the establishment of a baseline involves a degree of extrapolation and projection of data from recent years into future years. In doing so, it also recognises that changes will occur over time in the absence of the OWE Plan. This information

is important in informing the cost and benefits of the 'do nothing' option. The baseline therefore sought to identify how sectors may change over the 50 year time period of this assessment in the absence of the policy intervention, describing these changes, as far as possible, in quantitative terms in Section 3. Given the uncertainties in future trends in activity levels for other marine users and consequent changes in values, the baseline used in the assessment of impacts to other marine users has therefore assumed that volumes and values of activity, remain the same as now in each region over the appraisal period.

The SEA Environmental Report and draft OWE Plan contain information on the key marine users that might be affected by the draft OWE Plan and this has provided a useful starting point for determining the scope of the baseline. The SEA Environmental Report consultation responses were also reviewed to identify possible additional key sectors to ensure that impacts on other marine users and wider stakeholders were taken into account. At a national level, much information on the value of uses of the marine environment was recently collated for Charting Progress 2 (UKMMAS, 2010) and Scotland's Marine Atlas: Information for The National Marine Plan (Scottish Government, 2011). This included information on turnover, GVA and employment.

Wider information on the baseline relevant to the associated marine user sectors was drawn from a range of published data sources and reports, as documented in Section 3. In particular, there is a large degree of uncertainty over the baseline 50 years into the future.

## 2.7 Evaluating Costs and Benefits of Implementation Scenarios

### 2.7.1 Costs and Benefits to Other Marine Users and Interests

The evaluation of costs and benefits for other marine users and interests under the three implementation scenarios has been undertaken in a number of steps as follows:

- Identification of sectors potentially affected - this was based on a review of SEA Environmental Report consultation responses, wider information on the effects of offshore wind farm development on other marine users and a spatial analysis in GIS to identify potential interactions between the short term options and other marine users;
- Evaluation of interactions - the nature of the interactions between the short term options and other marine users were evaluated to determine whether specific interactions were likely to have a significant effect on the other marine user. This evaluation took account of stakeholder views and the existing evidence base; and
- Valuation (monetisation) of costs and benefits - where significant interactions were likely to occur, the costs and benefits to other marine users were estimated where possible based on specific scenarios identified in Section 4.

The Treasury Green Book notes that 'Costs and benefits considered should normally be extended to cover the period of the useful lifetime of the assets encompassed by the options under consideration'. For the purposes of this study an asset lifetime of 40 years has been assumed. The study has therefore been conducted over a period of 50 years from 2011 to 2060 to take account of the phasing of development and decommissioning. Costs and benefits

are discounted in line with the Treasury Green Book guidance at 3.5% for years 1-30 and at 3% for years 31-49.

### 2.7.2 Employment Impacts on Other Marine Users and Interests

In order to estimate job impacts, costs and benefits of the scenarios accruing to the Scottish economy were allocated to the most appropriate industry group (Table 2). The industry groups used based on the Standard Industrial Classification (SIC) (2003) classes, using the UK Standard Industrial Classification of Economic Activities 2003[3] to identify which of the 126 industry groups was the best fit for each cost type.

**Table 2. Allocation of expenditure types to industry groups**

| Cost Type | Industry Group | Justification |
|---|---|---|
| Fisheries | Sea fishing | Specific code available |
| Aquaculture | Fish farming | Specific code available |
| Navigation | Water transport | Includes sea and coastal water transport |
| Aviation | Air transport | Includes scheduled and non-scheduled air transport |
| Recreational Angling | Recreational services | Includes sporting activities |
| Recreational Boating | Recreational services | Includes sporting activities |
| Surfing and windsurfing | Recreational services | Includes sporting activities |
| Tourism | Hotels, catering & pubs etc | Includes accommodation, restaurants and bars |
| Wave and tidal energy | Research & development | Includes research and experimental design on engineering |
| Cables | Telecommunications | Specific code available (this also includes maintenance of the network) |

The relationship between costs to other marine users and jobs is complex. For example, navigation costs may increase due to the need to avoid the wind farms, which could take longer, but is unlikely to lead to a loss of jobs. Losses are more likely where there is reduced access (e.g. sea fishing), reduced crop (e.g. fish farming) or people choose to go elsewhere (e.g. tourism). We have therefore adopted different assumptions for each type of cost to other marine users, as set out in Table 3.

Appropriate multipliers have been identified for each of the industry groups and applied to relevant costs to estimate job impacts. The multipliers are based on the 2007 Type I multipliers for Scotland (as these are the latest multipliers that are available). The Type I multipliers take account of the direct and indirect effects, but not the induced effects. We have assumed when using these multipliers that the recent economic crisis has not affected the multipliers and, hence, that they can be applied without the need for adjustment.

[3] National Statistics (2003): UK Standard Industrial Classification of Economic Activities 2003, available from: http://www.statistics.gov.uk/methods_quality/sic/downloads/uk_sic_vol1%282003%29.pdf.

**Table 3. Approach to assessing impacts on other marine users**

| Sector | Approach |
|---|---|
| Fisheries | Costs relate to loss of harvest and reduction in catch per effort, which will result in losses in jobs and GVA. We have assumed for the purposes of the analysis that the value of fish landed in Scotland is equivalent to the value of landings by the Scottish fleet. This is a simplification, but no data are readily available to provide a more accurate analysis. |
| Aquaculture | No overall effect |
| Navigation | Impacts are increased steaming times/distances, increased risk of collision; assumed to be no loss of jobs |
| Aviation | Costs of radar mitigation; assumed to be no loss of jobs |
| Recreational angling | Displacement of activity affecting the supply chain, including the potential loss of jobs |
| Recreational boating | Mainly related to additional sailing distances with evidence suggesting no overall reduction in sailing. The cost are linked to additional distances which should not affect jobs |
| Surfing and windsurfing | No significant costs |
| Tourism | Potential reduction in attractiveness of area, which could lead to reduced numbers of visitors and spend, potentially affecting jobs in the supply chain |
| Wave and tidal energy | Mainly linked to competition for space, which might increase development time/opportunities, but should not affect jobs |
| Cables | Increase in maintenance and repair costs, which should not have a negative effect on jobs |

# 3. Baseline

## 3.1 Introduction

A number of potential incompatibilities with socio-economic interests were identified from the SEA Environmental Report and draft OWE Plan, including:

- Some types of commercial fishing activity (particularly trawling);
- Shipping and Ports (including some ferry routes);
- Aviation (civil and military radar, helicopter routes and de-icing areas);
- Recreational interests (including sailing, power-boating, kayaking/canoeing, sea angling, surfing, windsurfing);
- Tourism (including ecotourism); and
- A range of potential social impacts (for example, social impacts on rural communities dependent on fishing and on established communities).

The SEA (Marine Scotland, 2010a) indicated that Practice and Exercise Areas (PEXA) for the Navy may pose issues, although the MOD confirmed in their consultation response that there may be some scope to accommodate development in these areas, depending on case by case circumstances (Marine Scotland, 2010c). Further localised hazards were noted but these cannot be costed, are unlikely to be significant at the national or regional level and, therefore, have been excluded from the analysis.

Additional key sectors identified from the wider literature on the potential impacts of offshore wind farm development included:

- Aquaculture;
- Cables and pipelines; and
- Wave & tidal energy.

Table 4 provides a full list of the socio-economic sectors included in the baseline and assessment.

**Table 4. List of key sectors included in baseline**

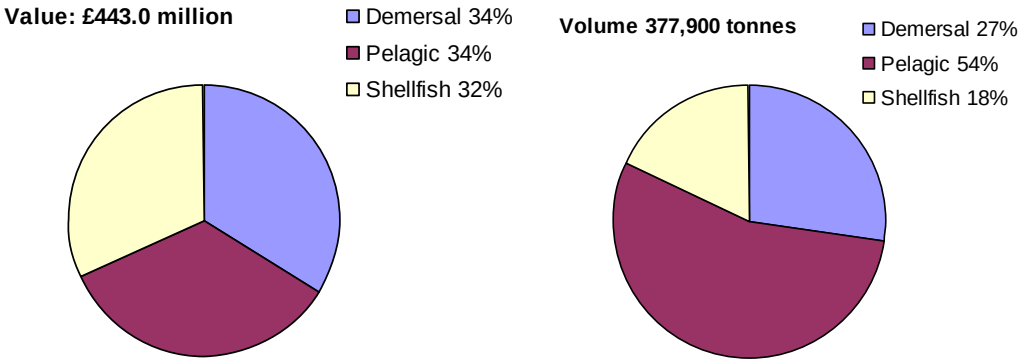
| Sector |
|---|
| ▪ Commercial Fisheries;<br>▪ Aquaculture;<br>▪ Shipping and Ports;<br>▪ Aviation;<br>▪ Wave and Tidal Energy Development;<br>▪ Cables and Pipelines;<br>▪ Recreational Boating;<br>▪ Recreational Angling;<br>▪ Surfing, Windsurfing and Kayaking;<br>▪ Tourism; and<br>▪ Social Impacts. |

For many of the sectors, it is not practical to develop a fully quantified baseline given the balance between the levels of uncertainty regarding future industry development and the relatively small impact it is likely to have on the results of the study. However, where it is deemed both possible and practical, including commercial fisheries, recreational angling and tourism, quantified baseline information is used in undertaking the assessment. The baseline information in this chapter consequently provides important contextual information in describing the nature and scale of activity at a regional level, both qualitatively and quantitatively where possible. A further definition of relevant baseline information, in the context of the scenario assessments, is reported in chapter 4 to allow greater transparency in demonstrating how the baseline information is used within such assessment.

## 3.2 Commercial Fisheries

Scotland is one of the largest sea fishing nations in Europe and the Scottish fleet is responsible for landing 66% of the total UK volume of fish (Scottish Sea Fisheries Statistics, 2009). In terms of the total value of landings by Scottish based vessels, the fishing sector contributed around £144 million GVA to the Scottish economy in 2009 (Scottish Government, 2010a).

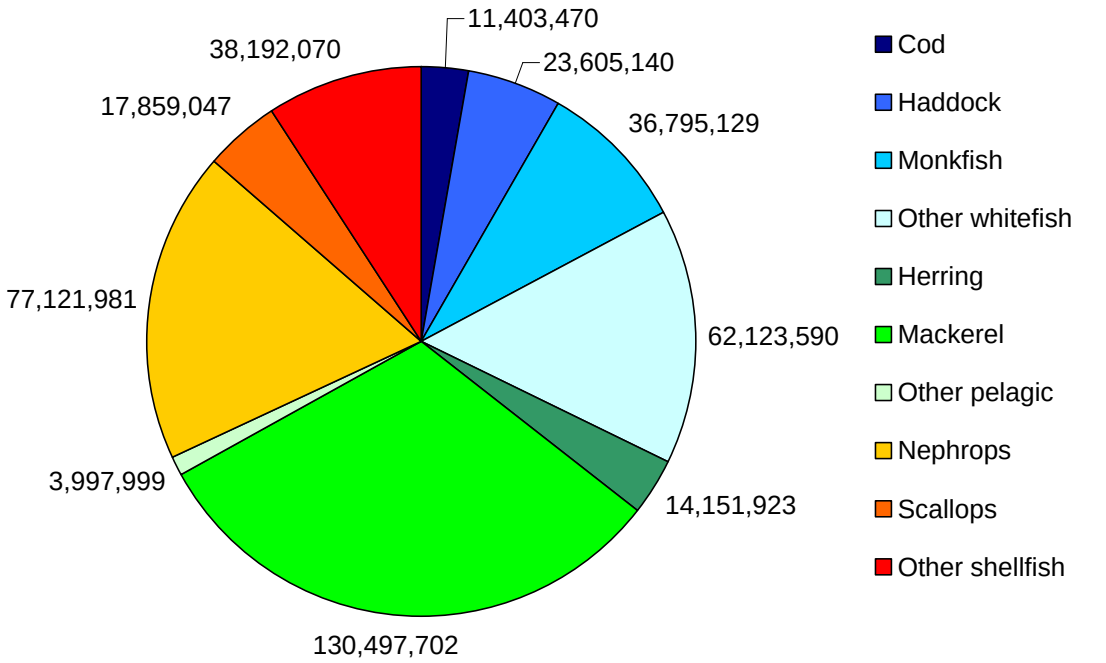
The current industry can be divided into the pelagic (such as herring, mackerel and whiting), demersal (including cod, saithe, plaice, sole) and shellfish (predominantly nephrops, scallops, lobsters and crawfish) sectors. The pelagic sector made up 54% of the total volume of landings and 34% of the total value by Scottish based vessels in 2009, the demersal sector made up 27% of the total volume and 34% of the total value and the shellfish sector made up 18% of landings and 32% of value (Figure 1). Total revenues from first sale landings have been relatively static over the past five years, although tonnages have continued to decline over this period; reflecting the broader UK pattern (UKMMAS, 2010).




(Source: Scottish Sea Fisheries Statistics, 2009)

**Figure 1. Total landings by Scottish based vessels by species type, 2009**

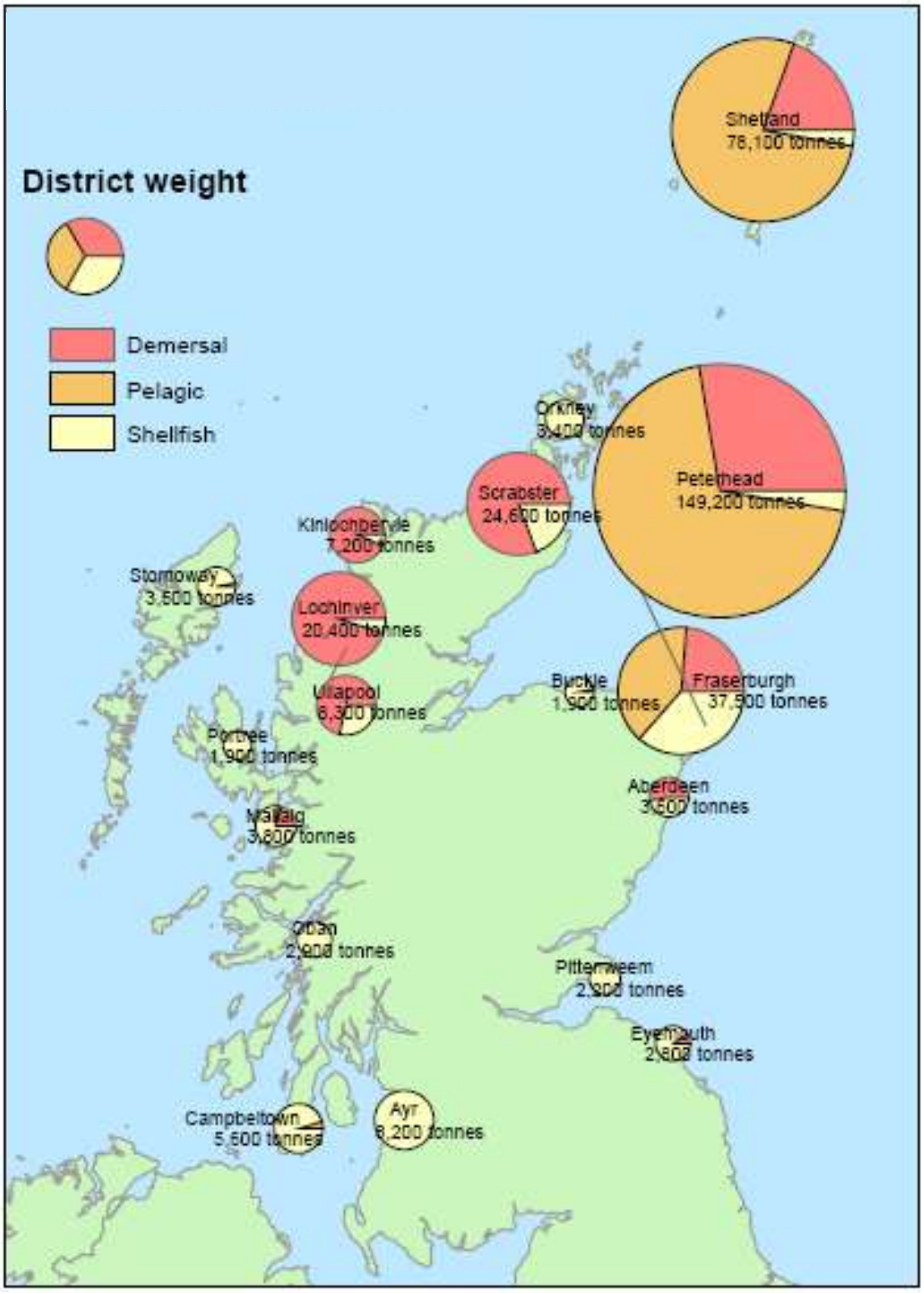
Seven species make up the bulk of the landings: mackerel, herring, haddock, cod, monkfish, *Nephrops* and scallops. The relative values of individual fish species caught in Scotland's sea regions in 2009 are shown in Figure 2.




(Source: Source: Scottish Government, 2011)

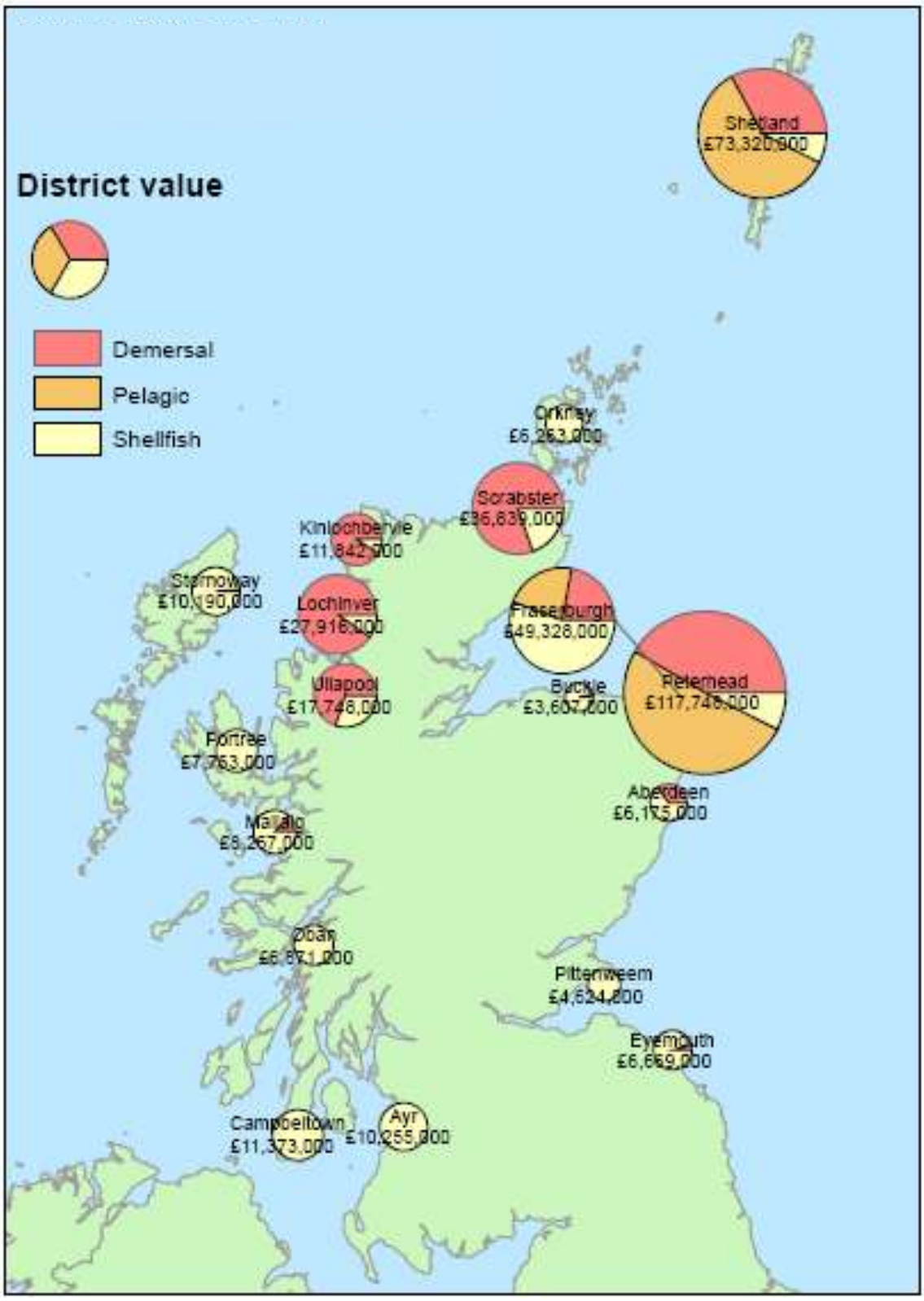
**Figure 2. Value of fish caught in Scotland's sea regions by species, 2009**

All fish landings are reported by the areas in which they were caught, known as ICES rectangles. This catch information, together with independent fish surveys, form the basis of the data used to assess the amount of fish that can be caught each year. Larger fishing vessels (15m and over) are fitted with a Vessel Monitoring System (VMS), which allows for more detailed and precise information about the location of fishing activity, however, smaller vessels are currently unmonitored by VMS. Fishery statistics are produced using this VMS/non-VMS classification (i.e. vessel length of <15m and 15m and over). Although the location of other EU and non-EU boats are provided by this system, landings by these boats abroad are more difficult to source and are therefore outside the scope of this assessment. Figures 3 and 4 show the weight and volume of fish landed by species type and district.




(Source: Scottish Sea Fisheries Statistics, 2009)

**Figure 3. Live weight (tonnes) landed by district (2009)**




(Source: Scottish Sea Fisheries Statistics, 2009)

**Figure 4. Value landed by district (2009)**

The number of active fishing vessels based in Scotland was 2,174 vessels in 2009 (Scottish Sea Fisheries Statistics, 2009) (see Table 5). The largest part of the commercial fishing industry operates from ports located in the north east of Scotland, especially around Peterhead and Fraserburgh. The western coast supports numerous small ports and harbours, the largest of which are Ullapool, Oban, Portree and Mallaig (Figure A2). Elsewhere, in the south east and south west, numerous small ports support local industries based on smaller vessels (<10m).

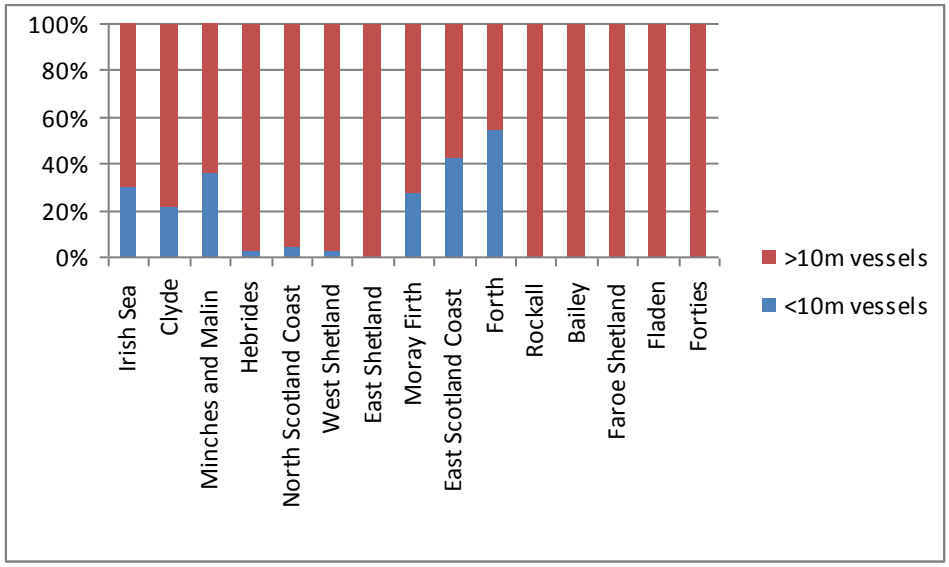
**Table 5. The number of active Scottish based vessels in 2009 by district and size**

| District | Number of Active Vessels in 2009 | 10 Metres and Under | >10 <15 Metres | 15 Metres and Over |
|---|---|---|---|---|
| Eyemouth | 100 | 73 | 16 | 11 |
| Pittenweem | 117 | 100 | 13 | 4 |
| Aberdeen | 96 | 81 | 8 | 7 |
| Peterhead | 100 | 46 | - | 52 |
| Fraserburgh | 220 | 102 | 11 | 107 |
| Buckie | 85 | 45 | 5 | 35 |
| Scrabster | 129 | 110 | 12 | 7 |
| **Total East Coast** | **847** | **557** | **65** | **225** |
| Orkney | 152 | 110 | 31 | 11 |
| Shetland | 182 | 134 | 14 | 34 |
| Stornoway | 258 | 203 | 30 | 25 |
| **Total Islands** | **592** | **447** | **75** | **70** |
| Lochinver | 14 | 11 | 1 | 2 |
| Kinlochbervie | 24 | 20 | 2 | 2 |
| Ullapool | 82 | 45 | 14 | 23 |
| Mallaig | 59 | 32 | 5 | 22 |
| Oban | 129 | 89 | 23 | 17 |
| Campbeltown | 135 | 83 | 33 | 19 |
| Ayr | 149 | 78 | 19 | 52 |
| Portree | 143 | 121 | 20 | 2 |
| **Total West Coast** | **735** | **479** | **117** | **139** |
| **Total** | **2,174** | **1,483** | **257** | **434** |

(Source: Scottish Sea Fisheries Statistics, 2009)

The Scottish fleet can be broadly split into vessels over and under 10m in length. The latter tend to operate mainly in inshore waters (up to 12nm from the coast) fishing for a mixture of quota and non-quota stocks and tend to focus mainly on shellfish (Scottish Government, 2011). As shown in Figure 5, the <10m inshore vessels form an important part of the Scottish fishing fleet along the east and west coasts of Scotland.

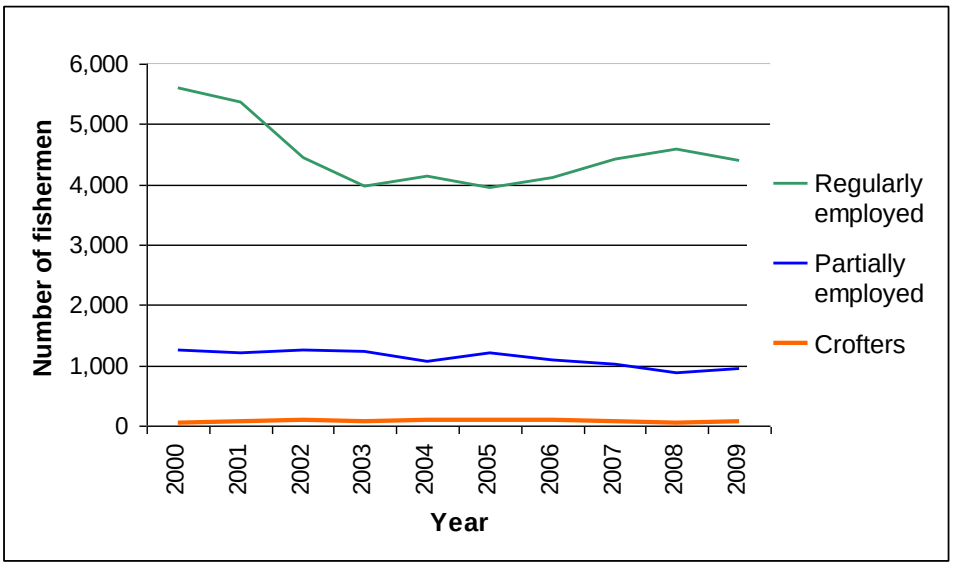
The >10m Scottish fleet tends to concentrate its activities in the northern North Sea, mainly in Scottish waters, but some vessels also fish in Norwegian waters, and waters to the west of Scotland.




(Source: Marine Scotland)

**Figure 5. % Catch by value for in each sea area, 2009**

Figure 6 shows the total number of fishermen employed on Scottish based vessels from 2000 to 2009. Including regularly and irregularly employed and crofters, a total of 5,409 people were employed as fishermen in 2009. Employment in fishing accounts for 0.2% of the total Scottish labour force, however, in some regions this percentage is much higher, for example, in Aberdeenshire and Argyll & Bute 1.03% and 1.24%, respectively, of the labour force were fishermen in 2009, and in Eilean Siar, Orkney & Shetland the figure was 3.79% (Scottish Sea Fisheries Statistics, 2009).



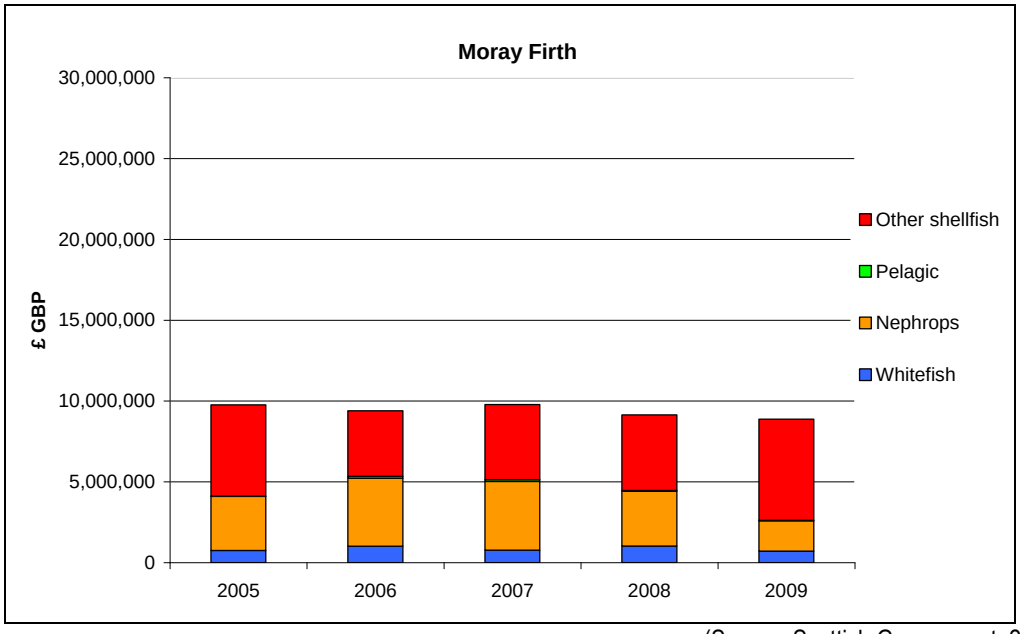

(Source: Scottish Sea Fisheries Statistics, 2009)

**Figure 6. Number of fishermen employed on Scottish based vessels (2000-2009)**

Total revenues from first sale landings have not changed much over the past five years although tonnages have decreased. However, the trend has been for decreasing employment and numbers of vessels between 2000 and 2009 due to intense decommissioning. Most future scenarios generally predict that revenues will remain stable over the next 50 years, if not increase due to improved fisheries management (Viner *et al*, 2006; Saunders *et al*, 2011). The worst case scenario under a 'slash and burn' culture is for some stocks to collapse in 50 years time. For the purposes of this assessment we have made the simplifying assumption that revenues and associated jobs will remain stable.

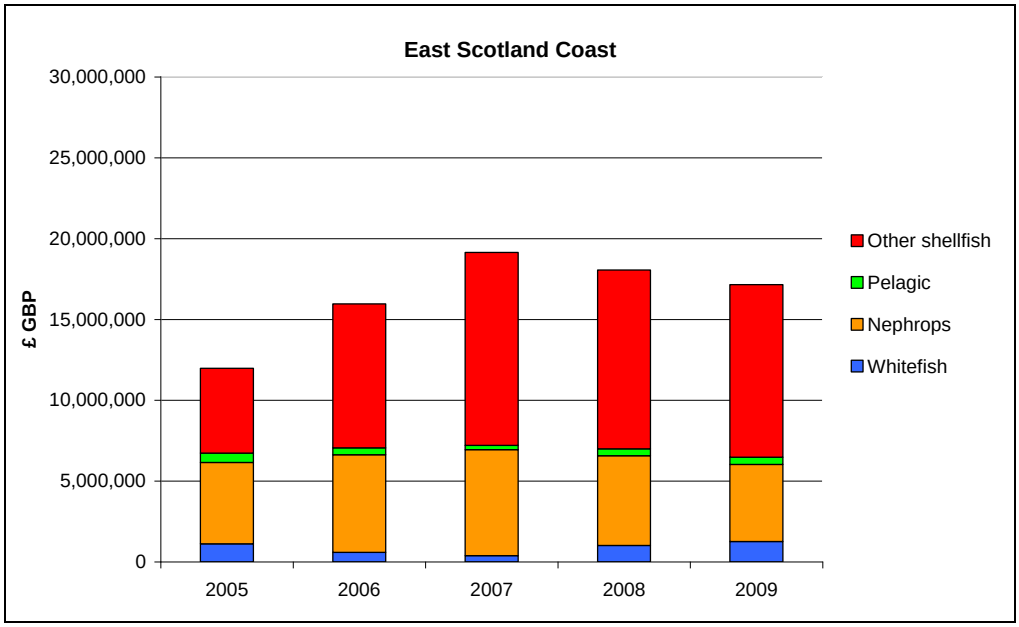
### 3.2.1 North East Region

For the North East region, *Nephrops* have the greatest proportion of landings by value (average 2000 to 2009) and scallops and squid are also important species in the Moray Firth region. Figures 7 and 8 show the value of catches by species type for the Moray Firth and East Scotland Coast sea areas in Scotland's Sea Atlas which make up the North East region from the coast to the 12nm territorial limit. The Fladen sea area makes up the remainder of the region beyond this limit and the value of catches for these areas are shown in Figure 9.



