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# Sectoral Marine Plan for Offshore Wind Energy (encompassing Deep Water Plan Options) Social and Economic Impact Assessment

## Scoping Report

June 2018

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# Non-Technical Summary

Offshore wind is a large scale technology with the potential to play a pivotal role in Scotland's energy system over the coming decades. The development of technologies such as floating wind, which offer scope for development in deeper water, have significant potential to contribute offshore wind energy supply at affordable prices. The Draft Sectoral Plan for Offshore Wind published in 2013 focused on conventional offshore wind technologies. The Scottish Government is therefore seeking to develop an updated Sectoral Marine Plan for Offshore Wind Energy which encompasses deep water plan options to provide the strategic framework for the future offshore wind deployment in Scottish waters.

The purpose of this report is to present the methodology for scoping and undertaking the socio-economic impact assessment as part of the overall Sustainability Appraisal for the draft Plan. The socio-economic assessment will contribute to informing Scottish Ministers' decisions on the content of the Plan.

The scope of the study has been limited to considering the costs to activities associated with potential future development within DPO areas. It does not consider the potential benefits to the offshore wind industry, supply chains or to wider society associated with such development. These benefits will be assessed separately through a Scenario Mapping exercise and taken into account by Scottish ministers in making decisions on Plan.

The study has been overseen by a Project Advisory Group which includes representatives from within Scottish Government, The Crown Estate Scotland and relevant stakeholders.

The methodology to inform the scoping and assessment of socio-economic impacts has built on similar previous studies and previous EIAs for offshore developments. It follows wider guidance on impact assessment including Scottish Government guidance on Business and Regulatory Impact Assessment and the Green Book methodology (HM Treasury, 2013).

The methodology covers:

- The approach to defining development scenarios for offshore wind;
- Defining relevant marine activities for inclusion in the assessment;
- Defining relevant information sources to provide a baseline description against which impacts can be assessed;
- The approach to scoping of potentially significant interactions between marine activities and possible development under the Plan;
- Proposed approach for assessing socio-economic impacts on marine activities;
- Approach to cumulative assessment.

# 1 Introduction

## 1.1 Background

1.1.1 The UK is the current market leader in offshore wind power, with around 6.7 GW of installed capacity by the end of March 2018[1], all of which consists of conventional fixed-bottom foundation technology located in relatively shallow water depths (<40 m) and near to shore (<30 km). As installed capacity increases and the opportunities in shallow near-shore sites is exhausted, projects will need to be developed further from shore and in deeper water, which will pose greater technical challenges and constrain efforts to reduce costs.

1.1.2 In response to this challenge the industry is considering the potential for deep water offshore wind foundation technology to unlock deep water sites at a competitive cost of energy. Scotland has natural advantages in terms of a combination of high wind speeds and abundant deep water sites.

1.1.3 To date, three floating wind demonstration projects have been granted consent with the Hywind demonstration project becoming operational in October 2017. A combination of high wind speeds, abundant near-shore deep water sites, and the ability to leverage existing infrastructure and supply chain capabilities from the offshore oil and gas industry create the requisite conditions to position Scotland as a world leader in floating wind technology.

1.1.4 As part of Scottish Ministers' review of the Draft Sectoral Plan for Offshore Wind Energy, there is an opportunity to incorporate deep water wind technologies within an updated Offshore Wind Plan to ensure the spatial strategy is in place to enable the successful development of this sector.

1.1.5 A range of different technologies have been proposed for floating offshore wind[2] (Figure 1):

- Spar-buoy: a cylindrical ballast-stabilised structure which gains its stability from having the centre of gravity lower in the water than the centre of buoyancy;
- Semi-submersible platform: Buoyancy stabilised platform which floats semi-submerged on the surface of the ocean whilst anchored to the seabed with catenary mooring lines; and
- Tension leg platform: a semi-submerged buoyant structure, anchored to the seabed with tensioned mooring lines, which provide stability.

1.1.6 These technologies all have different strengths and weaknesses and may be appropriate in different conditions.

**1.1.7** It is intended that the Sectoral Plan for Offshore Wind Energy will provide locations suitable for a range of different conventional and deep water wind

[1] http://www.renewableuk.com/page/UKWEDhome
[2] https://www.carbontrust.com/media/670664/floating-offshore-wind-market-technology-review.pdf

technologies although the Plan will be technology neutral with technology preferences determined by the market.

**Figure 1 Floating wind foundation typologies[3]**

## 1.2 Plan Development Process

1.2.1 The draft Plan will be developed based on Marine Scotland's established process for developing sectoral offshore energy plans (Figure 2). A scoping exercise has been undertaken by Marine Scotland Science to identify areas of constraint and opportunity for offshore wind development (Marine Scotland, 2018). The scoping exercise has identified a number of strategic areas of search (AoS) for offshore wind including deep water wind development (Figure 3). These areas will be refined to develop Draft Plan Option (DPO) areas based on informal consultation and draft Regional Locational Guidance (RLG) documents which provide further information on the planning process and detailed environmental, socio-economic and planning related information for each AoS.

[3] https://www.dnvgl.com/technology-innovation/broader-view/electrifying-the-future/third-generation-wind-power.html

**Figure 2 Sectoral marine planning process**

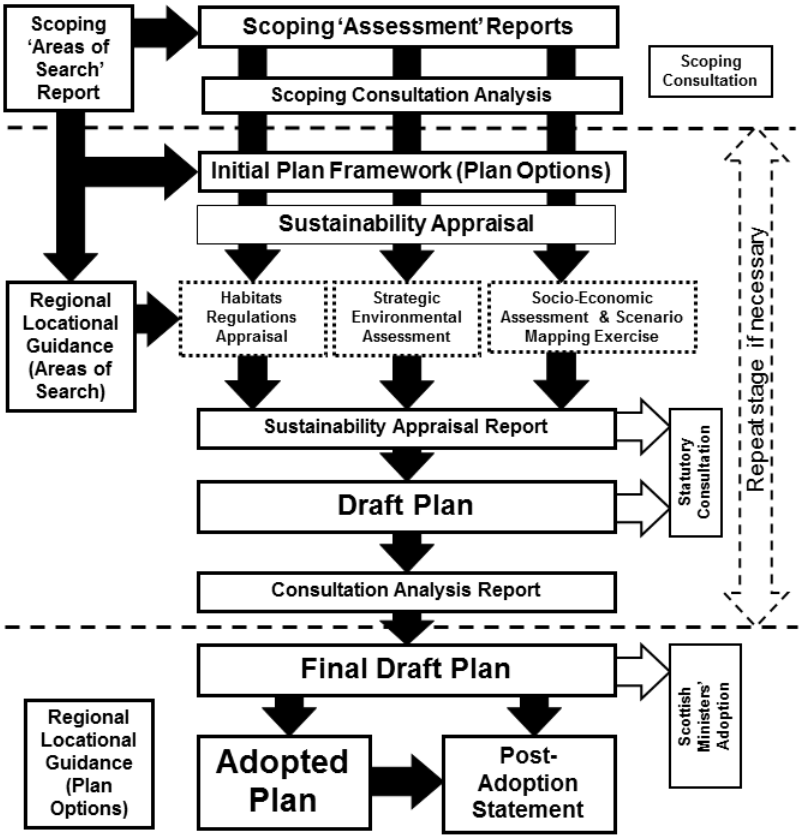
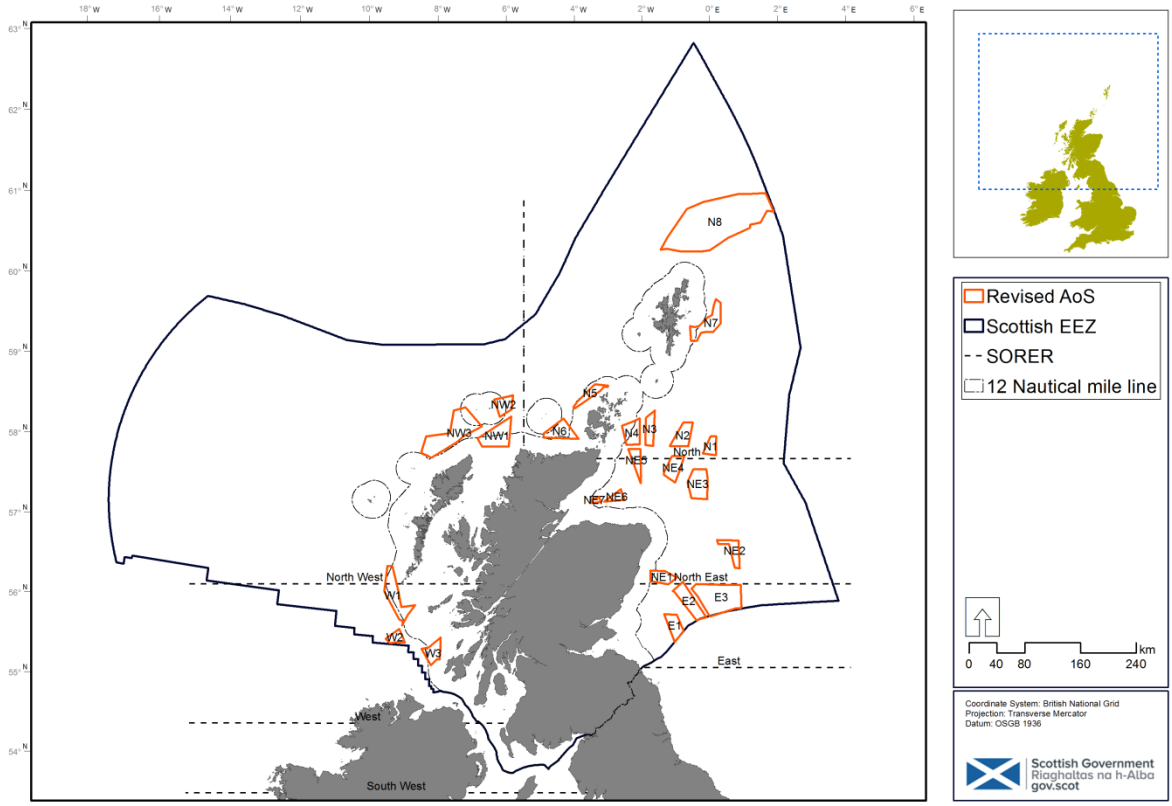


**Figure 3 Areas of Search for future offshore wind development**




1.2.2 The DPO areas will be appraised through:

- Strategic Environmental Assessment (SEA);
- Habitats Regulations Appraisal (HRA); and
- Socio-Economic Impact Assessment.

1.2.3 Together, these assessments will take account of strategic social, economic and environmental effects of possible development within the DPO areas as well as assessing the potential effects on species and habitats protected by European legislation (Natura 2000). These assessments will inform an overall Sustainability Appraisal of the DPO areas for offshore wind development.

1.2.4 Based on the findings of the Sustainability Appraisal, Marine Scotland will refine the DPO areas and take forward a draft plan for public consultation.

## 1.3 Socio-Economic Impact Assessment Scoping Study

1.3.1 The purpose of the study is to establish a methodology for scoping and undertaking the socio-economic impact assessment as part of the overall Sustainability Appraisal. The socio-economic assessment will contribute to informing Scottish Ministers' decisions on the content of the Plan.

1.3.2 The scope of the study has been limited to considering the costs to activities associated with potential future development within DPO areas. It does not consider the potential benefits to the offshore wind industry, supply chains or to wider society associated with such development. These benefits will be

assessed separately through a Scenario Mapping exercise and taken into account by Scottish ministers in making decisions on the Plan.

1.3.3 The study has been overseen by a Project Steering Group (PSG) comprising officials from within SG.

## 1.4 Report Structure

1.4.1 This report is structured as follows:

- Section 1: Introduction - this section; and
- Section 2: Methodology.

# 2 Methodology

## 2.1 Introduction

2.1.1 The methodology to inform the scoping and assessment of socio-economic impacts has built on similar previous studies including ABPmer *et al*., 2011; ABPmer & RPA, 2012; ABPmer & RPA, 2013 and previous EIAs for offshore developments. It follows wider guidance on impact assessment including Scottish Government guidance on Business and Regulatory Impact Assessment[4] and the Green Book methodology (HM Treasury, 2013).

2.1.2 The methodology described below covers:

- The approach to defining development scenarios for future offshore wind development;
- Defining relevant marine activities for inclusion in the assessment;
- Defining relevant information sources to provide a baseline description against which impacts can be assessed;
- The approach to scoping of potentially significant interactions between marine activities and possible development under the Plan;
- Proposed approach for assessing socio-economic impacts on marine activities; and
- Approach to cumulative assessment.

## 2.2 Approach to Defining Development Scenarios

2.2.1 The DPO areas for offshore wind development will identify potential broad areas within which future offshore wind arrays might be located. However, in order to provide a sufficient basis to carry out a quantitative socio-economic impact assessment, it will be necessary to make assumptions about the potential scale (potential installed capacity), nature (the types of technologies) and timing of possible development within these DPO areas. Possible socio-economic impacts associated with array export cables also need to be considered where practicable.

2.2.2 Given the inherent uncertainty in seeking to predict the scale and timing of development, it is proposed to progress the assessment using a number of scenarios, primarily relating to different possible scales of development within the strategic search areas, so that these uncertainties can be explored. The impacts of these scenarios can then be compared against the 'do nothing' option in seeking to estimate the potential socio-economic impacts associated with possible offshore wind development within the strategic search areas.

## 2.3 Developing Scenarios Relating to the Potential Scale of Future Development

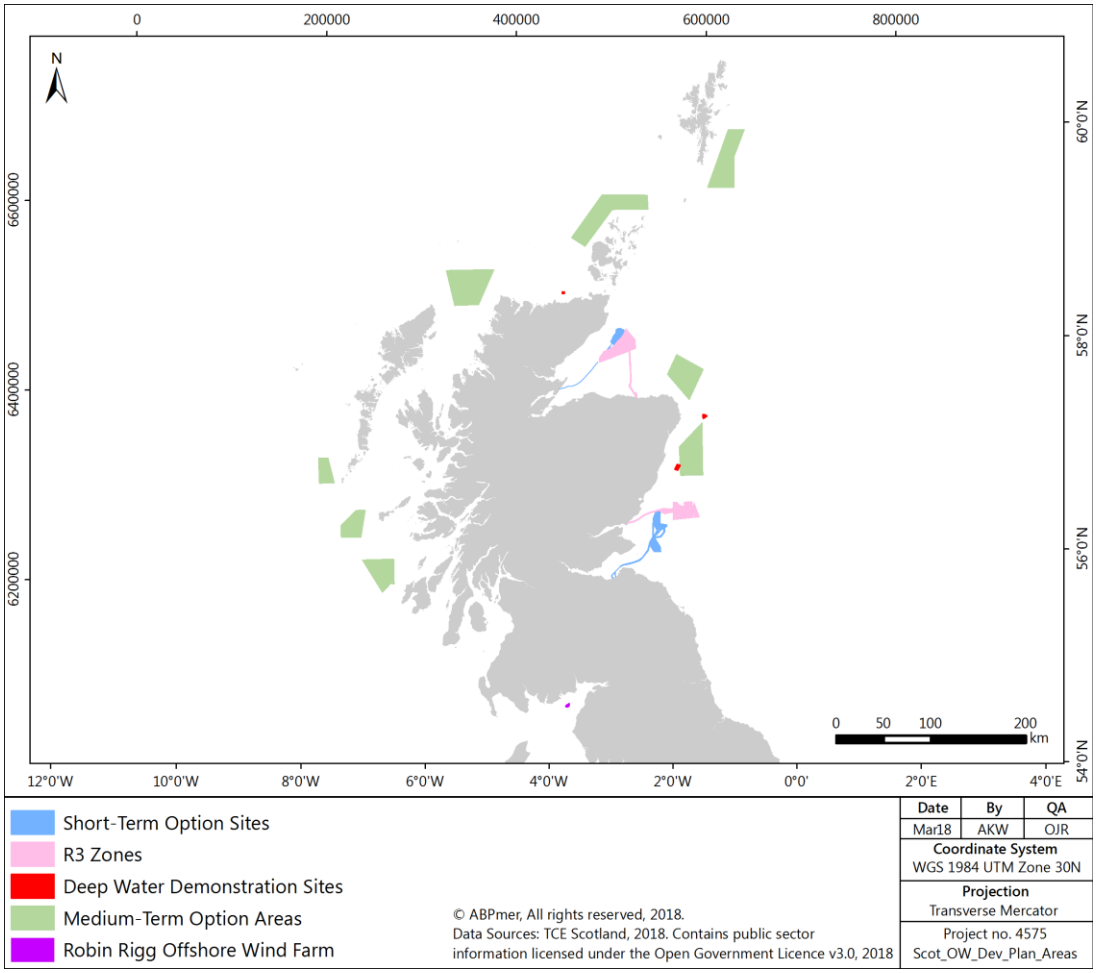
[4] https://beta.gov.scot/publications/bria-guidance/

2.3.1 To meet the 2050 carbon reduction target, heating needs to move away from natural gas and use low carbon sources. This change will primarily need to occur through the electrification of heating. The growth in electric vehicles (EVs) will also have a significant impact on demand.

2.3.2 Based on scenario modelling undertaken by National Grid[5], peak UK electricity demand is expected to rise from around 62 GW in 2016 to between 65-85 GW by 2050. This includes a forecast requirement for UK offshore wind capacity of between 8-18 GW by 2025 and 16-30 GW by 2050 (equivalent to around 50-100 TWh). Separately, the Energy Technologies Institute estimates that UK offshore wind deployment could reach 20-55 GW by 2050[6].

2.3.3 As at May 2018, Scotland had 217 MW of installed offshore wind capacity, but with a further 4.2 GW in construction or consented and awaiting construction[7] (Figure 4). The Robin Rigg Offshore Wind Farm in the Solway Firth accounts for around 174 MW of installed capacity.

**Figure 4 Current and planned offshore wind development in Scottish waters**




[5] http://fes.nationalgrid.com/
[6] http://www.eti.co.uk/insights/options-choices-actions-uk-scenarios-for-a-low-carbon-energy-system
[7] http://www.gov.scot/Topics/Statistics/Browse/Business/Energy/planningdata

2.3.4 In 2013, a Draft Sectoral Plan[8] for progressing ten medium-term option areas was published for consultation. The Plan remains to be finalised. This is the result of market uncertainty created by Electricity Market Reform. The DPO areas have been identified in Scotland's first National Marine Plan[9]. In December 2014, Scottish Ministers decided not to progress two of the plan options in South West Scotland and these have been removed from the draft Plan.

2.3.5 In Scotland, there are extensive deep water locations to the east, north, and west of the country, with 123 GW of the estimated 169 GW offshore wind potential located in water depths exceeding 60 m. Scottish Ministers anticipate that an initial plan for offshore wind might comprise 2 to 4 GW installed capacity within a number of DPO Areas.

2.3.6 Based on the above, three scenarios (termed 'Low Case', 'Central Case' and 'High Case') are proposed for the purposes of this study relating to different scales of possible future offshore wind development within the DPO areas in the period 2025 to 2035 as follows:

- Low Case: 2 GW installed capacity;
- Central Case: 4 GW installed capacity; and
- High Case: 8 GW installed capacity.

2.3.7 For the purposes of this study, it is proposed to allocate this capacity pro rata across all of the DPO areas based on their size, assuming a minimum size for a commercially viable array of 100 MW.

2.3.8 It is recognised that the scale of development within individual DPO areas may vary and is unlikely to be proportional to the size of area in every (or even any) case. However, for the purposes of this assessment, it is important that realistic scales of development are considered in each DPO area. It is therefore helpful to consider possible higher levels of potential development (High Case) within each DPO area to help to identify possible capacity constraints and how different scales of development within DPO areas might give rise to differing levels of socio-economic impact. It should be noted that although SG provided direction, the scenarios used are hypothetical and are not a formal commitment or statement of policy.

## 2.4 Consideration of Possible Future Technologies

2.4.1 There is currently significant uncertainty concerning the nature of possible deep water wind technologies that could be deployed and the methods of their construction. There is also uncertainty concerning the mix of conventional technologies and deep water wind technologies that might come forward under the Plan.

2.4.2 The precise nature of the technologies to be deployed and their construction methods has the potential to affect the nature and scale of impacts, including socio-economic impacts. However, it is not appropriate to make

[8] http://www.gov.scot/Publications/2013/07/8702
[9] http://www.gov.scot/Publications/2015/03/6517

detailed assumptions about project level technologies and construction methods in this plan level assessment. Some reasonable worst case assumptions have therefore been made to inform the socio-economic assessment as follows:

- Turbine size – up to 15 MW;
- Blade tip height – up to 280 m;
- Footprint of arrays – array area (km²) = 0.5 x MW installed capacity[10];
- Construction methods – foundation construction could entail percussive piling or gravity base foundations/anchors

2.4.3 While some socio-economic impacts may arise as a consequence of ecological impacts (which may vary to an extent depending on the technology) it will be a general requirement of the EIA and HRA processes to minimise such impacts to acceptable levels (where necessary underpinned by licence conditions). On this basis, it has been assumed that residual ecological impacts for offshore wind development projects will not be of sufficient magnitude to give rise to significant socio-economic impacts. This has been the experience of offshore wind development to date.

## 2.5 Developing an Indicative Programme

2.5.1 The timing of possible development at specific locations under the Plan is uncertain. The assumption is that the Plan will look to enable development within the period 2025 to 2035. Assuming Plan adoption in 2019, it is possible that consenting could be completed in some DPO areas within 4 years, with construction in these areas starting as early as 2025, and for those schemes to become operational by 2028. However, given that the draft Plan is seeking to facilitate development within the period 2025 to 2035 and given the uncertainty surrounding the precise timing of development, it will be assumed for the purposes of this assessment that all construction will commence in 2028 and that all developments will become operational in 2031. While this is a simplification, for impact assessment purposes it is likely to provide a broadly similar assessment of costs and benefits to an assumption that evenly distributes development over the period 2025 to 2035.

## 2.6 Taking Account of Cable Routes

2.6.1 There is currently a high level of uncertainty concerning the possible location and number of export cables associated with potential development within the DPO areas. These requirements will depend on the scale and location of

[10] The Hywind ES (Statoil, 2015) indicates that the proposed 30 MW array will occupy a total area of up to 15 km². The Kincardine Offshore Wind ES (Atkins, 2016) indicates that an indicative 48 MW array will occupy a total area of up to 19 km². This equates to approximately 2-3 MW per km² compared to around 7.6 MW per km² for conventional offshore wind (BOWL, 2012). The relatively greater area occupied by deep water wind projects is due to the anchoring configurations and will also be a function of water depth with larger areas required in deeper water. On a conservative basis, for the purpose of this assessment, it is therefore proposed that the footprint of future offshore wind projects will be assumed to be 2 MW installed capacity per km².

development within the strategic areas and the future development of grid connection points (both onshore and offshore). Some information is available from National Grid (2016) on potential and planned land-side grid connections. However, it is still challenging to predict the likely routes for export cable corridors. Given these uncertainties, the proposed approach for this this study is to identify all areas inshore of the DPO areas as potential export cable route corridors unless there is a clear cable landfall point indicated by current and/or planned grid connection points. The same export cable route corridors have been assumed for each of the three scenarios as these would not be expected to vary significantly as a result of changing the intensity of development within each strategic search area.

2.6.2 As part of the assessment these areas will be screened for possible socio-economic issues and used to inform the RLG. However, given the uncertainties in possible export cable routes, no quantitative assessment of potential socio-economic impacts will be made.

## 2.7 Defining Relevant Marine Activities

2.7.1 A wide range of human activities occur in the marine environment which could potentially be affected by aspects of deep water wind development. For consistency with previous assessments, the following categories of activity have been considered within the study:

- Aquaculture (finfish and shellfish);
- Aviation;
- Carbon Capture and Storage;
- Coast Protection and Flood Defence;
- Commercial Fisheries (including salmon and sea trout);
- Energy Generation;
- Military Activity;
- Oil and Gas (including exploration, production, interconnectors, gas storage);
- Ports and Harbours;
- Power Interconnectors (including offshore transmission networks);
- Recreational Boating;
- Shipping;
- Telecom Cables;
- Tourism (including heritage assets);
- Waste Disposal (dredge material); and
- Water Sports (including sea angling, surfing and windsurfing, sea kayaking, small sail boat activities and scuba diving)

## 2.8 Establishing a Baseline

2.8.1 To assess the potential socio-economic impacts of potential offshore wind development on relevant marine activities, it is necessary to establish a

baseline (counterfactual) against which the potential impacts of the Plan (intervention option) can be assessed.

2.8.2 Baseline information is therefore required for each relevant marine activity including:

- The current location, intensity and economic value of activity; and
- How the location, intensity and economic value might change over time in the absence of the Plan.

2.8.3 For each relevant marine activity, Appendix A provides an overview of the information sources that can be used to compile a suitable baseline.

## 2.9 Approach to Scoping

2.9.1 The potential for offshore wind development (including associated export cables) to give rise to socio-economic impacts on other activities depends on the nature and scale of interactions between them. The approach proposed for the scoping assessment is therefore to seek to define the potential interactions and to identify those interactions which have the potential to give rise to significant socio-economic impacts. The scoping assessment will draw on relevant previous studies and taking account of specific factors relevant to each strategic search area. The identification of potentially significant interactions has drawn on previous socio-economic assessments (e.g. ABPmer *et al*., 2011 and ABPmer & RPA, 2013) and wider sources on interactions such as MMO (2014).

2.9.2 To identify the potential for significant socio-economic impacts to occur, the scoping process will take account of:

- Whether the activity spatially overlaps with one or more DPO areas;
- For tourism, where more than 10% of a DPO is within 15 km of a seascape unit with a low 'Capacity Index', based on Scott *et al*. 2005 (see Appendix A15 for more detail);
- The extent to which the spatial overlap is judged likely to give rise to a significant interaction; and
- The likely scope to avoid a significant interaction through spatial planning of the location of arrays within a DPO area.

2.9.3 Where one or more potentially significant interactions is identified, further consideration will be given to the potential impact pathways by which socio-economic impacts may arise and the extent to which any or all of the relevant pathways require assessment. Where potential for significant socio-economic impacts is identified, these interactions will be subject to more detailed assessment.

2.9.4 Where potential impacts will need to be mitigated up-front by the developer as a condition of consent, it has been assumed that the residual impacts will not give rise to significant socio-economic impacts. The mitigation costs to be met by the developer have not been included in the costs presented in the assessments described within this study. For example, in the case of potential impacts to aviation radar, these will need to be mitigated by the

developer and therefore significant impacts to the aviation sector will be avoided and so are not quantified within this assessment.

2.9.5 Similarly, where potential socio-economic impacts are consequential on potential environmental impacts, it has been assumed that mitigation will be required for such impacts as a condition of consent and the residual environmental impacts will not give rise to significant socio-economic impacts.

2.9.6 Appendix A includes a partial scoping assessment for each activity but this will need to be completed once the DPO areas have been defined.

## 2.10 Approach to Assessing Social Impacts

2.10.1 Social impacts can occur as a result of knock-on effects from economic impacts, due to direct effects associated with changes that result from future development in DPO areas or due to knock-on effects from impacts on affected sectors. Unlike the economic effects, it is unlikely to be possible to monetise the social impacts but it is important that they are assessed so they can inform decision-making.

2.10.2 Our approach to the assessment of social impacts is based on the identification of value clusters. This draws on work undertaken by Collingwood Environmental Planning for Marine Scotland (2016), where value clusters were identified through discussion with local communities around the Scottish coast. Therefore, these value clusters provide the best mechanism for enabling the social impacts to be assessed. The value clusters for use in the study are presented in Table 1.

**Table 1 Clusters of social values**

| Value cluster levels | SIA categories | Value clusters |
|---|---|---|
| Individual | Way of life | 1. Family/family life/inter-generational issues |
| | Way of life | 2. Jobs/career/employment |
| | Way of life | 3. Money/cost of living |
| Community | Community | 4. Local jobs/local industry/community sustainability |
| | Community | 5. Transport connections/technology connections |
| | Community | 6. Education |
| | Community | 7. Shops/housing |
| | Community | 8. Socialising/recreation/parks/leisure |
| | Community | 9. Friends/being involved/supporting others |
| | Culture | 10. Local identity/cultural heritage/Gaelic |
| | Health | 11. Healthcare |
| | Environment | 12. Connection to nature/landscape |
| | Political | 13. Local political and decision-making systems |
| Wider political and environmental context | Environment | 14. Landscape/seascape/wildlife/environmental change |
| | Political | 15. National and EU level political and decision-making systems |

Source: Collingwood Environmental Planning Ltd *et al*. (2016): A two way conversation with the people of Scotland on the social impact of offshore renewables, Final Dialogue Report, March 2016.

2.10.3 The social impact assessment involves considering how development could affect each value cluster. The direct and indirect economic effects will be included to enable the knock-on effects of changes in jobs and GVA to be captured. Wider social impacts that result directly from development or as knock-on effects from impacts on sectors that are not reflected in an economic effect can also be identified and described. A rating system is used to enable comparison across all the social impacts. This is based on the typical level of impact that would be seen. Any variation in impacts across different groups within society is considered as part of the distributional analysis.

2.10.4 The rating system to be applied is provided in Table 2.

**Table 2 Rating system**

| Negative impacts (-) | Positive impacts (+) |
|---|---|
| Major (- - - -): sufficient negative impacts predicted to have a noticeable effect that is sufficient to cause complaints and/or protests from the community | Major (+ + + +): sufficient positive impacts predicted to have a noticeable effect that is sufficient to enable new services or activities within the community |
| Moderate (- - -): sufficient negative impacts predicted that result in concerns being raised by the community | Moderate (+ + +): sufficient positive impacts predicted that result in increased levels or expansion of existing activities or services |
| Minor (- -): negative impacts predicted that may be noticed but which are accepted by the majority of the community | Minor (+ +): positive impacts predicted that may be noticed but which support existing services or activities but not the extent that they can expand |
| Negligible (-): small negative impacts that are unlikely to be noticed by the majority of the community | Negligible (+): small positive impacts that are unlikely to be noticed by the majority of the community |
| Neutral/no overall impact: 0 | |
| Based on work undertaken by ABPmer and RPA for previous socio-economic impact assessments undertaken for Scottish Government and Marine Scotland | |

Source: Collingwood Environmental Planning Ltd *et al*. (2016): A two way conversation with the people of Scotland on the social impact of offshore renewables, Final Dialogue Report, March 2016

2.10.5 The methodology involves identification of one rating for each social impact. The impacts are linked to the sectors or activities that cause the effect and the value cluster to which they are relevant. This draws upon the scoping assessment, in particular the nature and scale of interactions that have been identified between offshore wind development and the activities. The rating assigned includes justification in the form of a description of the reasoning used to assign the rating, again drawing on the evidence from the scoping assessment. Further evidence collection may be required where social impacts could arise independently of socio-economic effects.