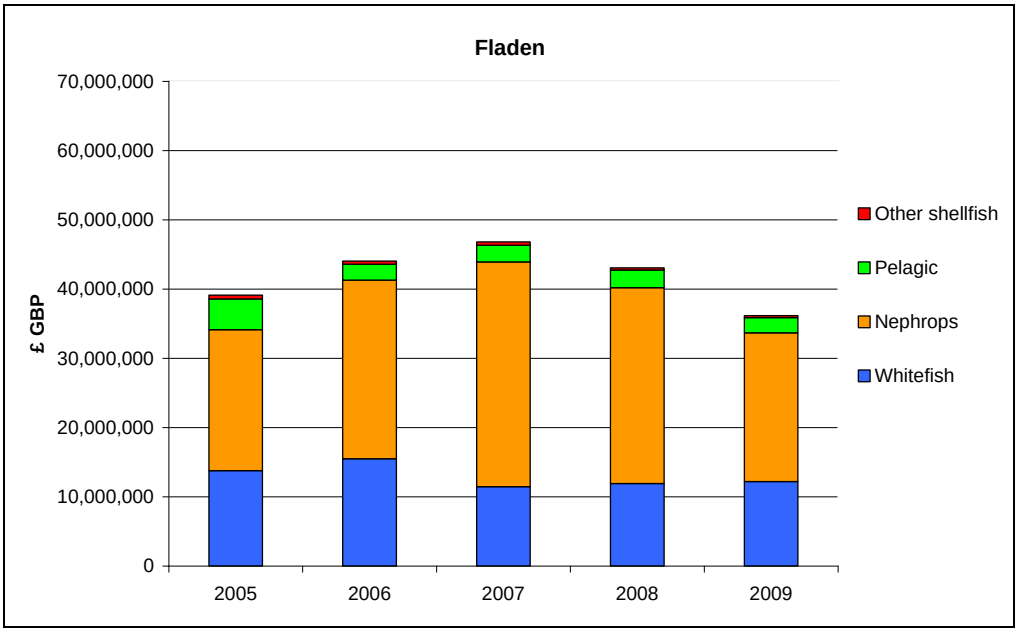

(Source: Scottish Government, 2011)

**Figure 7. Value of catches for Sea Area: Moray Firth (2005-2009)**




(Source: Scottish Government, 2011)

**Figure 8. Value of catches for Sea Area: East Scotland Coast (2005-2009)**




(Source: Scottish Government, 2011)

**Figure 9. Value of catches for Sea Area: Fladen (2005-2009)**

Beatrice OWF site lies within ICES rectangle 45E7 where the total value of landings (average for 2000 to 2009) is £1,681,287 (Figure A20). Scallops comprise the largest catch by value (over 55% of the total value) with the next largest, *Nephrops*, comprising nearly 15%.

The top three fishing methods (by value) deployed in ICES rectangle 45E7 are boat dredges, otter trawls and Scottish seines (Figure A21). Over 90% of the total catch by value is caught by vessels which are 15m and over in length (Figure A22) and the total effort is 2,721 days per year (average for 2000 to 2009).

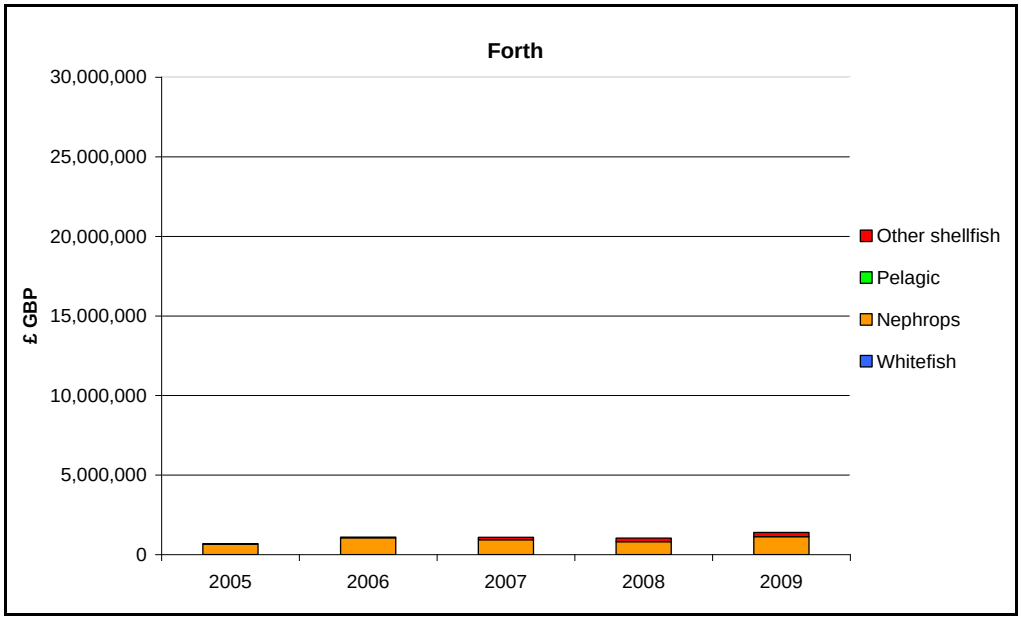
The highest y of vessels with VMS (average from 2005 to 2008) in this region occurs within the southern half of the Moray Firth and around the ports of Fraserburgh and Wick (Figure A23). The vast majority (over 99%) of all vessels sighted within the region are registered in the UK.

The Beatrice OWF site lies close to or within potential spawning grounds for cod, plaice, lemon sole and sandeels and nursery areas for herring, whiting, saithe and sandeels (Marine Scotland, 2010a).

### 3.2.2 East Region

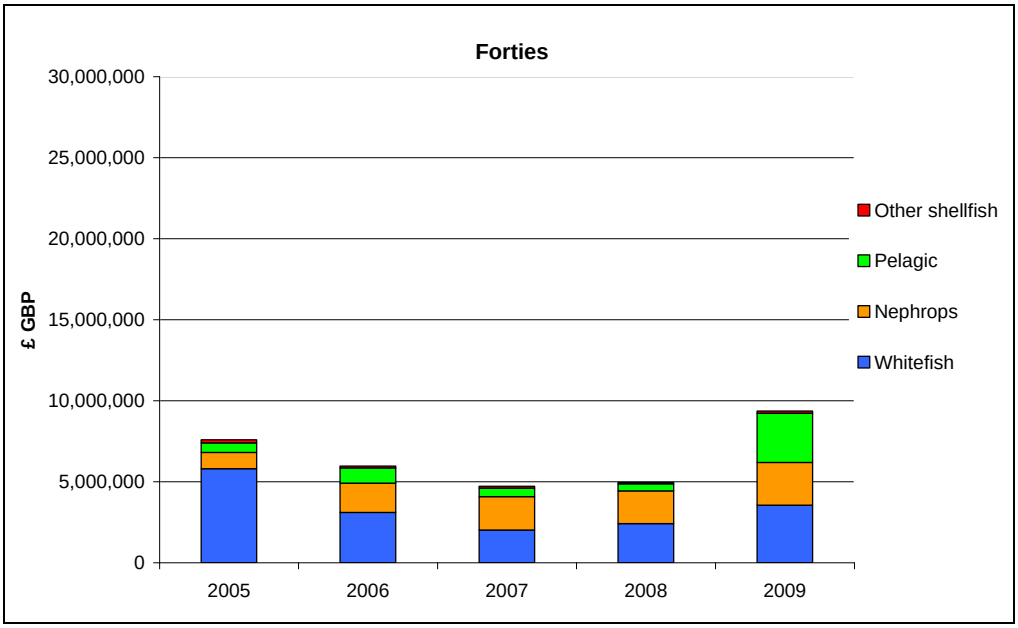
For the western part of the East Region (coastal regions comprising the Forth and East Scotland Coast sea areas identified in Scottish Government, 2011), the majority of landings by value (average 2000 to 2009) are shellfish species where *Nephrops*, scallops and lobsters have the highest values (Figure 10). The remainder (offshore part) of the East region is covered by the Forties sea area and the value of catches by species type for this area is shown in Figure 11 .

In the East region, the majority of the total catch by value is caught by vessels 15m and over. However, inshore and within the Moray Firth around 55% of the total catch by value is caught by vessels under 15m and around 40% by vessels under 10m in length (Figure 5).




(Source: Scottish Government, 2011)

**Figure 10. Value of catches for Sea Area: Forth (2005-2009)**




(Source: Scottish Government, 2011)

**Figure 11. Value of catches for Sea Area: Forties (2005-2009)**

Inch Cape, Neart na Gaoithe and Forth Array OWF sites overlap with ICES rectangles 42E7, 41E7, 41E8 and 40E8 (Figure A26).

The total value of landings from rectangle 42E7 (average for 2000 to 2009) was £1,772,497. Scallops comprise the largest catch by value (around 40% of the total value), with the next largest, lobsters, comprising over 25%. The two main fishing methods (by value) deployed in ICES rectangle 42E7 are pots and boat dredges (Figure A27) and over 60% of the total catch value is caught by vessels which are less than 15m in length (over 40% by vessels under 10m) (Figure A28).

The total value of landings from rectangle 41E7 (average for 2000 to 2009) was £4,273,475. *Nephrops* comprise the largest catch by value (nearly 60%), with the next largest, lobsters, comprising over 20%. The top three fishing methods (by value) deployed are otter trawls, pots and *Nephrops* trawls (Figure A27). In ICES rectangle 41E7, over 80% of the total catch value is caught by vessels which are less than 15m in length (over 45% by vessels under 10m) (Figure A28).

The total value of landings from rectangle 41E8 (average for 2000 to 2009) was £343,000. In rectangle 41E8, scallops comprise the largest catch by value (over half of the total value), followed by haddock (over 15%) and *Nephrops* (over 10%). The main fishing method (by value) deployed in ICES rectangle 41E8 is boat dredging (over 55% of the total catch value), followed by pair trawls (bottom), otter trawls and Scottish seines (Figure A27). In rectangle 41E8, over 80% of the total catch by value is caught by vessels which are 15m and over in length (Figure A28).

The total value of landings from rectangle 40E8 (average for 2000 to 2009) was £1,392,413. In rectangle 40E8, lobsters comprise the largest catch by value (around 40% of the total value), followed by *Nephrops* (around 20%) and edible crab (around 15%). The main fishing method (by value) deployed in ICES rectangle 40E8 is pots (over 60% of the total catch value), followed by otter trawls, *Nephrops* trawls and midwater otter trawls (Figure A27). In rectangle 40E8, over 80% of the total catch by value is caught by vessels which are less than 15m (and over 60% are less than 10m)(Figure A28).

The highest density of vessels with VMS (average 2005 to 2008) in this region occurs off and along the coast and particularly east of Arbroath and Dundee (Figure A29). Neart na Gaoithe and Forth Array OWF sites lie in areas of relatively low VMS vessel density, whereas Inch Cape OWF site lies in the area of highest vessel density in this region. The vast majority (over 98%) of all vessels sighted within the region are registered in the UK (Figure A31). Within the area of the Inch Cape OWF site 52 vessels (scallop dredgers, potters/whelkers and demersal stern trawlers) were sighted during surveillance operations between 2000 and 2009, 5 vessels (potters/whelkers, scallop dredgers and a demersal stern trawler) were sighted within the Neart na Gaoithe OWF site and no vessels were sighted within the Forth Array OWF site (Figure A30).

Spawning grounds and nursery areas for Biodiversity Action Plan (BAP) marine fish species are located within all three OWF sites in the East region, notably nursery areas for cod, whiting and saithe and also nursery areas for sandeel. Inch Cape OWF site also lies in a nursery area for plaice. Spawning grounds for plaice, whiting, and sandeel also lie within all three OWF sites, as well as mackerel spawning grounds at Inch Cape and Forth Array, and lemon sole spawning grounds at Neart na Gaoithe OWF site (Marine Scotland, 2010a).

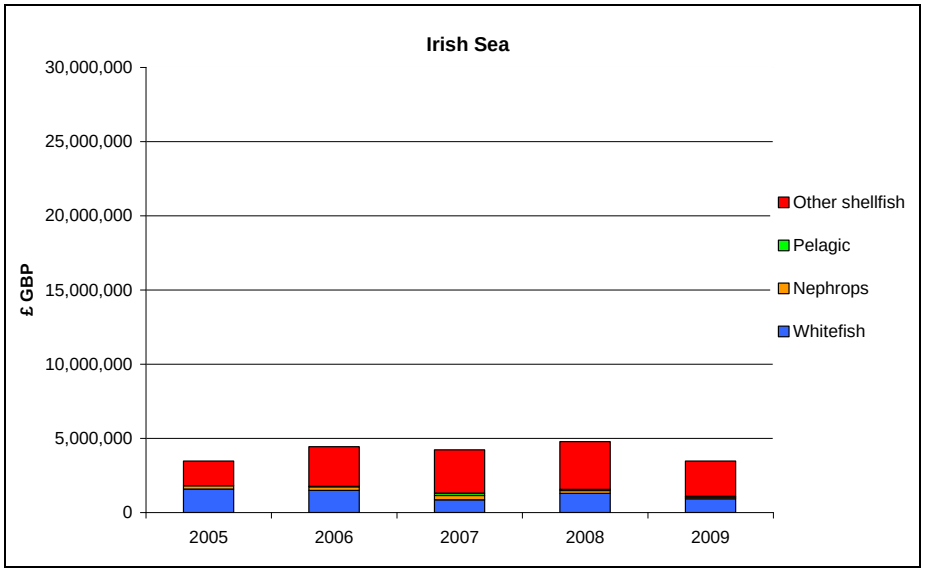
### 3.2.3 South West Region

For the South West region as a whole, the majority of landings by value (average 2000 to 2009) are shellfish species: *Nephrops*, scallops and cockles have the highest values. Figure 12 shows the value of catches by species type for the Irish Sea area.

In the east of this region (near the Solway Firth coast) the over 70% of the total catch by value is caught by vessels under 15m, however further away from the Scottish coast the majority (over 85%) of the total catch is by vessels 15m and over.

Solway Firth OWF site lies within ICES rectangle 38E6. The total value of landings from rectangle 38E6 (average for 2000 to 2009) is £521,805 (Figure A32). Mussels, brown shrimps and cockles comprise just over half of this total value. The top three fishing methods (by catch value) deployed in ICES rectangle 38E6 are mechanized dredges, beam trawls and otter trawls (Figure A33). The majority (over 70%) of the total catch by value is caught by vessels that are less than 15m in length (Figure A34) and the total effort is 3,516 days per year (average for 2000 to 2009).

Wigtown Bay OWF site lies within ICES rectangle 38E5. The total value of landings from rectangle 38E5 (average for 2000 to 2009) is £1,238,454 (Figure A32). Scallops, whelks, lobsters and queen scallops comprise over three quarters of this total value. The major fishing methods (by catch value) deployed in ICES rectangle 38E5 are boat dredges and pots (Figure A33). Around one third of the total catch by value is caught by vessels that are less than 15m in length (Figure A34) and the total effort is 2,395 days per year (average for 2000 to 2009).




(Source: Scottish Government, 2011)

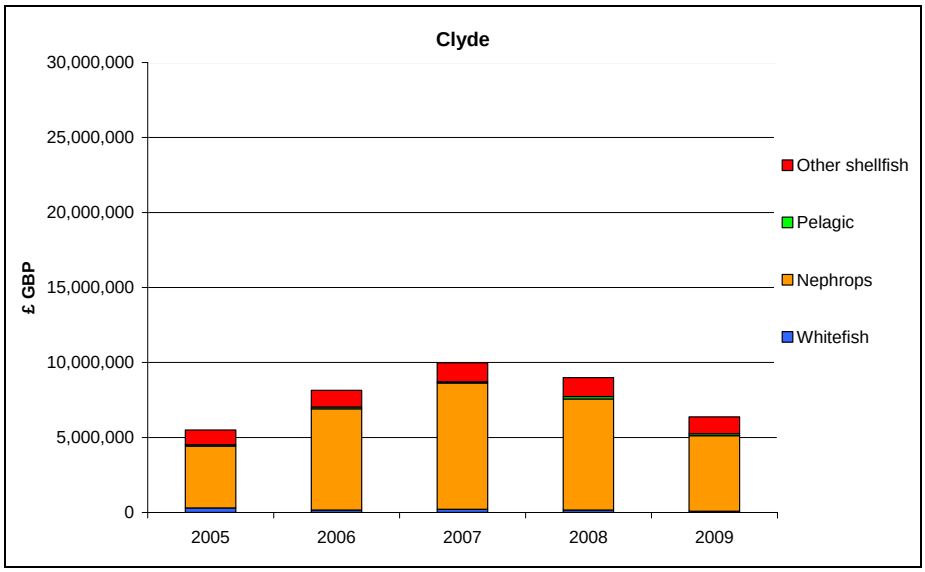
**Figure 12. Value of catches for Sea Area: Irish Sea (2005-2009)**

The highest density of vessels with VMS (average 2005 to 2008) in the South West region occurs towards the southern half offshore of Cumbria and around the Isle of Man (Figure A35). The majority (over 95%) of all fishing vessels sighted in the region between 2000 and 2009 are registered in the UK (Figure A37). Within the area of the Solway Firth OWF site 10 vessels (trawlers, a demersal stern trawler, a demersal side trawler and a potter/whelker) were sighted during surveillance operations between 2000 and 2009 and 2 vessels (trawlers) were sighted within the Wigtown Bay OWF site (Figure A36).

In the South West region, both OWF sites lie within nursery grounds for commercial fish species. There are also spawning grounds and nursery areas for UK BAP marine fish species in the footprint of the works, notably nursery areas for whiting, as well as herring and plaice nursery areas and cod, whiting and sole spawning grounds (Marine Scotland, 2010a).

### 3.2.4 West Region

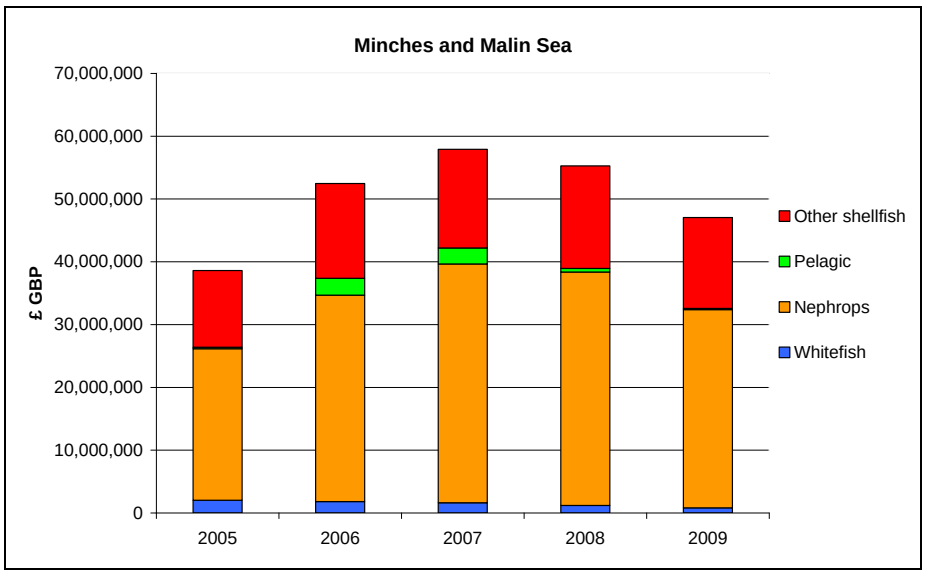
For the West region as a whole, the majority of landings by value (average 2000 to 2009) are shellfish species: *Nephrops*, scallops, queen scallops, crabs and lobsters have the highest values. Figures 13 and 14 below show the value of catches by species type for the Scotland's Sea Atlas Clyde and Minches and Malin Sea areas which make up the West region up to the 12nm territorial limit.




(Source: Scottish Government, 2011)

**Figure 13. Value of catches for Sea Area: Clyde (2005-2009)**

In the east of this region (around the islands of the southern Inner Hebrides) over 50% of the total catch by value is caught by vessels under 15m, however further west (away from the Scottish coast) and to the south of this region the majority of the total catch is by vessels over 15m.




(Source: Scottish Government, 2011)

**Figure 14. Value of catches for Sea Area: Minches and Malin Sea (2005-2009)**

Kintyre OWF site lies within ICES rectangle 39E4. The total value of landings from rectangle 39E4 (average for 2000 to 2009) is £5,593,593 (Figure A38). *Nephrops* comprise the largest catch by value (over 65% of the total value) with the next largest, scallops, comprising just over 10%. The top three fishing methods (by catch value) deployed in ICES rectangle 39E4 are otter trawls, *Nephrops* trawls and boat dredges (Figure A39). The majority (around 75%) the total catch by value is caught by vessels that are 15m and over in length (Figure A40) and the total effort is 21,028 days per year (average for 2000 to 2009).

Islay OWF site lies within ICES rectangle 40E3. The total value of landings from rectangle 40E3 (average for 2000 to 2009) is £1,740,054 (Figure A38). Scallops, edible and velvet crabs and lobsters comprise over 90% of the total value. Over 90% of the fishing methods (by catch value) are pots and boat dredges (Figure A39) and over 60% of the total catch by value is by vessels that are less than 15m in length (Figure A40). The total effort for ICES rectangle 40E3 is 3,317 days per year (average for 2000 to 2009).

The majority of the Argyll Array OWF site lies within ICES rectangle 41E2, whilst the northern part of the site extends into 42E2 and the eastern part of the site extends into 41E3. The total value of landings from ICES rectangles 41E2, 42E2 and 41E3 (average for 2000 to 2009) are £659,370, £2,418,644 and £3,089,637 respectively (Figure A38). *Nephrops*, edible crabs, scallops and lobsters form the majority of these totals by value.

Around the Argyll Array OWF site the largest groups of fishing methods (by value) deployed are otter trawls, pots and Scottish seines (Figure A39). Over 80% of the total catch by value is by vessels that are 15m and over in length (Figure A40) and the total effort is 2,449 days per year (average for 2000 to 2009). The total effort for ICES rectangles 42E2 and 41E3 are 12,561 days per year and 6,538 days per year, respectively.

The highest density of vessels with VMS (average 2005 to 2008) in this region occurs within the Firth of Clyde around Arran, with pockets of high density occurring just to the west of Kintyre (affecting the Kintyre OWF site) and south-east of Tiree (Figure A41). The Islay and Argyll Array OWF sites lie in areas of low VMS vessel density. The vast majority (over 95%) of all vessels sighted within the region are registered in the UK (Figure A43). Within the area of the Kintyre OWF site 4 vessels (scallop dredgers, potter/whelker and a demersal stern trawler) were sighted during surveillance operations between 2000 and 2009, 4 vessels (potters/whelkers and a gill netter) were sighted within the Islay OWF site and 8 vessels (potters/whelkers and a demersal stern trawler) were sighted within the Argyll Array OWF site (Figure A42).

All of the OWF sites in the West region lie completely or partially within spawning areas including mackerel and plaice (both BAP species) and sandeels. All sites also lie completely or partially within nursery areas including cod, whiting and saithe (all BAP species) as well as sandeels (Marine Scotland, 2010a).

## 3.3 Aquaculture

Aquaculture is a growing industry and has a turnover worth around £427m per year to the Scottish economy at farm gate prices in 2009. Contributions to this turnover included Atlantic salmon (£412m), rainbow and brown trout (£6m), halibut (£0.5m), mussels (£7m) and other shellfish (£1.4m). Farmed salmon exports are valued at £285m annually. Exports from fish and aquaculture are Scotland's largest food export (Scottish Government, 2011). The EU Strategy for the Sustainable Development of European Aquaculture described aquaculture as the fastest growing food production sector globally (with an average worldwide growth rate of 6-8% per year). Within the UK as a whole the industry has been projected to increase from 2006 to 2016 by 116% (Wilding *et al*., 2006).

A case study on salmon farming for Argyll and Bute (West region) (SSPO, 2010) indicated the following contributions and trends:

- The direct employment provided by members of SSPO has risen from 321 in 2008 to 393 (data up to June 2010)
- 72 new jobs were created in the last year;
- The increase in direct employment represents a 22% rise on the previous year;
- Nearly £4 million capital investment was made in Argyll & Bute in 2009;
- Over the last four years SSPO member companies have made £26.5m capital investments in Argyll & Bute;
- 23% of the total capital investments made in the whole of Scotland between 2006 and 2009 were made in Argyll & Bute;
- Gross pay has increased year-on-year, rising from £3.7m in 2007 to £9.8m in 2009; and
- 166% increase in value to communities through direct salaries over last three years.

This case study reflects trends throughout the industry to expand their business and increase staffing levels over the next five year (SSPO, 2010)

Locations of aquaculture installations in Scottish waters are shown in Figure A3. These include both non-operational and operational / producing farms as at 2009, and indicate that there is no significant regional or national interaction between farms and the short term options. More recent data was not available.

The study did not look at this sector in further detail for reasons of proportionality as, in general, it is not expected that the aquaculture sector will be significantly impacted upon at either the national or regional level by the OWE Plan.

## 3.4 Shipping and Ports

This section summarizes commercial shipping and port activity. Maintenance of strategic access for military vessels is also identified, where appropriate. Navigational interests associated with commercial fishing and recreation are described in Sections 3.3 and 3.9 respectively.

In 2006 the trade value of Scottish freight amounted to £65bn equivalent to 17% UK's total trade (British Ports Association, 2008). The cruise liner sector has seen particular growth in recent years (British Ports Association, 2008). An annual average growth rate of 3-4% is expected in the container and Ro-Ro sectors (DfT, 2008) which is expected to benefit the whole spectrum of container ports, from major hub, through secondary hub, to short-sea and feeder ports (Tri Marine Research Group, 2004). However, trade was significantly affected by economic downturn and is only recovering slowly. In addition, the trend throughout the latter part of the 20th century through to the present has been one of increasing vessel capacity, e.g. over the last fifteen years or so the capacity of the largest container vessel in service has virtually doubled from around 4,500 teu (Twenty Foot Equivalent Unit) to 8,400 teu (Tri Marine Research Group, 2004).

Ports and shipping provide for the transport of freight and passengers that incorporates a mix of international movements and coastal shipping routes, including ferry services to the Scottish islands. Port movements are dominated in the east coast by the Forth Ports which, in tonnage terms, exceeds all the other east coast ports collectively. On the west coast, the Clyde ports volumetrically account for the most freight, although overall tonnage is approximately one third of the Forth Ports freight.

Cargo and passenger port traffic figures are published each year in Scottish Transport Statistics (Scottish Government, 2009) and Department for Transport (DfT) Maritime Statistics Compendium (DfT, 2010). In 2009, 85.5million tonnes of cargo was handled through all Scottish ports. This is a reduction of around 11% compared to 2008 and 21% compared to 2005 as a result of the general economic downturn. Approximately 98% of cargo was handled by the 16 major ports (96% by the top 11), with Firth of Forth ports accounting for 44%. Figure A4 identifies the location of the 16 major ports in Scotland.

Figures 15 to 18 show the breakdown of cargo tonnage in 2009 by main categories, tanker cargos, container ships, Roll on Roll off (Ro-Ros) and dry cargo, respectively.

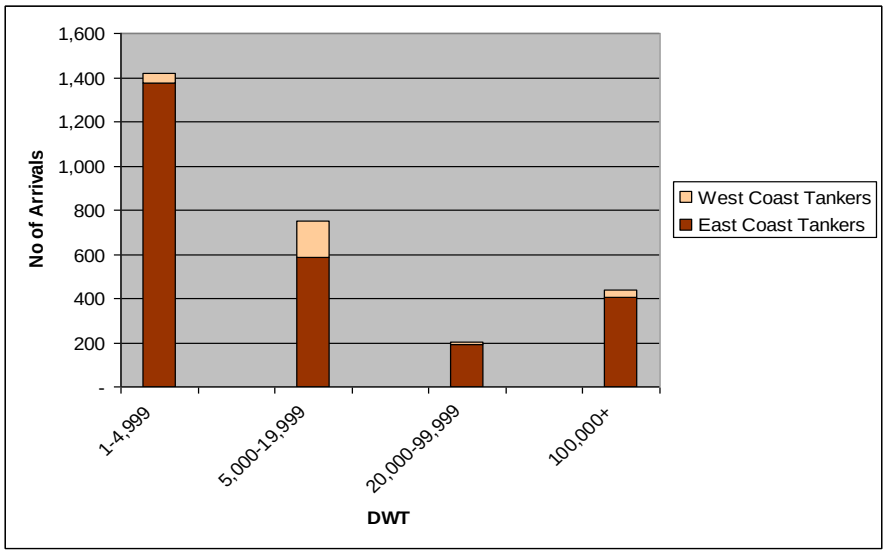



**Figure 15. Tanker arrivals Scottish East-West breakdown by deadweight tonnage (DWT): 2009**

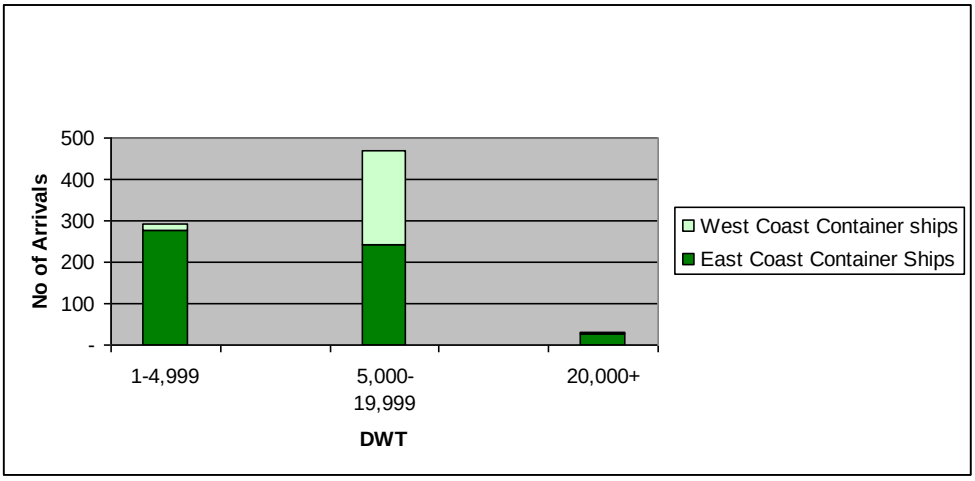



**Figure 16. Container ship arrivals Scottish East-West breakdown by deadweight tonnage (DWT): 2009**

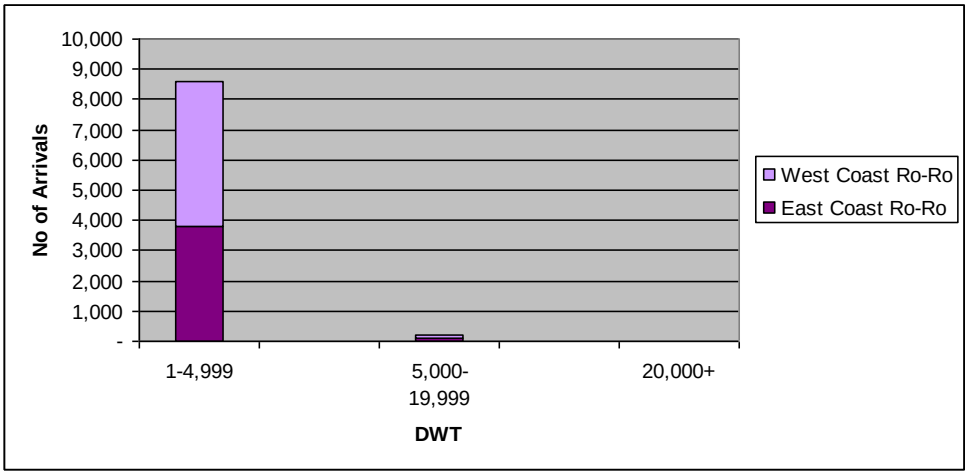



**Figure 17. Ro-Ro vessel arrivals Scottish East- West breakdown by deadweight tonnage (DWT): 2009**

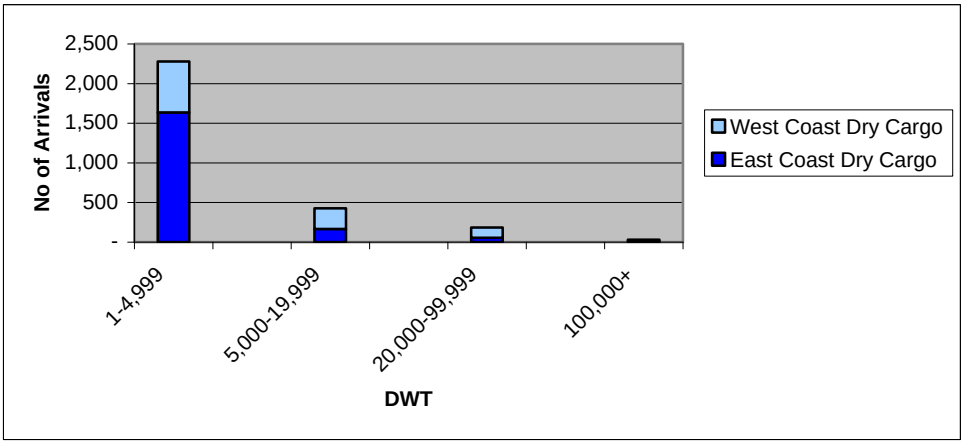
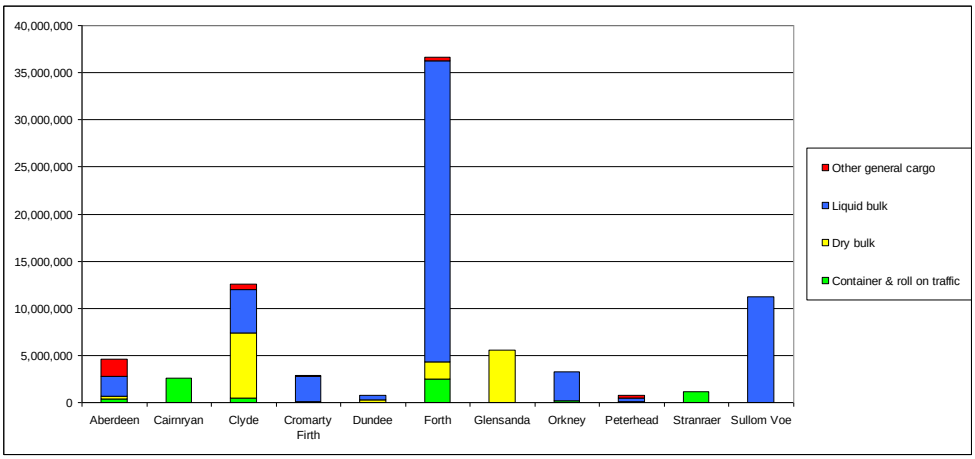



**Figure 18. Dry cargo arrivals Scottish East-West breakdown by deadweight tonnage (DWT): 2009**

Figures 15 to 18 indicate that East coast ports handle more cargo than the West coast with the exception of the Ro-Ro cargoes where the ferry services to Northern Ireland and the Western Isles account for most of the West coast traffic, particularly the services from Stranraer and Cairnryan. Figure 19 highlights the strategic importance of the Forth ports for tanker traffic and the Clyde for imports/exports on the West coast.