2.10.6 The Collingwood Environmental Planning report also identifies those social values that were identified as important to protect or as fragile by participants in different locations. These important social values are shown in Table 3, by location. The social impact assessment involves considering

whether any of the important social values in each location are likely to be affected by development. Where this is the case, these impacts will be highlighted. Consideration will be given to the need to increase the rating to reflect the local importance of these social values, with the justification for any increase in the rating also recorded in qualitative terms.

**Table 3 Social Values identified as being Locally Important**

| Location | Social values identified as important to protect/fragile |
|---|---|
| Kirkwall (Pentland Firth and Orkney Waters) | • Inter-generational mix<br>• Community safety<br>• Healthy local economy<br>• Jobs to keep young people<br>• Remoteness while remaining connected<br>• Environmental assets<br>• Cultural heritage: sites |
| Port Ellen, Islay (Argyll and the islands) | • Inter-generational mix<br>• Healthy local economy<br>• Jobs to keep young people<br>• Connectedness<br>• Control over island development<br>• Cultural heritage: Gaelic, events<br>• Environmental assets |
| Helmsdale, Caithness | • Inter-generational mix<br>• Strengthening local economy<br>• Jobs to keep young people<br>• Connectedness<br>• Community safety<br>• Cultural heritage: fishing<br>• Environmental assets<br>• Strong community organisations |
| Stranraer (Dumfries and Galloway-Solway) | • Restoring local economy<br>• Jobs for local people<br>• Sociability and community support<br>• Connectedness<br>• Improving environmental assets |
| St Andrews, Fife | • Restoring local economy<br>• Environmental assets<br>• Cultural heritage: town and events<br>• Community diversity |
| Glasgow | • Sociability and community support<br>• Cultural heritage: town and events<br>• Community diversity |

2.10.7 The ratings assigned to each impact and each value cluster will also be used as the basis for the distributional analysis (see Appendix B). In summary, the distributional analysis involves reviewing the ratings assigned to each social impact and assessing whether this rating should be increased or decreased for each sub-group. The justifications included with the average rating from the social impact assessment are used as the basis for identifying if an impact is expected to be worse (more negative or less positive) for each sub-group. Where there is expected to be a difference, the rating is revised for that sub-group and further justification (in the form of a narrative description) is provided as to why that change has been made.

## 2.11 Approach to Quantifying and Monetising Economic Impacts

2.11.1 In advance of completing the scoping exercise, and based on previous assessments for offshore wind development, the main activities for which there might be significant economic impacts associated with offshore wind development are considered to be commercial fisheries, commercial shipping and possibly tourism. Minor impacts could also occur to recreational boating and recreational angling depending on how close to shore arrays might be located.

2.11.2 Draft methods for detailed assessment of potentially significant interactions between offshore wind development and relevant aspects of these activities are provided in Appendix A. The detail of these methods will be further developed as part of the detailed socio-economic assessment as required. Should the scoping exercise identify additional activities requiring detailed assessment, methods for these assessments will be defined as appropriate.

2.11.3 Analysis of interactions between offshore wind development and other marine activities is generally based on spatial analysis using GIS tools to provide a quantitative estimate of the interaction. Estimates of economic impacts are then made in a number of different ways:

- Where an interaction would result in a material reduction in the level of output from an activity, the economic impact is assessed in terms of a reduction in Gross Value Added (GVA) and employment;
- Where an interaction would result in an increase in that activity's operating costs but which would not result in a reduction in economic output from that activity, the impacts are simply expressed in terms of monetary costs; and
- Where an interaction might create investment uncertainty for an activity, such uncertainties are noted in the analysis but not quantified.

2.11.4 Where an interaction has the potential to affect economic output, resulting in impacts to GVA and employment, in line with Scottish BRIA guidance, a distributional analysis of the economic impact will be carried out. The outputs from this distributional analysis will be used to inform the assessment of social impacts.

2.11.5 Further details on the methods to be used to assess impacts to GVA and employment and for the distributional analysis are provided in Appendix B. Based on previous experience, it is possible that on a worst case basis, development under the Plan could affect economic output from the fisheries sector. Therefore, specific detail is provided on how potential impacts on GVA and employment on the fisheries sector and the distributional impact will be assessed.

2.11.6 It is proposed that the economic assessment is undertaken for a time period of 30 years starting in 2018. This will ensure that the assessment covers the likely period of construction of deep water wind projects (2025 to 2035) and for a period of at least 10 years thereafter. This duration should capture the main period of potential impacts. However, it may be appropriate to increase the time period of the assessment if the scope is widened to include an assessment of potential benefits, particularly as many of the benefits are likely to continue for the life of offshore wind projects (around 25 years from the date of construction, assuming projects are decommissioned after this time).

## 2.12 Approach to Cumulative Assessment

2.12.1 For the purpose of this study, the cumulative impact of potential offshore wind development will be considered together with possible development under existing and draft offshore wind, wave and tidal plans. The assessment will consider cumulative effect at both regional and national scales, using the Scottish Offshore Renewable Energy Regions (SORERs) as the basis for the regional assessments. These regions were used previously to inform the cumulative assessment of the draft offshore wind, wave and tidal energy plans (ABPmer & RPA, 2013).

2.12.2 In general, at low levels of offshore wind development, the socio-economic impacts of additional levels of development are likely to be additive. In contrast, more intense offshore wind development, occupying a significant proportion of local, regional or national sea space may give rise to synergistic impacts. For example, above a certain threshold of impact, it may no longer be economic to continue with an activity and the whole of the activity may be lost. However, there is little if any evidence that indicates what the relevant thresholds might be, above which impacts may become synergistic.

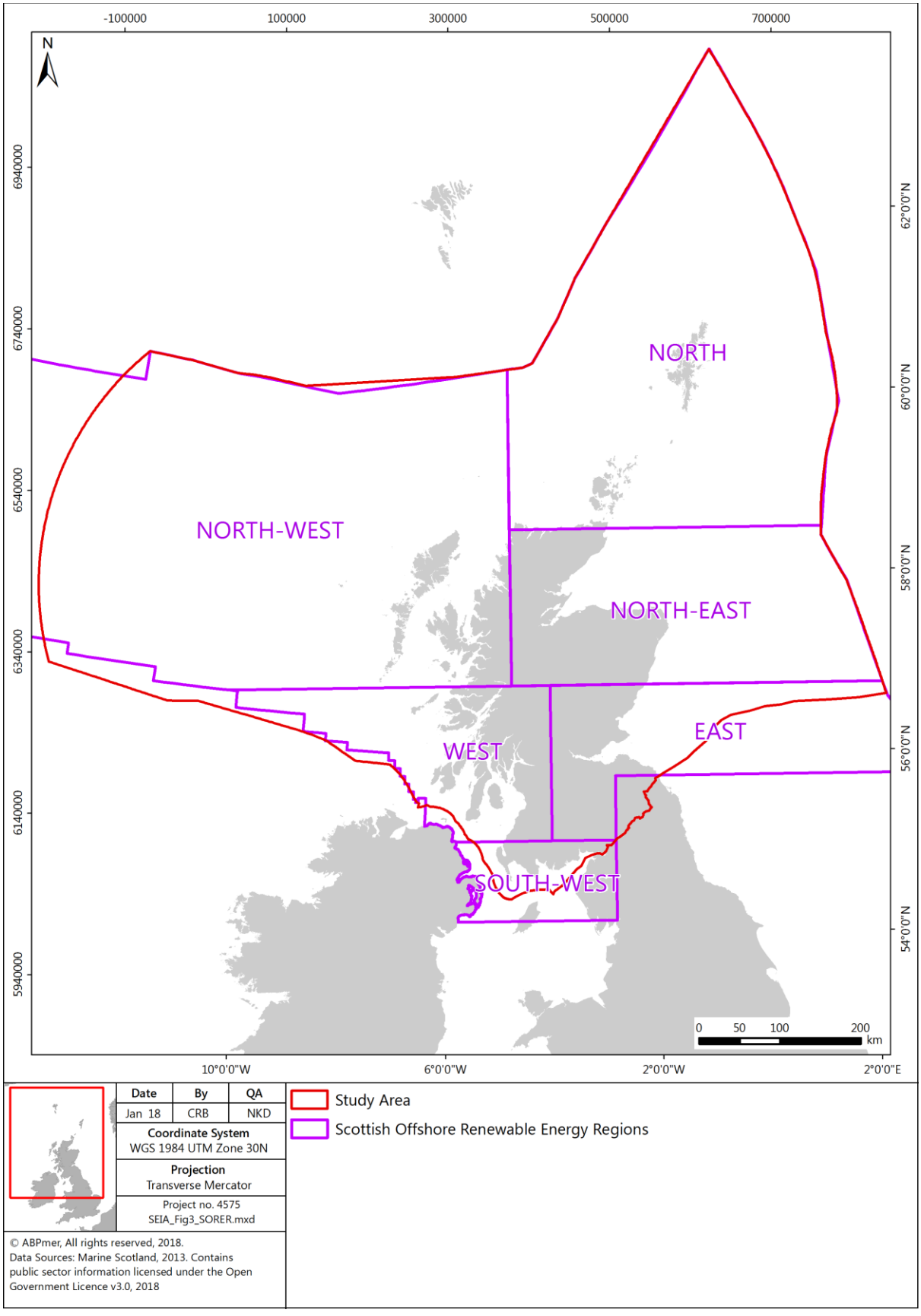
2.12.3 Given these constraints, the study generally proposed to adopt an additive approach to assessing the cumulative economic impact associated with multiple offshore renewables development locations and multiple offshore renewables technologies within a region and nationally. However, if the impacts are predicted to be particularly concentrated and intense at a local or regional level, specific consultation will be undertaken with the relevant sectoral interests to seek to evaluate the combined effect using expert judgement.

2.12.4 The approach to estimating the combined social effects and distributional impacts will be based on assigning a significance rating to impacts on different groups from changes to access and experiences from the

interactions associated with each sector. The number of each rating assigned has been summed to give an indication of not just the number of impacts, but also their likely overall cumulative significance for each group and each key area. The approach has followed the principles of the additive approach used across other sectoral interests, while retaining information on the range of significance of social impacts in a semi-quantitative manner. The following ratings have been applied:

- Very significant: almost all people in this location/group are likely to be affected;
- Significant: the most vulnerable people are likely to be affected;
- Slightly significant: some people or those who are more vulnerable are likely to be affected; and
- Not very significant: few people or those who are least vulnerable are likely to be affected.

**Figure 5 Scottish Offshore Renewable Energy Regions**



# 3 References

ABPmer & RPA, 2012. Socio-economic Baseline Reviews for Offshore Renewables in Scottish Waters. ABP Marine Environmental Research Ltd, Report No. R.1905 to Marine Scotland.

ABPmer & RPA, 2013. Draft Sectoral Marine Plans for Offshore Renewable Energy in Scottish Waters: Socio - Economic Assessment. Report No. R.2045 to Marine Scotland.

ABPmer, SQW and RPA, 2011. Economic Assessment of Short-term Options for Offshore Wind in Scottish Territorial Waters.

Atkins, 2016. Kincardine Offshore Windfarm - Environmental Statement, March 2016.

BOWL (Beatrice Offshore Wind Ltd), 2012. Beatrice Offshore Wind Farm Environmental Statement.

HM Treasury, 2013. The Green Book.

Marine Scotland, 2013. Sectoral Marine Plans for Offshore Wind, Wave and Tidal Energy in Scottish Waters Consultation Draft. The Scottish Government, Edinburgh 2013. Available online at: http://www.gov.scot/Resource/0042/00428241.pdf, accessed on 10 January 2018.

Marine Scotland, 2018. Scoping 'Areas of Search' Study for offshore wind in Scottish Waters, 2018.

MMO, 2014. Social impacts and interactions between marine sectors (MMO 1060), August, 2014.

National Grid, 2016. Electricity Ten Year Statement 2016: UK electricity transmission, November 2016.

Scott, K.E., Anderson, C., Dunsford, H., Benson, J.F. and MacFarlane, R. (2005). An assessment of the sensitivity and capacity of the Scottish seascape in relation to offshore windfarms. Scottish Natural Heritage Commissioned Report No.103 (ROAME No. F03AA06).

Statoil, 2015. Hywind Scotland Pilot Park - Environmental Statement, April 2015.

# 4 Abbreviations/Acronyms

| | |
|---|---|
| 4COffshore | 4COffshore Ltd |
| ABPmer | ABP Marine Environmental Research Ltd |
| AGL | Above Ground Level |
| AIS | Automatic Identification System |
| ANSP | Air Navigation Service Provider |
| AONB | Area of Outstanding Natural Beauty |
| AoS | Areas of Search |
| Aquatera | Aquatera Ltd |
| ATM | Air Traffic Movement |
| BDT | Beatrice Demonstrator Turbines |
| BERR | Department of Business, Enterprise and Regulatory Reform |
| boe | Barrel of oil equivalent |
| BOWL | Beatrice Offshore Windfarm Limited |
| BRIA | Business and Regulatory Impact Assessment |
| CAA | Civil Aviation Authority |
| CCGT | Combined Cycle Gas Turbine |
| CCS | Carbon Capture and Storage |
| CCSA | Carbon Capture & Storage Association |
| Cebr | Centre for Economics and Business Research |
| $CO_2$ | Carbon Dioxide |
| CPUE | Catch Per Unit Effort |
| DCO | Development Consent Order |
| DEA | Danish Energy Authority |
| DECC | Department of Energy & Climate Change |
| DfT | Department for Transport |
| DPO | Draft Plan Option |
| DTI | Department of Trade and Industry |
| EIA | Environmental Impact Assessment |
| EKOS | EKOS Limited |
| EMEC | European Marine Energy Centre |
| ES | Environmental Statement |
| ETI | Energy Technologies Institute |
| EU | European Union |
| EUROSION | European Initiative for Sustainable Coastal Erosion Management |
| EV | Electric Vehicle |
| FTE | Full Time Equivalent |
| GDP | Gross Domestic Product |
| GIS | Geographic Information System |
| GT | gigatonne |
| GVA | Gross Value Added |
| GW | Gigawatts |
| HIE | Highlands and Islands Enterprise |
| HM | Her Majesty's |
| HMNB | Her Majesty’s Naval Base |
| HMR | Helicopter Main Route |
| HRA | Habitats Regulations Appraisal |
| ICES | International Council for the Exploration of the Sea |

| | |
|---|---|
| ICF | ICF International, Inc |
| ICOMIA | International Council of Marine Industry Associations |
| IMO | International Maritime Organisation |
| KIS-ORCA | Kingfisher Information Service - Offshore Renewable & Cable Awareness |
| km | Kilometre |
| LFA | Low Flying Area |
| LUC | Land Use Consultants |
| m | Metre |
| MCA | Maritime and Coastguard Agency |
| MDS Transmodal | MDS Transmodal Ltd |
| MMO | Marine Management Organisation |
| MOD | Ministry of Defence |
| MPA | Marine Protected Area |
| MS | Marine Scotland |
| MSCC | Marine Science Co-Ordination Committee |
| MTDG | Marine Tourism Development Group |
| mtoe | Million tonnes of oil equivalent |
| MW | Megawatts |
| NATS | National Air Traffic Services |
| nm | Nautical Mile |
| NMPi | National Marine Plan interactive |
| NRIP | National Renewables Infrastructure Plan |
| O&M | Operations and Maintenance |
| Ofgem | Office of Gas and Electricity Markets |
| OSPAR | Oslo/Paris convention (for the Protection of the Marine Environment of the North-East Atlantic) |
| OWF | Offshore Wind Farm |
| PEXA | Practice and Exercise Areas |
| PSG | Project Steering Group |
| PV | Present Value |
| RLG | Regional Locational Guidance |
| RPA | Risk & Policy Analysts |
| RYA | Royal Yachting Association |
| SAC | Special Areas of Conservation |
| SAIC | Scottish Aquaculture Innovation Centre |
| ScotMap | Marine Scotland project which provides spatial information on the fishing activity |
| SDSR | Strategic Defence and Security Review |
| SEA | Strategic Environmental Assessment |
| SG | Scottish Government |
| SIA | Social Impact Analysis |
| SIFIDS | Scottish Inshore Fisheries Integrated Data System |
| SLVI | Seascape and Landscape Visual Impacts |
| SLVIA | Seascape and Landscape Visual Impact Assessment |
| SMRTS | Scottish Marine Recreation and Tourism Survey |
| SNH | Scottish Natural Heritage |
| SOEC | Solent Ocean Energy Centre |
| SORER | Scottish Offshore Renewable Energy Region |
| SQW | SQW Ltd |

| | |
|---|---|
| STECF | Scientific, Technical and Economic Committee for Fisheries |
| TSS | Traffic Separation Schemes |
| TTA | Tactical Training Area |
| TWh | Tera watt hour |
| UK | United Kingdom |
| UKCS | UK Continental Shelf |
| UKCPC | UK Cable Protection Committee |
| UKMMAS | UK Marine Monitoring and Assessment Strategy |
| UNESCO | United Nations Educational, Scientific and Cultural Organization |
| USA | United States of America |
| VMS | Vessel Monitoring System |
| WES | Wave Energy Scotland |
| ZTV | Zone of Theoretical Visibility |

# 5 Responding to the Consultation

We are inviting responses to this consultation by **18 July 2018**.