(Source: Scottish Government, 2011).

**Figure 19. Type of cargo at main Scottish ports in 2009**

### 3.4.1 North East Region

The principal ports in the North East Region comprise Aberdeen, Peterhead and Cromarty Firth (Figure A5). Aberdeen is the major supply base for the North Sea oil industry and supports around 11,000 people, a large number of which will are oil-related (British Ports Association, 2008). Cromarty Firth is also an important O&M base for the North Sea Oil Industry and accommodates the Nigg Oil Terminal which handles a significant oil cargo throughput as well as general bulk agricultural and timber cargoes (Figure 19). Peterhead is the UK's largest fishing port and is also a major oil industry support base.

Northlink Ferries services between Aberdeen and Lerwick and Kirkwall carry 140,000 passengers each year. This gives considerable economic and social benefits to both the port and harbour operators as well as the surrounding area, allowing for the movement of commercial traffic, local passenger traffic and growing numbers of tourists and visitors (British Ports Association, 2008).

Waypoint shipping data suggests that traffic to/from Cromarty/Inverness tends to follow the southern coast of the Moray Firth. The main north west/south east shipping route passes 10km to the north east of Beatrice. There were 52 cruise calls into Cromarty Firth in 2008 with a total of 48,100 passengers. This contributed significantly to the tourism economy of the Highlands. Following a slight dip in 2009, there were 52 scheduled visits for 2010 and a forecast of 61,000 passengers.

From Rattray Head at the southern entrance to the Moray Firth, the greater proportion of traffic routes to or from the south, either come from the south west up the coast from the Forth or from the south east direct from the North Sea production areas (Figure A5).

### 3.4.2 East Region

The Forth Estuary collectively handles some 39 million tonnes of cargo annually and includes the ports of Grangemouth, Burntisland, Methil, Leith and Rosyth. Grangemouth is Scotland's largest container port, handling 9 million tonnes of cargos annually, of which, 2.5 million tonnes is dry cargo representing incoming raw materials for Scottish industry and outgoing finished product[4]. The Port of Burntisland on the north side of the estuary is strategically placed to provide fast onward distribution of goods by road and rail and also provides support services to the North Sea oil industry. Wood pulp and timber account for most of the trade through Methil although other dry bulk goods including exports of stone and coal are handled through the port. Leith is the largest enclosed deepwater port in Scotland and has the capability to handle handymax (midrange bulk carrier) ships up to 50,000 DWT[5].

To the north in the Tay Estuary are the ports of Dundee and Perth. The Port of Dundee specialises in forest products, but also provides support facilities to offshore oil & gas and a terminal for a range of general and bulk cargoes. Perth handles a range of cargos including those related to agricultural interests, such as animal feedstuffs and fertilisers, timber, chemicals and barite ore.

Montrose handles imports and exports of forest products and various bulk, semi bulk, break bulk cargoes and containers.

Since 2002, Rosyth has provided regular ferry connections with Zeebrugge in Belgium which provides an important entry point for European freight carriers into the UK (British Ports Association, 2008).

The majority of the shipping traffic in the vicinity is inbound to/outbound from the Forth estuary with few passing vessels. The south routed traffic dominates, followed by the north route with the least traffic approaching/leaving from the east (Figure A6) Ships arriving from the south and departing to the south outnumber those to and from the north by 3:1 (Chamber of Shipping, 2010).

### 3.4.3 South West Region

Ships from the ferry terminals at Stranraer, Cairnryan and Troon regularly sail to Belfast and Larne in Northern Ireland, providing an important freight and passenger link. These services are economically significant to Scotland and the rest of the UK (British Ports Association, 2008). In 2009 Cairnryan handled 602,000 passenger movements, 154,000 accompanied passenger cars and shipped 200,000 freight units (DfT, 2010).

The port of Silloth on the south side of the Solway Firth principally handles agribulk cargoes and in particular is the main import route for Prime Molasses - a major UK supplier of molasses to the animal-feed industry. The port handles approximately 100 ship visits per year/a mix of

4 Forth Ports Plc. Website: http://www.forthports.co.uk/ports/ports/index.jsp [accessed 24 December 2010].
5 Forth Ports Plc. Website: http://www.forthports.co.uk/ports/ports/index.jsp [accessed 24 December 2010].

tankers for the molasses and dry bulk primarily importing fertilizer products. All visits to the port pick up a pilot a mile offshore from Workington and then follow the English coast up to the port (Chris Puxley, ABP Silloth, pers. comm. 7 Jan 2011).

The North Channel that passes between The Rhins and Mull of Gallway and Mull of Kintyre on the mainland and the coast of Northern Island provides a major conduit for Atlantic shipping and vessels travelling to and from UK west coast ports. High vessel densities (more than seven vessels per day) occur in parts of the North Channel, and the areas between Stranraer in Scotland and Larne and Belfast in Ireland. Most traffic passes to the west of the Isle of Man (Figure A7).

### 3.4.4 West Region

Clydeport handles approximately 13 million tonnes of freight per annum which is predominantly dry bulk and liquid bulk with small quantities of container traffic and general cargo (Figure 19). Glensanda port is dedicated to export granite from the adjacent quarry to destinations throughout northern Europe. Some 6million tonnes of granite are shipped annually placing Glensanda in the top 20 UK ports for export[6]. Oban just to the north of the West region, while not a large port, provides vital ferry and freight services to the Inner and Outer Hebrides operated principally by Caledonian Macbrayne ferries.

In addition to the port traffic the West region has a great deal of shipping activity including through traffic using the Irish Sea and the North Channel that includes both the transatlantic traffic to /from west coast UK ports and the north bound traffic that passes either through the Minch or the deep water route to the west of Lewis and Harris that is favoured by tankers Figure A8). Dry cargo vessels appear to take less distinct routes than tankers and make port calls throughout the west coast. Typically they tend to transit through the Minches, rather than using the deep water route to the west of the Western Isles (Faber Maunsell & Metoc plc, 2007).

Campbeltown is a busy fishing port and an important area for ship building. The port also provides ferry services to Ballycastle in Northern Ireland and Troon in South Ayrshire, Scotland. The port has been flagged in the NRIP as an important area for investment and development, in providing manufacturing facilities and a base for operation and maintenance to support offshore wind developments. As a consequence of its inclusion as an NRIP location the Argyll and Bute Council with ERDF support and in partnership with HIE plans to invest significantly in improved harbour and related infrastructure (Robert Pollock, Argyll and Bute Council, pers. comm. 8 Feb 2011).

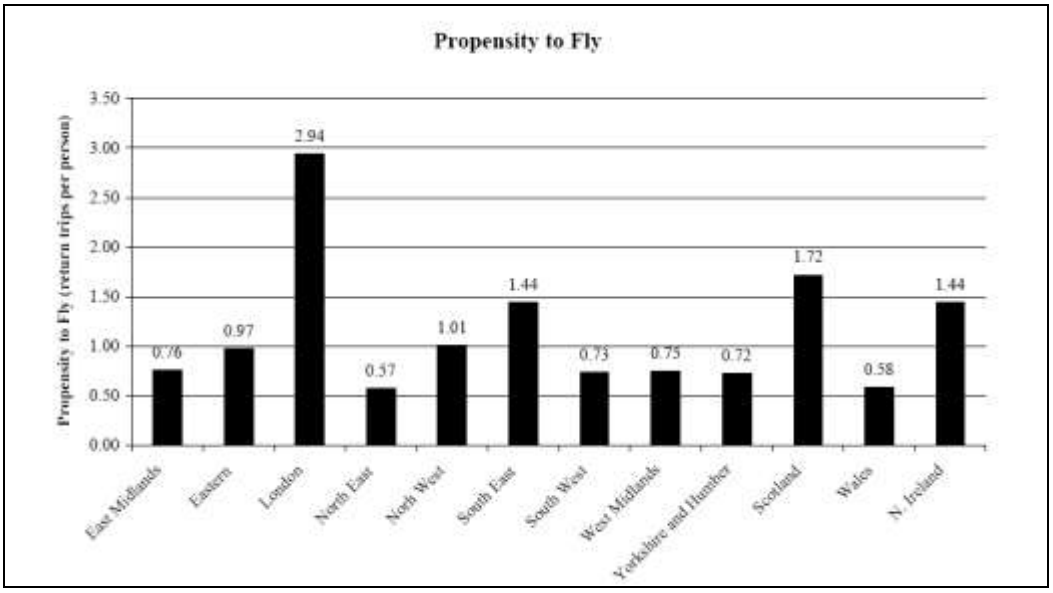
## 3.5 Aviation

Aviation interests encompass a range of activities and services that fall under both civil and military aviation. The baseline provides a brief overview of the interests and considers both the civil and military activity within each of the regions.

6 Ports and Harbours of the UK website: http://www.ports.org.uk/index.asp

For an economy on the geographic margins of Europe, good air transport linkages are vital for growth (DfT, 2002). Aviation forms a critical component of Scotland's economy, contributing to its independence as a nation by providing direct access to markets as well as providing lifeline services to otherwise inaccessible settlements throughout the mountainous and island terrain. The Scottish Government also acknowledges that good air links support Scotland's economy, including the tourism industry, and aims to encourage the development of direct routes to Scotland to foster inward investment and tourism (York Aviation, 2010).

The importance of air travel to Scotland can be illustrated by what is termed the 'propensity to fly' which measures the number of return air trips in an area per head of population (but includes trips made by out-of-area tourists and business people). Figure 20 shows that, apart from London, Scotland records the highest figure in the UK.




(Source: DfT , 2002)

**Figure 20. Propensity to fly**

Demand at UK airports is forecast to grow strongly (DfT, 2009). Under a central case passenger numbers are projected to increase from 241 million passengers per annum (mppa) in 2007 to 465mppa in 2030 (within the range 415-500mppa). In 2007, passenger throughput at Scottish airports was 25mppa (Scottish Air Transport Statistics). Assuming a pro-rata growth for Scotland, passenger traffic is forecast to increase steadily to 46mppa in 2030 (in the range of 41 to 50mppa).

Coastal aviation activity, particularly military aviation is concentrated in the East and North East regions, (Figure A9) although UK radar interference problems nationally are of greatest concern in the Glasgow area (Paul Askew, CAA, pers. comm. 20 Dec 2010).

Aviation statistics are published in Scottish Transport Statistics No.29 December 2010 (Scottish Government, 2010b). Passenger and freight movements through Scotland's four principal civilian airports are shown in Figures 21 and 22 respectively. Figure 23 provides summary information on passenger movements at minor Scottish airports.

Employment at Glasgow and Edinburgh airports in 2003 was about 7,250 staff on a Full Time Equivalent (FTE) basis. This is a small fraction of total employment in the central belt of Scotland, but with significance well beyond its absolute numbers. The Fraser of Allander Institute estimated that a further 15,000 jobs in the region are supported directly or indirectly by the two airports (The David Hume Institute, 2003).

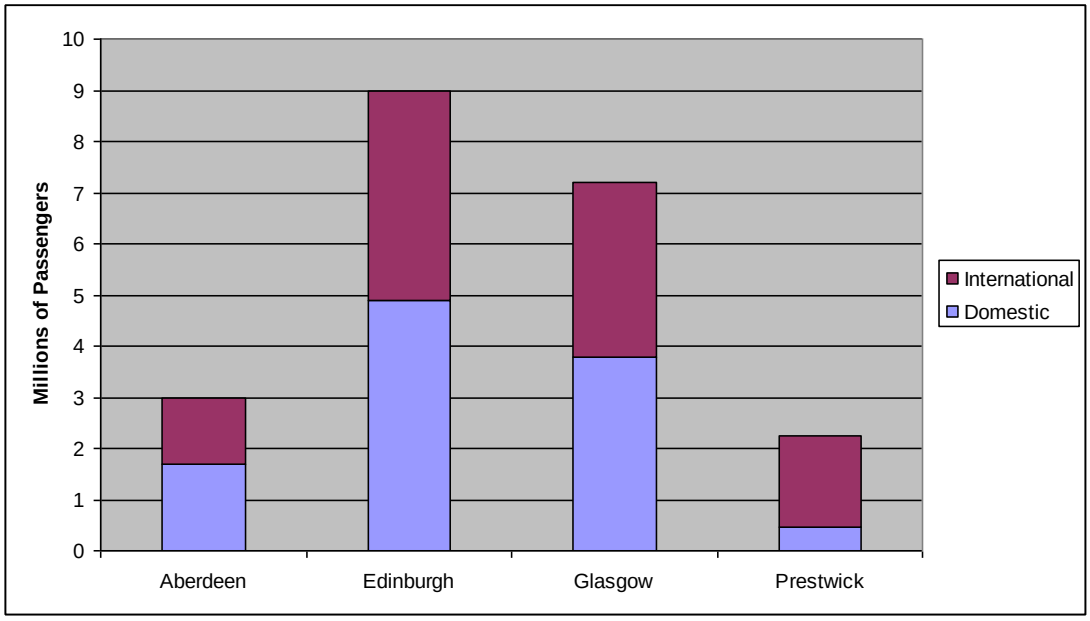
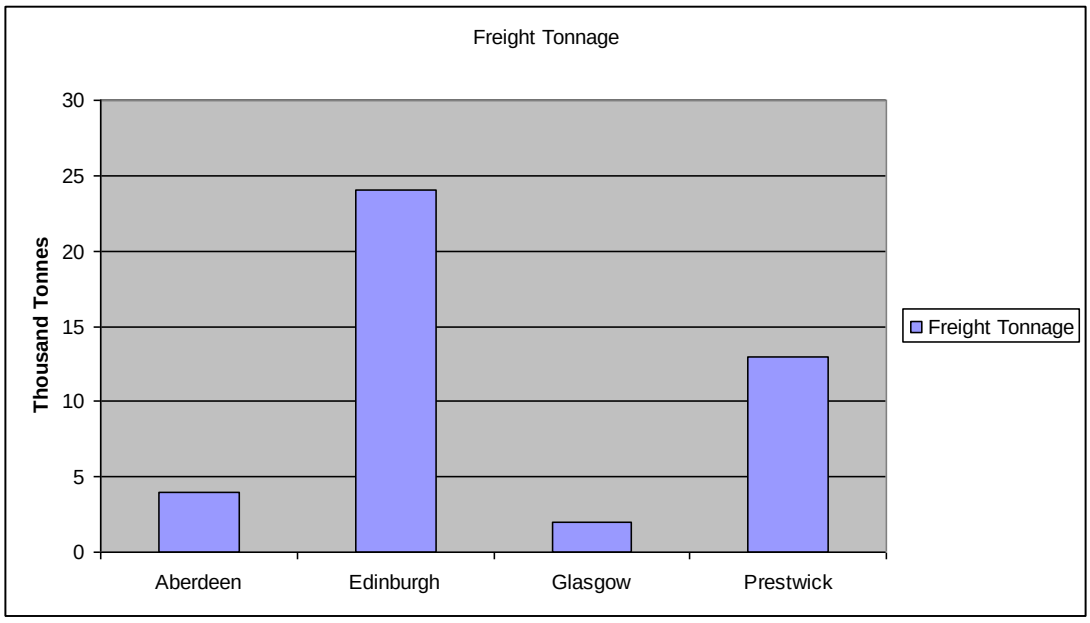
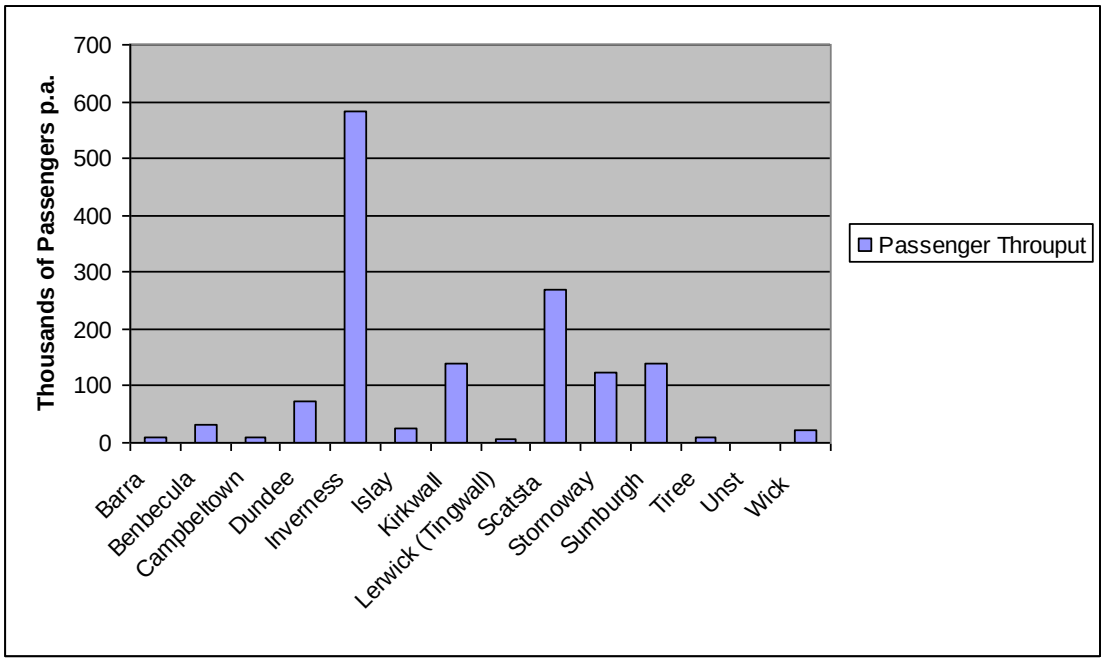



**Figure 21. Passenger movements through selected Scottish airports: 2009**




(Source: Scottish Government, 2010b)

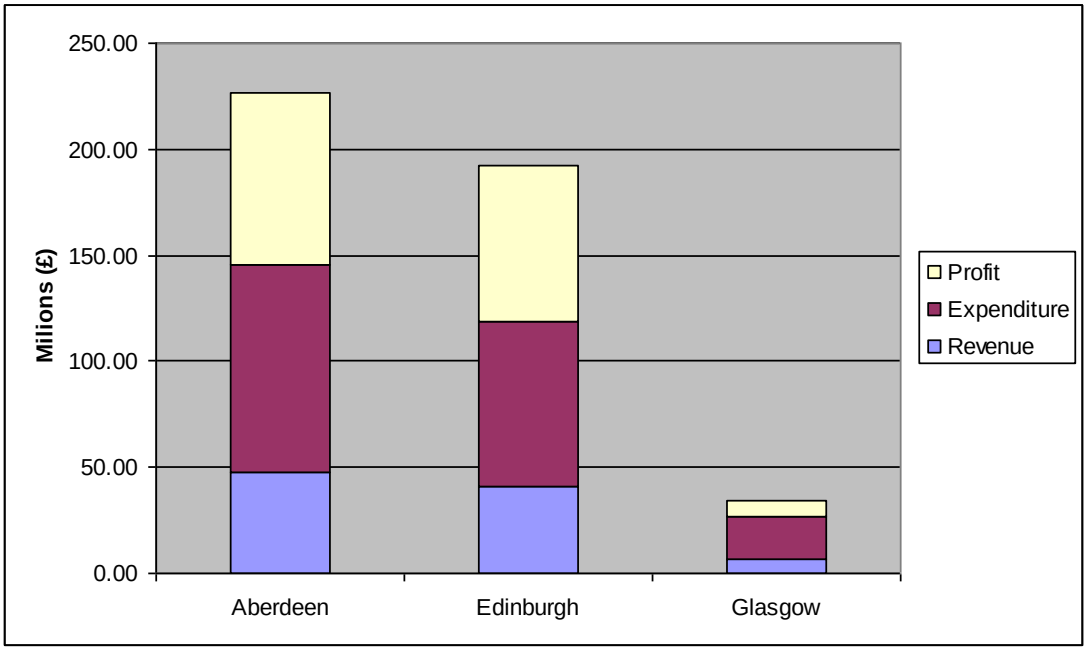
**Figure 22. Freight handled through selected Scottish airports: 2009**




(Source: Scottish Government, 2010b)

**Figure 23. Passenger movements through minor Scottish airports: 2009**

The breakdown of revenue and expenditure for Aberdeen, Edinburgh and Glasgow airports is shown in Figure 24. It can be seen that these airports currently operate at a profit.




(Source: Scottish Government, 2010b)

**Figure 24. Income and expenditure breakdown for major airports: 2009**

### 3.5.1 North East Region

#### 3.5.1.1 Civilian

The principal civilian airports are Inverness and Aberdeen; both airports offer a range of domestic services and international flights to a limited range of European destinations. In terms of passenger throughput, Aberdeen is Scotland's third largest airport, handling 3 million passengers per annum of which 1.7 million are on domestic flights (Figure 21). The Airport also provides links to a range of destinations (e.g. Bergen and Stavanger) owing to the City's position as a centre for the oil and gas industry. The airport is also the world's busiest commercial heliport: around 16% of passenger throughput in 2009 was carried on helicopter flights, which made up around 37% of air transport movements at the Airport (York Aviation, 2010). Passenger traffic at Aberdeen has grown by 13.3% over the past five years and its market share has increased from 11.7% to 13.3% (York Aviation, 2010). The airport has an exceptionally high proportion of business travellers (56%). For comparison, business passengers account for only around 30% of traffic at Edinburgh and Glasgow (York Aviation, 2010).

Aberdeen airport is a major generator of GVA and supports a significant number of jobs both in Aberdeen City and Shire and across Scotland. In 2009, the airport is estimated to support 2,050 full time equivalent (FTE) directly on-site, a further 320 FTE through direct off-site effects and a further 1,020 FTE in the City and Shire and 1,500 FTE across Scotland through indirect and induced impacts. In total, the airport contributes around £114 million of GVA in Aberdeen City and Shire and £126 million across Scotland. As an example, expenditure associated with visitors using Aberdeen in 2009 was around £51 million (York Aviation, 2010).

Wick civil airport lies to the north of North-East Region. Wick operates scheduled air services to Aberdeen, 3 times daily and to Edinburgh once a day. In addition, the North Sea Helicopter Advisory Route W4D (Aberdeen to Wick) also routes directly over the Moray Firth (ERM, 2010). The Beatrice Offshore Oil Platforms and the 6nm helicopter safeguarding zone around these platforms overlaps with part of the short term option area.

#### 3.5.1.2 Military

The Moray Firth exercise areas that are used by the RAF as low flying practice areas, firing and bombing ranges encompass the area occupied by the short term option.

RAF Kinloss that was home to the military reconnaissance Nimrod aircraft from the 1970s until 2010 is now due to close on 13 March 2011 following the Government's decision to cancel the Nimrod MRA4 programme[7]. The future for nearby RAF Lossiemouth also remains uncertain, although Air Chiefs have recommended retention of RAF Lossiemouth, if necessary at the expense of RAF Leuchars. Under this scenario, RAF Lossiemouth would remain as Scotland's only lasting operational RAF air base where the Typhoon fighter aircraft would be based[8]. RAF Tain is located just to the north of the head of the Moray Firth just to the west of Tarbat Ness. It

7 Royal Air Force RAF Kinloss Website: http://www.raf.mod.uk/rafkinloss/

8 Press Article dated 14 December 2010 on Scottish TV website: http://news.stv.tv/scotland/north/215639-reprieve-for-raf-lossiemouth-as-raf-leuchars-set-for-closure

is in routine use for practice weapons training by aircraft from RAF Lossiemouth to the south east.

### 3.5.2 East Region

#### 3.5.2.1 Civilian

Edinburgh airport is Scotland's busiest airport, handling 9 million passengers p.a., broadly similar to the combined throughput of Glasgow and Aberdeen. Of this figure, 4.9million are domestic passengers travelling to/from other UK destinations including the Scottish Islands. An extensive network of European flights operates from Edinburgh and additionally a small number of services to the Eastern seaboard of America. In 2005, the airport was estimated to contribute £300million to the Scottish economy (BAA Edinburgh, 2005). Development plans published in autumn 2009, suggest the airport has the potential to boost Scotland's economy by £867 million per year by 2030. The plans incorporate provision for a second parallel runway and extension of the terminal to accommodate an initial increase of passengers to a capacity of 13million passengers by 2013.

There are no existing promulgated helicopter routes local to the Forth where the short term options are concentrated (Marine Scotland, 2010c)

#### 3.5.2.2 Military

RAF Leuchars is currently a Forward Operating Base for the new fleet of Typhoons and as such will become a training facility for low flying aircraft. There are unconfirmed reports that the air base could close in favour of retaining RAF Lossiemouth (see above).

### 3.5.3 South West Region

#### 3.5.3.1 Civilian

There are no major airports in the south west region. The short term options lie over 80km from Douglas Airport and Prestwick. Aviation traffic is essentially through traffic and there is likely to be little interaction between aviation traffic and short term options, with the possible exception of any effects upon en route radar tracking.

#### 3.5.3.2 Military

Military interests in the south west region include:

- An Air Traffic Radar facility at West Freugh former RAF station;
- Luce Bay Gunnery and Bombing Range (currently protected by Bylaw but under review);
- Kirkcudbright; Training Area on the north coast of the Solway Firth providing field fire and dry training exercise; and
- Portpatrick port.

Of these, only the first two are of direct relevance to the short term wind farm developments in the south west and the former has been identified as a potential concern in relation to potential short term options.

### 3.5.4 West Region

#### 3.5.4.1 Civilian

The principal civilian airport on the west coast is Glasgow International that operates an extensive range of domestic flights as well as international flights to a wide range of European destinations with some long haul flights, in particular to the American eastern seaboard and Caribbean. The airport handled 7.2 million passengers in 2009 of which 3.8million were domestic.

A study by the Fraser of Allander Institute found that in 2002, Glasgow Airport supported 15,700 jobs across Scotland, with more than 5,000 people directly employed at the airport. The report also found that the airport's contribution to the Scottish economy is more than £700million p.a. (BAA Glasgow, 2006). The Glasgow Airport Master Plan provides for forecast increases in numbers of passengers from 8.8 million p.a. in 2006 to 13 million p.a. by 2015 with £290million of investment over 10 years. Direct airport employment is forecast to increase to 8,200 by 2015, and to 12,100 by 2030, attracting further inward investment into the region (BAA, 2006).

Prestwick airport international traffic is limited to European destinations. The airport handles a significant volume of airfreight, 13,000 tonnes p.a. although this has reduced significantly from a 2003 peak of 40,000 tonnes. The throughput of passengers at Prestwick is nearly 2.3 million p.a., most of which are on domestic flights (Figure 21).

An assessment of economic impact of Glasgow Prestwick Airport based upon previous passenger surveys the report estimates that around 580,000 visitors who travelled to Scotland through Glasgow Prestwick Airport in 2006/07 spent approximately £173 million. The figure includes an allowance for the multiplier or knock-on effects through the rest of the economy. This is equivalent to 4% of the total tourism expenditure in Scotland (£4.1 billion). In Ayrshire expenditure by passengers using Glasgow Prestwick Airport (visitors and outbound Scottish residents) is around £40 million, equivalent to a fifth of the total expenditure made by overnight tourists in Ayrshire and Arran (£204 million) (SQW, 2008).

In addition, there are smaller airports at Tiree, Islay, Campbeltown, Oban, Coll, Colonsay, all with scheduled flights.

The Highlands and Islands Airports Ltd. (HIAL) Campbeltown airport offers a twice daily scheduled service to Glasgow airport. The airport handles around 9000 passengers per annum. (Anne Phillips, HIAL, pers. comm. 10 Jan. 2011).

#### 3.5.4.2 Military

HMS Gannet is located at the north side of Glasgow Prestwick Airport and operates 3 Sea King helicopters in a Search and Rescue capacity. There are no other military air bases on the west coast.

## 3.6 Wave and Tidal Energy Development

The UK is currently leading the world in the wave and tidal energy industry, with the world's first commercial scale wave device, established testing facilities and awarded project development leases (RenewableUK, 2010).

The European Marine Energy Centre (EMEC) testing facilities for both wave and tidal devices are present on the coast of Orkney within the OWE Plan North Region. In 2010, The Crown Estate awarded 11 lease agreements to marine energy developers in the Pentland Firth & Orkney waters. Eleven agreements were signed for 6 wave and 5 tidal projects with a potential to generate 1.6 GW of marine energy. Marine Scotland also published Regional Locational Guidance (Harrald *et al*, 2010) under The Saltire Prize Programme, which identified the 5 least sensitive areas for wave and tidal developments. Two wave interest areas are present within the North region, one wave interest area is in the North West region and two areas of tidal interest are within the West Region. The Crown Estate announced a Further Scottish Leasing Round for wave and tidal energy generation in September 2010 using the Regional Locational Guidance as a guide for developers in submitting lease applications. This Further Scottish Leasing Round also invited applications for the rest of Scottish territorial waters and did not include the existing Pentland Firth & Orkney Waters Strategic Leasing Area.

### 3.6.1 Wave Energy Resources

There is a large potential wave energy resource within Scottish waters (ABPmer, 2008). In particular, the North West and North OWE Plan Regions all have large wave energy resources. The proposed interest areas for wave energy in relation to the Saltire Prize are shown in Figure A10.

The world's first commercial size wave energy device, Limpet (Land Installed Marine Powered Energy Transformer), was installed near Portnahaven on the coastline of Islay in 2000. Limpet is a shoreline device which uses the principle of an oscillating water column. The outputs from the Limpet device are supplied to the local community but are limited by grid infrastructure at 150kW. Although this maximum output has been reached on occasion, the annual average performance is around 20kW (Wavegen, 2002).

Due to the economic viability of converting wave energy resources, there are no currently proposed wave developments within the West Region. Wave resources in South West, North East and East Region are lower compared to the West and North coasts and development in these areas is unlikely to be viable in the short and medium term.

### 3.6.2 Tidal Stream Energy Resources

Scottish territorial waters provide some of the best and most extensive tidal stream resources in the world. As with wave energy, most of the resource is located in North and West Scotland with few if any commercially exploitable resources elsewhere. The two areas of tidal future interest (Southwest of Islay and Mull of Kintyre) are located within the West Region (Figure A10). Southwest of Islay covers 646km$^2$ off the coast of the Rinns of Islay and the Oa

peninsular, where high offshore tidal velocities and large spring tides exist generating an estimated annual mean resource of up to 5.9kW/m.

ScottishPower Renewables is proposing to develop a Demonstration Tidal Site in the Sound of Islay with the intention of deploying ten pre-commercial submerged tidal stream-generating devices by 2012. The proposed site would have an output capacity of up to 10MW of renewable power for export to the grid (ScottishPower Renewables, 2010). Mull of Kintyre covers 141km$^2$ southwest of the Kintyre peninsular, the site experiences a maximum mean tidal flow of between 3m/s (spring) and 1.5m/s (neap). The site is estimated to have an annual mean tidal resource of up to 3.1kW/m (Harrald *et al*, 2010). Both of these sites have the potential to interact with offshore wind development in West Region.

The current energy generation capacity outputs from wave and tidal technologies are less than 1% of the whole Scottish renewable energy market outputs, whereas wind (on and offshore) supplies more than 50% of the outputs (Table 6).

**Table 6. Scottish renewable energy generation capacity (17 December 2010)**

| Sector | Output (MW) |
|---|---|
| Wind (on and offshore) | 2,550.06 |
| Hydro | 1,395.06 |
| Energy from Waste | 99.68 |
| Biomass Electricity | 88.09 |
| Biomass Heat | 206.29 |
| Wave | 1.6 |
| Tidal | 1.25 |
| **Total** | **4342.03** |

(Source: Scottish Renewables website)

It is estimated that Scotland has the potential to deliver about 33GW of energy from wave and tidal resources[9] (Scottish Renewables Website) However both technologies are in the early stages of development and currently large scale developments face a number of challenges if they are to reach the stage at which projects can be commercially viable (RenewableUK, 2010). Although it remains possible that there will be future spatial conflict between OWE development and other marine renewables, it remains premature to assess the extent of such conflict. It is recommended that these interactions, along with the potential for cumulative effects from offshore wind and wave and tidal technologies on other marine users, continue to be monitored and assessed in the future.

## 3.7 Cables and Pipelines

The seabed provides important physical space for telecom cables as part of national and international data transfer networks. Similarly a number of power cables cross the sea bed to provide electricity to island communities or offshore oil platforms. Offshore wind farm development will also lead to a proliferation of power cables on the seabed. A number of pipelines also serve the offshore oil & gas industry.

9 Scottish Renewables Website: http://www.scottishrenewables.com/technologies/marine/

Figure A11 illustrates the distribution of cables and pipelines throughout the Plan area in relation to the short term options. Cables include HVDC power cables and telecommunication cables. The majority of pipelines are situated in the North East Region off Aberdeen where they service the offshore oil industry. A pipeline runs to the Beatrice oil field just southwest of the proposed Beatrice offshore wind farm.

There are two gas pipelines in the south-west that connect the Republic of Ireland and the Isle of Man to sources in Scotland. Both pipelines are owned by Bord Gáis Éireann (English: Irish Gas Board). Interconnector 1 and 2 run from Moffat and Beattock in central Dumfries and Galloway, through the Wigtown Bay area on the coast and on respectively to Loughshinny, North County Dublin and Gormanstown, County Meath in the Republic of Ireland. A spur off Interconnector 2 provides a link to the Isle of Man.

Further north, Northern Ireland is connected to the national natural gas supply by the 'East-West' interconnector, otherwise known as the Scotland to Northern Ireland Pipeline, which crosses the Irish Sea from the Rhinns of Galloway in Scotland to Island Magee. These pipelines are vital links for Northern Ireland, the Republic of Ireland and Isle of Man.

Future developments in telecom cables are likely to focus on upgrading and increasing the capacity of existing cables along the same routes at present. The future of power cable development is more uncertain but most developments are likely to be related to increased cables for renewable energy developments.

## 3.8 Recreational Boating

For the purpose of this study, recreational boating has been considered to include sailing, powerboating and motorboat/cruising. Where any other boating activity has been included, this is highlighted within the report.

The Scottish Coast, and particularly the West coast, is identified as being one of the World's premier destinations for sailing. Recreational boating and marine and sailing tourism contribute about £300 million to the Scottish economy [10]. Overall, the sector is expected to grow in the long term (UKMMAS, 2010).

The UK Atlas of Recreational Boating (RYA, 2005) and data from the Royal Yachting Association (RYA) indicates that, within the current study area, sailing is concentrated around the Moray Firth, Solway Firth and the Firths of Clyde, Tay and Forth, with lesser sailing activity elsewhere (cited in Marine Scotland, 2010a). The main cruising routes and areas of greatest sailing and racing use are described in further detail for each region below[11]. The RYA's

[10] Cited in the RYA Scotland's and the SBA's Offshore Wind SEA consultation responses. This value was based on a report by Scottish Enterprise (2006) (Mike Balmforth, SBA, pers. comm. 18 Jan 2011). This report estimated that the annual economic impact of the marine leisure industry in Scotland was £250 million, supporting around 7,000 jobs.

[11] The cruising routes shown in the RYA Atlas give the typical routes followed by recreational sailors at the present time. Routes may change in future due to new developments (e.g. marinas), changes in wind patterns or increased shipping traffic (Graham Russell, RYA Scotland, pers. comm. 18 Jan 2011)

Position Statement on offshore energy developments (RYA, 2009), which encompasses the whole of the UK, notes that most of the general day sailing and racing areas are close to the shore.

Indicative estimates of the number of people participating in sailing and power/motor boating activities in Scotland can be taken from the British Marine Federation (BMF) Watersports and Leisure Participation Survey 2009 (BMF, 2009). This report estimated that in 2009, 57,047 people participated in sailboat activities and/or yacht cruising, 12,486 participated in sailboat and/or yacht racing and that 49,015 engaged in motor boating/ cruising or canal boating in the Border and Scotland ITV regions[12].

In Scotland, the BMF estimates that in 2009/10 the total turnover of the leisure, super yacht and small commercial marine industry (which includes a wide range of waterborne recreational pursuits as well as boat building, specialised equipment manufacture, sales, training, insurance services and finance) was £92.7million (BMF, 2010). Of this, the 'value added contribution' which is the principal measure of national economic benefit was £29.2million. The industry in Scotland supported around 1,579 FTE jobs. It should be noted that a proportion of this revenue comes from inland activities. UKMMAS (2010) estimated that 62% of the total value in 2006/07 related to the marine environment. Using the same proportion, the total value related to the marine environment in 2009/10 was £57.5million.

An assessment of the current economic impact of sailing in Scotland was undertaken by Scottish Enterprise & Tourism Resources Company (2010) and a summary is shown below in Table 7. The study indicated that there is a total berthing/mooring capacity available across Scotland for 12,500 vessels. The study stated that the value of the market could increase from its current value of £101 million to £145 million after 10 years. The same report also provided a breakdown of the economic value of sailing and the number of berths in different regions of Scotland and these results are described in each of the relevant regional sections below.

**Table 7. Economic impact of sailing in Scotland**

| Activity | Total Activity (by Scottish and Non-Scottish Boat Owners) | Tourist Activity (by Non-Scottish Boat Owners Only) |
|---|---|---|
| Expenditure | £101.3million | £27.0 million |
| Employment (FTEs) | 2,732 | 724 |
| GVA | £53.0million | £14.0million |

(Source: Scottish Enterprise & Tourism Resources Company, 2010)

A survey undertaken by Land Use Consultants (2006) to estimate expenditure on specialist marine and coastal activities in Scotland showed that the average amount individuals spent per annum on sailing was £924 (73 respondents, total expenditure of all respondents £67,482) and on speed boating was £558 per annum (17 respondents, total expenditure of all respondents £9,485).

[12] The Border and Scotland ITV Regions comprise the Grampian, Scottish and Border ITV Regions. Grampian Television covers the North and North East of Scotland, Scottish Television covers Central Scotland and Border Television covers the Dumfries and Galloway region, part of the south west area of Ayrshire, the Scottish Borders but also parts of Northumbria and most of Cumbria in England.

### 3.8.1 North East and East Regions

Sailing activity in the East Region is shown in Figure A12. Sailing and racing areas occur in the Firth of Tay and Firth of Forth and along the southern section of coastline in this region. Recreational use is centred on the Firth of Forth, Firth of Tay and St Andrew's Bay (Marine Scotland, 2010a), with moderate use cruising routes extending up and down the coastline from these areas. Recreational boating on the East Coast of Scotland is increasingly making a contribution to local economies where former fishing harbours are being turned into marinas (Graham Russell, RYA Scotland, pers. comm. 18 Jan 2011).

Sailing activity in the North East Region is shown in Figure A13. Recreational use here is centred on the inner Moray Firth which is an important area for recreational sailing (ERM, 2010). Figure A13 shows that moderate use cruising routes connect the sailing areas in the Moray Firth with marinas in the northern part of this region. One moderate usage and one light usage cruising route pass through the short term option area whilst another medium usage cruising route passes close to the south west corner of the area.

An indicative estimate of the economic impact of sailing in these two regions is provided by the Scottish Enterprise & Tourism Resources Company (2010) and shown in Table 8 below.

**Table 8. Sailing area values and berth numbers**

| Sailing Tourism Study Region | Scottish Sea Areas Included | Relevant OWE Plan Region* | Value (£million) | Number of Pontoons | Number of Moorings |
|---|---|---|---|---|---|
| North (Gairloch-Helmsdale-Peterhead, Orkney & Shetland) | North Scotland Coast<br>West Shetland<br>East Shetland<br>Moray Firth | Part of North East Helmsdale-Peterhead) | 10.1 | 1,792 | 224 |
| East (Peterhead-Fife Ness-Berwick) | East Scotland Coast<br>Forth | Part of East and North-East | 7.9 | 1067 | 480 |

(Source: Scottish Enterprise & Tourism Resources Company 2010, summarised in Scottish Government, 2011)

### 3.8.2 West and South West Regions

The West of Scotland is an internationally important yachting destination (RYA Scotland consultation response). Scottish Government (2011) describes the distribution of sailing as being concentrated in the 'Clyde region' (comprising the Clyde Estuary and Solway) and along the west coast (comprising parts of the West and North West OWE Plan Regions) where the RYA Atlas of recreational boating indicates there are heavy recreational cruising routes[13] and several 200+ berth marinas.

Sailing activity in the West Region is shown in Figure A14. The figure highlights that recreational use is most concentrated near the west coast within the sounds of the Inner

[13] Heavy use = 6 or more recreational craft may be seen at all times during summer/daylight hours. Includes entrances to harbours, anchorages and places of rescue; Moderate use = popular – some recreational craft will be seen at most times during summer daylight hours; Light use = routes known to be commonly used. (Source: RYA, 2005).

Hebrides. Heavy recreational use is made of the Sound of Mull, the Firth of Lorne, the north of the Sound of Jura and the Crinan Canal. Heavy use is also made of cruising routes in the Sound of Luing, Seil Sound, Shuna Sound and Loch Melfort and of a route from the Crinan Canal, south through Loch Fyne and the Firth of Clyde via the Kyles of Bute and south of the Isle of Bute. Heavy usage cruising routes also exist between Arran and the mainland (Marine Scotland, 2010a). Light and medium usage cruising routes connect these heavy routes with the Inner and Outer Hebrides (note the latter falls within the North West OWE Plan Region).

Light usage cruising routes are present off Tiree and a 'light' route from the Firth of Lorne to the coast of Tiree north of Hynish (Figure A14). Another 'light' route exists from near Kintra on Mull through the Sound of Gunna (Scottish Power Renewables, 2010). A light usage route passes off of Islay and medium usage routes off the Kintyre coast and around the Mull of Kintyre. It should be noted that the RYA UK Recreational Boating Atlas highlights the fact that many lightly used routes are the only routes available and therefore have considerable local importance

Sailing activity in the South West Region is shown in Figure A15. The figure highlights that sailing areas occur along virtually the whole of the coastline in this region. There are a large number of medium usage routes within the Solway Firth and the North Channel and several routes intersect short term development option areas.

Marine-related leisure and recreation make a particular contribution to the Scottish rural economy on the west coast and the Hebrides. An indicative estimate of the economic impact of sailing in these two regions is provided by the Scottish Enterprise & Tourism Resources Company (2010) and shown in Table 9 below. It must be noted that these values are only indicative as the sailing tourism study regions reported, which are considered to reflect the geography of the main 'sub-national' sailing economies in Scotland, do not align with the OWE Plan regions and tend to span various parts of several of the OWE Plan Regions.

**Table 9. Sailing area values and berth numbers for Clyde and the West**

| Sailing Tourism Study Region | Scottish Sea Areas Included | Relevant OWE Plan Region* | Value (£million) | Number of Pontoons | Number of Moorings |
|---|---|---|---|---|---|
| Clyde (Clyde Estuary & Solway) | Clyde<br>Irish Sea | Mainly South-West but part of West region | 44 | 3333 | 2038 |
| West (Argyll, Ardnamurchan-Gairloch & Outer Hebrides) | Minches & Malin sea Hebrides | Part of West and North West regions | 39 | 1030 | 2637 |
| * OWE Plan regions partially or fully included in the sailing tourism study region. | | | | | |

(Source: Scottish Enterprise & Tourism Resources Company 2010, summarised in Scottish Government, 2011)

The geographic profiling clearly indicates the clustering and concentration of facilities on the Clyde and on the West Coast when compared to the North and East coasts.

## 3.9 Recreational Angling

Sea angling is carried out along most of the Scottish coastline mostly within 6nm (The Scottish Sea Angling Conservation Network (SSACN)[14].

Radford *et al* (2009) estimated that 125,188 adults and 23,445 children went sea angling in Scotland in 2008 with a total expenditure of £141 million. Sea angling in Scotland supported 3148 FTE jobs in 2008, representing an income of £69.67million[15] (Radford *et al*., 2009). The same study estimated that if sea angling ceased to exist, 1675 FTEs with an income of £37 million would be lost (cited in UKMMAS, 2010). A review of the economic valuation of sea angling (Defra, 2004) suggested there was a stable or increasing demand for sea angling with increasing use of charter and private boats. Radford and Riddington (2004) estimated the economic contribution of Scotland's salmon and sea trout game angling to be £85.6m. A survey undertaken by Land Use Consultants (2006) to estimate expenditure on specialist marine and coastal activities in Scotland showed that the average amount individuals spent on sea angling was £1,375 per annum (96 respondents, total expenditure of all respondents £131,960) and on shore angling was £861 per annum (82 respondents, total expenditure of all respondents £70,575).

Figure A16 shows the levels of sea angler participation levels within each of the four OWE Plan regions, highlighting that sea angling activity is highest in the West and East OWE Plan regions.

There is little information on the future of the industry, however, if we assume that commercial fisheries are improved under Common Fisheries Policy measures and that water quality will improve under measures implemented under the Water Framework Directive and those likely to implemented under the Marine Strategy Framework Directive, then recreational angling is likely to improve as well. Forecasts for general tourism also indicate an improvement due to increased temperatures, although climate change may have unforeseen consequences for fish stocks.

### 3.9.1 North East and East Regions

Radford *et al* (2009) estimated the sea angling activity and economic value in eight regions of Scotland. Two of these regions, Edinburgh and East and North East Scotland fall within the OWE Plan East and North East Regions. As the areas in Radford *et al* (2009) do not align with the OWE Plan regions the values should only be taken as indicative values for comparison between areas.

14 The Scottish Sea Angling Conservation Network's (SSACN) Offshore Wind SEA consultation response, available on the Scottish Government website: http://www.scotland.gov.uk/Publications/2010/11/03131226/0

15 The authors highlighted that the jobs and incomes supported by sea angling in Scotland were estimated using a model of the Scottish economy and not by summing the totals for each region. Hence there was a slight difference between the Scottish totals and the sum of the regional values (discussed later in the text of this report) even though conceptually they should have been identical.

Along the East Coast, sea angling charter vessels operate out of Arbroath and to a lesser extent Stonehaven, although shore angling here is relatively more popular than sea angling (Radford *et al*, 2009).

The total estimated regional sea angling activity and expenditure within these two regions is shown in Table 10 below.

**Table 10. Estimated regional sea angling activity and expenditure**

| Region | No. Resident Sea Anglers | Annual Sea Angler Days Spent in Region | % of Total Activity Undertaken on the Shore | Total Annual Sea Angler Expenditure (£M) | % of Expenditure Spent on Shore Angling | Number of Jobs Supported |
|---|---|---|---|---|---|---|
| Edinburgh, Fife & South East | 20455 | 250868 | 50% | 26.9 | 51% | 504 |
| North East Scotland | 8904 | 234307 | 55% | 15.5 | 57% | 343 |

(Source: Radford *et al*, 2009)

As can be seen, Edinburgh, Fife and the South East Region had the greatest total expenditure on sea angling (approx £26.9 million) compared to other regions.

### 3.9.2 South West Region

The SSACN's Offshore Wind SEA consultation response stated that the Solway Firth in the south-west is used extensively for sea angling, particularly charter fishing. The Dumfries and Galloway region, particularly Luce Bay and the Mull of Galloway, have relatively sheltered waters, good shore access and a variety and reasonable abundance of sea fish. It therefore supports shore, own boat and chartered sea angling.

The majority of the people undertaking sea angling in this region (79%) are visitors from the rest of the UK (Radford *et al* 2009), who provide an important source of income for the local economy. SSACN estimate that sea angling is worth about £25million per year to the Solway area (Steve Bastiman, SSACN, pers. comm. 11 Jan 2011).

With respect to specialist and competition anglers, Scotland offers the prospect of catching tope in Luce Bay. Tope are worth about £10 million per year to several communities in Dumfries and Galloway (UKMMAS, 2010). An annual shark 'tagging' event held over one weekend in mid June in this region was attended by about 220 sea anglers in 2010. A survey requesting information on the expenditure of the participants showed that this event attracted between £40-£50,000 into the local economy via expenditure on bait, food, drink, boat hire etc (Steve Bastiman, SSACN, pers. comm. 11 Jan 2011)

The total estimated sea angling activity, expenditure, number of jobs supported and associated income from sea angling in the Dumfries and Galloway regions (geographically defined as the Local Authority area of the same name; which falls within the OWE Plan South West region) was as follows:

- Number of resident sea anglers = 3,224;
- Annual sea angler days spent in region = 233,080;
- 49% of the total sea angling activity was shore angling, while boat and charter activity comprised 32% and 19% of the total respectively;
- Total annual sea angler expenditure = £25.3million;
- 47% of the total expenditure was spent on shore angling; and
- Jobs supported = 534.

### 3.9.3 West Region

The SSACN's Offshore Wind SEA consultation response stated that Loch Etive and Sunart and Clyde are regions that are used extensively for sea angling. Although the Firth of Clyde has relatively poor fish stocks and is not capable of supporting regular sea angling charter activity, the local population size means there are reasonable numbers of local shore anglers who rely heavily on seasonal fish stocks such as mackerel. Own boat and charter boat angling is popular at other locations on the West Coast where there are a number of excellent sheltered lochs enabling safe comfortable fishing (Radford *et al*, 2009). The Firth of Lorne and the Sound of Mull have become the centre for common skate angling contributing over £15 million per year to the local economy. Lochs Sunart and Etive attract vast numbers of shore and boat anglers seeking spurdog, and this fishery is estimated to be worth £15 million per year (UKMMAS, 2010). The SSACN hold two shark/ray/skate tagging events per year in this region and estimate that the event held in November 2010 attracted £28,000 into the local economy from sea anglers (Steve Bastiman, SSACN, pers. comm. 11 Jan 2011).

Radford *et al* (2009) estimated the sea angling activity and economic value in eight regions of Scotland. Two of these regions, Argyll and Lochaber and Glasgow and West, fall roughly within the OWE Plan West region, but also incorporates the southern part of the OWE Plan North West Region, hence the values may result in a slight overestimate of economic contribution.

The total estimated regional sea angling activity and expenditure within these two regions is shown in Table 11. Compared to other regions in the Radford *et al* (2009) study, Glasgow and the West had the greatest number of adult resident sea anglers (23,548) and the greatest number of angler days (269,783).

**Table 11. Estimated regional sea angling activity and expenditure**

| Region | No. Resident Sea Anglers | Annual Sea Angler Days Spent in Region | % of total Activity Undertaken on the Shore | Total Annual Sea Angler Expenditure (£M) | % of total Expenditure Spent on Shore Angling | Number of Jobs Supported |
|---|---|---|---|---|---|---|
| Argyll and Lochaber | 5825 | 252615 | 47% | 22.6 | 40% | 524 |
| Glasgow and west | 23548 | 269783 | 38% | 24.1 | 36% | 523 |

(Source: Radford *et al*, 2009)

## 3.10 Surfing, Windsurfing and Kayaking

Indicative estimates of the number of people participating in surfboarding and windsurfing in Scotland can be taken from the BMF Watersports and Leisure Participation Survey 2009 (BMF,

2009). This report estimated that 52,869 adults (> 16 years) participated in surfing, 23,952 adults participated in windsurfing and 37,416 participated in canoeing in the Border and Scotland ITV regions[16].

Separately, Surfers Against Sewage (SAS; 2010) conducted an initial study into the number of recreational water users in Scotland in 2010 and estimated that there were approximately 300,000 recreational water users (which includes surfers, windsurfers, kayakers, and kite surfers amongst a range of other activities) using the coastal waters of Scotland.

There is limited data concerning the expenditure of surfing-related tourism in the UK (SAS, 2009) and currently no specific economic data on the value of surfing, windsurfing or kayaking to the Scottish economy (within the current study area) has been sourced. At a UK level the economic value of the surf industry was estimated at £200 million in 2007 (UKMMAS 2010). The total number of people participating in surfing in the UK in 2009 was estimated to be 645,827 (BMF, 2009). If it is assumed that the Scottish value is pro rata to the estimated number of individuals engaging in surfing activity in Scotland, this would give a Scottish value of around £16.4m p.a.

The majority of surfing competitions held in Scottish waters are based at Thurso East in the North region. This surf spot is considered Scotland's prime surfing location and holds the O'Neill Cold Water Classic annually and has also held the Association of Surfing Professionals (ASP), World Qualifying Series (WQS) in 2006. The other major location in Scotland for surf competitions is at Fraserburgh, the details of which are discussed further in the North East section. No information was sourced relating to the economic value of these events, but for comparison, the 2001 Newquay Board Masters Tournament was estimated to be worth £17 million to the local economy (Arup, 2001). The UK's main windsurfing competition is held annually at Tiree (the Tiree International Wave Classic) which is discussed further in the West section.

### 3.10.1 North East Region

Surfing is popular on the south side of the Moray Firth but is rarely undertaken around the vicinity of the Beatrice array in beaches along the northern Moray Firth (SAS, 2010). Figure A17 shows the surf beach locations in this region identified in Scottish Government (2011) although it should be noted that the locations along the north coast of Scotland and Orkney (where some of the UK's best surf breaks are situated; SAS, 2009) fall outside of the North East Region. This figure highlights that the closest surf beaches to the short term option area are in the vicinity of the villages of Keiss, Reiss and Ackergill (for surf locations see Table 12 below). The SAS (2009) report shows about 24 surfing locations occur within the OWE Plan North East Region and these are listed in Table 12 below. Fraserburgh is a particularly popular surfing location in this area and regularly holds surf competitions and events such as the UK Surf Tour and Fraserburgh Surf Festival. A survey conducted by Event Scotland predicted the

[16] Some of these activities are carried out inland as well as at the coast. Table 44 in the BMF (2009) study indicates what proportion of each activity is actually carried out at the coast and this information was used to adjust overall totals.

Fraserburgh Surf Festival competition would generate a £100,000 windfall for the town, with surfers and visitors making use of local hotels and restaurants[17].

**Table 12. Surfing and windsurfing locations in the North East Region**

| General Location | Surf Location | Windsurf Locations |
|---|---|---|
| Moray Firth - North | Sinclair's Bay | Sinclair's Bay |
| | Keiss | |
| | Ackergill | |
| Moray Firth - South | Lossiemouth | Nairn |
| | Spey Bay | Findhorn Bay |
| | Sandend Bay | Sandend Bay |
| | Fraserburgh | Fraserburgh |
| | Cullen | |
| | Boyndie Bay | |
| | Banff | |
| | Pennan | |
| | Wisemans | |
| | Phingask | |
| | West point | |
| | Sunnyside Bay | |
| Eastern coast (South of Fraserburgh) | St Combs to Inverallochy | St Combs |
| | Peterhead to St Combs | Scotstown |
| | Cruden Bay | Cruden Bay |
| | Stonehaven | Stonehaven |
| | Balmedie to Newburgh | Balmedie |
| | Aberdeen Beach | Aberdeen Beach |
| | Aberdeen Harbour | |
| | Nigg Bay | |
| | Sandford Bay | |
| | Inverbervie | |

(Based on SAS, 2009 and the windsurf magazine 'beach guide')

### 3.10.2 East Region

Table 13 identifies key surfing and windsurfing locations in East Region. SAS (2009) describe how Scotland's east coast receives swells from the north and north-east and consistent offshore winds, although it also receive swells from the east and south east. Figure A18 shows the surf beach locations in this region identified in Scottish Government (2011). This figure highlights the presence of surf beaches adjacent to the Inch Cape, Neart na Gaoithe and Forth arrays. The SAS (2009) report shows about 10 surfing locations within the East region (although it should be noted that the area described in SAS (2009) comprises both the East and North East OWE Plan Regions and hence other surfing locations detailed in SAS, 2009 are listed in the North East Region section above). Along the southern part of the East coast of Scotland the higher population densities and more accessible surfing breaks lead to more intense use of locations such as Pease Bay (SAS, 2009).

[17] Source: The Press and Journal Website : http://www.pressandjournal.co.uk/Article.aspx/1927287

**Table 13. Surfing and windsurfing locations in the East Region**

| General Location | Surf Location | Windsurfing Location |
|---|---|---|
| South East Scottish Coast | Johnshaven | Montrose |
| | Lunan Bay | Lunan Bay |
| | Arbroath | Arbroath |
| | St Andrews West | Carnoustie |
| | St Andrews East | Largo Bay |
| | Kingsbarns | Queensferry |
| | Dunbar | Portobello |
| | White Sands | Longniddry bents |
| | Pease Bay | Gosford sands |
| | Coldingham Bay | Gullane |
| | | North Berwick |
| | | Sinclairs Bay |

(Based on SAS, 2009 and the windsurf magazine 'beach guide')

### 3.10.3 South West Region

No specific surfing or windsurfing locations within the South West Region (Scottish coastline) were identified from internet searches or from the information provided by stakeholder consultees.

### 3.10.4 West Region

Surfers against Sewage (SAS; 2009) describe how the west coast of Scotland and the Hebrides are exposed to well waves generated in the Atlantic Ocean and offer a range of west to north facing beach and reef breaks along the coasts of the Mull of Kintyre and the Isles of Islay, Tiree, Harris and Lewis (note the latter two are outwith the current study area). Some of these spots are described as being of very high quality, although the remoteness of the locations means that they are uncrowded most of the time (SAS, 2009). Figure A19 shows the surf beach locations in this region identified in Scottish Government (2011). This figure highlights the presence of surf beaches on Tiree, Islay and Kintyre in relatively close proximity to the short term option areas in West Region. A large number of windsurfing locations are also present in this region.

The SAS (2009) report maps 17 surfing locations on Tiree, Islay and Kintyre and the windsurf magazine 'beach guide' maps 21 locations along the Ayrshire coast and on Tiree, Islay and Kintyre. These locations are listed in Table 14.

Tiree has a niche in outdoor activities. The Scottish Government's analysis of the responses to its Offshore Wind Draft Plan and SEA stated that 60 to 70% of the islands tourism is based on watersports such as surfing and kite surfing. In particular the island is a very important area for windsurfing. The UK's national windsurfing championships (the Tiree International Wave Classic) is held annually in October on Tiree and is of significance both for the sport and the local economy. This event contributed £0.36million to the local economy in 2004 (SNH, 2008, cited in UKMMAS, 2010).

**Table 14. Surfing and windsurfing locations in the West Region**

| West Coast Location | Surf Location | Windsurf Locations |
|---|---|---|
| Ayrshire coast | | Girvan |
| | | Turnberry |
| | | Maidens |
| | | Prestwick |
| | | Troon beach (north and south) |
| | | Ardrossan |
| | | Helensburgh |
| | | Largs |
| | | Sailcoats |
| Tiree | Balephetrish | Crossapol |
| | Balevullin Bay | Gott Bay |
| | The Hough | Balevullin Bay |
| | The Maze | The Maze |
| | Port Bharrapol | The Green |
| | Balephuil | The loch |
| Islay | Ardnave Bay | Loch Indaal |
| | Saligo Bay | Tragh baile aonghais |
| | Machir Bay | Machir Bay |
| | Laggan Bay | Laggan Bay |
| | Lossit Bay | |
| Kintyre | Caravans | Southend |
| | Macrihanish | Macrihanish |
| | Middle Beach | |
| | Westport | |
| | Graveyards | |
| | Dunaverty | |

(Based on SAS, 2009 and the windsurf magazine 'beach guide')

## 3.11 Tourism

Scottish tourism depends heavily on the country's landscape, with 92% of visitors stating that scenery was important in their choice of Scotland as a holiday destination and the natural environment being important to 89% of visitors (Riddington *et al*, 2008).

There are 27,000 Scottish tourism businesses and more than 200,000 people are employed in tourism in Scotland, representing about 9% of all Scottish jobs (SDI, 2009). Tourism is often associated with other specific recreational activities including marine ecotourism, recreational boating and a range of other water sports. This section focuses on general tourism and ecotourism. Recreational activities are described in other sections of this report as the interactions and issues in relation to offshore wind development are often distinctly different. There is some possibility of a degree of double counting using this approach but not to the extent that it materially affects the conclusions of the study.

This section provides information relating to the national and regional value of general tourism and ecotourism to the Scottish economy. Where possible, values related to coastal tourism have been highlighted, as this provides the most relevant information in relation to any potential economic impacts of short term option development on tourism. An indication of the importance of coastal tourism in Scotland is provided by Atkins (2004) who stated that 2.2 million holidays were taken in 2004, generating about £440million (cited in Marine Scotland, 2010a). A survey of UK and International visitors to Scotland showed that 55% explored Scottish beaches and coastline during their holiday (n=650; Harris Interactive, 2008).

The volume and value of tourism in Scotland in 2009 is provided by VisitScotland (2009a). The summary statistics from this report are shown in Table 15 below:

**Table 15. 2009 tourism statistics for Scotland**

| 2009 | Trips* (million) | Nights (Million) | Spend (£Million) | Average Length of Stay (Nights) | Average Spend per Night (£) | Average Spend per Trip |
|---|---|---|---|---|---|---|
| | 15.03 | 67.99 | 4095 | 4.5 | 60.23 | 272.48 |

* Tourism trips are defined as a stay of one or more nights away from home for the purpose of holidays, visits to friends or relatives, business/conference trips or any other purpose except, for example, boarding education or semi-permanent employment.

(Source: VisitScotland, 2009a)

In the future the tourism sector is likely to continue to expand with sustained growth in 'short breaks' to the coast (e.g. WAG, 2008; Atkins, 2004) and increases in tourist numbers as a result of a warmer climate (Viner *et al*, 2006). Scottish Development International (SDI; 2009) stated that the tourism industry in Scotland has demonstrated consistent and sustained growth, creating further investment opportunities. A number of major resort developments are currently planned.

One tourism sector that could be affected by seascape impacts from offshore wind farm development is golfing. Scottish Enterprise identify this as a key market in the Scottish tourism industry, alongside whiskey tourism, country sports, mountain biking and food tourism[18]. Many golf courses in Scotland are set among natural and wild landscapes and this is a key factor in attracting tourists (Tourism Intelligence Scotland, 2010). Of the various golf courses throughout Scotland, the links courses (coastal courses) generated significantly more revenue from their visitors than any inland courses (SQW, 2009). An industry led body, Golf Tourism Scotland, was established in 2005 to support the market. Regional aspects of the industry are detailed below.

A recent report by ABPmer (2010) assessed the economic value of coastal and marine cultural heritage in Scotland. Examples of heritage resources included in the study were assets such as wrecks, castles, harbours, coastal and marine visitor centres, lighthouses, historic ships and

[18] Scottish Enterprise website: http://www.scottish-enterprise.com/your-sector/tourism/how-we-can-help/tourism-product-development.aspx

maritime and coastal heritage museums[19]. The results showed that in 2008, the 71 cultural assets that were able to report visitor numbers received about 1.9 million visitors. Due to the fact that the vast majority of these visitable coastal and marine heritage assets are sites that are freely open to the public (e.g. standing stones) the economic evaluation was based on a sub-set of 97 of the assets which included 'managed visitable heritage assets, all historic ships and maritime museums. The results showed that visitor income from the managed heritage assets (calculated for the 20 managed heritage assets that could supply data) was approximately £1.55million in 2008 while expenditure on employment for the same year was approximately £1.13million.

Marine wildlife tourism is defined as 'any tourist activity with the primary purpose of watching, studying or enjoying marine wildlife' (Masters *et al*., 1998). The sector includes viewing a range of marine species such as whales, dolphins, basking sharks, seals and seabirds. The sector may be water-based, land-based, or both and may also be formally organised or undertaken independently (META, 2002).