Please respond to this consultation using the Scottish Government's consultation platform, Citizen Space. You view and respond to this consultation online at https://consult.gov.scot/marine-scotland/offshore-wind-scoping. You can save and return to your responses while the consultation is still open. Please ensure that consultation responses are submitted before the closing date of **18 July 2018**.

If you are unable to respond online, please complete the Respondent Information Form (see "Handling your Response" below) to: SectoralMarinePlanning@gov.scot

Or by post to:

Offshore Wind Sectoral Marine Plan Scoping Consultation
Marine Scotland Planning and Policy (1A South)
Scottish Government, Victoria Quay
Edinburgh
EH6 6QQ

**Handling your response**
If you respond using Citizen Space (http://consult.scotland.gov.uk/), you will be directed to the Respondent Information Form. Please indicate how you wish your response to be handled and, in particular, whether you are happy for your response to published.

If you are unable to respond via Citizen Space, please complete and return the Respondent Information Form attached included in this document. If you ask for your response not to be published, we will regard it as confidential, and we will treat it accordingly.

All respondents should be aware that the Scottish Government is subject to the provisions of the Freedom of Information (Scotland) Act 2002 and would therefore have to consider any request made to it under the Act for information relating to responses made to this consultation exercise.

**Next steps in the process**
Where respondents have given permission for their response to be made public, and after we have checked that they contain no potentially defamatory material, responses will be made available to the public at http://consult.scotland.gov.uk. If you use Citizen Space to respond, you will receive a copy of your response via email.

Following the closing date, all responses will be analysed and considered along with any other available evidence to help us. Responses will be published where we have been given permission to do so.

**Comments and complaints**

If you have any comments about how this consultation exercise has been conducted, please send them SectoralMarinePlanning@gov.scot

**Scottish Government consultation process**
Consultation is an essential part of the policy-making process. It gives us the opportunity to consider your opinion and expertise on a proposed area of work.

You can find all our consultations online: http://consult.scotland.gov.uk. Each consultation details the issues under consideration, as well as a way for you to give us your views, either online, by email or by post.

Consultations may involve seeking views in a number of different ways, such as public meetings, focus groups, or other online methods such as Dialogue (https://www.ideas.gov.scot) Responses will be analysed and used as part of the decision making process, along with a range of other available information and evidence. We will publish a report of this analysis for every consultation. Depending on the nature of the consultation exercise the responses received may:

- indicate the need for policy development or review
- inform the development of a particular policy
- help decisions to be made between alternative policy proposals
- be used to finalise legislation before it is implemented

While details of particular circumstances described in a response to a consultation exercise may usefully inform the policy process, consultation exercises cannot address individual concerns and comments, which should be directed to the relevant public body.

# 6 Respondent Information Form

Scottish Government
Riaghaltas na h-Alba
gov.scot

**Sectoral Marine Plan for Offshore Wind Energy (encompassing Deep Water Plan Options) – Social and Economic Impact Assessment Scoping Report**
**Please Note** this form **must** be completed and returned with your response.

Are you responding as an individual or an organisation?

☐ Individual

☐ Organisation

Full name or organisation's name

| |
|---|
| |

Phone number
Address

| |
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| |

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| |

Postcode

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Email

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| |

The Scottish Government would like your permission to publish your consultation response. Please indicate your publishing preference:

☐ Publish response with name

☐ Publish response only (without name)

☐ Do not publish response

**Information for organisations:**

The option 'Publish response only (without name)' is available for individual respondents only. If this option is selected, the organisation name will still be published.

If you choose the option 'Do not publish response', your organisation name may still be listed as having responded to the consultation in, for example, the analysis report.

We will share your response internally with other Scottish Government policy teams who may be addressing the issues you discuss. They may wish to contact you again in the future, but we require your permission to do so. Are you content for Scottish Government to contact you again in relation to this consultation exercise?

☐ Yes

☐ No

## Consultation Question

Please provide any comments you have in relation to Sectoral Marine Plan for Offshore Wind Energy (encompassing Deep Water Plan Options) - Social and Economic Impact Assessment Scoping Report.

# Appendix A Description of Interactions and Assessment Methods

## A.1. Introduction

This appendix provides a high level baseline overview of each activity. Potential interactions with offshore wind are identified and an initial scoping assessment is presented, together with proposed methods for detailed scoping where further assessment is considered necessary.

## A.2. Aquaculture

### A.2.1 Sector Definition

This sector relates to the sea-based production of finfish, shellfish and seaweed within aquaculture installations, including cultivated beds of shellfish.

### A.2.2 Overview of Activity

Marine (sea-based) aquaculture in Scotland is concentrated on the west coast of the mainland and in the Western Isles, Orkney Islands and Shetland Islands. Installations are normally positioned in sea lochs, voes and inlets (Scotland's Aquaculture, 2015). While a number of marine finfish species are farmed in Scotland (including rainbow trout, halibut and Arctic charr), the industry is dominated by Atlantic salmon production (95% of finfish production in 2015), with 171,722 tonnes of salmon produced in 2015 with a value of £637 million (HIE and SAIC, 2017). Mussels and Pacific oysters are the main species of shellfish produced in terms of both volume and value. In total, 7,270 tonnes of mussels and 2.7 million Pacific oysters were produced in 2015 and the value at first sale for all species (including native oysters and king and queen scallops) was £10.1 million (Marine Scotland, 2016). Although there is interest and research into the viability of cultivating seaweed for bioenergy production in Scotland, at present, there is no commercial scale cultivation of seaweed. As such, seaweed is not considered further in this study.

There is strong government support for the expansion of the Scottish aquaculture industry (Black and Hughes, 2017) and the industry has ambition to grow aquaculture production to 350,000 tonnes for marine finfish (approximately double the average harvest for 2014/2015) and 21,000 tonnes for mussels (a 133% increase on the average harvest for 2014/2015 harvest) by 2030 (Black and Hughes, 2017; HIE and SAIC, 2017). How expansion of the industry is achieved (e.g. via expansion of on-shore, near-shore and/or offshore aquaculture) and to what extent these ambitions are realised will depend on numerous factors including the level of social acceptance of aquaculture, markets and economics, availability of marine space at sites with suitable environmental conditions and technological developments, including in relation to offshore aquaculture in more exposed locations. Future potential scenarios for aquaculture in Scotland, or the UK (including Scotland), have been explored in a number of studies for example Black and Hughes (2017), HIE and Marine Scotland (2017) and Celtic Seas Partnership (2016).

Figure A.2.1 shows an overview of aquaculture activity in Scotland. Information sources that can be used in the assessment are listed in Table A.2.1.

## Figure A.2.1 Active finfish and shellfish aquaculture sites in Scotland

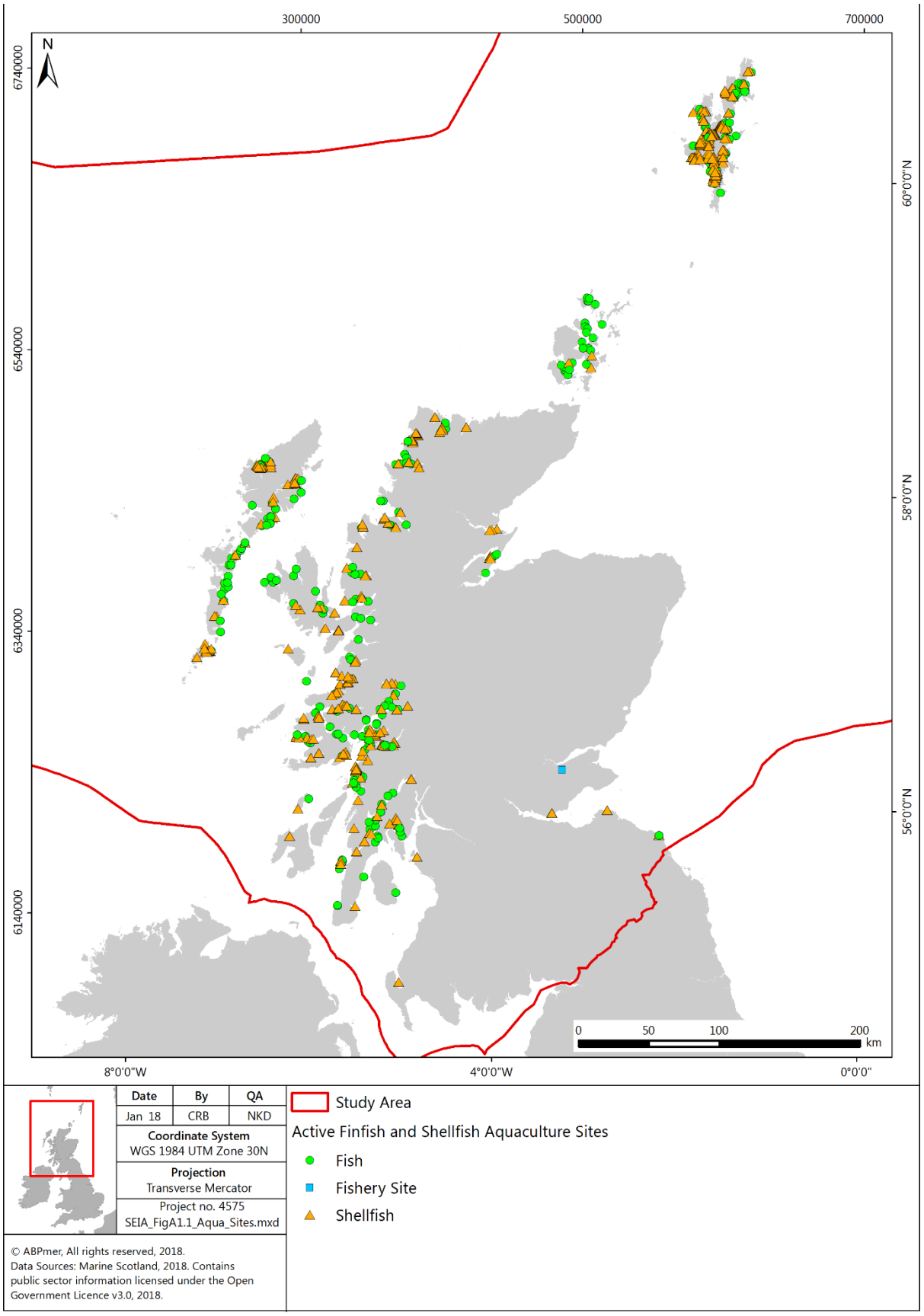


**Table.A.2.1 Information sources for the aquaculture sector**

| Data Available | Information Source |
|---|---|
| Location of aquaculture farms in Scotland | Scottish Government (NMPi) (2016) https://marinescotland.atkinsgeospatial.com/nmpi/ |
| Volume and value of finfish production in Scotland | Scottish finfish farm production survey http://www.gov.scot/Topics/marine/Fish-Shellfish/FHI/surveys |
| Volume and value of finfish production in Scotland | Scottish shellfish farm production survey http://www.gov.scot/Topics/marine/Fish-Shellfish/FHI/surveys |
| Future trends | Black and Hughes (2017) https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/635209/Future_of_the_sea_-_trends_in_aquaculture_FINAL_NEW.pdf |
| | Highlands and Islands Enterprise (HIE) and Marine Scotland (2017) http://www.gov.scot/Topics/marine/Publications/TopicSheets/tslist/aquavalue |
| | Celtic Seas Partnership (2016) http://futuretrends.celticseaspartnership.eu/ |

## A.2.3 Potential Interactions with Offshore Wind

Table A.2.2 shows potential interaction pathways between aquaculture and offshore wind arrays and export cables. Based on the approach to scoping described in Section 2 in the main report, the table also records whether the interaction:

- Is not likely to result in a significant socio-economic impact on the sector; or
- Is likely to result in a significant socio-economic impact on the sector and hence will require a detailed assessment;

The rationale underlying this expert judgement is provided in the table. Where it is not currently possible to make a judgement regarding the likelihood of a significant socio-economic impact due to insufficient information (for example, in relation to the extent of overlap between a sector activity and the DPO Areas) the table indicates that scoping will be required to be undertaken once sufficient information becomes available. Furthermore, as described in the main report, there is currently no information regarding the likely location of export cable routes/corridors and as such, it is not possible to undertake a meaningful assessment of the potential for any sector activity/export cable interaction to give rise to significant socio-economic effects. Rather, the potential for any interaction will be identified in Regional Locational Guidance.

## Table A.2.2 Potential interaction pathways

| Potential Interaction | Technology Aspect and Phase | Potential Socio-economic Consequences | Initial Scoping Assessment |
|---|---|---|---|
| Exclusion from sea areas (i.e. constraints on the development of future aquaculture sites where conditions may be suitable) | Arrays (construction and operation) | Reduction in income for aquaculture producers | Currently, active aquaculture sites are unlikely to overlap with DPO Areas, which will be located further offshore and in more exposed areas compared to current aquaculture site locations. However, the aquaculture sector will look to move further offshore in the future. Assuming that DPOs are not permitted to 'sterilise' large areas of sea-space where conditions may be suitable for other sector activity, it is considered that there is scope to avoid significant interactions between offshore wind and aquaculture through spatial planning.<br><br>**No detailed assessment required.** |
| | Export cables (construction and operation) | Reduction in income for aquaculture producers | Export cable routes are uncertain. Constraints inshore of DPOs will be identified in the RLG.<br><br>**No detailed assessment possible.** |

| Potential Interaction | Technology Aspect and Phase | Potential Socio-economic Consequences | Initial Scoping Assessment |
|---|---|---|---|
| Disturbance or injury to finfish aquaculture species (underwater noise) | Arrays (construction) | Reduction in income for aquaculture producers through stress/injury or loss of stock | Any potentially significant impacts to farmed finfish species would be expected to be minimised through the application of mitigation measures as part of the licensing process. The consequential impacts to aquaculture production businesses are therefore considered to be negligible.<br><br>**No detailed assessment required.** |
| Facilitation of the spread of non-native species | Arrays (construction and maintenance) | Reduction in income and employment for aquaculture producers through introduction (via vessel movement/ballast water exchange) or facilitation of the spread of non-native species detrimental to the cultivated species or their habitat | Any potentially significant impacts to farmed species would be expected to be minimised through the application of mitigation measures as part of the licensing process, for example, through the preparation and implementation of biosecurity plans. The consequential impacts to aquaculture production businesses are therefore considered to be negligible.<br><br>**No detailed assessment required.** |

| Potential Interaction | Technology Aspect and Phase | Potential Socio-economic Consequences | Initial Scoping Assessment |
|---|---|---|---|
| Resuspension of sediments and/or release of contaminants associated with disturbance of sediments | Arrays (construction) | Reduced business profitability and income through reduction in water quality, subsequent deterioration of growing conditions (especially shellfish) and/or contaminant uptake by shellfish species | Any potentially significant impacts to farmed species would be expected to be minimised through the application of mitigation measures as part of the licensing process. The consequential impacts to aquaculture production businesses are therefore considered to be negligible.<br><br>**No detailed assessment required.** |
| | Export cables (construction) | Reduced business profitability and income through reduction in water quality, subsequent deterioration of growing conditions (especially shellfish) and/or contaminant uptake by shellfish species | Any potentially significant impacts to farmed species would be expected to be minimised through the application of mitigation measures as part of the licensing process. The consequential impacts to aquaculture production businesses are therefore considered to be negligible.<br><br>**No detailed assessment required.** |

## A.2.4 Scoping Methodology

No detailed assessment required.