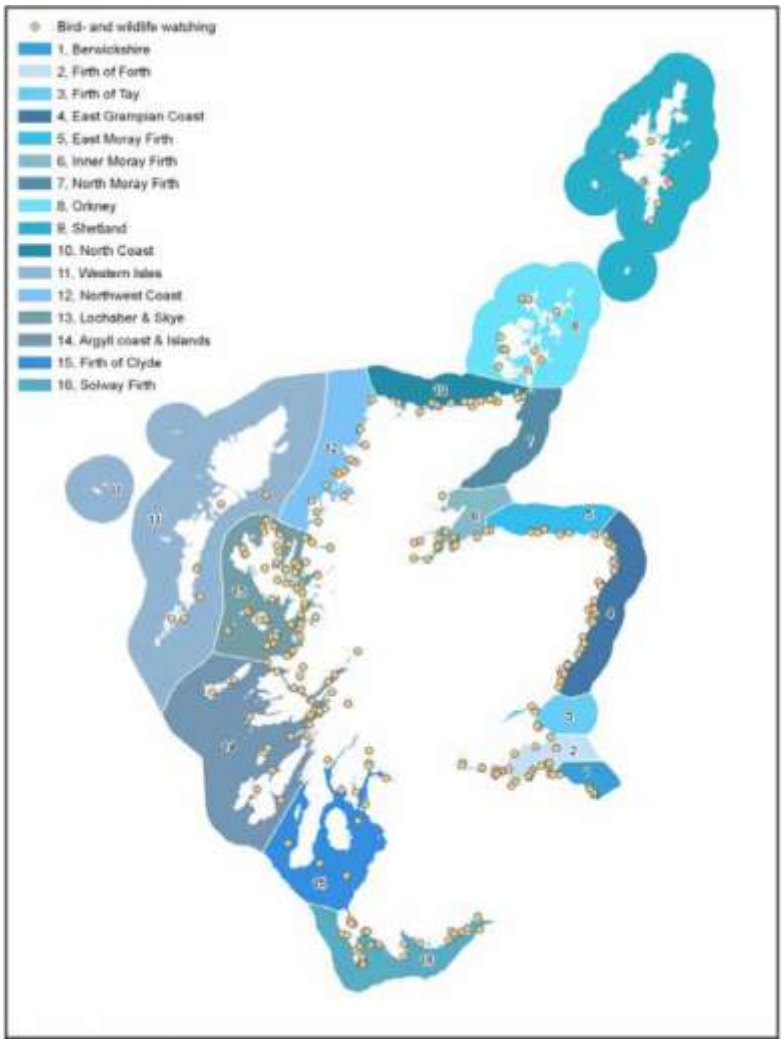
Coastal wildlife tourism in Scotland has a strong emphasis on viewing cliff-nesting seabirds and seals at haul-out sites. Marine wildlife tourism operators provide access to offshore areas to view dolphins, porpoise, basking sharks and seals (Scottish Government, 2011).

Expenditure by coastal and marine wildlife visitors in Scotland has been estimated at £163 million (£100 million attributable to coastal wildlife tourism and £63million attributable to marine wildlife tourism), generating £92million of income for the Scottish economy and employing just under 4,400 FTE employees (Bournemouth University, 2010). From these values, the authors estimated that the net economic impact of marine wildlife tourism in Scotland was £15 million, with 633 additional FTE jobs, while coastal wildlife tourism had a net economic impact of £24 million with 995 additional FTE jobs. Land Use Consultants (2006) found that Lochaber and Skye, Argyll Coast and Islands, East Grampian Coast, Firth of Forth, Solway Firth and Inner Moray Firth were the most important areas for marine and coastal wildlife tourism (Figure 25).

O'Connor *et al.* (2009) undertook an assessment of the economic benefits of whale watching worldwide. The study found that the sector in Scotland had a total expenditure of £11,394,704 (converted from USD[20] with direct expenditure of £3,077,647 and indirect expenditure of £8,317,057). Unlike in some countries, in Scotland, most operators offer marine cruises or 'sea-faris', where whale and dolphin sighting is a complementary attraction together with bird, seal and nature watching activities, rather than dedicated whale watching tours. The values above therefore are for this more generic sector. Since the last census in 1998, the number of tourists has almost doubled, equating to an annual average growth of 8.5% over the last 10 years. Five operators in Scotland are land-based.

19 The criterion for inclusion in the assessment was that the asset should be accessible to visitors including divers and hence values cited from this study will include diving-related tourism.

20 USD converted to GB Sterling using the cross currency rate of 0.6246, taken from the financial times website on 18 January 2011.




(Dots represent the number of hits per seascape unit)

(Source: Land Use Consultants, 2006)

**Figure 25. Bird watching and wildlife watching**

### 3.11.1 North East and East Region

VisitScotland's corporate website[21] provides information on the volume and value of tourism in different regions of Scotland. The information on tourism statistics in Eastern and Northern Scotland, within regions which fall completely or partially within the OWE Plan East and North East Regions are shown in Tables 16 and 17 below. It is important to note that these are indicative values only as the VisitScotland regions do not align with the OWE Plan East or North East regions and presumably represents tourism both at the coast and inland. As such, the values shown below are likely not to be particularly representative of coastal tourism in the OWE Plan East and North East regions.

21 VisitScotland Website: http://www.visitscotland.org/default.aspx

**Table 16. Tourism related statistics in East and North East VisitScotland Regions in 2009***

| VisitScotland Region | Relevant OWE Plan Region | Type of Visitor | Trips (Million) | Nights (Million) | Spend (£Million) |
|---|---|---|---|---|---|
| Edinburgh & Lothians | East - Border the southern Firth of Forth area | UK resident | 2.46 | 6.6 | 562 |
| | | Overseas | 1.33 | 7.44 | 458 |
| Angus & Dundee | East - Northern part of East region | UK resident | 0.43 | 1.5 | 74 |
| | | Overseas | 0.07 | 0.71 | 31 |
| Perthshire | East - The sub-region of Perth borders the Firth of Tay | UK resident | 0.74 | 2.45 | 141 |
| | | Overseas | 0.13 | 0.63 | 45 |
| Kingdom of Fife | East - Sub-regions border the southern Firth of Tay area and the northern Firth of Forth area. | UK resident | 0.54 | 1.93 | 106 |
| | | Overseas | 0.13 | 0.87 | 78 |
| Scottish Borders | East - Southern section of the East Region | UK residents | 0.37 | 1.2 | 80 |
| | | Overseas | 0.04 | 0.29 | 31 |
| Aberdeen & Grampian | North East - southern part of the North East Region | UK residents | 1.25 | 4.38 | 246 |
| | | Overseas | 0.24 | 1.67 | 98 |
| Highlands | North East - relevant sub-regions cover the northern part of the North East Region. | UK residents | 1.87 | 8.35 | 436 |
| | | Overseas | 0.46 | 2.2 | 129 |

* The document states that for regional data, three-year averages have been used for UKTS and IPS statistics for 2009 to minimise any atypical results for a particular year, giving a better indication of overall trends.

(Sources: VisitScotland 2009 b,c)

The Argyll coast and islands are particularly important for bird and wildlife watching (Land Use Consultants, 2006). In the coastal waters of the Firths of Forth and Tay, bird and wildlife watching boat trips take visitors to the Isle of May, Inchcolm Island, Bass Rock and other locations (SeaEnergy Renewables, 2010). North Berwick represents an important focus of attraction for land-based dolphin watchers (O'Connor *et al*. 2009). VisitScotland (2009a) reported that 291,474 people visited the Scottish seabird Centre, North Berwick, which was classed as a major visitor attraction.

**Table 17. Tourism related employment in East and North East VisitScotland Regions in 2007**

| VisitScotland Region | VisitScotland Sub-Region | Number of People Employed | % of Total Employment |
|---|---|---|---|
| Edinburgh & Lothians | Edinburgh City | 30,900 | 12.6 |
| | East Lothian | 2,800 | 6.3 |
| | West Lothian | 4,200 | 5 |
| Angus & Dundee | Dundee City | 5,300 | 8.3 |
| | Angus | 3,300 | 6.4 |
| Perthshire | Perth & Kinross | 7,700 | 11.8 |
| Kingdom of Fife | Fife | No data | No data |
| Scottish Borders | Borders | 3,700 | 6.9 |
| Aberdeen & Grampian | Aberdeen | 11,200 | 10.4 |
| | Aberdeenshire | 7,200 | 5.9 |
| Highlands & Islands | Highlands | 14,200 | 13.2 |

(Source: VisitScotland 2009 b,c)

In the north, the Moray Firth and the Orkney Islands (the latter outwith the scope of the current study) account for approximately 35-40% of the marine wildlife watching activities, using Inverness and John O'Groats as departing points. Land-based cetacean watching is heavily focused on Chanonry Point, Moray Firth. According to local estimates, these areas can attract more than 20,000 dedicated participants a year (O'Connor *et al*, 2009). The total income from direct tourism expenditure reliant solely on the presence of the east of Scotland bottlenose dolphin population is considered to be at least £4 million, providing approximately 202 FTE jobs (ACES, 2010).The bulk of dolphin tourist expenditure is received by general tourist providers around the Moray Firth region, particularly Highland (61.3%) and Moray (14.2%); around 10% is received further south by Aberdeenshire (4.5%), Angus and Dundee (3.9%), and Fife (2.6%), with the remainder (13.4%) spread throughout other areas of Scotland (ACES, 2010).

In a response to the Offshore Wind SEA and Draft Plan consultation, the National Trust for Scotland highlighted that St Abbs Head is a very well known beauty spot, famous for its feeling of wilderness[22]. It is visited by 50,000 visitors per year and is a regionally important tourist attraction.

Dive tourism has also been highlighted as being important to the local economies of the Berwickshire coastline with the underwater biological diversity of the Voluntary Marine Reserve off St. Abbs Head and Eyemouth attracting thousands of participants. Data collated by Scottish Enterprise Borders (SEB) in 2007 estimated that 25,000 dives were undertaken in the waters off St Abbs and Eyemouth and contributed £3.7 million to the local economy. The SEB data suggests that the activity supports 81.7 FTEs in the Scottish Borders area and has a GVA of £1.5 million per annum.

VisitScotland (2009a) reported that 291,474 people visited the Scottish Seabird Centre, North Berwick, which was classed as a major visitor attraction.

There are 22 links courses in the north east region and 14 in the east[23]. The majority of the north east courses are in the Aberdeenshire region, whilst most of the east coast courses are in East Lothian and one in Berwickshire.

### 3.11.2 South West Region

Information on tourism statistics in South West Scotland, within regions which fall completely or partially within the OWE Plan East Region are shown in Tables 18 and 19. It is important to note that these are indicative values only as the results are presented for regions which do not necessarily align precisely with the OWE Plan regions and presumably represent tourism both at the coast and inland.

22 The National Trust for Scotland's consultation response available on the Scottish Government website: http://www.scotland.gov.uk/Publications/2010/11/03131226/0

23 VisitScotland's Golf Website: http://golf.visitscotland.com/courses.aspx[Accessed 24/2/2011]

The RSPB's Mull of Galloway Reserve sits on Scotland's most southerly point, its sheer sea cliffs being home to thousands of birds including kittiwakes, puffins, razorbills, guillemots and black guillemots. In both 2008 and 2009, an income into the local area of over £100,000 was attributable directly to seabirds. This equates to between 3 and 4 full time jobs being supported in the region in addition to the staff employed at the Reserve (RSPB, 2010).

There are 5 links golf courses in the South West region[23] along the coastal margins of the Solway Firth and Luce Bay.

**Table 18. Tourism related statistics in Southern VisitScotland Regions in 2009***

| VisitScotland Region | Relevant OWE Plan Region | Type of Visitor | Trips (Million) | Nights (Million) | Spend (£Million) |
|---|---|---|---|---|---|
| Dumfries & Galloway | Approximately whole of South West Region | UK residents | 0.75 | 2.6 | 119 |
| | | Overseas | 0.057 | 0.42 | 24 |
| **Total** | | | **0.807** | **3.02** | **143** |

* The document states that for regional data, three-year averages have been used for UKTS and IPS statistics for 2009 to minimise any atypical results for a particular year, giving a better indication of overall trends.

(Source: VisitScotland, 2009c)

**Table 19. Tourism related employment in Southern VisitScotland Regions in 2007**

| VisitScotland Region | VisitScotland Sub-Region | Number of People Employed | % of Total Employment |
|---|---|---|---|
| Dumfries and Galloway | Dumfries & Galloway | 6,900 | 10.3 |

(Source: VisitScotland, 2009c)

### 3.11.3 West Region

No specific information on tourism values for the OWE Plan West Region are available. The most relevant statistics relate to VisitScotland's Argyll, Loch Lomond, Stirling and Forth Valley region (Tables 20 and 21), although parts of this region extend a long way inland and are thus unlikely to be affected by short term option development.

**Table 20. Tourism related statistics in Western VisitScotland Regions in 2009***

| VisitScotland Region | Relevant OWE Plan Region | Type of Visitor | Trips (Million) | Nights (Million) | Spend (£Million) |
|---|---|---|---|---|---|
| Argyll, Loch Lomond, Stirling & Forth Valley | Roughly the rest of the West Region (up to the Isles of Mull, Tiree and Coll but excluding the very northern part of the West Region i.e. the highlands which fall within this regions) | UK residents | 1.57 | 6.0 | 325 |
| | | Overseas | 0.29 | 1.26 | 83 |
| **Total** | | | **1.86** | **7.26** | **408** |

* The document states that for regional data, three-year averages have been used for United Kingdom Tourism Survey (UKTS) and International Passenger Survey (IPS) statistics for 2009 to minimise any atypical results for a particular year, giving a better indication of overall trends.

(Source: VisitScotland, 2009d)

**Table 21. Tourism related employment in Western VisitScotland Regions in 2007**

| VisitScotland Region | VisitScotland Sub-Region | Number of People Employed | % of Total Employment |
|---|---|---|---|
| Argyll, Loch Lomond, Stirling & Forth Valley | Argyll & Bute | 5,400 | 13 |
| | Stirling | 5,200 | 12.5 |

(Source: VisitScotland, 2009d)

Tourism is the second largest private industry in Tiree in terms of GVA, with bed places having increased by 50% since 1996 (Scottish Agricultural College, 2004). Tourism and recreation are a significant part of the economic base of Kintyre[24]. Both Islay and Kintyre have a successful ecotourism industry with a range of activities including boat tours for wildlife viewing (birds, whales, sharks, dolphins and porpoises; AMEC, 2010a and b).The Scottish Government's analysis of the responses to its Offshore Wind Draft Plan and SEA stated that 60 to 70% of the island of Tiree's tourism is based on watersports such as surfing, windsurfing and kite surfing[25] (for detailed analysis of the value of these recreational activities see Sections 3.10 and 3.11).

The west coast of Scotland accounts for approximately 55-60% of total marine wildlife watching visitors. The industry on the west coast is mainly centred in the Hebrides Islands, using Oban as a departure point to sail around the Isle of Mull, Isle of Iona, Treshnish Isles and Staffa (which fall within the OWE Plan West Region) and Rhum, Eigg, Gairloch and Kyle of Lochalsh to the Isle of Skye and Isle of Lewis (all within the OWE Plan North West region which is outwith the scope of the current study) (O'Connor *et al*, 2009). The Isle of Mull also represents an important focus of attraction for land-based dolphin watchers (O'Connor *et al.* 2009).

In 2000, an estimated total of approximately 242,000 tourists were involved in cetacean-related tourism activities in Western Scotland. Cetacean-related tourism was estimated to be worth over £7.8 million a year to the regions economy, accounting for 2.5% of the total income from tourism. In remote areas the activity may account for as much as 12% of total tourism revenue. Direct economic income from cetacean tourism activities was estimated to be £1.77 million per year, the rest (£6.03 million) accounts for income generated indirectly by cetacean-related tourism. Cetacean-related tourism was estimated to create 59 full-time and one part-time jobs, with 38% of these positions being seasonal (Parsons *et al.* 2003).

Dickie *et al* (2006) estimated that reintroduced sea eagles on the island of Mull attract up to €2.48 million of visitor spending each year. It should be noted that UKMMAS (2010) highlights that there are wide discrepancies in economic assessments of marine wildlife sector and that caution is required when using such indicators of value to assess regional patterns and trends.

There are 27 links golf courses in the West region[23] located along the coastal margins of the mainland, such as the new Machrihanish Dunes golf course and associated tourism developments, and offshore islands such as Colonsay and Islay.

[24] The Village at Machrihannish Dunes/Kintyre Development Company Ltd Draft Plan and SEA consultation response, available on the Scottish Government website: http://www.scotland.gov.uk/Publications/2010/11/03131226/0

[25] Analysis of consultation responses available on the Scottish Government website http://www.scotland.gov.uk/Publications/2010/12/22153227/0

## 3.12 Social Issues

Social issues have been defined as 'The consequences to human populations of any public or private actions that alter the ways in which people live, work, play, relate to one another, organize to meet their needs and generally cope as members of society. The term also includes cultural impacts involving changes to the norms, values, and beliefs that guide and rationalize their cognition of themselves and their society' (Interorganisational Committee on Principles and Guidelines for Social Impact Assessment, 2003).

The consideration of social issues could therefore include a wide range of different factors that are relevant to all regions such as:

- Location/siting - in relation to visual impact and noise;
- Economic - implications for existing activities and opportunities associated with potential development in terms of jobs, skills and career opportunities;
- Infrastructure - pressure on existing medical services, transport infrastructure, public services and schools capacity; implications for housing availability and house prices; and
- Cultural heritage - dilution of native language, changes to existing land use patterns or loss of way of life (marine wilderness).

For the purpose of this report, it is determined that the 'economic' elements of the social impacts are covered fully within the prior sections regarding the impacts on other marine activities and users. Therefore, the analysis under the 'Social Issues' section will focus predominantly on the remaining factors listed above.

Although the SEA considers landscape and seascape aspects, this is mainly in respect to their influence on the tourist industry and recreational users. However, landscape and seascape are also important in relation to psychological health and the quality of emotional and/or spiritual connections with their surrounding environment.

# 4. Assessment of Impacts on Other Marine Users and Interests

## 4.1 Introduction

This section builds on the Baseline provided in Chapter 3, and assesses the potential national and regional interactions between short term options in the Draft Plan and other marine activities. The impacts associated with these interactions are also quantified where possible.

## 4.2 Commercial Fisheries

### 4.2.1 Introduction

This analysis assumes that all of the short term options have the potential to affect commercial fisheries, since fishing activity currently takes place, to a greater or lesser extent, within all the regions affected by the short term options. Also, all sites lie completely or partially within spawning or nursery grounds for one or more of the commercial species impacts to which could affect future fish stocks.

Based on consultation and previous studies of offshore wind farm impacts, the construction and operation of offshore wind farms has the potential to impact on commercial fishing through:

- Disturbance of mobile species and disruption or damage to habitats, nursery and spawning grounds, direct damage to sessile species, leading to displacement of or reduction in fish and shellfish resources;
- Reduction in or loss of access to traditional fishing grounds;
- Displacement of activity to existing (less profitable) fishing grounds;
- Consequent increase in fishing pressure and competition on alternative available grounds;
- Obstruction of navigation routes to and from fishing grounds leading to increased steaming times;
- Fouling of fishing gear on cables and seabed infrastructure;
- Safety issues for fishing vessels in transiting wind farm arrays or in diverting around them; and
- Potential reduced Catch Per Unit Effort (which is exacerbated by cumulative effects of other pressures on fishing areas, including other offshore wind farm, Marine Protected Areas, oil and gas, aggregate extraction, dredging and port developments) and consequential loss of profit.

It is important to consider the nature and the period of the impacts. Some will be permanent, for example, loss of seabed habitat and associated ecological assemblages in the footprint of turbine structures. Other effects may be temporary, for example, disturbance due to seabed preparation or piling. The duration and timing of temporary effects is relevant along with the potential for interactions with other sites and or activities which may have cumulative in-combination effects. (Marine Scotland, 2010a)

Some of the impact risks can be mitigated by developers through the careful siting of offshore wind farm, careful timing of construction work, configuration of turbines to allow navigation and fishing in between, adequate cable burial, appropriate marking and lighting of developments, and adequate early consultation with the fishing industry.

Offshore wind farms also have the potential to have positive impacts on commercial fishing, for example opportunities for certain gear types (e.g. static gear) within the offshore wind farm if mobile gears are displaced.

Some benefits for enhancing biodiversity may arise from the removal of trawling activity and creation of artificial reef habitats, however, other areas are likely to receive additional pressure as a result of displaced effort, (Marine Scotland, 2010c) which may negate the beneficial effects. Also, the potential beneficial effects of the infrastructure (and artificial habitat and ecological assemblages) may not be permanent, since they may be removed during decommissioning (Marine Scotland, 2010a).

Determining the sensitivity of different fishing activities is difficult since there is a lack of clarity over which fishing activities would be permitted within different sites, whether fishermen would be prepared to continue fishing even if they were allowed, and whether, if they were allowed, they would be able to carry on when maintenance vessels were actively working within arrays (Blyth-Skyrme, 2010a). All of these factors can influence future fisheries values.

Mobile (i.e. towed and drift) gear fishing vessels appear likely to be prohibited from fishing within offshore wind farm sites and so they can be assumed to have maximum sensitivity to developments. Cable routes may also represent significant impacts to these gears, where cables, cable trenches or snags resulting from trenching can act as barriers. Static gear vessels may be able to fish within offshore wind farm sites, although these vessels will be displaced from around turbines (usually 50m exclusion zones) and, potentially, from cable routes. Recent studies, particularly in the North East of England, indicate that fixed gear fishing (e.g. pots) and trawling by vessels under 10m can co-exist with offshore wind farms (Blyth-Skyrme, 2010a).

The most likely overall consequences of offshore wind farm development for commercial fisheries interests are generally considered to be negative, particularly for fishermen using mobile gear and for smaller vessels which do not always have the capability to relocate to other fishing grounds. Switching to other fishing methods is restricted by availability of capital, licences and quota. Fishermen whose income is currently gained from areas of potential offshore wind farm development may not be able to operate profitably after wind farm construction. (Mackinson *et al*., 2006).

### 4.2.2 Development of Scenarios

A number of potential impacts on commercial fishing have been identified which could affect profitability of the sector, namely:

- Effects on fish stocks or spawning and nursery grounds as a result of construction or operation of the short term options;

- Effects of displacement of fishing activity during construction and/or operation of the short term options; and
- Effects of increased steaming times to and from fishing grounds.

The impacts of OWF development on fish stocks remain uncertain. While some wind farm construction techniques (such as percussive piling of monopiles) have the potential to cause significant changes in underwater noise, there are no documented studies of long-term changes in the abundance or distribution of fish as a result of wind farm construction activity. Furthermore, mitigation measures may be required for short term option development to avoid adverse effects to Atlantic salmon, river and sea lamprey and allis and twaite shad which are all features of conservation importance within certain Special Areas of Conservation (SAC) around Scotland (ABPmer, 2011). On this basis it is unlikely that the residual underwater noise impacts would give rise to significant effects on target species for commercial fishermen.

Experiences with offshore wind development in English waters indicate that changes in water turbidity during construction and operation are limited both in magnitude and duration and within the range of values naturally encountered within the marine environment. No significant impacts on target species for commercial fishermen would therefore be anticipated.

A range of fish and a number of other species found in Scottish waters are potentially capable of responding to anthropogenic sources of EMF. Certain fish species, including common ones such as plaice, are understood to be both magnetically and electrically sensitive and a range of other species, notably cetaceans and many crustacea, to be magnetically sensitive. Most attention, however, has focused on elasmobranchs (sharks, skates and rays). The conclusion of most project-specific environmental impact assessments is that whilst it is possible that an interaction between these species and sub-sea cables could occur the result is unlikely to be of any significance at a population level (DECC, 2009). A study by Gill *et al* (2009) assessed whether electromagnetic sensitive fish responded to EMFs with the characteristics and magnitude of EMF associated with offshore wind farm power cables. Although overall the study showed that some electrosensitive elasmobranchs responded to the presence of EMF that was of the type and intensity associated with sub-sea cables, the response was not predictable and did not always occur. When the response did occur it appeared to be species dependent and individual specific. There was no evidence to suggest any positive or negative effect on elasmobranchs of the EMF encountered and the authors stated that such effects could only be determined through a combination of monitoring at offshore wind farms and further experimental-based studies of specific behavioural responses that could indicate potential impacts. In soft sediment environments, it is likely that power cables will be buried below the sediment surface. This mitigation measures will significantly further reduce the exposure of fish to electromagnetic fields.

Short term option development also has the potential to lead to increases in local fish stocks, particularly where commercial fishing within arrays is restricted. However, it is difficult to quantify what if any additional benefit might be achieved and there is no clear evidence from existing wind farms to quantify such benefits.

Based on the above, this study has assumed that short term option development will not give rise to any significant or permanent negative or positive impacts on fish stocks.

The construction of short term options will result in the loss of and damage to fish spawning and nursery areas. The extent of such losses will be small relative to the overall size of wind farm arrays, being limited to the turbine footprints and some temporary damage along cable routes (Marine Scotland, 2010b). However, the potential displacement of towed gears within wind farm arrays and along cable routes may result in lower levels of bed disturbance in these areas and could potentially lead to improvements in the quality of spawning or nursery areas. Overall, this assessment has therefore assumed that impacts on spawning and nursery grounds will be neutral.

The short term options have the potential to cause vessels to detour around wind farm arrays, increasing steaming times to and from fishing grounds. Offshore wind farms should not form physical barriers to the movement of fishing vessels through the sites, however, additional costs in terms of time and fuel may result where fishermen are forced to steam further than normal to reach the far side of an offshore wind farm before fishing (Blyth-Skyrme, 2010a). Experiences with offshore wind farms in English waters suggests that commercial fishing vessels can generally transit through arrays without any significantly increased navigation risks. Indeed, the European Boating Association position statement states that there is no danger to a vessel under 24 metres in length navigating through the farm taking reasonable care. On this basis it has been assumed that effects on steaming times are negligible and the cost impacts are therefore insignificant.

For the purposes of this assessment, the principal cost impact that has been assessed therefore relates to the estimated cost impacts of fisheries displacement from the short term option arrays. Cost estimates have been developed for the three scenarios based on the assumptions identified in 22.

The future value of commercial fisheries is uncertain, particularly in the longer term. It is possible that reforms to the Common Fisheries Policy will lead to stock recovery for some species. For the purposes of this assessment it has been assumed that the value of first sale landings will remain relatively constant over time in real terms.

**Table 22. Assumptions for scenarios for fisheries**

| Scenario | Assumption |
|---|---|
| High Impact Scenario | All forms of commercial fishing permanently displaced<br>Lost fisheries revenue is 2 x indicative total annual average landings value 2000-2009 (all gear types) for 50 years |
| Medium Impact Scenario | All mobile gear fisheries permanently displaced<br>Lost fisheries revenue is 1 x indicative annual average landings value 2000-2009 (mobile gears only) for 50 years |
| Low Impact Scenario | All mobile gear fisheries permanently displaced;<br>Lost fisheries revenue is 1 x indicative annual average landings value 2000-2009 (mobile gears only) for five years |

The calculation of the landings values used in the cost estimate scenarios was based on the total annual landings catch data collated by the Marine Management Organisation (MMO) by ICES rectangle. Annual data for the period 2000 to 2009 were used in the analysis and the

average of these years was taken in order to arrive at an average total annual landings catch value for each ICES rectangle by vessel length, vessel nationality, fishing gear, species caught and port of landing.

The value of the total catch was assumed to apply equally to the whole ICES rectangle and this total value was reduced proportionally by the size of each short term option development area lying within the ICES rectangle(s). The value of the catch taken by mobile or static gear was calculated in order to produce the different cost estimates for the scenarios. The data for each ICES rectangle was assumed to apply equally to the whole rectangle since no data were available on the actual positions of the catch or of the location of fishing grounds within the ICES rectangle. This total value was then reduced proportionally by the size of each short term option development area lying within the ICES rectangle(s) irrespective of the mobility of the species.

The estimated value of catch within potential short-term options development areas that have been developed as part of this study are necessarily crude in assuming that fisheries value is evenly distributed across each ICES rectangle. In order to reflect the uncertainty in the distribution of fisheries value, the high impact scenario has used a multiplier of 2 x indicative total annual average landings value to represent a case where the displaced fisheries were relatively more valuable than the average across the ICES rectangle.

In the high and medium impact scenarios, it has been assumed that the cost impacts of fisheries displacement are permanent and that the affected fishermen are unable to relocate to alternative fishing grounds. In the low impact scenario, it has been assumed that over time, fishermen are able to make use of alternative fishing grounds such that the cost impact reduces to zero after 5 years.

### 4.2.3 Estimated Costs and Benefits

The estimated costs associated with each scenario for each region are presented in Table 23 below. No significant benefits have been identified. It is possible that some of these potential impacts may be offset by project level mitigation measures or, for example, the establishment of local fisheries funds. Such actions would represent transfers to fishermen from offshore wind developers. As these would be project level mitigation measures, and the result of site-specific negotiations between commercial parties, it is outwith the scope of this assessment to investigate them.

**Table 23. Estimated annual loss of fisheries value as a result of displacement of commercial fisheries for the three scenarios**

| Region | Scenario | | |
|---|---|---|---|
| | High Impact (£'000) | Medium Impact (£'000) | Low Impact[1] (£'000) |
| South West | 59 | 20 | 20 |
| West | 696 | 251 | 84 |
| North East | 130 | 65 | 65 |
| East | 760 | 260 | 174 |

[1] Costs applied only for a period of five years from construction

## 4.3 Aquaculture

### 4.3.1 Introduction

The main potential risks to aquaculture interests identified from consultation and the wider literature include:

- Environmental impacts to aquaculture species as a result of short term option construction, operation and decommissioning (changes in underwater noise, turbidity and water quality); and
- Displacement of existing or future aquaculture activity as a result of construction of short term options.

The draft SEA Environmental Report (Marine Scotland, 2010a) identified potential effects to wild fish arising from offshore wind farm development, including changes in underwater noise and water quality. The Information for Appropriate Assessment for the draft Plan for Offshore Wind Energy (ABPmer, 2011) also identified similar potential effects to wild Atlantic salmon and identified additional mitigation measures that might need to be applied to short and medium-term options to avoid adverse effects to the integrity of SAC for which Atlantic salmon was a designated feature. Given that adequate mitigation measures will be required by law to protect wild Atlantic salmon, these measures would also be expected to protect farmed fish. Only one fish farm site is located within close proximity (<2km) to a short term option in the West Region. However, this site is a larval rearing unit and research facility and is located onshore in tanks. All other fish farm sites are located approximately 20km or more away (see Figure A3). Consultation responses to the draft Environmental Report did not identify any specific concerns in relation to the aquaculture sector (Marine Scotland, 2010b).

As noted above, there are no spatial overlaps between short term option development areas and existing aquaculture installations. Offshore aquaculture could become strategically important to the UK in the future due to a finite supply of available inshore sites (James and Slaski, 2006; Faber Maunsell Limited, 2008). Species that are already farmed in Scotland such as salmon as well as emerging species such as bass, cod and bream have the potential to be farmed in offshore areas. However its success will be dependant on improved safety and technological development (Faber Maunsell Limited, 2008; Defra, 2008).

However, it has also been proposed that offshore aquaculture and OWE could be co-managed in the same area (Blyth-Skyrme, 2010b and Mee, 2006). Combining offshore wind farming and marine aquaculture is an opportunity to share stakeholder resources and could lead to greater spatial efficiency in the offshore environment (Michler-Cieluch *et al*, 2009). While this could increase the income from the OWF lease, the technology is premature and may also create conflict with other users such as shipping by creating a navigation hazard. In addition to overcoming these constraints, the Crown Estate currently prohibits any other income earning activity by the OWFs in the leased area and so a change in law would also be required (Mee, 2006).

Based on the above, it is unlikely that significant negative or positive effects are likely to be experienced by the aquaculture sector as a result of the short term offshore wind development

and no separate assessment of cost impacts to aquaculture interests has therefore been undertaken.

## 4.4 Shipping and Ports

### 4.4.1 Introduction

Based on experience with existing offshore wind farm developments, short term option development has the potential to affect commercial shipping interests in a number of different ways. Potential negative effects include:

- Obstruction of commercial navigation routes resulting in:
  - Increased steaming distance/time;
  - Where ferries are affected, reduced turnaround time and increased cleaning costs;
  - Potential long-term loss of revenue;
- Changes to existing navigational arrangements requiring additional buoyage;
- Interference with marine navigation radar systems;
- Displacement of recreational craft into commercial shipping lanes;
- Increased collision risk at sea; and
- Displacement of anchorages/fouling of anchors on cables.

Impacts to shipping may also have the potential to affect trade passing through ports, particularly in circumstances where impacts mean that shipping routes become less viable and shipping lines seek to identify alternative routes to another port.

A number of potential benefits may also arise, for example, commercial opportunities for construction and O&M vessels associated with wind farm construction and operation and port expansion to service construction and O&M activities.