## A.2.5 Data Limitations

There are no major data limitations relating to aquaculture in Scotland.

# A.3. Aviation

## A.3.1 Sector Definition

This sector relates to civil aviation, which comprises scheduled air transport (including all passenger and cargo flights operating on regularly scheduled routes) and general aviation (including all other civil flights, private or commercial). Military aviation is covered separately in the Military Activity Section.

## A.3.2 Overview of Activity

Aviation forms a critical component of Scotland's economy by providing direct access to markets as well as providing lifeline services to otherwise inaccessible settlements throughout the mountainous and island terrain (ABPmer, RPA and SQW, 2011). Helicopter routes are also important in servicing offshore oil and gas installations.

Major airports (aerodromes) located in Scotland include Edinburgh, Glasgow, and Glasgow Prestwick, while minor airports include: Stornaway, Benbecula, Barra, Coll, Tiree, Colonsay, Islay, Campbeltown, Dundee, Inverness, Wick John O'Groats, Kirkwall and Sumburgh. The 2015 air transport statistics are shown in Table A.3.1 for airports for which statistics were available from Transport Scotland.

**Table A.3.1 Air transport statistics for Scottish airports in 2015**

| Airport | Air Transport Movements | Terminal Passengers (thousand) | Freight (tonnes) |
|---|---|---|---|
| Aberdeen | 106,755 | 3,469 | 6,545 |
| Barra | 881 | 11 | 19 |
| Benbecula | 3,286 | 32 | 313 |
| Campbeltown | 1,123 | 8 | - |
| Dundee | 1,543 | 22 | - |
| Edinburgh | 106,748 | 11,113 | 19,322 |
| Glasgow | 75,585 | 8,710 | 13,193 |
| Glasgow Prestwick | 8,623 | 610 | 11,242 |
| Inverness | 14,425 | 668 | 2,507 |
| Islay | 1,739 | 29 | 288 |
| Kirkwall | 12,951 | 150 | 94 |
| Lerwick | 1,748 | 4 | - |
| Scatsta | 13,338 | 254 | 702 |
| Stornoway | 8,644 | 125 | 1,173 |
| Sumburgh | 13,606 | 270 | 998 |
| Tiree | 1,111 | 10 | 44 |
| Unst | - | 0 | - |
| Wick John O'Groats | 4,276 | 24 | 1 |

Source: Transport Scotland 2017

It was estimated in 2016 that Edinburgh Airport contributes nearly £1 billion to the Scottish economy annually and supports more than 23,000 jobs in Scotland[11]. For Glasgow Prestwick Airport, in 2012 it was estimated that the airport's total annual contribution to the Scottish economy was £61.6 million through a total of 1,810 jobs directly or indirectly associated with the airport (York Aviation, 2012). In 2010, Glasgow Airport was assessed as contributing nearly £200 million to Scotland's economy and supported nearly 4,500 jobs directly and over 7,300 in Scotland as a whole (York Aviation, 2010 cited in Glasgow Airport Draft Master Plan, 2011). At the time of writing, no more recent estimates of economic contribution for Glasgow Prestwick or Glasgow Airports were sourced.

Figure A.3.1 shows civil aviation aerodromes, helicopter rescue centres and stations and helicopter main routes (HMRs)[12] in Scotland, where information was available. National Air Traffic Services (NATS) provides air traffic control services to aircraft flying in UK airspace, and over the Eastern part of the North Atlantic. The locations of radar installations, where known, are also provided in Figure A.3.1.

With regard to future trends in aviation, air traffic movement (ATM) forecasts for two main airports in in Scotland, are shown in Table A.3.2.

[11] http://www.edinburghairport.com/about-us/media-centre/press-releases/edinburgh-airport-worth-%C2%A31-billion-every-year-to-scotlands-economy

[12] HMRs represent the routes typically flown by helicopters operating to and from offshore destinations and are 'signposts' to aid flight safety (i.e. signposting concentrations of helicopter traffic to other air space users). Whilst HMRs have no airspace status and assume the background airspace classification within which they lie, they are used by the Air Navigation Service Provider (ANSP) (i.e. NATS Aberdeen) and helicopter operators for flight planning and management purposes. While compliance with the HMR structure is not compulsory, in the interests of flight safety, civil helicopter pilots are strongly encouraged to plan their flights using HMRs wherever possible. The HMRs do not predict the flow of helicopter traffic (UK Aeronautical Information Package; NATS website).

## Figure A.3.1 Civil aviation aerodromes and infrastructure

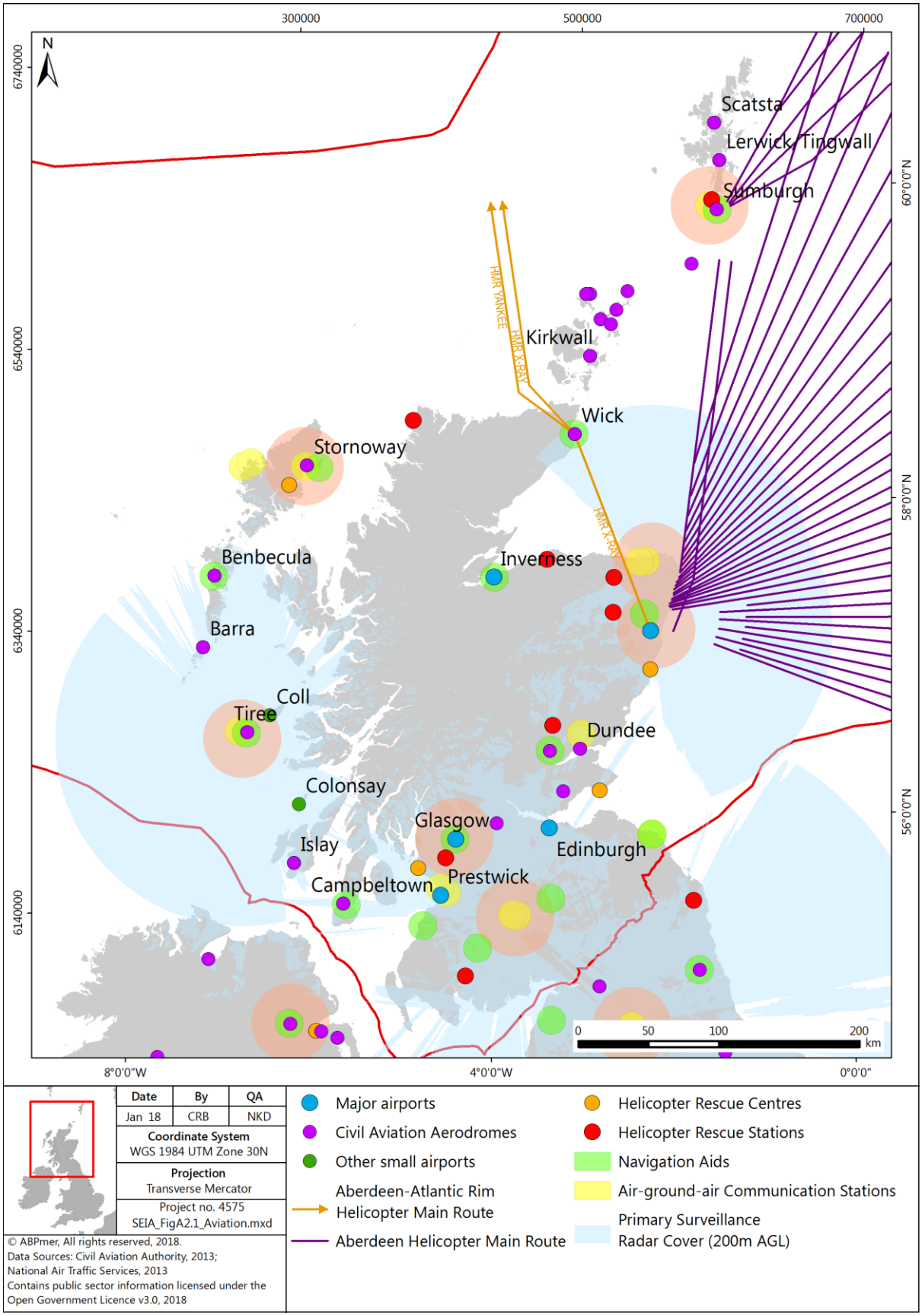


**Table A.3.2 Forecasts for Air transport Movements (million people per annum)**

| Airport | 2030 | 2040 | 2050 |
|---|---|---|---|
| Edinburgh | 13 | 15 | 18 |
| Glasgow | 12 | 13 | 15 |

Source: Department for Transport 2017

Information sources that can be used in the assessment are listed in Table A.3.3.

**Table A.3.3 Information sources for the civil aviation sector**

| Data Available | Information Source |
|---|---|
| Licensed aerodromes (UK) | CAA Aerodromes and boundary maps https://www.caa.co.uk/Commercial-industry/Airports/Aerodrome-licences/Licences/Aerodrome-licences-and-boundary-maps/ |
| Primary radar, secondary radar, air-ground-air communications, navigation aids, NATS safeguarding zones (UK) | NATS Self-assessment maps http://www.nats.aero/services/information/wind-farms/self-assessment-maps/ |
| Main helicopter routes (UK) | Aeronautical Information Publication (NATS website) |
| Passenger and freight statistics (Scotland) | Transport Scotland: Scottish Transport Statistics No 35 – datasets https://www.transport.gov.scot/publication/scottish-transport-statistics-no-35-datasets/ |
| Air Passenger Demand Forecasts (UK including Scotland) | Gov.UK: UK aviation forecasts 2017 https://www.gov.uk/government/publications/uk-aviation-forecasts-2017 |

## A.3.3 Potential Interactions with Offshore Wind

Table A.3.4 shows potential interaction pathways between aviation and offshore wind arrays and export cables. Based on the approach to scoping described in Section 2 in the main report, the table also records whether the interaction:

- Is not likely to result in a significant socio-economic impact on the sector; or
- Is likely to result in a significant socio-economic impact on the sector and hence will require a detailed assessment.

The rationale underlying this expert judgement is provided in the table. Where it is not currently possible to make a judgement regarding the likelihood of a significant socio-economic impact due to insufficient information (for example, in relation to the extent of overlap between a sector activity and the DPO Areas) the table indicates that scoping will be required to be undertaken once sufficient information becomes available. There are not expected to be any significant interactions between export cable routes and aviation interests

## Table A.3.4 Potential interaction pathways

| Potential Interaction | Technology Aspect and Phase | Potential Socio-economic Consequences | Initial Scoping Assessment |
|---|---|---|---|
| Height obstruction of commercial helicopter navigation routes | Arrays (construction and operation) | Additional track miles for helicopters owing to height obstruction in inclement weather, resulting in additional costs | Any potential significant impacts would only be expected where HMRs intersected with DPO areas.<br><br>**Scoping assessment to be completed once DPOs defined.** |
| Height obstruction of commercial aircraft navigation routes | Arrays (construction and operation) | Loss of trade at airports | Developments that compromised air safety on approaches to and from commercial airports would not be granted consent.<br><br>**No detailed assessment required.** |
| Interference with radar systems | Arrays(operation) | The need to provide radar mitigation for strategic en route and low level radar interference. | Radar mitigation will be required as a condition of consent if there is a potentially significant effect. This cost will be borne by the developer rather than the airline industry or regulator.<br><br>**No detailed assessment required.** |

## A.3.4 Scoping Methodology

Spatial overlap between DPOs and Helicopter Main Routes to be assessed, once DPO areas are available.

## A.3.5 Assessment Methodology

If a significant interaction between DPOs and Helicopter Main Routes is identified through scoping, further consideration will be given to the potential socio-economic impacts on in consultation with helicopter service providers.

## A.3.6 Data Limitations

Helicopter Main Routes (HMRs) represent the routes typically flown by helicopters operating to and from offshore destinations and are 'signposts' to aid flight safety (i.e. signposting concentrations of helicopter traffic to other air space users). Whilst HMRs have no airspace status and assume the background airspace classification within which they lie, they are used by the Air Navigation Service Provider (ANSP) (i.e. NATS Aberdeen) and helicopter operators for flight planning and management purposes. While compliance with the HMR structure is not compulsory, in the interests of flight safety, civil helicopter pilots are strongly encouraged to plan their flights using HMRs wherever possible. The HMRs do not predict the flow of helicopter traffic (ABPmer and RPA, 2013).

# A.4. Carbon Capture and Storage

## A.4.1 Sector Definition

This sector relates to a carbon abatement technology that enables fossil fuels to be used with substantially reduced carbon dioxide ($CO_2$) emissions. Carbon capture and storage (CCS) combines three distinct processes: capturing the $CO_2$ from power stations and other industrial sources, transporting it (usually via pipelines) to storage points, then injection of the $CO_2$ into deep geological formations (e.g. deep saline aquifers or depleted oil and gas fields) for permanent storage

## A.4.2 Overview of Activity

Although CCS is an active field of research and development and a growing industry with 15 large-scale CCS projects in operation globally, there are currently no full-scale CCS demonstration projects in operation at coal- or gas-fired power plants within the UK.

In 2007, the Department of Business, Enterprise and Regulatory Reform (BERR) launched its first competition for the UK Government to support the development of CCS projects in the UK. However, this was cancelled in 2011 before funds were awarded. In 2012 the Department launched a commercialisation 'competition', with the aim to see CCS projects developed before 2020. The two preferred bidders that undertook design and engineering stage research and development had been identified for the second CCS Competition: (1) Shell's Peterhead CCS project; and (2) Capture Power Limited's White Rose CCS project. The Peterhead CCS project involved capturing around 85% of the $CO_2$ from an existing combined cycle gas turbine (CCGT) power station at Peterhead (Aberdeenshire, Scotland), before transporting it offshore and storing it in the Goldeneye depleted gas field 2.5 km beneath the North Sea. The White Rose CCS project involved capturing around 90% of the $CO_2$ from a new super-efficient coal-fired power station at the Drax site in North Yorkshire, before transporting offshore and storing it in a saline rock formation beneath the North Sea. However, as part of the 2015 Spending Review, the UK Government announced the £1 billion capital funding allocated to the second competition was no longer available (National Audit Office, 2017).