Many of the potential negative effects can be mitigated by developers through careful siting of offshore wind farms, enhancements to marine radar systems, appropriate marking and lighting of developments and adequate cable burial. However, there are some ongoing negotiations from earlier offshore wind farm developments where commercial shipping companies maintain that developers have adversely affected navigation interests (Stewart Walker, Stewart Walker Associates, pers. comm. 22 Dec 2010), highlighting the commercial sensitivities of offshore wind farms on the shipping sector. Based upon consultation with the shipping industry, this is considered to be the area of greatest commercial concern to port/shipping operators and forms the core of this assessment.

Costs to provide appropriate navigational arrangements are relatively straightforward to estimate based on guidelines and existing case studies. Buoyage arrangements can also incorporate low cost mitigation measures to address navigation radar impacts, for example the incorporation of radar reflectors can enable radar users to 'tune out' radar clutter caused by offshore wind farms (BWEA, 2007).

Available evidence indicates that recreational traffic can continue to safely navigate through offshore wind farms (see recreational boating section) and therefore the displacement of recreational traffic into commercial shipping lanes is likely to be minimal.

The short term options do not overlap with any existing anchorage areas. It is possible, but unlikely, that the cable routes selected by developers could transect anchorage areas. For the purposes of this assessment it has been assumed that short term option development will not affect any existing anchorage areas.

Detailed quantification of additional mitigation requirements to address collision risks or navigation radar impacts (e.g. infill radar) cannot be determined at this stage pending the completion of detailed navigation impact assessments. Based on experiences with R1/R2 developments in England, it is possible that no additional mitigation measures will be required to address these impacts, with the main concern and cost impact relating to potential diversion of vessels around wind farm structures.

### 4.4.2 Development of Scenarios

To develop the scenarios for the impact assessment a range of available evidence including direct consultation with key interest parties, information from existing offshore wind farm developments and research studies has been considered.

#### 4.4.2.1 Additional steaming

Only limited data was available to estimate the effects upon shipping routes within each region as the detailed navigational risk assessments have not been undertaken for the offshore wind farm sites. The assessment had been based on waypoint ship density data as limited AIS data (which can provide more detail on vessel type) was available. The main interactions between shipping routes and the short term options have been identified as follows:

- North East Region - waypoint shipping data suggests that traffic to/from Cromarty/Inverness tends to follow the southern coast of the Moray Firth. The main north west/south east shipping route passes 10km to the north east of the short term development option. According to the same data, shipping movements within the proposed site boundary are less than 50 movements p.a. Taking into consideration the baseline data, there will be little if any impact upon commercial navigation resulting from short term development in the north east region.
- East Region:
  - North East/South West bound traffic in the Forth Approaches - estimated number of vessels affected 991 p.a.[26] requiring a nominal increase in steaming distance of 4nm.

[26] The waypoint data suggests that >= 150 ships pass through each year. The shortcomings of this data were acknowledged by The Crown Estate in their sensitivity analysis of the spatial planning in support of the Draft Plan for Offshore Wind Energy in Scottish Territorial Waters (Davies and Aires, 2011). In 2009 there were 3,304 ship visits to Fort Ports. By review of the AIS plots it is estimated that approximately 30% traffic uses the north east / south west route and the figure of 991 ships affected has been based upon this.

  - East/West route out of Dundee -estimated number of vessels p.a. 2190 involving a nominal increase in steaming distance of 5nm.
- South West Region[27] - it has been estimated that approximately 100 vessels may need to divert by up to 2nm (inbound and outbound).
- West Region:
  - Sound of Islay - estimated number of vessels affected p.a. 432[28] involving a nominal increase in steaming distance of 1nm.
  - Sound of Jura - estimated number of vessels affected p.a. 432[29] involving a nominal increase in steaming distance of 1.25nm.

Based on these interactions, scenarios have been developed for the additional fuel costs based upon two generic vessel types based upon size, fuel consumption and manning costs as set out in Table 24 below. In the absence of reliable information on vessel types, and in order to provide a basis for estimating cost impacts, it has been assumed that the affected vessels in East and South West Regions are bulk cargo vessels but that in West Region, owing to depth constraints the affected vessels are coasters (i.e. small cargo vessels). Fuel consumption has been based upon data from Kemp (2008) who presented information on fuel consumption for a range of different vessel tonnages. Fuel consumption rates for a coaster were based on an assumed tonnage of 1600 tonnes and for a bulk coaster 5000 tonnes.

**Table 24. Generic data used in calculating costs for additional steaming time**

| Vessel Description | Fuel Consumption (tonnes per hr.) | Fuel Cost (£s/tonne) | Manning Costs (£s per hr.) | Assumed Cruising Speed (knots) |
|---|---|---|---|---|
| Bulk cargo vessel | 0.4 | 650 | 750 | 15 |
| Coaster | 0.13 | 650 | 200 | 8.5 |

These assumptions have been used to develop estimated costs associated with increased steaming distances. It should be noted that these costs are indicative and would need to be refined following completion of site specific risk assessments. The severity of effect of a diversion upon different carriers will vary according to their profit margins. By way of illustration, a 1nm diversion on a 200nm trip might represent a 0.5% increase in running costs. The minor nature of the additional steaming distances identified above mean that in most cases it is extremely unlikely that they would prejudice the trade associated with the route or lead to shipping lines seeking to transfer traffic to another port.

To reflect uncertainty in the detailed location and scale of short term development, and thus the implications for additional steaming requirements, the scenarios have used the assumptions set out in Table 25.

27 Consultation responses to the SEA Environmental Report identified a number of concerns for shipping in SW Region. However, these concerns related to the medium term options rather than the two short term options assessed here.

28 The waypoint data suggests approximately 144 vessels per year. Given that the waypoint data under-represents shipping traffic, a figure of 3 x waypoint data has been used based on discussions with Chamber of Shipping

29 The waypoint data suggests approximately 144 vessels per year. Given that the waypoint data under-represents shipping traffic, a figure of 3 x waypoint data has been used based on discussions with Chamber of Shipping

**Table 25. Assumptions for scenarios for commercial shipping**

| Scenario | Assumption |
|---|---|
| High Impact Scenario | Diversion of all traffic around short term option areas; additional annual costs to shipping lines associated with increased steaming distances; |
| Medium Impact Scenario | Offshore wind developers exercise the 30% flexibility on licence area boundaries to change the shape of their sites to minimize shipping conflicts, reducing high scenario impact by 80%. |
| Low Impact Scenario | Reduced scale of development in East and West Regions and flexibility on licence area boundaries, all conflicts with shipping routes are avoided. |

#### 4.4.2.2 Additional navigational arrangements including buoyage

An estimate of buoyage has been made for the construction and operational phase based on the short term options on a regional basis. This estimate is based upon typical configurations for existing offshore wind farms using the IALA Recommendation O-139 on The Marking of Man-Made Offshore structures. The requirement is to mark all Significant Peripheral Structure (SPS). A Significant Peripheral Structure (SPS) is the 'corner' or other significant point on the periphery of the wind farm. It is assumed that the costs of these mitigation measures fall to developers, and would be contained within the capital expenditure costs of developing offshore wind farms. A recent Scottish renewables report (Scottish Renewables, 2010) estimated overall capital expenditure costs for STW and Round 3 offshore wind farms as being around £3.1m per MW installed. It is assumed that costs of buoyage would be included within these.

#### 4.4.2.3 Military Interests

Agreement has been reached with the MOD to ensure that the short term wind development in East Region will not impede strategic defence navigational access into the Firth of Forth. In the future, the short term developments may reduce flexibility in the R3 Firth of Forth Array and an east-west corridor for maritime navigation will need to be retained (Defence Estates Safeguarding, 2010). It is understood that both developer aspirations in terms of turbine spacing/density and Shipping/MOD requirements for maintained sea routes can be satisfied by the existing development plans , although vessels will need to manoeuvre around arrays.

Short term option areas within West Region overlap within the Earadale Practice and Exercise Area (PEXA). Given the proximity of Faslane submarine base, the area is likely to be occasionally used by submarines transiting or on training sorties. The developer should be able to proceed with the desired turbine density within the site but Defence Estates Safeguarding has made representations concerning the orientation of the turbine spacing and the accuracy of charting the turbines (Jon Wilson, Defence Estates Safeguarding, pers. comm. 6 Jan, 2011).

### 4.4.3 Potential Benefits to Shipping from Wind Farm Developments

There are a number of potential benefits to the shipping sector and to ports associated with offshore wind farm development. The construction and maintenance of offshore wind farms requires support from suitable vessels including barges to transport and install structures, cable laying vessels and maintenance vessels. Offshore wind farm development also requires suitable port facilities to act as supply bases during construction and operation. The potential

benefits to the supply chain associated with short term option development are described in Section 4.3 and has not been quantified here.

There may also be other potential opportunities for the shipping sector. For example, P&O Shipping has made provisional plans to exploit the market opportunities provided by the expansion in the offshore wind farm construction by the provision of floating hotels (floatels) that would serve as food and accommodation bases for workers during construction at some sites and potentially as operational maintenance bases, thereafter (Stewart Walker, Stewart Walker Associates, 22 Dec 2010).

### 4.4.4 Estimation of Costs and Benefits

The estimated costs associated with each scenario for each region are presented in Table 26 below. No significant benefits have been identified. The most significant costs are estimated to occur in East Region owing to the higher densities of shipping and larger average vessel size.

**Table 26. Estimated annual costs associated with additional steaming times**

| Region | Scenario | | |
|---|---|---|---|
| | High Impact (£'000) | Medium Impact (£'000) | Low Impact (£'000) |
| South West | 10 | 0 | 0 |
| West | 30 | 0 | 0 |
| North East | 0 | 0 | 0 |
| East | 1,550 | 310 | 0 |

## 4.5 Aviation

### 4.5.1 Introduction

#### 4.5.1.1 Civil aviation

Based on previous experiences with offshore wind farm development, the construction and operation of OWF has the potential to cause a hazard to civil aviation through:

- Interference with both en-route and approach civilian navigation radar systems;
- Increased risk of aircraft collision as a result of the above; and
- Height obstruction of commercial navigation routes.

However, we also note that the development of offshore wind farms may provide commercial benefits for the aviation sector in terms of increased passenger numbers to local airports as a result of increased economic activity associated with wind farm construction and operation. It is not possible at present to quantify these benefits.

#### 4.5.1.2 Defence aviation

The principal interest of the MOD with respect to the draft plan published relates to the potential for offshore wind turbines to obstruct or cause interference to the operation of both air traffic and air defence radar systems (Defence Estates Safeguarding, 2010).

The MOD response to the SEA noted that whilst Air Traffic Control radars at aerodromes had been recognised in the SEA, precision approach radar systems at military aerodromes, MOD air traffic control facilities not located at aerodromes as well as Air Defence and Meteorological radar sites had not been taken into account (Defence Estates Safeguarding, 2010). These facilities also have the potential to be affected by offshore wind farm development.

In some areas, the construction and operation of short term OWF has the potential to interfere with military operations within or occasionally outside of PEXAs.

### 4.5.2 Development of Scenarios

Based on previous experiences with offshore wind farm developments, the potential related economic impacts resulting from both interaction with civilian and military aviation include:

- The need to provide radar mitigation that may range from site-specific blank and fill (with potentially the need to install a new radar to strategic initiatives such as those being pursued through the Aviation Investment Fund Company Ltd;
- Planning delays associated with the provision of radar mitigation;
- Additional track miles for aircraft/helicopters owing to physical interference or radar clutter;
- Change to and or reduction in the scale/output of wind farm projects to mitigate for physical obstruction caused to aircraft; and
- In extreme cases, cancellation of wind farm developments owing to insurmountable problems.

Strategic solutions are being pursued to provide mitigation for en-route aircraft control in controlled airspace above 5500ft, and in relation to low-level radar that informs ATC in airport controlled airspace. It is possible that short-term option developers may contribute to the funding of these strategic solutions, or for regional/local solutions where necessary. For the purposes of this assessment, it has been assumed that these costs are included within the overall estimated capital cost of offshore wind developments, which have been estimated at being around £3.1m per MW installed (Scottish Renewables, 2010). As per other mitigation measures that form a part of capital costs of wind farm development, these have not been considered further in the analysis.

A range of potential further region specific issues are discussed below.

#### 4.5.2.1 North East Region

Initial consultation with NATS has highlighted that the Beatrice OWF will be visible to the Allanshill Primary Radar located near Fraserburgh. In addition to this the NATS North Sea Helicopter Advisory Route W4D (Aberdeen to Wick) also routes directly over the site. Consequently, NATS has suggested that the extent of the potential impacts will require further assessment (ERM, 2010).

It is assumed that helicopters using the Aberdeen - Wick Advisory Route will not be routinely affected by the construction of the short term option and will maintain a safe height above the turbines. However, in the event of inclement meteorological conditions, helicopters may not be able to overfly Beatrice and may need to divert 7nm on both the inbound and outbound route. Such conditions are assumed to affect 10% flights and the associated costs in terms of additional fuel/time/other resources are considered to be minor and not significant at Plan level.

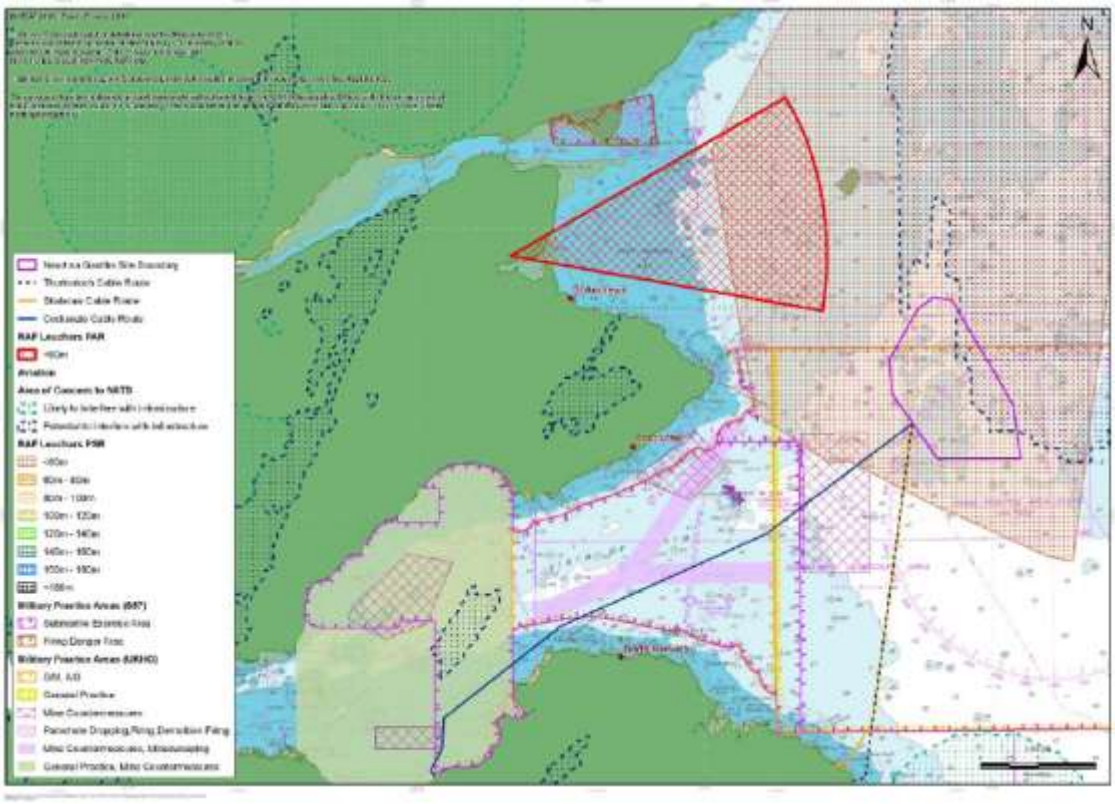
The short term option lies approximately 65km and 80km respectively of the RAF Air bases of Kinloss and Lossiemouth. As noted previously, RAF Kinloss is scheduled to close in March 2011 and impact on Lossiemouth is not envisaged due to the distance from the proposed development. Its location within the Moray Firth exercise areas that are used by the RAF as low flying practice areas, firing and bombing ranges. However, the presence of air traffic control radars (including Precision Approach Radars (PAR) has not been taken into consideration and may therefore be a relevant constraining factor in the progression of the short term development. Whilst the location of the Air Defence Radar at RAF Buchan has been recognised the presence of the nearby Hill of Dudwick Meteorological Weather Radar has not been identified and may therefore be a relevant constraining factor in the progression of the sites identified (Defence Estates Safeguarding, 2010).

The full impact upon airspace and radar of short term OWFs in the North East region is being assessed as part of the Beatrice EIA through consultation with the MOD CAA and other stakeholders (ERM, 2010).

#### 4.5.2.2 East Region

National Air Traffic Services (NATS) have confirmed that there will be no impact upon civil aviation radar operations by the proposed Forth Array scheme (Fred Olsen Renewables, 2010). However NATS remit embraces en route radar facilities only. The Civil Aviation Authority (CAA) has noted that, as a result of needing to lower their operating altitude in inclement meteorological conditions, helicopters may not be able to overfly wind farm developments, and thus would be forced to alter their track to go laterally around the sites, resulting in additional track miles, costs and emissions (Civil Aviation Authority, 2010).

While it is understood that there are no direct objections from MOD to short term developments in East Region it is evident from review of the correspondence that the new developments will constitute an additional constraint that will reduce the flexibility in mitigating radar interference for the medium term options. While account has been taken of the PAR, the scoping undertaken, to date, would suggest that there could be further issues affecting military radar, e.g. the primary surveillance radar (PSR) for RAF Leuchars affecting a large portion of low level (<80m) coverage for RAF Leuchars (Figure 26). It is not possible to estimate costs of potential mitigation measures, pending more detailed project level assessment. It is possible that the potential improvements that may be required for low level radar to facilitate civilian aircraft may also address some of the issues for military aircraft.




(Source: Mainstream Renewable Power, 2009)

**Figure 26. Military practice areas and RAF Leuchars in relation to Neart na Gaoithe offshore wind farm**

#### 4.5.2.3 South West Region

No specific civil aviation issues for the South West region were identified from the review of the literature and consultation. The MOD Air Traffic Radar facility at West Freugh has not been taken into consideration and may therefore be a relevant constraining factor in the progression of the sites identified in this region (Defence Estates Safeguarding, 2010).

#### 4.5.2.4 West Region

Campbeltown does not have a civilian radar system (Anne Phillips, HIAL, pers. comm. 10 Jan. 2011); in view of the close proximity of one of the short term options to the runway approach, aircraft using the airport will be physically obstructed by the proposed layout of the OWF and HIAL have written to SSE Renewables advising them of which turbines interfere with aircraft using the airport. Modifications to the layout of the site may be achievable within the overall flexibility provided by the lease (the lease footprint can be varied by up to 30% by agreement) without reducing installed capacity.

None of the short term options are expected to cause low level radar clutter issues as Prestwick is still in excess of 75km away from the nearest of the short term options.

Based upon feedback obtained, to date, there is no significant impact from short term wind farm developments upon military aviation/radar in the west region; military interests likely to be affected by these developments relate more to submarine operations (see Section 4.6.2).

### 4.5.3 Estimation of Costs and Benefits

It is possible that short-term option developers may need to contribute to strategic radar solutions within each region. It has been assumed that these costs are incorporated within the estimated capital cost of around £3.1m per MW installed capacity.

No specific costs to civil or military aviation interests have been quantified, although the regional analysis has identified some potential issues that may need to be addressed at project level. There is likely to be some scope at project level to mitigate impacts where necessary.

## 4.6 Wave and Tidal Energy Development

### 4.6.1 Introduction

Short term option development has the potential to affect wave and tidal development through competition for space (in areas of resource overlap) and competition for electricity supply or through changes in coastal processes which reduce the suitability of wave and tidal resources. Wave and tidal energy is up to 10 years behind wind energy in development, making it difficult to asses the economic effects of OWF development on possible future wave and tidal renewable energy development.

While the locations for short term option development in West Region overlap with areas of potential future wave resource, it is unlikely that such areas will be a priority for deployment of wave converters. The extensive areas of wave resource off Scotland's North and West coasts mean that the loss of small areas of potential future wave resource for offshore wind development is unlikely to significantly constrain development of the industry.

The short term options do not overlap with the primary areas for tidal stream deployment, although the Islay Array is located just to the north of the main tidal stream resource off Islay. It is unlikely that short term option development will significantly affect the suitability of existing tidal stream resources.

It is possible that investment in offshore wind development may affect the pace of development and implementation of wave and tidal development in the short term within the context of a competitive energy supply sector. However, this should not prevent wave and tidal technologies from contributing to the energy supply mix in the future alongside offshore wind.

For the purposes of this assessment, it has been assumed that short term options development will not give rise to any significant costs or benefits for wave or tidal stream energy interests.

## 4.7 Cables and Pipelines

### 4.7.1 Introduction

Short term options development has the potential to affect existing cable and pipeline interests. While site selection and planning has avoided interaction with existing cables and pipelines (Figure A11), it is possible that export cable routes could cross over some existing cables. While this does not pose any major issues during the construction phase, UKCPC have indicated their concern that the general proliferation of cables in the marine environment, particularly as a result of offshore wind development may increase the costs of maintaining existing cables in the future. In particular, where there are multiple cables in close proximity, it is likely to become more difficult to retrieve cables for maintenance. Furthermore, where maintenance is required in the vicinity of cable crossovers, this is likely to preclude maintenance techniques which involve cable retrieval. Instead, more expensive maintenance methods will be required, relying on the use of divers or ROVs. These methods will be significantly more expensive than traditional cable maintenance techniques.

While ease of maintenance is a general concern of the cables industry, UKCPC has indicated that it has no specific concerns in relation to the short term option developments (Richard Hill, UKCPC, pers. comm. 18 Jan 2011) and therefore it has been assumed that there will be no significant costs to existing cables and pipelines associated with short term options development.

In relation to pipelines, 'Interconnector 2' runs just 50 m to the south-east of the proposed site for the Wigtown Bay offshore wind farm. As described in Section 3.8, this pipeline provides gas to the Republic of Ireland and the Isle of Man. 'Interconnector 1' however runs 7 km through the middle of the site before continuing on to Dublin. Issues with these pipelines would be the subject of site-specific discussions, and as such are outwith the scope of this assessment.

Oil and Gas UK provide an example of pipeline constraints with a Round 2 wind farm site in England (Mick Borwell, Oil and Gas UK, pers. comm. 21 Jan 2011). Maintenance barges for pipeline work are generally anchored and require a nominal working space of 500 m either side of the pipeline. A similar issue with the proposed Triton Knoll offshore wind farm development resulted in the site being split into two discrete regions either side of a 1 km buffer zone for three existing sub-sea pipelines (IPC, 2010). Comments from the Health and Safety Executive on Triton Knoll highlighted the need to ensure that the proposed development did not adversely interact with major accident hazard pipelines (MAHPs) (IPC, 2010). Exclusion zones for pipelines tend to be agreed at a site-specific level and may be less or more than the distance cited in the Triton Knoll case.

For the purposes of this assessment, it has been assumed that short term options development will not give rise to any significant national or regional costs or benefits for cables and pipelines interests.

## 4.8 Recreational Boating

### 4.8.1 Introduction

Based on previous experiences with offshore wind farm developments, the construction and operation of offshore wind farms has the potential to negatively impact on recreational boating activities through:

- Increased collision risk with rotor blades and/or sub-surface structures particularly in narrow channels with strong tidal flows[30] ;
- Loss or alteration of 'essential routes' into sheltered harbours and anchorages used for shelter during poor weather conditions;
- Loss of cruising routes or displacement of cruising routes into commercial routes;
- Altered recreational boating vessel transit through wind farm areas incurring additional fuel costs;
- Racing/sailing areas relocated;
- A reduction in recreational boating activity related to a perceived loss of scenic quality of the seascape. SEA Environmental Report consultation responses[31] particularly highlighted these issues for development in the West Region; and
- Reduced levels of investment in marinas and recreational boating infrastructure in response to the uncertainty created by short term option development.

Some of the risks posed by offshore wind development can be mitigated by developers through careful siting of offshore wind farms and appropriate marking and lighting of developments. The RYA Position Statement on minimising adverse impacts of marine renewables on recreational sailing (RYA, 2009) suggested that good design may mitigate against some of the anticipated visual impacts.

No racing or sailing areas are likely to be affected within any of the regions and therefore no impacts on these facilities are anticipated.

The European Boating Association (EBA) position statement states that 'there is no danger to a vessel under 24 metres in length navigating through the farm taking reasonable care'. During stakeholder consultations, the RYA concurred with the EBA position statement, that it was safe for vessels under 24m to navigate through offshore wind farms once construction was complete and that there was no need to avoid passing through them (Caroline Price, RYA, pers. comm. 17 Jan 2011)[32]. A questionnaire undertaken by the RYA as part of a study into recreational boating in wind farm strategic areas revealed that the perception of the majority of sailors was that navigating through a wind farm, in which turbines would be 500-700m apart, is feasible with 75% of respondents stating that in favourable conditions, they did not anticipate a problem navigating through with only 14% stating that they would not navigate through in any conditions

30 For example, SEA Environmental Report consultation responses from RYA Scotland and the Scottish Boating Alliance (SBA) indicated that there should be minimum clearance height of 22m between the Mean High Water Springs level and the turbine blades to ensure the safety of most small recreational craft.

31 RYA Scotland and the Scottish Boating Alliance (SBA) Offshore Wind SEA Consultation responses

32 It was highlighted that this did not mean that OWFs were not a hazard under certain conditions, e.g. fog (Graham Russell, RYA Scotland, pers. comm. 18 Jan 2011)

(RYA, 2004). However, the RYA highlighted that since that survey in 2004, when offshore wind farms were relatively new, people now have more experience of sailing through offshore wind farms and concerns have shifted from navigating through individual offshore wind farms to the challenges related to navigating through areas of coastline (e.g. the east coast of England) with numerous offshore wind farm developments and shipping lanes (Caroline Price, RYA, pers. comm. 17 Jan 2011).

Anecdotal evidence from England suggested that while members had expressed that cruising may be "more challenging" due to the presence of offshore wind farms, the RYA had not heard members state that they would not go sailing in an area because of offshore wind farms. Many people undertake recreational boating activity in a specific area which they know well and, in general, do not change this behaviour but instead adapt to any changes that occur within that area (Caroline Price, RYA, pers. comm. 17 Jan 2011).

As such, based on this limited evidence from the effect of offshore wind farms in England, it has been assumed that there will be no significant negative impacts relating to collision risk/navigation or changes in recreational boating activity levels related to perceived reductions in seascape quality. The latter assumption has been made with low confidence, based on anecdotal evidence that offshore wind farms in England have not altered the distribution of recreational boating activities whilst recognising that certain regions in Scotland, may be more sensitive to seascape-related impacts, for example, due to the 'wilderness and uncluttered scenery' being a 'selling point' for the recreational boating sector in Scotland (Mike Balmforth, SBA, pers. comm. 18 Jan 2011). It should also be noted that these assumptions are made using 'national level' information (i.e. from the 'UK Recreational Boating Atlas') and not from detailed assessment of local cruising routes, which were not available at the time of assessment, but which were highlighted in local stakeholder workshops. As such, project level assessments will need to take such local cruising routes into consideration.

In relation to the loss of essential routes into anchorage points, examination of the UK Recreational Boating Atlas suggested that no cruising routes into anchorage points passed through any of the short term developments options in the South West, East or North East Regions. Consultation with RYA Scotland identified one existing cruising route in the West Region up the west coast of Kintyre that the organisation considered essential from a safety point of view. If vessels 'following'[33] the cruising route were unable to navigate through the offshore wind farm development (e.g. due to adverse weather conditions), safety issues may arise, especially as once committed to this route (in either direction), it is difficult to turn back. The route in question is frequently taken to avoid overfalls and other inshore hazards in the area (Graham Russell, RYA Scotland, pers. comm. 18 Jan 2011)., For this assessment it has been assumed that no loss or alteration of essential routes will occur, based on the position of recreational boating organisations that there are no need for exclusion zones for small (<24m) vessels from offshore wind farms, however a potential safety issue in relation to an essential cruising route in the West Region has been noted.

No potentially significant positive effects on recreational boating interests have been identified.

[33] Although cruising routes are marked as a line, they are in practice wider, particularly when a vessel is under sail and beating into the wind (Graham Russell, RYA Scotland, pers. comm. 18 Jan 2011).

### 4.8.2 Development of Scenarios

Within the analysis, potential impacts related to additional fuel costs have been estimated. However, for the low and medium impact scenarios, no costs have been identified based on the assumptions that there are no significant navigational issues associated with cruising through offshore wind farms for vessels under 24m, no decrease in recreational boating activity arising from loss of 'scenic quality', and only temporary disruption to general sailing areas during construction (Table 27).

For the high impact scenario, additional costs have been assumed to be restricted to additional fuel costs for a small proportion of vessels which choose to divert around wind farm option areas which are intersected by recreational cruising routes (Table 27). No detailed information on the number of vessels passing along cruising routes, the proportion of vessels travelling under motor[34] or a more recent estimate of the number of vessels which may choose to deviate around an offshore wind farm was available. Hence, for the purposes of this assessment, it was only possible to calculate the additional fuel costs for a hypothetical number of vessels which may deviate around the offshore wind farms, in this instance chosen as 1,000 boats. Such a value is likely to represent relatively conservative number for vessels that would choose to divert around a wind farm in normal circumstances, based on experiences with offshore windfarms in English waters.

**Table 27. Assumptions for scenarios for recreational boating**

| Scenario | Assumption |
|---|---|
| High Impact Scenario | 1,000 recreational vessels per annum choose to divert around short term option areas; additional annual costs to associated with increased steaming distances. |
| Medium Impact Scenario | Vessel transit through offshore wind farms is unaffected. No additional costs incurred. |
| Low Impact Scenario | Vessel transit through offshore wind farms is unaffected. No additional costs incurred. |

In order to calculate the additional fuel costs for vessels choosing to deviate around offshore wind farms, the cost of marine diesel was taken as £0.96 per litre. The mileage per litre for vessels under motor depends on the size and speed of the vessel in question, ranging from about 13-63litres/hour[35]. For the purposes of this assessment, for a 'generic' averaged sized boat, a fuel consumption of 40litres/hour for a boat travelling at 20 knots has been assessed. At this speed, the mileage was calculated as approximately 1km/litre.

An indicative diversion route length was estimated within each region by measuring the difference between a 'current' cruising route through an array and an alternative cruising route. Within each region, an indicative example of a diversion distance around an array(s) was estimated. In regions where cruising routes intersected more than one array, the likely largest

34 Most recreational vessels in Scottish waters are sailing vessels and skippers will try to sail (i.e. rather than motor) whenever possible, although sailing craft may have to use auxiliary power (i.e. motor) to avoid dangers or shorten passage time (Graham Russell, RYA Scotland, pers. comm. 18 Jan 2011)

35 Fuel costs and the mileage of vessels under motor estimated based on an internet search of boat specification documents from yacht brokerages and from enquiries with local marinas in England.

diversion distance (assessed visually) was measured and used as the value for that specific region (e.g. the diversion distance around the Solway Firth was measured in the South West Region). The exception to this was in the East Region, where the distance to divert a cruising route which intersected both the Neart na Gaoithe and Forth Arrays was calculated. Where more than one cruising route intersected an array, the longest route through the array (assessed visually) was measured and an alternative route created (i.e. the 'diversion length' was calculated for the longest section of cruising route intersecting any given array). It must be noted that these alternative cruising routes were not devised to take into account of other natural or man-made navigational hazards (i.e. they may not represent realistic deviation routes) and as such only represent indicative values of potential deviation distances.

Using this method, indicative estimates of the cost of diverting around an offshore wind farm in each region was estimated for 1,000 boats per annum as the diversion distance (km) x price of marine diesel/litre.

The indicative diversion distance per region is shown below:

- West: 10km (around Kintyre Array);
- South West: 7km (around Solway Firth Array);
- East: 14km (around the Neart na Gaoithe and Forth Arrays); and
- North East: 3km (around the Beatrice Array).

Because of the absence of data in this area, and the quantity of assumptions that have needed to be made to develop cost estimates, there is a high degree of uncertainty around the estimated cost impacts. However, all the estimated costs are very small, and it is not believed that these estimates provide a realistic indication. For the costs to be more significant, the number of vessels deviating around the short term option arrays would need to be several orders of magnitude greater than estimated. Based on the available evidence from England, this seems unlikely.

### 4.8.3 Estimation of Costs and Benefits

The estimated costs associated with each scenario for each region are presented in Table 28 below. The most significant costs are estimated to occur in East Region reflecting the potentially greater diversion distances that might be incurred.

**Table 28. Estimated annual costs associated with additional steaming times**

| Region | Scenario | | |
|---|---|---|---|
| | High Impact (£'000) | Medium Impact (£'000) | Low Impact (£'000) |
| South West | 7 | 0 | 0 |
| West | 10 | 0 | 0 |
| North East | 3 | 0 | 0 |
| East | 13 | 0 | 0 |

## 4.9 Recreational Angling

### 4.9.1 Introduction

Based on previous experiences of offshore wind farm development, the construction and operation of offshore wind farms can have a range of potential impacts on recreational angling including both positive and negative impacts which can give rise to economic impacts on the supply chain (boat hire, fishing tackle sops, bait sales, associated spend on accommodation etc). Potential negative impacts include:

- Displacement of boat anglers from, or decreased access to, traditional recreational sea angling areas within wind farms;[36]
- Temporary exclusion of shore anglers during cable laying on the shore;
- Impacts on fish stocks during construction and/or operation of offshore wind facilities as a result of impacts to feeding, breeding and/or migration of species of angling interest (e.g. through increased noise, vibration, turbidity or electromagnetic fields) (SSACN consultation response).[37]

The construction and operation of offshore wind farms has the potential to positively impact on recreational angling through:[38]

- Additional sea angling opportunities created by offshore wind farms through:
  - Increased land-based infrastructure (e.g. all weather harbours, all tide slipways, boat storage areas) arising from the construction and operation of wind farms designed to accommodate and made available to sea anglers;
  - Provision of mooring buoys for recreational sea angling within wind farm;
- New structures within, and exclusion zones around, the offshore wind farms provide suitable habitat for, and allow the recovery of stocks levels of, recreational sea angling species of interest. New structures and/or cable protection such as rock armour, at the cable landfall sites may provide suitable habitat for angling species of interest and hence create new or improved opportunities for shore angling; and
- Possible development of new sea angling fisheries in areas which are currently void of targetable fish and/or recovery of areas where sea angling has been absent due to the depletion of the target fish species . Possible development of new sea angling areas in response to displacement or restriction to sea angling in wind farms.

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36 Concern was expressed by SSACN in its response to the Offshore Wind SEA consultation that if the OWE developments steer clear of main shipping lanes, the wind farms are likely to be moved further into areas typically used by anglers in kayaks and boats. Concern was also expressed that the exclusion of commercial trawling may be extended to include the banning of sea angling (e.g. the Robin Rigg Bill defines trawling as "any fishing activity which involves dragging a net or line along the seabed").

37 A primary concern raised in SSACN's consultation response relates to the unknown impact of EMF arising from OWF cables on elasmobranch species, and in-particular, whether EMF may alter the migration patterns of any elasmobranch species which exhibit migratory patterns and the subsequent impact on sea angling activity and economic input into local economies. For example, sea anglers in North Wales claimed that Tope ceased to be present after an OWF was installed off the north coast of Wales, in an area that had previously been a prime Tope area (Steve Bastiman, SSACN, pers. comm. 11 Jan 2011).

38 SSACN consultation response to the Offshore Wind SEA consultation.

### 4.9.2 Development of Scenarios

To develop the scenarios for the impact assessment we have taken account of a range of available evidence including information from existing offshore wind farm developments and research studies.

The impacts of offshore wind farms on fish stocks remain uncertain to some extent. The issues have been described in Section 4.4 in relation to commercial fish stocks. The evaluation concluded that short term option development should not cause any significant impacts on fish stocks, assuming appropriate mitigation measures were implemented.

While some restrictions on shore fishing could be imposed during construction of the cable landfall, such restrictions would be local to the works and temporary. Placement of rock armour at the landfall could improve shore fishing opportunities, but this is unlikely to provide a particularly significant benefit as the area of shoreline affected would be very small. The study has therefore assumed that impacts on shore fishing would therefore be negligible.

The other potential benefits from short term option development (improved shore-side facilities, provision of moorings within offshore wind farms and development of new fisheries) are all very uncertain and have all therefore been assumed to be negligible.

The development of the scenarios has focused on the potential impact of displacement of recreational fishing activity from within short term option developments (Table 29) and the economic consequences for expenditure associated with recreational angling.

**Table 29. Assumptions for scenarios for recreational angling**

| Scenario | Assumption |
|---|---|
| High Impact Scenario | All boat-based recreational fishing activity within wind farm arrays located within 6nm of the coast[39] ceases and is not offset by increased levels of activity elsewhere within the region or Scotland. |
| Medium Impact Scenario | It has been assumed that costs will be 20% of the high estimate scenario on the basis that the total value of recreational fishing activity within development areas is unlikely to be lost completely to the region or Scotland and it is unlikely that exclusion policies would apply to the full extent of all wind farms. |
| Low Impact Scenario | No significant displacement of recreational fishing activity occurs. This is based on experiences with some English offshore wind farms where anchoring exclusions are limited to 50m exclusion zone around each turbine tower which represents a very small proportion of each wind farm array. |

In the high impact scenario, it has been assumed that all boat-based recreational fishing activity within wind farm arrays located within 6nm of the coast ceases and is not offset by increased levels of activity elsewhere within the region. For those regions within which short term development is proposed within 6nm of the coast (West and South West Regions), the area of development which falls within 6nm was measured and calculated as a percentage of the total area of coastal water within 6nm for the appropriate region. The proposed short-term options in East and North East Regions are located beyond 6nm and it has therefore been

[39] Based on SSACN observation that the great majority of recreational angling occurs within 6nm of the coast.

assumed that recreational angling impacts in these regions will be negligible. Based on the estimates of total annual sea angling expenditure within different regions in Scotland from Radford *et al* (2009) (see sections 3.10.1 to 3.10.3), the estimated loss of sea angling expenditure that would arise from the displacement of boat angling from areas of offshore wind farms within 6nm could be calculated as:

**(Area of development within 6nm/regional area within 6nm) x expenditure on boat-based angling in region**

These calculations assume that the regional sea angling expenditure values presented in Radford *et al* (2009) relate to sea angling undertaken within 6nm of the coastline and that boat-based sea angling is spatially evenly distributed within the area contained between the coastline and 6nm.

In both the medium and high impact scenarios, it has been assumed that the displaced activity is lost from Scotland on the basis that a high proportion of anglers are visitors from elsewhere in the UK and may no longer choose to visit Scotland (Radford *et al*, 2009). However, it is recognised that this is likely to be an oversimplification and that some activity will simply be displaced within regions or within Scotland as a whole.

### 4.9.3 Estimation of Costs and Benefits

Estimates of costs associated with the different scenarios are presented in Table 30 below. No significant benefits have been identified. The main costs are estimated to occur in South-West and West Regions.

**Table 30. Estimated reductions in expenditure on recreational angling**

| Region | Scenario | | |
|---|---|---|---|
| | High Impact (£'000) | Medium Impact (£'000) | Low Impact (£'000) |
| South West | 420 | 80 | 0 |
| West | 800 | 160 | 0 |
| North East | 0 | 0 | 0 |
| East | 0 | 0 | 0 |

## 4.10 Surfing, Windsurfing and Kayaking

### 4.10.1 Introduction

Based on previous experiences with offshore wind farm developments, the main potential impacts of concern for surfing and windsurfing associated with short term option development include:

- Effects on the quality of the wave for surfing (wave height, period and direction); and
- The visual impact of offshore wind development on the seascape setting for surfing and windsurfing.

Surfing and windsurfing largely take place close to shore and therefore generally do not occur within the footprint of wind farm arrays. We were unable to source information on the impacts on sea-kayaking, but given that most kayakers stay within several hundred metres of the shore (based on informal discussions with experienced kayakers), it is considered unlikely that they will be particularly affected by offshore wind farms.

SAS (2010) note that when 'valuing' the worth of a wave, the number of surfers that would be affected if the wave was destroyed or degraded needs to be considered. In general, the value of a wave increases as a function of the number of people that surf it, where a wave is probably worth more if it is in accessible part of the UK with a regular surfing population nearby compared to if it is in a less accessible area. However, many surfers are willing to travel large distances to undertake surfing at good quality spots (Lazorow, 2009). Therefore, high quality waves located in remote areas could bring economic benefits to a rural area through travel, accommodation and subsidence expenditure of visiting surfers.

Surfing wave quality is fundamental to the economic value of surfing (SAS, 2009). The principle impacts of renewable energy developments on surfing wave resources concern potential changes to the wave climate (i.e. wave height, period and direction) particularly at the coast, as well as changes to sedimentary processes (transport and deposition) and water clarity (turbidity) during OWF construction and operation. For example, as a wave passes through an OWF development, there is potential for energy to be blocked and re-directed by the renewable device structures (SAS, 2009), impacting on wave height and wave angle.

Good evidence of the changes in wave height and direction is available from existing wind farm sites. For example, as part of the EIA for the Round 1 Burbo OWF development in Liverpool Bay (shortest distance from array boundary to land about 3.37nm/6.2km), ABPmer (2002a) undertook modelling to investigate the near- and far-field changes in wave regime on waves passing through 30 turbine structures of 4m diameter. The model predicted that in general the effects were related to small reductions in wave height (typically < 0.1m, equivalent to about a 3% reduction in wave height) and that down-drift of the wind farm the influence on the near-field wave climate quickly dissipated such that the differences in wave climate became minimal (<0.02m).

Similarly, a model to assess the influence of a proposed development at Scarweather Sands (30 turbines, assumed 'maximum impact scenario' of a gravity base 28mx28mx3m height supporting a 5.6m diameter turbine mast; shortest distance from array boundary to land about 5.7km ) on the baseline wave regime revealed that the proposed development would generally cause localised changes to the 'near-field' area (ABPmer, 2002b). These effects included small changes in wave height (falling within the range of 0-5% change in baseline wave conditions) immediately in the lee of individual structures, but without significant 'far-field' effects. The report stated that natural changes in the morphology of Scarweather Sands were likely to cause greater degrees of variation in the far-field wave regime. The results also indicated that the OWF effect on regional sediment pathways (erosion and deposition) were negligible. Further modelling of the effects of the Scarweather Sands Offshore Wind Farm were undertaken in 2003 (ABPmer, 2003), including assessment of the effects of the development on wave height at different stages of the tidal cycle and the effect of the development on the

swell component of the wave climate to assess the impact on the surf in Rest Bay. The results showed that the greatest effect on wave climate occurred at the time of high water and supported the previous findings that the development would have no significant effect on the wave climate at the shoreline.

A study of changes to the near and far-field wave regime at Scroby Sands OWF (30 monopile wind turbines, 4.2m in diameter; shortest distance from array boundary to land about 0.93nm/1.75km) using field measurement techniques and modelling showed that the effects arising from a monopole-based wind farm was a reduction in wave height of 2-5% in the immediate vicinity of the wind farm with this effect decreasing rapidly with distance from the wind farm such that wave climate reached background values within a distance of 2-3 turbine spacings (Cefas, 2005). It was concluded that the wave diffraction (changes to incoming wave direction) and interference effects arising from monopole arrays are negligible and, by inference, nearshore effects were also likely to be negligible.

Evidence from existing wind farm developments therefore indicates that there have been no significant changes in wave quality at the shoreline as a result of these developments. A concern raised by stakeholders is that OWFs proposed under future leasing are larger than existing offshore wind farms (e.g. numbers of turbines, diameters of foundations) and hence the diffraction and wave height effects may be greater. For example, RPS (2005) found that the magnitude of far-field impacts from the London Array OWF on wave climate were related to foundation type and the state of the tide with the greatest impact (reduced wave height of up to 5cm at the north Kent coast at times of high water during peak ebb tides) was predicted for Gravity Base Structure (GBS) foundations. Nevertheless it remains unlikely that future developments will significantly affect wave quality at the shoreline and the cost impact is therefore considered to be negligible.

The effect of the visual impact of offshore wind development on the attractiveness of locations for surfing and windsurfing is uncertain. SAS (2009) notes that wave quality is the most important factor affecting the economic value of surfing. However, it is possible that the overall attractiveness of an area for tourism could be affected by visual impact and in turn this could reduce surfing or windsurfing activity undertaken as part of wider tourism activity. This issue is discussed further in the tourism impact assessment and no separate cost estimate is provided here.

A perceived reduction in the attractiveness of an area as a result of offshore wind farm development has the potential to affect decisions on the suitability of specific locations for hosting surfing or windsurfing events. However, the primary reason that locations around Scotland are chosen for such events are the wind and wave conditions. Given that short term option development is unlikely to affect these conditions, it is unlikely that future hosting of specific events would be affected.

On this basis, it is unlikely that any significant national or regional costs will be incurred by surfing or windsurfing interests as a result of short term option development and no cost estimates have been included for any of the scenarios.

## 4.11 Tourism

### 4.11.1 Introduction

The construction and operation of offshore wind farms can have a range of potential impacts on tourism including both positive and negative impacts based on information from existing offshore and onshore wind farm developments.

Potential negative impacts on tourism may occur through:

- Visual effects on the landscape and seascape[40] deterring visitors to an area or deterring tourism investment;
- Disturbance or injury to coastal or marine wildlife interests (e.g. for wildlife watching) during construction or operation of the wind farm; and
- Disruption to site access for tourism operations.

Impacts on tourism from visual effects may arise due to a visitor's a perceived reduction in the attractiveness of 'quality' of the landscape (i.e. the important feature attracting tourists) due to the presence of an offshore wind farm, which may potentially result in reduced prices for tourism services and/or reduced numbers of tourists. For example, concern was raised in several consultation responses to the Offshore Wind Energy Draft Plan and SEA regarding highly sensitive seascapes in the West and South West Regions and the potential for development to have significant adverse impacts on the scenic amenity during construction and operation of the offshore wind farm[41].

In addition to general impacts on tourism numbers, there is the potential for offshore wind farm development to adversely affect investment in new resort development in circumstances, where such development is promoted on the basis of a rural location and uncluttered seascapes, for example, golfing or watersports resorts.

Potential positive impacts on tourism may occur through:

- Visual effects on landscape and seascape during operation creating tourism opportunities, providing add-on benefits to existing wildlife excursions and attracting visitors to an area.

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40 For the purposes of this study, the definition of 'seascape' has been taken from DTI (2005) in which it is stated that seascape is a term for: "*the coastal landscape and adjoining areas of open water, including views from land to sea, from sea to land and along the coastline" and describes "the effect of landscape at the confluence of sea and land.*

41 VisitScotland and The Village at Machrihannish Dunes/Kintyre Development Company Ltd consultation responses, available on the Scottish Government website: http://www.scotland.gov.uk/Publications/2010/11/03131226/0
An analysis of all of the consultation responses are available on the Scottish Government website: http://www.scotland.gov.uk/Publications/2010/12/22153227/0

### 4.11.2 Development of Scenarios

To develop the scenarios for the impact assessment we have taken account of a range of available evidence including information from existing offshore wind farm developments and relevant studies relating to onshore wind farms.

A survey by Riddington *et al* (2008) estimates the impacts of onshore wind farm development on tourism expenditure in Scotland. Based on this research, the estimated potential reductions in general expenditure of tourists in four case study areas are shown in Table 31.The study suggests that the impact from onshore wind farms on visitors' intentions to return to the area is likely to be low. The vast majority of visitors (93-99%) who had seen a wind farm suggested that the experience would not have any effect; in fact there were some tourists for whom the experience increased the likelihood of a return visit rather than decreasing it. In the absence of a comparable study for offshore wind development, the findings from the onshore study have been used to estimate impacts associated with offshore wind farms, although it is recognised that the findings from onshore studies may not be perfectly transferable.

**Table 31. Estimated reduction in general expenditure of tourists by area**

| Study Areas from Riddington *et al* (2008) | Relevant OWE Plan Region | Tourists Affected* (%) | Tourist Expenditure Reduction (%) | Tourist Expenditure (£Million) | Expenditure Reduction (£Million) |
|---|---|---|---|---|---|
| Caithness and Sutherland | | 60.75 | 1.54 | 37.35 | 0.58 |
| Stirling, Perth & Kinross | | 51.00 | 1.30 | 657 | 8.54 |
| The Scottish Borders | | 62.29 | 1.58 | 175 | 2.77 |
| Dumfries & Galloway | South West | 67.62 | 1.72 | 359 | 6.17 |

* The number of tourists that may come into contact with any of the projects that were built, permitted or in the process of applying for permission within the planning system.

Recent studies in Denmark by Ladenburg & Dubgaard (2009) & Ladenburg (2010) suggested that people who use the coastal zone (e.g. anglers, recreational boaters) significantly perceive the visual impacts of offshore wind farms to be more negative compared to people who do not use the coastal area for those specific purposes. The results also indicated that respondents who visit the beach on a frequent basis also have stronger preferences for reducing visual disamenities (i.e. reducing visual impacts) when compared to less frequent visitors. The results suggested that the recreational value of the coastal use is potentially jeopardised by visual impacts from the offshore wind farms in the Danish studies, which the authors described as being *"not located at [a] relatively large distance from the shore".* The authors concluded that potential reductions in capital cost (investment, construction and running costs) by locating OWFs at relatively closer distances to the shore might be outweighed by the reduction in visual amenity benefits in coastal areas with a large recreational activity. As such, the optimal location (i.e. distance from the shore) of offshore wind farms might be further away from the coast in areas with a high level of recreational activities compared to coastal areas with relatively little recreational activity.

The 'Keep Wigtown Bay Natural' response to the Offshore Wind SEA consultation[42] highlights a survey undertaken along the Wigtown Bay coastline in August 2010, which asked 79 visitors what had attracted them to the area and how likely they were to return in the future. Of the responses, 44% included 'scenery' as a reason they had been attracted to the area and 100% of respondents indicated that they would consider returning to the area in the future. However, after being shown 'scaled photo-montages' of the proposed wind farm (panoramic photographs of the array from various locations produced according to offshore wind industry summary guidance), 80% of respondents stated that the development would affect their decision to return (14% said it would not affect their decision, 6% stated "don't know"). Given that the estimated total spend of the respondents in the local area was £34,360 (n=79; mean total spend £435), it was calculated that losing 80% of return visitors would result in a loss of £27,488 to the local economy.

In contrast, some studies have suggested that offshore wind farms could bring economic benefits to the local tourism industry. A report by BWEA (2006) reviewed numerous studies and surveys assessing the impacts of wind farms on tourism in the UK, including two operational OWFs in England and Wales. The report stated that E.ON UK's Scroby Sands Information Centre welcomed 30,000 people in the first six months (from May 2004), and in 2009, 42,000 people visited (Jenny Hogan, Scottish Renewables, pers. comm. 3 Feb 2011). The report also refers to a public attitude survey towards the operational North Hoyle OWF in North Wales undertaken in 2004. Two thirds (67%) of the residents in the Rhyl and Prestatyn areas said that the presence of the North Hoyle OWF had not affected the number of people visiting or using the area; 11% of residents said numbers had increased while 4% said numbers had decreased; the remaining 82% did not see any effect on visitor numbers [43].

Commercial wildlife boat trips such as whale watching trips have the potential to be impacted directly by the physical presence of the wind farms by making access difficult to routes often used by the boats or by interrupting lines of sight while scanning for wildlife with scopes or binoculars. In addition, changes to the abundance or distribution of target species in an area arising from potential environmental impacts (see section 4.13) could cause 'knock-on' effects to the marine wildlife tourism sector. Although there is some uncertainty concerning actual environmental impacts, such risks are generally considered to be low. In particular, most of the species of interest to marine ecotourism such as cetaceans, seals and seabirds are protected under the EC Birds and Habitats Directives with a legal obligation to ensure that adverse effects on the integrity of designated sites are protected and wider provisions to avoid or minimise disturbance of protected species. Therefore, any impact to marine ecotourism species would be expected to be very minor. The current assessment has therefore assumed these impacts to be negligible.

Impacts from offshore wind farms specifically on visitors to coastal/links courses are unknown, as are the impacts on future golf course development in such areas.

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42 Available on the Scottish Government website: http://www.scotland.gov.uk/Resource/Doc/339274/0112241.pdf

43 Taken from summary provided on the Parliament UK Website: http://www.publications.parliament.uk/pa/cm200708/cmselect/cmdius/216/216we96.htm

The assessment of impacts on tourism has focused on potential changes in tourism expenditure based on visual impact but also takes account of the potential to deter tourism investment. If landscape and visual impacts arising from offshore wind farm development have a negative effect on tourism through deterring visitors to a region, the loss of tourism expenditure could lead to a reduction in economic activity and result in a loss of income and/or jobs. The review of available information above indicates that both positive and negative impacts could occur. However, the existing evidence base is underdeveloped, and further research is required to provide an improved understanding of overall impacts.

Proposed development in the East and North East Regions is further offshore (a minimum of 14km from the nearest land) and in areas where existing seascapes are less sensitive (Scott *et al*, 2005). The impacts on general tourism in these regions are therefore considered to be negligible under all scenarios. The economic impact assessment has therefore focused on potential changes in West and South West Regions. The basis for the scenarios is given in Table 32.

**Table 32. Assumptions for scenarios for tourism**

| Scenario | Assumption |
|---|---|
| High Impact Scenario | Negative impacts arising from short term option development results in a 1.72% reduction in tourism expenditure in both the West and the South West Regions (based on the worst case scenario in the Dumfries and Galloway regional case study in the Riddington *et al*, 2008 study). It has also been assumed that there are no positive impacts on tourism and hence this effect is not negated to any degree. Loss of investment in a resort development in West Region leading to a loss of annual revue of £3m p.a. |
| Medium Impact Scenario | Negative impacts arising from short term option development result in a 1.30% reduction in tourism expenditure in both the West and the South West regions (based on the best case scenario in the Stirling, Perth and Kinross regional case study in the Riddington *et al*, 2008 study). This figure was chosen to represent a scenario in which there was a reduction in tourism spend arising from seascape visual impacts of the short term options (e.g. about 1.5% based on the Caithness and Sutherland and Scottish Borders regional case studies in the Riddington *et al*, 2008 study) but that positive impacts arising from new tourism opportunities related to the short term option development offset this to a certain degree. |
| Low Impact Scenario | While there is the potential for an indirect negative effect on tourism visitor numbers and hence tourism expenditure, positive effects arising from the creation of new tourism opportunities, such as offshore wind farm-related information centres and boat trips to the offshore wind farms, may negate these impacts |

The value of tourism in the South West Region has been based on the total tourism expenditure from domestic and overseas visitors in the Dumfries and Galloway area; £143m in 2009 (see Table 18). Likewise, the value of tourism in the West Region has been based on the total tourism expenditure in the Argyll, Loch Lomond, Stirling and Forth Valley Region: £408m in 2009 (see Table 20). Tourism expenditure has been assumed to be constant over time. It is important to note that these values represent all tourism within the VisitScotland regions and not just coastal tourism and are therefore likely to be over-estimated. In addition, the VisitScotland regions did not necessarily align with the OWE Plan regions and this is particularly true for the West Region.

In the high and medium impact scenarios, the loss of tourism expenditure within each region was calculated as follows:

- The total tourism spend (£million) within the most relevant VisitScotland regions were identified for the OWE Plan West and South West Regions;
- The area within each OWE Plan Region which may be affected negatively by short term development options as a result of seascape impacts was estimated based on the likely spatial extent of the main visual impact along a coastline. These values, which were derived by estimating the proportion of the region for which the arrays would be visible, were estimated as 6% for the West Region and 15% for the South West Region with reference to the form and topography of the local coastline;
- From these two sets of values the proportional regional value of tourism expenditure within the zone of influence of the short term option developments was calculated;
- The estimated loss of general tourism-related expenditure per region was then calculated as : Estimated tourism expenditure within the zone of influence of offshore wind farms x 0.0172 (high impact scenario) or x 0.013 (medium impact scenario).

The lack of resolution of the data and difficulties in estimating the zone of influence of offshore wind farms mean that the estimated cost impacts are relatively uncertain.

The assessment for the medium and high impact scenarios has assumed that the expenditure is lost from the relevant region and from Scotland as a whole. The Riddington *et al* (2008) study on which the assessment is based, has estimated reductions in expenditure for its case study areas, which are broadly of a similar scale to draft Plan regions. Thus the assumption that displacement occurs from within a Region is possibly valid. However, the assumption that displacement occurs for Scotland as a whole is likely to be conservative, as some expenditure is likely to be displaced to other Regions within Scotland.

In addition to estimates of general tourism related impacts, the high impact scenario also assumed that short term option development in West Region would lead to a loss of investment in one resort development, leading to a loss of annual revenue of £3m. This is based on information provided by SDI and Argyll and Bute Council relating to a specific development proposal in West Region which would be of regional significance (Kenneth Clark and Robert Pollock pers. comm. Jan-Feb 2011).

### 4.11.3 Estimation of Costs and Benefits

Estimates of costs associated with the different scenarios are presented in Table 33 below. The highest costs are estimated to occur in West Region particularly associated with the potential loss of a major resort development.

**Table 33. Estimated reductions in expenditure on tourism**

| Region | Scenario | | |
|---|---|---|---|
| | High Impact (£'000) | Medium Impact (£'000) | Low Impact (£'000) |
| South West | 370 | 280 | 0 |
| West | 3,420 | 320 | 0 |
| North East | 0 | 0 | 0 |
| East | 0 | 0 | 0 |

## 4.12 Social Impacts

### 4.12.1 Description of Costs and Benefits

Social impacts tend to occur as an indirect consequence of impacts to environmental and economic factors such as water quality, noise, seascapes and landscapes, and jobs. However, the scale of impact is difficult to assess given the lack of information on social values. Monitoring information from existing wind farms does not take such aspects into account meaning that there is a lack of information on the precise nature of impacts and levels of significance. Finally, existing wind farms are very different in scale and location (mostly onshore) to many of the projects proposed in the Draft plan, particularly in relation to remote and fragile communities, complex coastal seascapes and unique social structures, and may not provide appropriate examples to support the evidence base.

In addition, this assessment considers the potential for beneficial impacts from developer contributions such as jobs, manufacturing, assembly, construction, operations and maintenance and infrastructure improvements (road networks, ports and air travel).

The regional assessments below provide information on specific impacts that have been highlighted within the consultation responses on the SEA (Marine Scotland, 2010c) and wider social impacts and benefits that may accrue as a result of implementation of the scenarios. No attempt has been made to value social impacts and benefits in this study.

#### 4.12.1.1 North East and East Regions

No specific social impacts were identified in consultation responses to the SEA Environmental Report, although a number of other impacts will have potential social consequences. Beneficial consequences are likely to accrue as a result of job creation, skills training and long-term employment. Development of the supply chain may also support regeneration and help to tackle deprivation. Negative social impacts may arise as a result of economic impacts, particularly for example in relation to commercial fishing, which may affect local fishing communities. Within the North East and East Regions the scale of social impacts is expected to be relatively minor whereas the scale of potential benefits could be large, particularly if higher retention rates are achieved, thus boosting investment and jobs. The size of all social impacts, both positive and negative, is likely to be related to the scale of implementation.

#### 4.12.1.2 South West Region

Impacts on communities were a strong theme within the public consultation workshops in the region, with concerns about negative impacts not being compensated with any local economic benefits. People were also very concerned about impacts on the wellbeing of local communities, including from noise, loss of tourism jobs and income, and energy costs. Potential impacts on people's health were raised as well as more specific impacts including noise and shadow flicker.

There were many views that the scale of development overall would undermine some of the essential qualities of the Solway coast, including its wild and isolated character. Landscape, seascape and visual impacts were the most significant concerns, forming a key theme within the local consultation workshops and an issue shared by the vast majority of individual respondents. There was concern that impacts on the scenic quality of the area could reduce the attractiveness of the region as a retirement location and undermine fragile housing markets. Impacts on property, business value and house prices were general concerns

Negative social impacts may also arise as a result of economic impacts, particularly for example in relation to impacts on tourism or commercial fishing, which may affect local communities. Such social costs are likely to be related to the scale of implementation.

Beneficial consequences are likely to accrue at a regional level as a result of job creation, skills training and long-term employment, particularly if high retention rates can be achieved. Development of the supply chain may also support regeneration and help to tackle deprivation. It remains unclear how many of these benefits may accrue locally.

#### 4.12.1.3 West Region

As with the South West Region the majority of concerns identified by stakeholders related to visual, landscape and seascape impacts and the indirect consequences for the community in terms of quality of life. A range of other concerns were also identified including:

- Impacts on the value and sale of properties and businesses;
- Availability and affordability of housing;
- Health impacts as a result of construction noise and disturbance, shadow flicker and vibration;
- Capacity of local health services, education services, transport infrastructure, water and sewerage infrastructure;
- Radio and TV reception;
- Fragility of local communities in being able to adapt to change;
- Changes to traditional ways of life (e.g. crofting and fishing); and
- Demographic change and its potential for secondary effects on services, the community and the environment.

Negative social impacts may arise as a result of economic impacts, particularly for example in relation to impacts on tourism or commercial fishing, which may affect local communities.

Beneficial consequences are likely to accrue at a regional level as a result of job creation, skills training and long-term employment, particularly if high retention rates can be achieved. Development of the supply chain may also support regeneration and help to tackle deprivation. It remains unclear how many of these benefits may accrue locally.

It has been noted that further baseline surveys might be required to better reflect the characteristics of west coast communities that could be affected by proposals within the Plan. Argyll Renewables Communities (2010) made a number of recommendations concerning the requirements for future research to better inform the assessment of social impacts and to avoid unacceptable impacts.

## 4.13 Environmental Impacts

### 4.13.1 Introduction

The draft SEA Environmental Report (Marine Scotland, 2010a) provides information on the potentially significant environmental effects of the short term options. The report summarises the potentially significant effects in the absence of mitigation measures and also identifies the potential residual effects following application of strategic and specific project-level mitigation measures.

It is beyond the scope of this Impact Assessment to seek to place monetary values on the potential environmental effects. However, where the potential environmental changes could affect other marine users or interests, the study has sought to value these potential impacts. For example, the study does not seek to calculate a monetary value for changes in landscape or seascape but does provide an evaluation of the potential economic impact of those changes on relevant activities such as tourism.

Table 34 (adapted from Table 8.4 of the SEA Environmental Report) summarises the predicted residual environmental effects for each region for the main receptor categories.

**Table 34. Summary of potential residual environmental effects of short term options**

| Region | Climatic Factors | Water | Geology, Sediments & Coastal Processes | Biodiversity, Flora & Fauna | Landscape & Visual Amenity | Population & Human Health | Cultural Heritage | Material Assets |
|---|---|---|---|---|---|---|---|---|
| North-East | | | | | | | | |
| East | | | | | | | | |
| South-West | | | | | | | | |
| West | | | | | | | | |

| Key | |
|---|---|
| **Symbol** | **Impact Significance** |
| | Moderate to Major Positive |
| | Minor Positive |
| | Neutral |
| | Uncertain |
| | Minor Negative |
| | Moderate to Major Negative |
| | Moderate change (relates to landscape and visual amenity only) |

(Adapted from Marine Scotland, 2010a)

The findings of the SEA Environmental Report relate to full implementation of the Plan. Reduced development could significantly reduce visual impacts and reduce risks to other receptors. However, the climate change benefits would be correspondingly reduced.

## 4.14 Summary of Impacts to Other Marine Users and Interests

A summary of other marine users and interests that are considered likely to incur costs as a result of short-term option development is presented in Table 35. Specific costs may accrue to the commercial fishing, shipping, recreational boating, recreational angling and tourism sectors. For the shipping and ports sector and the aviation sector it may also be necessary to implement additional mitigation measures. However, it is considered unlikely that these costs would fall to these sectors. For the purposes of this study it has been assumed that these costs are included within the overall construction costs of the short-term options.

**Table 35. Summary of affected sectors and impacts**

| Sector | Significant Cost Impact to Sector? | Main Economic Impact |
|---|---|---|
| Commercial Fisheries | ✓ | Loss of revenues from displacement of fishing activity |
| Aquaculture | × | |
| Shipping and Ports | ✓ | Increased costs from additional steaming distances |
| Aviation | × | |
| Wave and Tidal Energy Development | × | |
| Cables and Pipelines | × | |
| Recreational Boating | ✓ | Increased costs from additional steaming distances |
| Recreational Angling | ✓ | Loss of expenditure on related activities from displacement or cessation of activity |
| Surfing, Windsurfing and Kayaking | × | |
| Tourism | ✓ | Loss of expenditure from displacement or cessation of activity |
| Social Impacts | ✓ | Not quantified. Negative impacts as a result of impacts to existing economic activities; positive impacts as a result of offshore wind farm supply chain development |

Table 36 presents a summary of estimated annual costs (undiscounted) for those sectors that are considered likely to incur costs as a result of short-term option development. The total annual costs range from £0.34m in the low impact scenario to £8.28m in the high impact scenario. The highest estimated costs are associated with commercial fisheries, shipping and ports, recreational angling and tourism sectors which are all broadly of a similar magnitude. Approximately 60% of the high impact scenario costs are estimated to occur in West Region, primarily related to potential cost impacts on tourism.