With regard to future trends, the House of Commons Energy and Climate Change Committee (2016) reported on the future of CCS in the UK, suggesting that a new strategy for CCS (in conjunction with a new gas strategy) should be promptly devised. Deloitte (2016) reviewed the situation for CCS in the UK since Government funding was withdrawn in late 2015 and made a number of conclusions and recommendations. This included the need to address uncertainty that currently exists within the CCS industry and consider a wider strategic approach to develop a $CO_2$ transport and industrial network that connects locations (actual or planned) of major power generation plants and industrial facilities with storage sites.

There is also currently a high level of uncertainty about the future location and scale of CCS activity in UK seas. Initially, attention is likely to focus on carbon storage in depleted oil and gas fields, but other structures such as saline aquifers could also be used. It may also be possible to combine permanent storage of $CO_2$ with the enhanced production of hydrocarbons. A project commissioned by the Energy Technologies Institute (ETI) evaluated five potential offshore, subsurface stores of $CO_2$ emissions, selected for their potential contribution to mobilising commercial-scale CCS projects in the UK. This included two open saline aquifers off the Scottish coast (Captain X and Forties 5 Site 1, both in the Central North Sea) as well as two depleted gas fields (Viking A in the Southern North Sea and Hamilton) in the East Irish Sea and one aquifer with structural closures (Bunter Closure 36) in the Southern North Sea. The project confirmed that there are no major technical hurdles to moving industrial scale $CO_2$ storage forward in the UK. The UK offshore environment could form the basis of a storage resource that could service the needs of many parts of Europe in addition to the UK (Pale Blue Dot Energy, 2016).

Figure A.4.1 shows an overview of carbon capture and storage potential with respect to the location of saline aquifers. Information sources that can be used in the assessment are listed in Table A.4.1.

Figure A.4.1 Location of saline aquifers

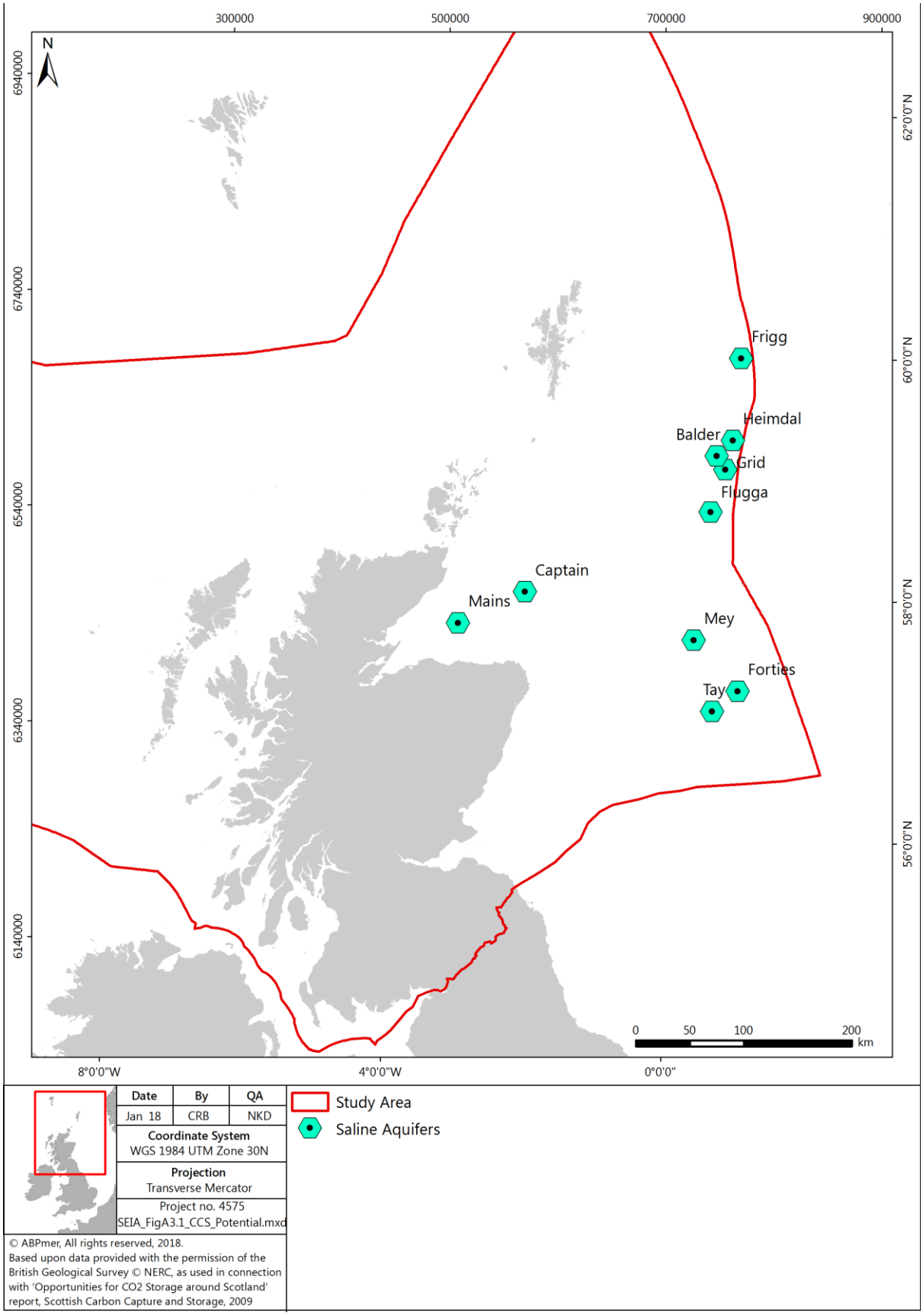


**Table A.4.1 Information sources for CCS**

| Data Available | Information Source |
|---|---|
| Outputs of collaborative research projects to facilitate the development of CCS in Scotland (2009-2015) | Scottish Carbon Capture and Storage website: http://www.sccs.org.uk/expertise/reports |
| Carbon Capture and Storage – opportunities for Scotland in the emerging CCS industry | Scottish Enterprise website: Knowledge Hub: https://www.scottish-enterprise.com/knowledge-hub/articles/publication/scotland-and-the-central-north-sea-ccs-hub |
| Strategic UK CCS Storage Appraisal | Pale Blue Dot Energy, 2016 |

## A.4.3 Potential Interactions with Offshore Wind

Table A.4.2 shows potential interaction pathways between potential CCS storage sites and offshore wind arrays and export cables. Based on the approach to scoping described in Section 2 in the main report, the table also records whether the interaction:

- Is not likely to result in a significant socio-economic impact on the sector; or
- Is likely to result in a significant socio-economic impact on the sector and hence will require a detailed assessment;

The rationale underlying this expert judgement is provided in the table. Where it is not currently possible to make a judgement regarding the likelihood of a significant socio-economic impact due to insufficient information (for example, in relation to the extent of overlap between a sector activity and the DPO Areas) the table indicates that scoping will be required to be undertaken once sufficient information becomes available. Furthermore, as described in the main report, there is currently no information regarding the likely location of export cable routes/corridors and as such, it is not possible to undertake a meaningful assessment of the potential for any sector activity/export cable interaction to give rise to significant socio-economic effects. Rather, the potential for any interaction will be identified in Regional Locational Guidance.

## Table A.4.2 Potential interaction pathways

| Potential Interaction | Technology Aspect and Phase | Potential Socio-economic Consequences | Initial Scoping Assessment |
|---|---|---|---|
| Competition for space (sterilization of seabed potential storage areas/obstruction of potential pipeline routes) | Arrays (construction and operation) | Development constrained through increased costs and a deterrent to investment.<br><br>Reduction in future employment opportunities | Any potential significant impact would only be expected where DPO areas overlapped with, or were located inshore of, identified deep geological formations (saline aquifers or depleted oil and gas fields). Where only a small area of DPO area overlapped with a potentially suitable geological formation, it would be assumed that spatial planning could be used to avoid significant impacts.<br><br>**Scoping assessment to be completed once DPOs defined.** |
| | Export cables (operation) | Increased costs associated with any required 'crossing' of CCS pipeline/infrastructure with any export cables linking the DPO areas to land | Any potential significant impact would only be expected where export cable corridors overlapped with, or were located inshore of, identified deep geological formations (saline aquifers or depleted oil and gas fields).<br><br>Export cable routes are uncertain. Constraints inshore of DPOs will be identified in the RLG.<br><br>**No detailed assessment possible.** |

## A.4.4 Scoping Methodology

The spatial overlap between DPOs and potential CCS storage locations to be assessed, once DPO areas are available.

## A.4.5 Assessment Methodology

If a significant interaction between DPOs and potential CCS storage locations is identified through scoping, further consideration will be given to the potential socio-economic impacts in consultation with the Carbon Capture & Storage Association (CCSA).

## A.4.6 Data Limitations

There are no commercial scale CCS projects in the UK and uncertainty remains regarding the economic viability and the future location and scale of CCS activity in the UK.

# A.5. Coast Protection and Flood Defence

## A.5.1 Sector Definition

This sector relates to the land-based activity of coastal defence, which influences the marine environment. Coastal protection and flood defence measures are used to prevent or reduce flood risk and coastal erosion. Examples of coastal and flood defences include groynes, sea walls and embankments, termed 'hard engineering', and beach replenishment, managed retreat and coastal realignment, termed 'soft engineering'.

## A.5.2 Overview of Activity

Both hard and soft flood protection and coastal defence assets are generally located in or adjacent to intertidal areas and therefore their extent is limited to a narrow margin around the coastline (Figure A.5.1). Hard engineering defences include sea walls, groynes and rock armour, while soft engineering options include beach replenishment and managed realignment.

In 2004, the EUROSION project estimated that 733 km of Scotland's coastline was protected by defence works and artificial beaches (EUROSION, 2004), while Scottish Natural Heritage (SNH) estimated that 307 km of Scotland's mainland coast is comprised of coastal defences (Baxter *et al*. 2011).Scotland's Marine Atlas (Baxter *et al*, 2011) provides details of flood defence and coast protection schemes in Scotland, which at that time included 14 flood defence schemes (since 1961), 10 coast protection schemes (since 2000) and 2 managed realignment schemes.

Coastal protection and flood prevention schemes do not contribute directly to the economy and hence it is not possible to assign an economic value to this sector. However, the main benefit of flood defence and coastal protection schemes is the protection of property and reduced damage to economically important land and infrastructure (Baxter *et al*. 2011). Foresight (2004; cited in Masselink and Russell, 2013) estimated that the cost of damage due to coastal erosion in the UK was £15 million per year which, in the worst case, may rise to £126 million per year by 2080.

Future sea level rise and the potential for increasingly severe storm events due to climate change may place Scotland's coastal infrastructure and habitats under increasing threat and hence increase the economic importance of this sector (UKMMAS, 2010; Baxter *et al*. 2011).

Figure A.5.1 shows an overview of the types of coastal protection and flood defence schemes in Scotland. Information sources that can be used in the assessment are listed in Table A.5.1.

Figure A.5.1 Coastal protection schemes

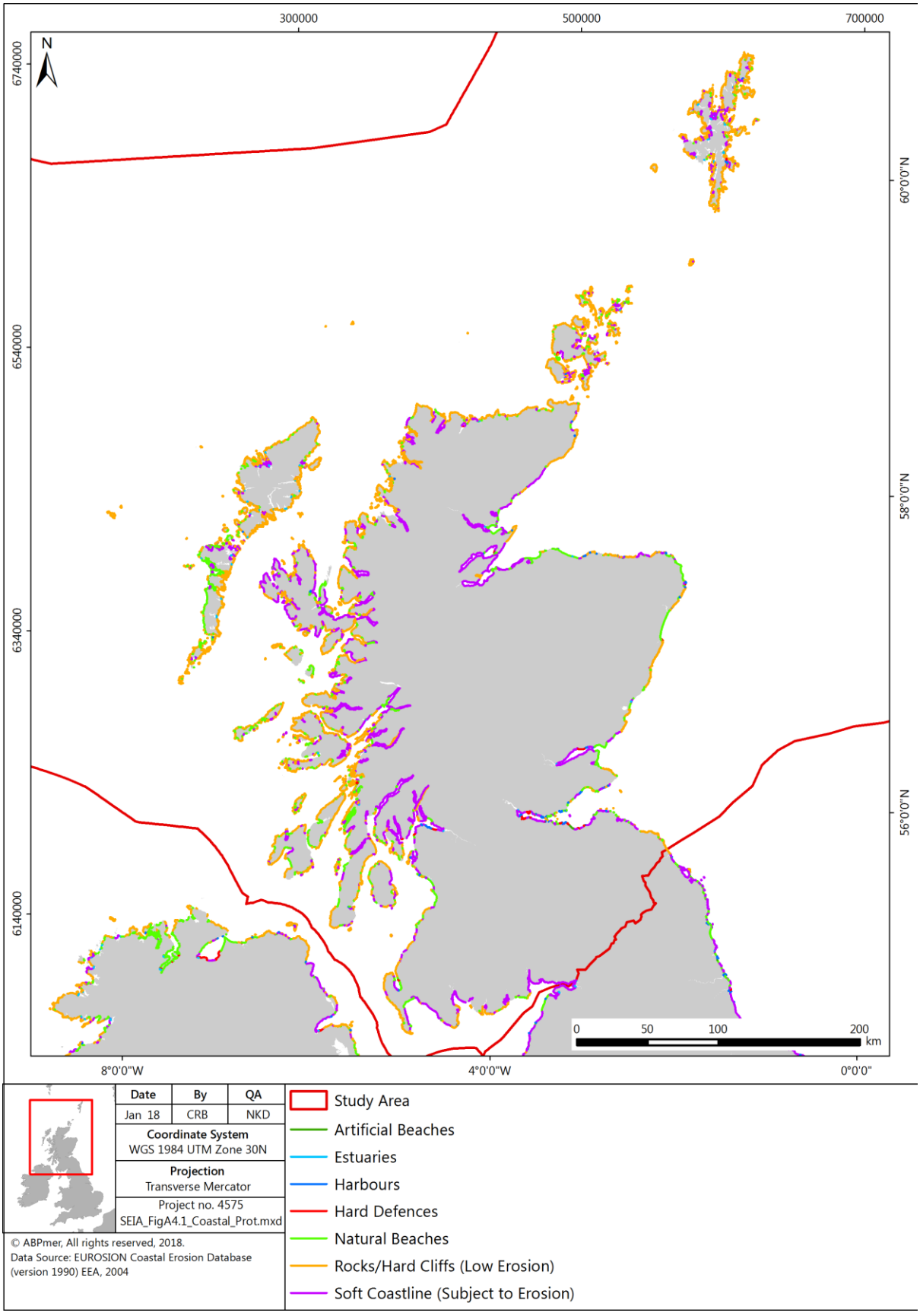


**Table A.5.1 Information sources for coastal protection and flood defence sector**

| Data Available | Information Source |
|---|---|
| Locations of soft and hard engineered flood defence schemes (Europe/Scotland) | EUROSION: http://www.eurosion.org/ |
| Locations of soft and hard engineered flood defence schemes in Scotland | Baxter *et al*. 2011 |

## A.5.3 Potential Interactions with Offshore Wind

Table A.5.2 shows potential interaction pathways between coastal protection and flood defence and offshore wind arrays and export cables. Based on the approach to scoping described in Section 2 in the main report, the table also records whether the interaction:

- Is not likely to result in a significant socio-economic impact on the sector; or
- Is likely to result in a significant socio-economic impact on the sector and hence will require a detailed assessment;

The rationale underlying this expert judgement is provided in the table. Where it is not currently possible to make a judgement regarding the likelihood of a significant socio-economic impact due to insufficient information (for example, in relation to the extent of overlap between a sector activity and the DPO Areas) the table indicates that scoping will be required to be undertaken once sufficient information becomes available. Furthermore, as described in the main report, there is currently no information regarding the likely location of export cable routes/corridors and as such, it is not possible to undertake a meaningful assessment of the potential for any sector activity/export cable interaction to give rise to significant socio-economic effects. Rather, the potential for any interaction will be identified in Regional Locational Guidance.