**Table 36. Summary of estimated costs to other marine users (£m per annum undiscounted)**

| | North East | East | South West | West | Total |
|---|---|---|---|---|---|
| Commercial Fisheries[1] | £0.07m- £0.13m | £0.17m-£0.76m | £0.02m-£0.06m | £0.08m-£0.70m | £0.34m-£1.65m |
| Shipping and Ports | | £0m-£1.55m | £0m-£0.01m | £0m-£0.03m | £0m-£1.59m |
| Recreational Boating | £0m-£0.003m | £0m-£0.01m | £0m-£0.01m | £0m-£0.01m | £0m-£0.03m |
| Recreational Angling | - | - | £0m-£0.42m | £0m-£0.80m | £0m-£1.22m |
| Tourism | - | - | £0m-£0.37m | £0m-£ 3.42m | £0m-£3.79m |
| Social Impacts | Not quantified | Not quantified | Not quantified | Not quantified | - |
| **Total Quantified Costs** | **£0.07m-£0.13m** | **£0.17m-£2.32m** | **£0.02m-£0.87m** | **£0.08m-£4.96m** | **£0.34m-£8.28m** |
| **[1] NB: low costs only apply for 5 years following construction; high costs apply for full plan period.** | | | | | |

# 5. Assessment of Costs and Benefits to Other Marine Users

## 5.1 Introduction

This section provides estimates of the costs and benefits over 50 years from 2011 to 2060 that may be experienced by different marine users and interests in relation to the various implementation scenarios

## 5.2 Assessment of Costs and Benefits to Other Marine Users and Interests

A number of marine users and interests have been identified as potentially incurring additional costs associated with implementation of the Plan scenarios including the commercial fishing, shipping, recreational boating, recreational angling and tourism sectors.

Developers and operators of offshore wind farms may also incur some additional costs to mitigate some potential impacts on other marine users. These include costs associated with implementing solutions to maintain navigational safety (e.g. appropriate buoyage of offshore wind farm arrays) and costs associated with possible modifications and enhancement to aviation radar systems. It has been assumed that these are included within the costs of offshore wind farm construction and operation. The scale of such costs relative to the overall investment in offshore wind is estimated to be very small.

While some potential benefits have also been identified, these are likely to be small in terms of value and not significant in the context of the Plan as a whole. The extent to which such benefits might be realised remains very uncertain and it has not been possible to quantify them.

Table 37 presents a summary of estimated annual costs (undiscounted) for those sectors that are considered likely to incur costs as a result of short-term option development. The total annual costs range from £0.34m in the low impact scenario to £8.28m in the high impact scenario. The highest estimated costs are associated with commercial fisheries, shipping and ports, recreational angling and tourism sectors which are all broadly of a similar magnitude. In the high impact scenario, approximately 60% of the high impact scenario costs are estimated to occur in West Region, primarily related to potential cost impacts on tourism.

**Table 37. Summary of estimated costs to other marine users (£m per annum undiscounted)**

| | North East | East | South West | West | Total |
|---|---|---|---|---|---|
| Commercial Fisheries[1] | £0.07m- £0.13m | £0.17m-£0.76m | £0.02m-£0.06m | £0.08m-£0.70m | £0.34m-£1.65m |
| Shipping and Ports | | £0m-£1.55m | £0m-£0.01m | £0m-£0.03m | £0m-£1.59m |
| Recreational Boating | £0m-£0.003m | £0m-£0.01m | £0m-£0.01m | £0m-£0.01m | £0m-£0.03m |
| Recreational Angling | - | - | £0m-£0.42m | £0m-£0.80m | £0m-£1.22m |
| Tourism | - | - | £0m-£0.37m | £0m-£ 3.42m | £0m-£3.79m |
| Social Impacts | Not quantified | Not quantified | Not quantified | Not quantified | - |
| **Total Quantified Costs** | **£0.07m-£0.13m** | **£0.17m-£2.32m** | **£0.02m-£0.87m** | **£0.08m-£4.96m** | **£0.34m-£8.28m** |
| **[1] NB: low costs only apply for 5 years following construction; high costs apply for full plan period.** | | | | | |

The total discounted costs to other marine users are presented in Table 38, ranging from £1.4m in the low impact scenario up to £168.7m in the high impact scenario. This large range reflects the available evidence base, the length of the appraisal period and current uncertainties about the extent of impacts, particularly in advance of detailed project-level assessments.

**Table 38. Summary of estimated costs to other marine users (£m discounted)**

| Sector | North East | East | South West | West | Total |
|---|---|---|---|---|---|
| Commercial Fisheries | £0.3m-£2.6m | £0.7m-£15.4m | £0.1m-£1.1m | £0.3m-£14.4m | £1.4m-£33.5m |
| Aquaculture | - | - | - | - | - |
| Shipping and Ports | - | £0m-£31.4m | £0m-£0.2m | £0m-£0.6m | £0m-£32.2m |
| Aviation | - | - | - | - | - |
| Wave and Tidal Energy Development | - | - | - | - | - |
| Cables and Pipelines | - | - | - | - | - |
| Recreational Boating | £0m-£0.1m | £0m-£0.3m | £0m-£0.2m | £0m-£0.2m | £0m-£0.8m |
| Recreational Angling | - | - | £0m-£7.9m | £0m-£16.6m | £0m-£24.5m |
| Surfing, Windsurfing and Kayaking | - | - | - | - | - |
| Tourism | - | - | £0m-£6.9m | £0m-£70.8m | £0m-£77.7m |
| Social Impacts | Not quantified | Not quantified | Not quantified | Not quantified | - |
| **Total Quantified Costs** | **£0.3m-£2.7m** | **£0.7m-£47.1m** | **£0.1m -£16.3m** | **£0.3m-£102.6m** | **£1.4m-£168.7m** |

Under the high impact scenario, the largest costs are estimated to relate to reductions in tourism expenditure, although commercial fisheries, shipping and ports, and recreational angling sectors also incur substantial costs. Approximately 61% of the costs are estimated to fall in West Region with relatively low costs associated with the single short-term development option in North-East Region.

While the costs to other marine users may be relatively small at the national and regional levels, they may still be significant to individual sectors and stakeholders locally.

## 5.3 Assessment of Employment Impacts

The cost impacts on other marine users have the potential to give rise to employment impacts for some, but not all, affected sectors. For example, cost impacts to the shipping and recreational boating sectors relate to an increase in operating costs, particularly fuel costs, and these would not be expected to give rise to employment impacts unless they resulted in a cessation of the activity. In both instances, the additional costs are considered to be minor relative to overall operating costs. For example a deviation of a few kilometres for a ship navigating across the North Sea is likely to represent only 1-2% of total journey length. On this basis, the study has assumed that there will be no employment impacts for these sectors.

However, for commercial fisheries, recreational angling and tourism, the cost impacts could give rise to employment impacts as a result of reduced expenditure (recreational angling tourism) affecting the income of businesses supplying these services or as a result of reduced

income for fishermen. Many of the businesses in these sectors are small and may be susceptible to losses of revenue.

Isolating the costs identified in Table 37 above and applying simple economic multipliers representing commercial fisheries, tourism and recreational sea angling, it is estimated that around 140 jobs may no longer be supported in these sectors by year 6 in the high impact scenario, remaining at this level throughout the operating period (Table 39). This estimate is subject to considerable uncertainty, as discussed in Section 5.6.

In the high impact scenario, around 70% of the affected jobs are in Tourism, and around 14% are in Commercial Fisheries. Around 80% of employment impacts per annum are estimated to occur in West Region. These impacts are substantially lower in the medium and low impact scenarios.

**Table 39. Employment impacts of the three scenarios on commercial fisheries, recreational angling and tourism sectors**

| Scenario | Maximum Gross No. Jobs Lost/Not Supported | |
|---|---|---|
| | Number | Year |
| High Impact | 140 | 6 |
| Medium Impact | 26 | 8 |
| Low Impact | 4 | 6 |

The reduction in employment opportunity can be compared with data on the total number of employees in these sectors, from Section 3 of this report. This indicates a total of around 5,000 people employed in fishing in Scotland, just over 3,000 in sea angling and over 200,000 in tourism as a whole, with around 4,400 of these in marine and coastal wildlife tourism. The numbers of jobs indicated in Table 39 are a small proportion of these totals, but could still be significant locally.

## 5.4 Social Costs and Benefits

A range of costs and benefits may be experienced by wider society. The creation of jobs has the potential to provide important societal benefits in all Regions and at a national level. The contribution to tackling climate change will also provide important benefits at national and international scale. The size of these social benefits would be expected to vary in accordance with the scale of implementation of the Plan and the level of retention rates.

There is currently a high level of uncertainty about the costs to society associated with Plan implementation owing to the difficulties in quantifying social impacts. Some social costs may arise in South West and West Regions. Key issues relate to the impact of development on visual amenity. There are also stakeholder concerns that the scale of development overall would undermine some of the essential qualities of these Regions, including their wild and isolated character. Other specific concerns relate to possible impacts associated with shadow flicker, impacts on TV reception, infrastructure provision, health impacts and the effects on property prices and housing availability.

## 5.5 Environmental Costs and Benefits

The SEA Environmental Report identifies the potentially significant environmental effects associated with Plan implementation, taking account of mitigation measures. The key beneficial effect is the contribution to reducing carbon emissions. The most significant negative effects relate to visual impacts in West Region and South-West Region, although a range of other minor negative impacts may also occur. Partial implementation of the Plan under the low impact scenario would be expected to lead to a reduced visual impact in West Region, but with a corresponding decrease in carbon savings.

## 5.6 Data Gaps, Limitations and Uncertainties

In seeking to estimate future costs and benefits associated with the three scenarios, there are a large number of data gaps, limitations and uncertainties. As with all socio-economic assessments, the establishment of a baseline involves a degree of extrapolation and projection of data from recent years into future years. While the study has sought to accommodate many of the uncertainties through the use of alternative scenarios, the estimates will be influenced by the nature of the current evidence base, and the assumptions that have necessarily been applied to assess potential impacts over the potential lifespan of offshore wind developments.

### 5.6.1 Data Gaps and Limitations of Data

The estimates of costs and benefits to other marine users have been based on existing available data and evidence. National and regional data have been used, reflecting the nature of the study. However, more fine grained analysis would require site-specific data. The inherent difficulties in estimating future levels of activities and their value are also recognised.

Estimates of the costs of mitigation measures for aviation and navigation impacts are particularly uncertain, pending more detailed project-level assessments of aviation and navigation risks. Similarly, estimates of commercial fisheries impacts have necessarily been based on national and regional spatial data and more site specific information is required to develop more accurate assessments of potential displacement, for example:

- Fish spawning and nursery ground data are in the process of being revised, but at present are over 10 years old;
- Fisheries analysis could be improved if more detailed data was used - e.g. position data on <15 metre vessels which is currently lacking, number and type of boats visiting short term option development sites, and the total landings of fish and shellfish taken from these sites; and
- The methodology used to estimate the economic impact on the commercial fisheries sector while appropriate for providing an indication of regional scale impacts is not adequate for estimating the cost impacts at site level. The preferred method (as recommended by Cefas) for site level assessments uses accurate estimates of the numbers of boats from all local ports which visit the area in question, by gear type, and either the proportion of their year that they spend there, or the proportion of their annual income that they derive from it.

Furthermore, actual impacts to the commercial fishing sector will be sensitive to the outcome of discussions between site developers and the fisheries representatives in terms of which types of activity may be allowed to continue within arrays and along cable routes.

The spatial scale at which tourism data was available to the study was relatively coarse, reducing the sensitivity of the assessment. Data at a more disaggregated level would facilitate more accurate assessments of cost impacts. There is a lack of data on the numbers and types of vessels using recreational sailing routes. This proved a key limitation in seeking to quantify the cost impacts. Similarly there is a paucity of publicly available data on commercial shipping data. Improved availability of AIS data would significantly ease the task of estimating impacts to commercial shipping and improve the reliability of estimated potential cost impacts.

The study has not sought to quantify social impacts owing to the difficulties of valuing such impacts. However, the importance of social impacts has been highlighted by a considerable number of stakeholders, particularly in West and South West Regions, and further data collection and assessment of these potential impacts is needed to better inform decision-making at project level.

### 5.6.2 Uncertainties

There are high levels of uncertainty concerning potential cost impacts to other marine users, including commercial fisheries, tourism and recreational boating.

Accurate quantification of fisheries impacts is recognised as being challenging, particularly because of potential cumulative effects on fisheries activity from other types of marine development, the establishment of a Marine Protected Area network and ongoing reform of the Common Fisheries Policy. Owing to the limited data available to the study the cost estimates only provide a first order assessment of impact, although the scenarios are considered to reflect the range of potential cost impacts in each region.

While some information exists in relation to the effects on tourism of onshore and offshore wind farms elsewhere in Europe, the circumstances are not fully comparable to those applying in some of the short-term option areas. Furthermore, it is difficult to define an appropriate zone of influence for offshore wind farms and thus to determine the size of the area over which economic impacts might be experienced. Further research on the impacts of offshore wind farms on tourism, particularly where these are located relatively close inshore is required.

Similar high levels of uncertainty apply to the cost estimates for the recreational boating sector. While experiences elsewhere indicate that navigation risks for recreational vessels transiting offshore wind farm arrays are not significant, strong concerns remain amongst local sailing communities in some Regions.

# 6. Conclusions

The study has sought to estimate the potential impacts of short-term option offshore wind farm development in Scottish Territorial Waters on the full range of other marine users and interests at regional and national scale. The assessment of impacts has taken account of the potential spatial interaction between short-term option development and other marine users and interests and the extent to which such interactions might impose additional costs on those users and interests. To reflect the inherent uncertainties in the nature and scale of those interactions at Plan level and the uncertainties in associated cost impacts, the assessment has used different scenarios to explore the potential range of cost impacts – termed 'low impact', 'medium impact' and 'high impact' scenarios reflecting the different assumptions used.

Based on this assessment, five sectors have been identified as potentially experiencing cost impacts including the commercial fishing, shipping, recreational boating, recreational angling and tourism sectors (Table 40).

**Table 40. Summary of affected sectors and impacts**

| Sector | Significant Cost Impact to Sector? | Main Economic Impact |
|---|---|---|
| Commercial Fisheries | ✓ | Loss of revenues from displacement of fishing activity |
| Aquaculture | × | |
| Shipping and Ports | ✓ | Increased costs from additional steaming distances |
| Aviation | × | |
| Wave and Tidal Energy Development | × | |
| Cables and Pipelines | × | |
| Recreational Boating | ✓ | Increased costs from additional steaming distances |
| Recreational Angling | ✓ | Loss of expenditure on related activities from displacement or cessation of activity |
| Surfing, Windsurfing and Kayaking | × | |
| Tourism | ✓ | Loss of expenditure from displacement or cessation of activity |
| Social Impacts | ✓ | Not quantified. Negative impacts as a result of impacts to existing economic activities; positive impacts as a result of offshore wind farm supply chain development |

Developers and operators of offshore wind farms may also incur some additional costs to mitigate some potential impacts on other marine users. These include costs associated with implementing solutions to maintain navigational safety (e.g. appropriate buoyage of offshore wind farm arrays) and costs associated with possible modifications and enhancement to aviation radar systems. It has been assumed that these are included within the costs of offshore wind farm construction and operation. The scale of such costs relative to the overall investment in offshore wind is estimated to be very small.

The total discounted costs to other marine users are estimated to range from £1.4m in the low impact scenario up to £168.7m in the high impact scenario (Table 41). This large range reflects

the available evidence base, the length of the appraisal period and current uncertainties about the extent of impacts, particularly in advance of detailed project-level assessments.

Under the high impact scenario, the largest costs are estimated to relate to reductions in tourism expenditure, although commercial fisheries, shipping and ports, and recreational angling sectors also incur substantial costs. Approximately 61% of the costs are estimated to fall in West Region with relatively low costs associated with the single short-term development option in North-East Region.

Implementation of the short-term options also has the potential to give rise to a range of social impacts. Positive impacts would be associated with job creation in the offshore wind farm supply chain. Some social costs may arise in South West and West Regions associated with a reduction in the number of jobs supported in commercial fishing, recreational angling and tourism sectors. Other social impacts may arise as a result of impacts to visual amenity. There are also stakeholder concerns that the scale of development overall would undermine some of the essential qualities of these Regions, including their wild and isolated character. Other specific concerns identified through the consultation on the SEA Environmental Report relate to possible impacts associated with shadow flicker, impacts on TV reception, infrastructure provision, health impacts and the effects on property prices and housing availability.

While the costs to other marine users may be relatively small at the national and regional levels, they may still be significant to individual sectors and stakeholders locally.

**Table 41. Summary of estimated costs to other marine users (£m discounted)**

| | North East | East | South West | West | Total |
|---|---|---|---|---|---|
| Commercial Fisheries | £0.3m-£2.6m | £0.7m-£15.4m | £0.1m-£1.1m | £0.3m-£14.4m | £1.4m-£33.5m |
| Aquaculture | - | - | - | - | - |
| Shipping and Ports | - | £0m-£31.4m | £0m-£0.2m | £0m-£0.6m | £0m-£32.2m |
| Aviation | - | - | - | - | - |
| Wave and Tidal Energy Development | - | - | - | - | - |
| Cables and Pipelines | - | - | - | - | - |
| Recreational Boating | £0m-£0.1m | £0m-£0.3m | £0m-£0.2m | £0m-£0.2m | £0m-£0.8m |
| Recreational Angling | - | - | £0m-£7.9m | £0m-£16.6m | £0m-£24.5m |
| Surfing, Windsurfing and Kayaking | - | - | - | - | - |
| Tourism | - | - | £0m-£6.9m | £0m-£70.8m | £0m-£77.7m |
| Social Impacts | Not quantified | Not quantified | Not quantified | Not quantified | - |
| **Total Quantified Costs** | **£0.3m-£2.7m** | **£0.7m-£47.1m** | **£0.1m -£16.3m** | **£0.3m-£102.6m** | **£1.4m-£168.7m** |

Three sectors – commercial fisheries, recreational angling and tourism – may experience employment impacts as a result of reduced expenditure and/or loss of revenues. Applying simple economic multipliers to the relevant costs for these sectors indicates that around 140 jobs may no longer be supported in these sectors by year 6 in the high impact scenario, remaining at this level throughout the operating period (Table 42).

In the high impact scenario, approximately 70% of the affected jobs are in tourism, and 14% are in commercial fisheries. Around 80% of employment impacts per annum are estimated to occur in West Region. These impacts are substantially lower in the medium and low impact scenarios.

**Table 42. Employment impacts of the three scenarios on commercial fisheries, recreational angling and tourism sectors**

| Scenario | Maximum Gross No. Jobs Lost/Not Supported | |
|---|---|---|
| | Number | Year |
| High Impact | 140 | 6 |
| Medium Impact | 26 | 8 |
| Low Impact | 4 | 6 |

The reduction in employment opportunity can be compared with data on the total number of employees in these sectors, from Section 3 of this report. This indicates a total of around 5,000 people employed in fishing in Scotland, just over 3,000 in sea angling and over 200,000 in tourism as a whole, with around 4,400 of these in marine and coastal wildlife tourism. The numbers of jobs indicated in Table 42 are a small proportion of these totals, but could still be significant locally.

The overall cost and employment impacts on other marine users are considered to be small at national and regional scale. However, it remains possible that the impacts could be more significant at local level.

Further research is required to quantify the effects of offshore wind farm development on tourism, particularly where developments may be located relatively close inshore. The acquisition of more spatially resolved commercial fishing data would help to better inform commercial fishing impacts. A better understanding of the nature of interactions between short-term options and other marine users and interests will be gained as project level studies are commissioned and such information should be taken into account when the Plan is reviewed.

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Ports and Harbours of the UK: http://www.ports.org.uk/index.asp

RenewableUK (formerly BWEA): http://www.bwea.com

Royal AirForce: RAF Kinloss: http://www.raf.mod.uk/rafkinloss

Scottish Enterprise: http://www.scottish-enterprise.com

Scottish Government: http://www.scotland.gov.uk

Scottish Renewables: http://www.scottishrenewables.com

Scottish TV: http://news.stv.tv

The Press and Journal: http://www.pressandjournal.co.uk

VisitScotland (Corporate Website): http://www.visitscotland.org/default.aspx

VisitScotland (Golf Website): http://golf.visitscotland.com/courses.aspx

# Appendices

# Appendix A
# Figures (Separate Document)

# Appendix A. Figures (Separate Document)

See pdf App A ffgs in separate document

# Appendix B
# Membership of Project Advisory Group

# Appendix B. Membership of Project Advisory Group

Marine Scotland - Marine Analytical Unit
Marine Scotland - Marine Renewables and Offshore Wind Team
Office of the Chief Economic Adviser's Energy Economics team
Offshore Renewable Energy Policy Team
Scottish Enterprise
Highlands and Islands Enterprise
Scottish Renewables
VisitScotland
The Crown Estate
SFF
Chamber of Shipping
CoSLA
Joint Nature Conservation Committee (JNCC)
Dumfries and Galloway Council
Argyll and Bute Council
Highland Council
Shetland Islands Council
Forth Ports/UK Major Ports Group
Civil Aviation Authority
Oil and Gas UK
Association of Scottish Shellfish Growers
Scottish Salmon Producers' Organisation

# Appendix C
# List of Stakeholder Organisations Contacted During the Study

# Appendix C. List of Stakeholder Organisations Contacted During the Study

Local Authorities:
- Aberdeen City Council (Aberdeen) (no response)
- Argyll & Bute Council (Campbeltown, Machrihanish)
- Convention of Scottish Local Authorities (CoSLA)
- Dumfries & Galloway Council (Stranraer/Cairnryan)
- Eilean Siar (Arnish) (no response)
- Shetland Islands Council
- The Highland Council (Nigg, Ardersier, Kishorn, Highland Deephaven)

OWF Site Developers:
- Dong Wind (UK) Ltd
- E.ON Climate & Renewables UK
- Fred Olsen Renewables (no response)
- Mainstream Renewable Power Ltd (no response)
- RWE npower renewables
- Scottish and Southern Energy Renewables (no response)
- Scottish Power Renewables (no response)
- SeaEnergy Renewables Ltd (no response)

Port & Harbour Authorities:
- ABP Silloth
- British Ports Association (no response)
- Forth Ports
- UK Major Ports Group

Marine Navigation:
- Chamber of Shipping
- DFDS Shipping Line (no response)
- Isle Of Man Steampacket Ferry Services
- Maritime & Coastguard Agency
- Northern Lighthouse Board (no response)
- Trinity House

Commercial Fisheries:
- Clyde Fishermen's Association
- Marine Scotland Science
- Moray Firth Inshore Fisheries Group (no response)
- Scottish Fishermen's Federation

Aquaculture:
- Association of Scottish Shellfish Growers
- Scottish Salmon Producers Association

Renewables:
- RenewableUK (no response)
- Renewable Energy Association (no response)
- Scottish Renewables
- UKERC

Oil & Gas:
- Oil & Gas UK

Recreation/Tourism:
- British Surfing Association
- Event Scotland (no response)
- Royal Yachting Association (RYA)
- RYA Scotland
- Scottish Boating Alliance / British Marine Federation
- Scottish Sea Angling Conservation Network
- Scottish Surfing Federation (no response)
- Sport Scotland (no response)
- Surfers Against Sewage
- UK Windsurfing Association
- VisitScotland

Aviation:
- Bristow Helicopters European Operations - Aberdeen (no response)
- Cambridge Associates
- Civil Aviation Authority
- Highlands and Islands Airports Ltd. (HIAL) (no response)
- Infratil - Operator of Glasgow Prestwick Airport
- Ministry of Defence
- National Air Traffic Services

Other:
- Highlands and Islands Enterprise
- Scottish Development International
- Scottish Enterprise
- The Crown Estate

# Appendix D
# Published and Unpublished Reports and Data

# Appendix D. Published and Unpublished Reports and Data

| Data and Information | Source |
|---|---|
| Information on draft OWE Plan and N-RIP | |
| ▪ Draft Offshore Wind Energy Plan (Marine Scotland, 2010b) | Online |
| ▪ Draft N-RIP and N-RIP2 (Scottish Enterprise and Highlands & Islands Enterprise, 2010a,b) | Online |
| ▪ Project level short term OWF scoping reports | Marine Scotland |
| Information on other marine uses | |
| ▪ General sources: | |
| - Charting Progress 2 Productive Seas Chapter | Freely available |
| - Scotland's Marine Atlas: Information for The National Marine Plan | Marine Scotland |
| - SEA Environmental Report consultation responses | Marine Scotland |
| ▪ Commercial Fisheries | |
| - Landings Values Data (2000-2009): Data for all UK vessels landings into all ports and non-UK vessels landings into UK ports; | MMO |
| - Effort Data (2000-2009): Data for all UK vessels landing into all ports and non-UK vessels landing into UK ports; | MMO |
| ▪ Recreational activities (recreational angling, kayaking, windsurfing, kitesurfing, diving, walking, ecotourism etc) | Limited information available from Marine Scotland, The Crown Estate |
| ▪ Tourism | VisitScotland |

# Appendix E
# Special Data Layers

# Appendix E. Spatial Data Layers

| Spatial Data | Source |
|---|---|
| Draft OWE Plan and N-RIP | |
| Renewables | |
| ▪ Location of short term OWE sites | Marine Scotland |
| ▪ Location of N-RIP sites | Marine Scotland |
| Information on other marine uses | |
| Fisheries | |
| ▪ Coastal Salmon & Sea Trout catches | Marine Scotland |
| ▪ Surveillance Sightings Data (2000-2009): Data for all vessels sighted by method and nationality; | MMO |
| ▪ VMS Data Position Plots (2005 to 2008/2009): Data for UK Over-15m vessels only | MMO |
| Aquaculture | |
| ▪ Finfish Farm - locations and catch figures | Marine Scotland |
| ▪ Shellfish Farm - locations and catch figures | Marine Scotland |
| Leisure and Recreation | |
| ▪ Designated Bathing Waters | Scottish Government |
| ▪ Designated Wrecks - Marine | Historic Scotland (ABPmer) |
| ▪ Blue Flag Beaches & Seaside Awards | Scottish Government |
| ▪ Dive Sites & Surfing beaches | Scottish Government |
| ▪ Recreational Sea Anglers Regions & Economic Data | Scottish Government |
| ▪ RYA Cruising Routes, Racing & Sailing Areas, Marinas and Training Centres | RYA |
| ▪ Traditional Boat Festival | Historic Scotland (ABPmer) |
| ▪ Scottish Boating Alliance Regions | Scottish Government |
| ▪ Scheduled Monuments (Marine) | Historic Scotland (ABPmer) |
| ▪ Historic Ships | Historic Scotland (ABPmer) |
| ▪ Vessels designated as Controlled Sites & Protected Places | Historic Scotland (ABPmer) |
| ▪ World Heritage Sites | Historic Scotland (ABPmer) |
| ▪ Other recreational activities (kayaking, windsurfing, kitesurfing, walking, ecotourism, etc) | Limited info avail from Marine Scotland/The Crown Estate |
| ▪ Tourism | VisitScotland |
| Maritime Transport | |
| ▪ AIS Shipping Data (1st week Jan, Mar, Jun 7 Sept 2010) | MCA |
| ▪ Dept for Transport 16 Largest Scottish Ports | Scottish Government |
| ▪ Dept for Transport 16 Largest Ports with import tonnages | Scottish Government/DfT |
| ▪ Explosives Ports & Scottish Government Ports | HSE/Scottish Government |
| ▪ Ferry routes 2010 | Scottish Government |
| ▪ Ferry Routes with DfT Statistics | Scottish Government |
| ▪ Scotland to Europe Ferry Routes | Scottish Government |
| ▪ IMO Routing Regions | SeaZone |
| ▪ Traffic Separation Schemes & Deep Water Routes | SeaZone |
| Military Defence | |
| ▪ Coastal MOD Locations | MOD |
| ▪ MOD Practice Zones | SeaZone |
| Gas Storage | |
| ▪ Carbon Dioxide Storage Potential - Hydrocarbon Fields | Scottish Government |
| ▪ Carbon Dioxide Storage Potential - Saline Aquifers | Scottish Government |

| Spatial Data | Source |
|---|---|
| Renewables | |
| ▪ Beatrice Wind Farm Safety Zone | The Crown Estate |
| ▪ EMEC Tidal & Wave Power Test Facilities | Scottish Government |
| ▪ NRIP Sites | Scottish Enterprise |
| ▪ Offshore Wind SEA Medium-Term Options | Scottish Government |
| ▪ Offshore Wind SEA Short term Options | Scottish Government |
| ▪ Pentland Firth & Orkney Strategic Area | The Crown Estate |
| ▪ Pentland Firth & Orkney Waters R1 Lease Option Areas | The Crown Estate |
| ▪ Robin Rigg Wind farm | The Crown Estate |
| ▪ Saltire Prize Tidal & Wave Areas of Interest | The Crown Estate |
| ▪ Wind Demonstration Sites | The Crown Estate |
| Power Cables | |
| ▪ Scottish & Southern Energy GRID Infrastructure | SSE |
| ▪ Scottish Power GRID Infrastructure | Scottish Power |
| ▪ Offshore Power Cables | SeaZone |
| Oil and Gas | |
| ▪ Hydrocarbon Fields | DECC |
| ▪ Hydrocarbon Pipelines | DECC |
| ▪ Licensed Blocks | DECC |
| ▪ Platforms | SeaZone |
| ▪ Significant Discoveries not yet developed | DECC |
| Telecoms | |
| ▪ Telecoms Cables | Global Marine Systems/ British Telecom/SeaZone |
| Waste Disposal | |
| ▪ Marine Disposal Sites | Marine Scotland |
| Other infrastructure/uses | |
| ▪ Helicopter routes, de-icing areas, flight pathways | CAA/Marine Scotland/The Crown Estate |

# Appendix F
# Initial Stakeholder Contact Letter

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Our ref: R/3979/sch/001

To Stakeholder Contact List
(Appendix A)

6 December 2010

Dear Sir/Madam

**Economic Assessment of the Draft Plan for Offshore Wind in Scottish Territorial Waters**

ABPmer, in association with economic consultants SQW and Risk & Policy Analysts has been commissioned by Marine Scotland to prepare an economic impact assessment for the short-term options in the Draft Plan for Offshore Wind Energy in Scottish Territorial Waters.

This letter provides initial information on the purpose and nature of the study, explains how we intend to consult with stakeholders and sets out how you may be able to contribute.

Background to the Study

Marine Scotland consulted on the Draft Plan for Offshore Wind Energy in Scottish Territorial Waters[1] and an accompanying SEA Environmental Report[2] in May 2010. The feedback received through this process has emphasised the importance of considering social and economic factors when developing the Plan, particularly around the potential impact of offshore wind on other marine industries and users.

Reflecting best practice in SEA, the environmental assessment was frontloaded and used to define the content of the Draft Plan. However, environmental impact is just one of a number of considerations to be taken into account. Strategic Environment Assessment legislation requires plan making bodies to consider the impact of plans on material assets. This study therefore seeks to assess the economic and social costs and benefits associated with the short-term options contained within the Draft Plan and the impact at local, regional and Scottish levels. The study will focus on the short term options identified as there is greater certainty about these developments at this point in time.

The analysis will assess the impact of development in the following broad areas of Scotland specified within the Draft Plan:

- North East: focusing on Beatrice;
- East: Inch Cape, Neart na Gaoithe, Forth Array;
- South West: Solway Firth, Wigtown Bay;
- West: Argyll Array, Islay, Kintyre

[1] Marine Scotland, 2010a. Draft Plan for Offshore Wind Energy in Scottish Territorial Waters. (May 2010)
http://www.scotland.gov.uk/Publications/2010/05/14155221/0

[2] Marine Scotland, 2010b. Strategic Environmental Assessment (SEA) of Draft Plan for Offshore Wind Energy in Scottish Territorial Waters: Volume 1: Environmental Report
http://www.scotland.gov.uk/Publications/2010/05/14155353/0

As no sites in the North or North West areas have been identified among the short term options, no development options from these areas will be considered within the analysis.

The economic impact assessment will be carried out in accordance with Better Regulation Executive guidance on impact assessment and in line with Treasury Green Book requirements. It will include an assessment of costs and benefits to offshore wind developers, the supply chain, other marine users, the public sector and wider society. It will be accompanied by a competition assessment and small firms impact test. The study will further inform the Adoption and Post-Adoption process for the Draft Plan.

The study is being conducted between December 2010 and February 2011. Delivery of the study is being managed by Marine Scotland, supported by an Advisory Group.

How you can contribute to the study

The project is a high-level study which will draw on existing available information (see Appendix B), including information in the SEA Environmental Report and consultation responses. The study team will also be approaching some stakeholders directly where we consider that they may hold additional relevant data. If you think you have some specific data that will be relevant to the study, please contact us. Given the short time-scales for the study we want our engagement with stakeholders to be effective as possible. An initial list of stakeholder groups to which this letter has been sent is provided in Appendix A. If you think there are other stakeholders that we should contact, please let us know.

**In response to this letter we would therefore be grateful if you could do the following four things:**

- **Let us know if another person within your organisation is the more appropriate contact for this study;**
- **Let us know your preferred means of engagement for this study (email, telephone, face-to-face);**
- **Provide us with contact details of any other stakeholders that you think we should contact in addition to the list in Appendix A;**
- **Notify us of any specific information that you think is relevant to this study (additional to list at Appendix B).**

We would particularly like to hear from other marine users or wider stakeholders who consider that they might be affected as a result of plan implementation.

Where to get more detailed information

If you require further information on the study, please feel free to contact ABPmer's Project Manager, Justine Saunders (jsaunders@abpmer.co.uk; 023 8071 1840) or Phil Gilmour (phil.gilmour@scotland.gsi.gov.uk; 0131 244 6569) at Marine Scotland

Yours sincerely
for ABP Marine Environmental Research Ltd

Steve Hull

**Stephen Hull**
**Project Director**




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