## Table A.5.2 Potential interaction pathways

| Potential Interaction | Technology Aspect and Phase | Potential Socio-economic Consequences | Initial Scoping Assessment |
|---|---|---|---|
| Potential for increased erosion, depending on location and design of array | Array (construction and operation) | Damage to property, infrastructure or economically important land | The cumulative impact of offshore wind development, including floating wind arrays, on coastal processes at the coast is a current knowledge gap. Applying broad assumptions and criteria at a Sectoral level is likely to provide inaccurate results. Instead it is recommended that the economic consequences are discussed at project-level. This should be based on the output of wave modelling studies and in consultation with relevant stakeholders as part of the EIA scoping and consultation process.<br><br>**No detailed assessment possible.** |
| Overlap between export cable landfall and coast protection and flood defence infrastructure | Export cables (construction) | Damage to property, infrastructure or economically important land due to reduced protection/defence of the coastline from erosion and flooding | Export cable routes are uncertain and constraints inshore of DPOs will be identified in the RLG.<br><br>It is considered that there is scope for the export cable corridor to avoid sections of coastline with coastal protection and/or flood defence infrastructure (i.e. areas sensitive to erosion/flooding). Alternatively, |

| Potential Interaction | Technology Aspect and Phase | Potential Socio-economic Consequences | Initial Scoping Assessment |
|---|---|---|---|
| | | | should the landfall unavoidably overlap with such infrastructure, it is assumed that it would be repaired/replaced upon completion of the works.<br><br>**No detailed assessment required.** |

## A.5.4 Scoping Methodology

No detailed assessment is required in relation to impacts from export cable landfall. Any potential impact related to erosion/flooding at the coast arising from offshore arrays should be assessed at project level via EIA.

## A.5.5 Data Limitations

There is limited publically available information relating to the location, costs and expenditure in relation to recent flood defence and coastal protection developments in Scotland.

# A.6. Energy Generation

## A.6.1 Sector Definition

This sector is concerned with the generation of energy through wave, tidal and wind devices and the transmission of this power through submarine export cables to land.

**Wind energy**
Wind energy can be produced anywhere in the world where the wind blows with a strong and consistent force. Wind turbines are used to convert kinetic energy in the wind into electrical energy, in this context, in the offshore environment. For large scale sources of wind energy, turbines are usually built close together to form a wind farm that provides grid power.

**Wave energy**
Ocean wave energy technologies rely on the motion of waves to generate electricity. They are placed either on the sea surface or on the seabed (to harness near shore surge energy). Energy output is determined by wave height, wave speed, wavelength and water density.

**Tidal energy**
Tidal energy is produced through the use of tidal energy generators. Tidal technologies include tidal range (barrages and lagoons that rely on the static pressure differential created by the rise and fall of tides) and tidal stream technologies (which utilise the flow of water generated by the change of tidal height). Both tidal range and tidal stream energy generation opportunities are limited to a few locations around the UK e.g. funnels and headlands (tidal stream) and estuaries with specific dynamics (tidal range).

**Export cables**
Export cables are needed to bring the energy generated offshore to land to connect with onshore electricity distribution networks.

## A.6.2 Overview of Activity

**Wave, tidal stream and tidal range**
The development of wave and tidal infrastructure is spatially restricted to areas with an appropriate water depth, geology, met ocean conditions and resource availability. As shown in Figure A.6.1, all wave and tidal draft plan options and planned tidal developments in Scotland are located off the west coast of Scotland, the far north east coast of mainland Scotland, Orkney and the Shetland Islands. A dedicated renewable device test area (EMEC) has been in operation in Orkney since 2003 allowing developers to install single or multiple machines in a variety of site conditions.

There are two operational commercial tidal stream projects in Scotland, MeyGen in the Pentland Firth, and Bluemull Sound in Shetland. Phase 1A of the Meygen tidal array at Pentland Firth build out has been completed and has resulted in four

turbines exporting electricity to the grid. Phase 1B will involve the deployment of an additional four 1.5 MW turbines (Atlantis Resource Ltd, 2017). The first turbine of the Shetland tidal array was fully commissioned and exporting power to the grid in May 2016. Two further turbines have been installed since (4COffshore, 2017).

There are currently no tidal barrages/lagoons located within Scottish waters, although the potential for tidal range energy generation has been recognised within the Solway Firth (Celtic Seas Partnership, 2016). At present there are no commercial wave arrays in Scotland. Wave Energy Scotland (WES) was created in 2014 (at the request of the Scottish Government), to facilitate the commercialisation of the wave energy sector through supporting projects focused on Wave Energy Converter technology, with the aim of producing reliable technology which will result in cost effective wave energy generation (Wave Energy Scotland, 2017).

The establishment of a wave and tidal energy industry could bring economic benefits for Scotland. The industry estimates that marine renewables (wave and tidal) could support 10,000 direct jobs in 2020 and the Carbon Trust has estimated that there could be as many as 68,000 UK-based jobs by 2050 (DECC, 2012).

**Wind**

Current offshore wind projects in waters around Scotland includes 211 MW in operation, including Robin Rigg (Solway Firth) and Hywind Scotland (Moray Firth), and 680 MW in construction, including Beatrice (Crown Estate Scotland, 2017).

Figure A.6.1 shows offshore wind farms and lease areas which are predominately located off the east coast of Scotland and the existing draft plan option areas for offshore wind (Marine Scotland, 2013).

Employment generation as a result of renewables developments is dependent on the supply chain (particularly for offshore wind equipment) and the extent to which components are manufactured in the region. Within the offshore wind sector, manufacturing has the potential to provide the single biggest contribution to GVA, with operations and maintenance the next biggest contributor (ORE Catapult, 2014). Currently, a large proportion of the materials and components for offshore windfarms are outsourced from China and mainland Europe and thus associated employment is focused outside the UK (Celtic Seas Partnership, 2016).

**Export cables**

Offshore wave, tidal and wind developments are connected to onshore grid infrastructure through export cables. The presence of these is therefore associated with the amount of these activities in a particular marine plan area.

**Future trends for wave, tidal and wind**

The Scottish Government’s proposed key energy target is that half of Scotland's heat, transport and electricity energy needs are met by renewables by 2030 (Scottish Government, 2017).

Figure A.6.1 shows an overview of energy generation activity in Scotland. Information sources that can be used in the assessment are listed in Table A.6.1.

Figure A.6.1 Energy generation activity in Scotland

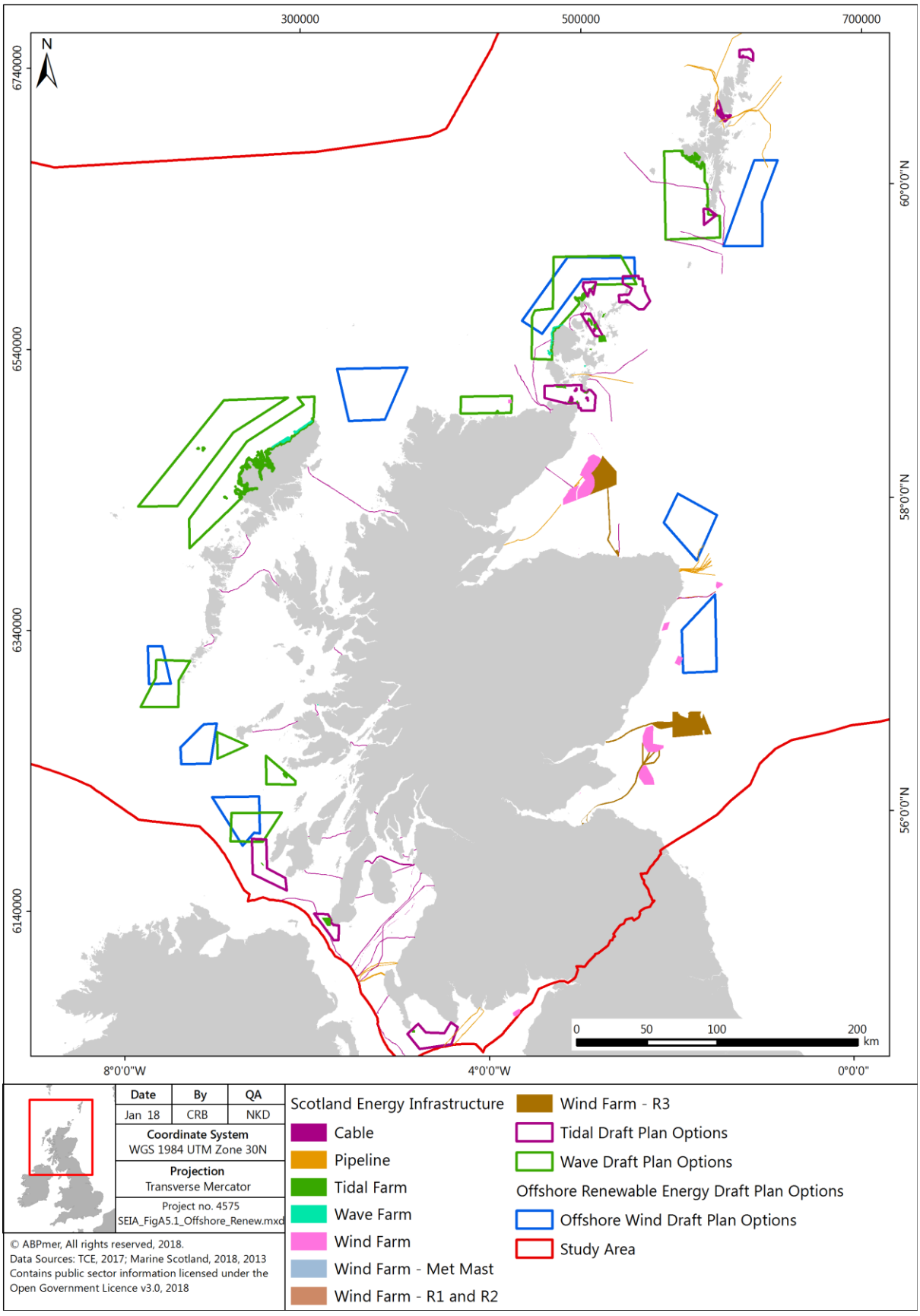


**Table A.6.1 Information sources for the energy generation sector**

| Data Available | Information Source |
|---|---|
| Information on wave, tidal and wind energy in Scotland | The Crown Estate 2017 http://www.crownestatescotland.com/the-assets/marine/asset/wave-and-tidal; http://www.crownestatescotland.com/the-assets/marine/asset/offshore-wind |
| Offshore renewables and cables and pipelines activity in Scotland | The Crown Estate, 2017 http://www.crownestatescotland.com/maps-and-publications |
| Wind, wave and tidal lease areas in Scotland | Marine Scotland NMPi https://marinescotland.atkinsgeospatial.com/nmpi/ |

## A.6.3 Potential Interactions with Offshore Wind

Table A.6.2 shows potential interaction pathways between energy generation and offshore wind arrays and export cables. Based on the approach to scoping described in Section 2 in the main report, the table also records whether the interaction:

- Is not likely to result in a significant socio-economic impact on the sector; or
- Is likely to result in a significant socio-economic impact on the sector and hence will require a detailed assessment.

The rationale underlying this expert judgement is provided in the table. Where it is not currently possible to make a judgement regarding the likelihood of a significant socio-economic impact due to insufficient information (for example, in relation to the extent of overlap between a sector activity and the DPO Areas) the table indicates that scoping will be required to be undertaken once sufficient information becomes available. Furthermore, as described in the main report, there is currently no information regarding the likely location of export cable routes/corridors and as such, it is not possible to undertake a meaningful assessment of the potential for any sector activity/export cable interaction to give rise to significant socio-economic effects. Rather, the potential for any interaction will be identified in Regional Locational Guidance.

## Table A.6.2 Potential interaction pathways

| Potential Interaction | Technology Aspect and Phase | Potential Socio-economic Consequences | Initial Scoping Assessment |
|---|---|---|---|
| Competition for space (offshore) within DPO areas | All arrays | Reduced renewable energy capacity | Potential significant interactions to be considered likely where there is spatial overlap between newly identified DPO areas with existing wind, wave and tidal DPO areas, where the area of overlap is greater than 10% of the combined DPO areas. If the overlap represents less than 10% of the combined DPO areas, it is considered significant interaction can be avoided through spatial planning of arrays within the DPO areas.<br><br>**Scoping assessment to be completed once DPOs defined.** |
| Competition for transmission capacity | All arrays | Either reduced energy output from other energy sources (due to displacement by renewables) or reduced renewable energy capacity | Potential significant interactions may occur where there is competition for export cable corridors from arrays for suitable landing locations that meet all the technical and environmental criteria for connection to a substation with available capacity. A shortage of suitable locations could lead to cables being brought onshore several kilometres from the connection point, thus significantly increasing the scope, costs and consenting risks of the onshore transmission works being developed. Hence, when determining DPO areas for further development, the financial and consenting risks associated with grid capacity, the location of connection points |

| Potential Interaction | Technology Aspect and Phase | Potential Socio-economic Consequences | Initial Scoping Assessment |
|---|---|---|---|
| | | | with spare capacity and availability of suitable landing points should all be considered.<br><br>**Scoping assessment to be completed once DPOs defined.** |
| Increased difficulty of access at cable crossing points with existing/planned export cables | Export cables | Increased maintenance costs for cable owners; loss of revenue for asset owners; loss of revenue for dependent businesses/customers | Export cable routes are uncertain. Constraints inshore of DPOs will be identified in the RLG.<br><br>**No detailed assessment possible.** |
| Cable crossings with potential future export cables | Export cables | Increased maintenance costs for cable owners; loss of revenue for asset owners; loss of revenue for dependent businesses/customers | Export cable routes are uncertain. Constraints inshore of DPOs will be identified in the RLG.<br><br>**No detailed assessment possible.** |

## A.6.4 Scoping Methodology

The spatial overlap between offshore wind DPOs and existing wind, wave and tidal DPO areas to be assessed, once the offshore wind DPO areas are available.

## A.6.5 Assessment Methodology

If a significant interaction between deep water wind and existing wind, wave and tidal DPOs is identified through scoping, further consideration will be given to the potential socio-economic impacts in consultation with Scottish Renewables and Renewables UK.

## A.6.6 Data Limitations

Offshore renewables (particularly wave energy) are not yet well established industries and therefore it is difficult to determine their interactions with each other and the degree to which any spatial overlap will affect energy generation. The future of transmission capacity will depend on where and when the Scottish Government's projections for investment and improvement works occur (£7 billion investment between 2013 and 2021; Scottish Government, 2017).

# A.7. Commercial Fisheries

## A.7.1 Sector Definition

This sector relates to the activity of catching fish and/or shellfish from wild fisheries for commercial profit (i.e. 'catch sector' activity). This sector does not include subsistence fishing or recreational angling.

## A.7.2 Overview of Activity

In 2016, the total volume of landings by UK fishing vessels (into the UK and abroad) was 701,100 tonnes with a first sale value of £936 million (MMO, 2017). The total volume of these landings into the UK was 445,600 tonnes with a total first sale value of £689 million (MMO, 2017).

Scotland is one of the largest sea fishing nations in Europe and in 2016 Scottish-based vessels landed 453,000 tonnes of fish and shellfish into the UK and abroad, with a value of £557 million (Scottish Government, 2017) (Table A.7.1). This represents a 25 % increase in value in real terms compared to 2015 and a 3 % increase in the quantity landed compared to 2015. These landings constituted 65 % of the quantity, and 59 % of the value, of all landings by UK vessels into the UK and abroad (MMO, 2017).

The pelagic species mackerel and herring are of particular importance to the Scottish fleet and in 2016, these species (together with blue whiting and horse mackerel) made up 65% by volume and 40% (£222 million) of the total value of landings made by Scottish vessels (Table A.7.1). Demersal species (including monkfish, cod and hake) made up 21% by volume and 30% by value of landings by Scottish vessels, with a total value of £169 million. Shellfish landings (including scallops, crabs and *Nephrops*) made up 14% by volume and 30% by value of all landings by Scottish vessels with a total value of £166 million (Scottish Government, 2017).

**Table A.7.1 Landings by Scottish vessels into the UK and abroad (2016)**

| Fishery Type | Landings ('000 tonnes) | Value (£ million) |
|---|---|---|
| Demersal | 95.4 | 169 |
| Pelagic | 294.4 | 222 |
| Shellfish | 63.6 | 166 |
| Total | 453.3 | 557 |

Source: Scottish Government, 2017

Figure A.7.1 shows the distribution of the value of demersal, pelagic and shellfish landings by the UK fleet, by ICES rectangle in 2016. Important areas for demersal fisheries are along the continental shelf edge and in the northern North Sea east of Orkney and Shetland. Pelagic catches are similarly distributed along the continental shelf edge and north and east of Scotland. In contrast, shellfish landings are predominantly from inshore areas, particularly around the west coast, but with some important areas also on the east coast.

Figure A.7.2 shows an overview of the spatial distribution of the value of landings from UK over 15 m vessels. There are important fishing areas in inshore areas on the west coast, along the shelf edge, around Shetland and across the North Sea. Under 15 m vessel activity tends to be concentrated in inshore areas within 12 nm and close to vessels' home ports (Figure A.7.3).

Information sources that can be used in the assessment are listed in Table A.7.2.

**Figure A.7.1 Value of demersal pelagic and shellfish landings from UK vessels by ICES rectangle, 2016**

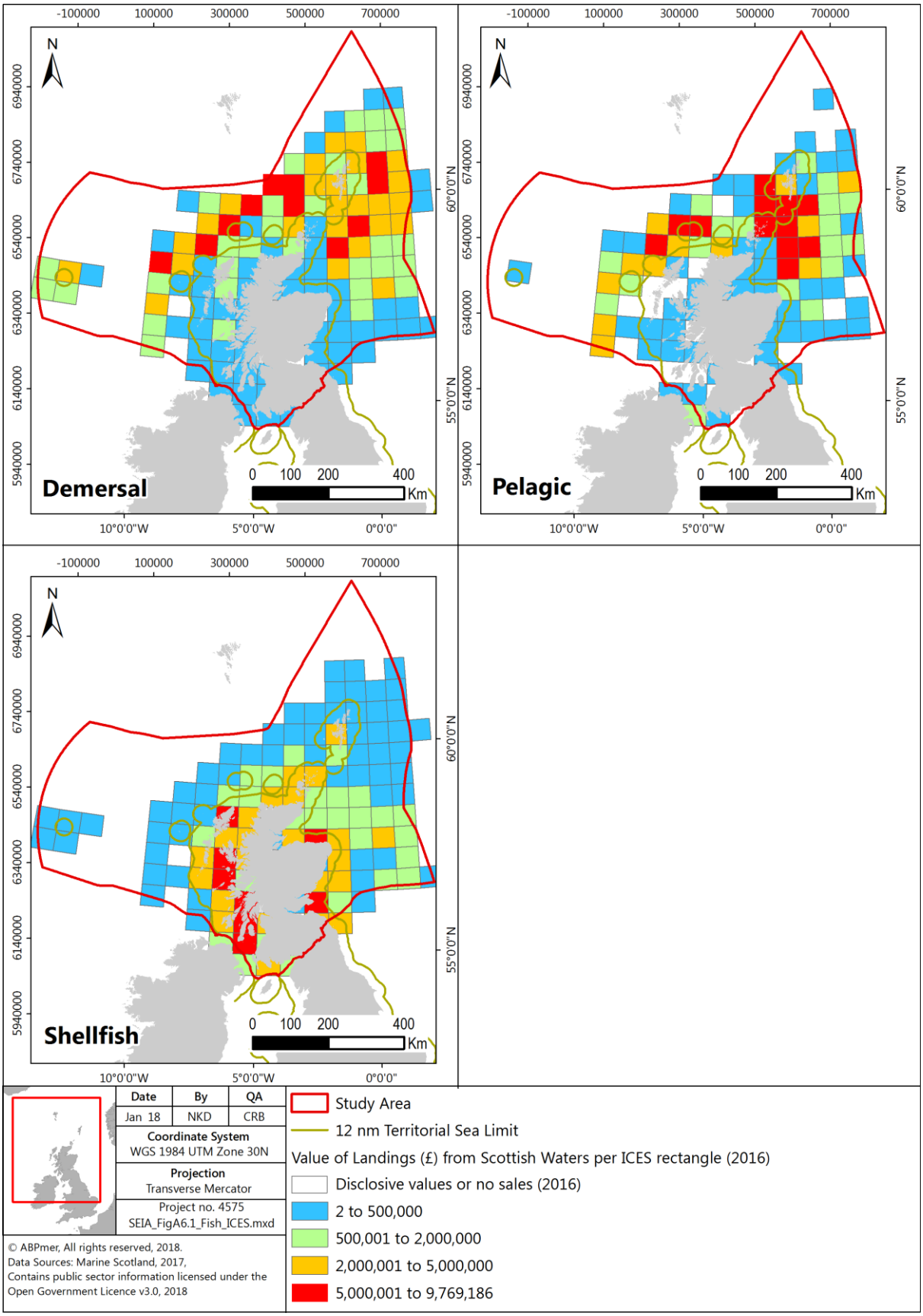


Figure A.7.2 Value of landings from >15 m UK vessels

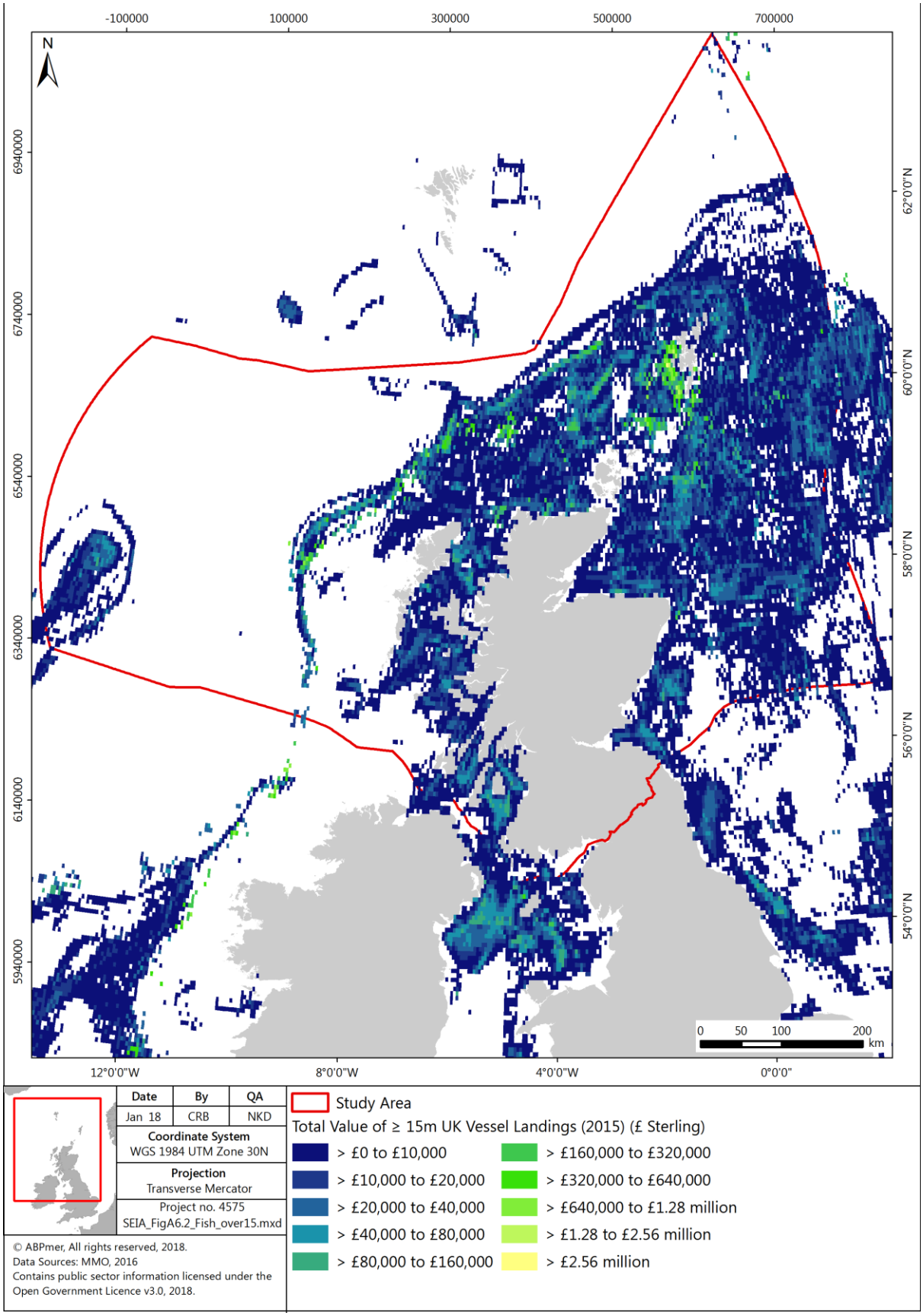


**Figure A.7.3 Value of landings from <15 m vessels from ScotMap**

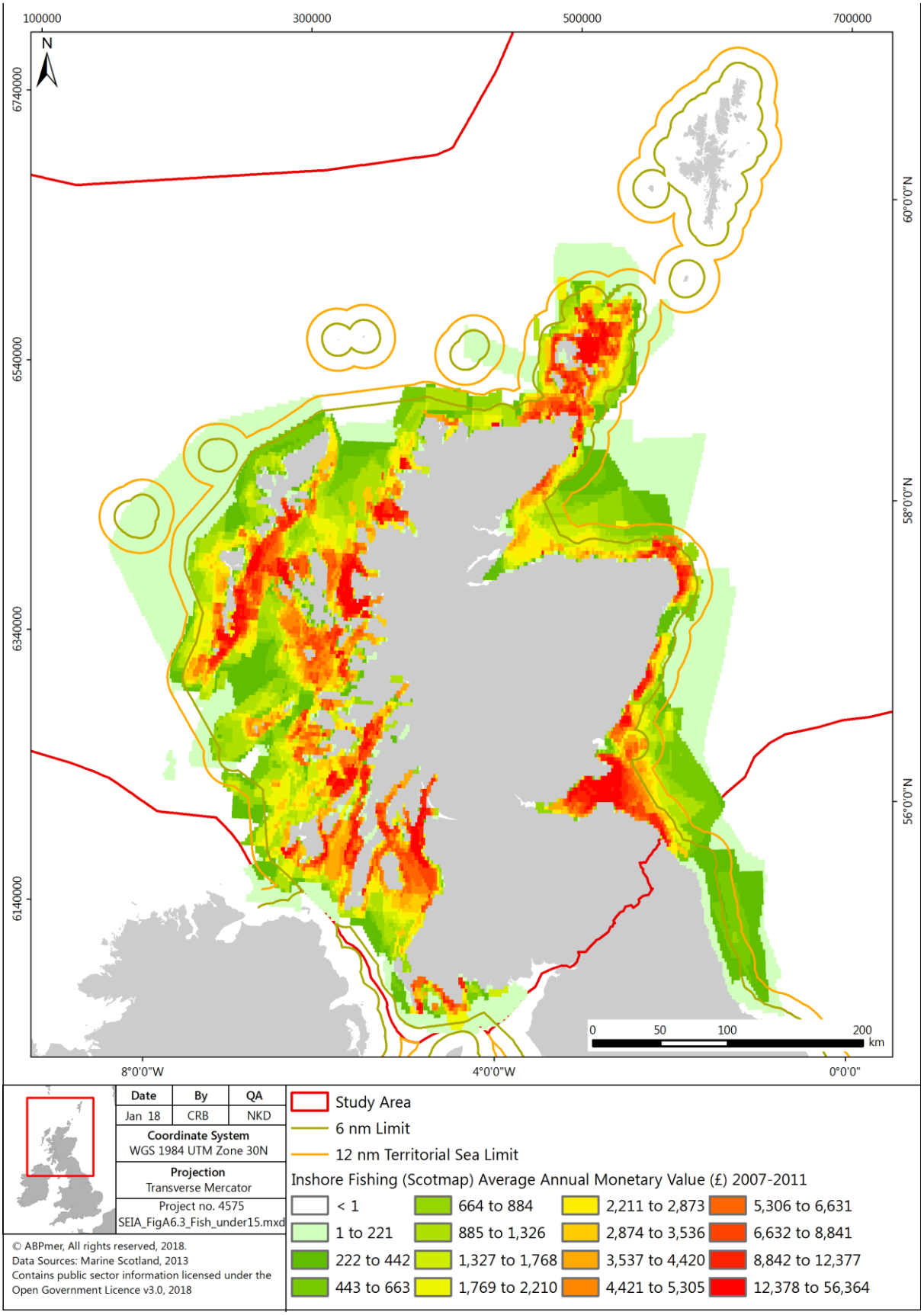


**Table A.7.2 Information sources for the commercial fisheries sector**

| Data Available | Information Source (latest available data set) |
|---|---|
| Volume and value of landings (UK/Scotland) | By ICES rectangle (UK/Scottish vessels): MMO 2012-2016 UK fleet landings by ICES rectangle (https://www.gov.uk/government/statistics/uk-sea-fisheries-annual-statistics-report-2016)<br><br>By Port: UK sea fisheries annual statistics (2016 data): https://www.gov.uk/government/statistics/uk-sea-fisheries-annual-statistics-report-2015<br><br>Scottish Sea Fisheries Statistics (2016 data) http://www.gov.scot/Topics/Statistics/Browse/Agriculture-Fisheries/PubFisheries |
| Landings and effort of other European vessels | Scientific, Technical and Economic Committee for Fisheries (STECF) dataset on landings and effort by ICES rectangle for European Member States (2012-2016). |
| Spatial distribution of the value and volume of landings declaration and satellite data (for UK vessels ≥12 m in length), demersal/pelagic/shellfish | 1/200th ICES rectangle data |
| Volume and value of landings from inshore fleet | Marine Scotland: ScotMap data (2012): http://www.gov.scot/Topics/marine/science/MSInteractive/Themes/ScotMap |
| Fleet register – number of vessels. Power and tonnage, by home port | UK sea fisheries annual statistics (2016 data): https://www.gov.uk/government/statistics/uk-sea-fisheries-annual-statistics-report-2016 |
| Scottish salmon and sea trout fishery statistics | Marine Scotland: Scottish salmon and sea trout catches (2016 data): http://www.gov.scot/Topics/marine/Publications/stats/SalmonSeaTroutCatches/StatPubs |
| Information on local fishery activities, operational areas and economic significance of local fisheries | Inshore Fisheries Groups |
| Scottish Inshore Fisheries Integrated Data System (SIFIDS) | The SIFIDS project is seeking to develop an integrated system for the collection, collation, analysis and interrogation of data from the Scottish inshore fishing fleet. |
| OSPAR Initial Assessment data layers on surface and sub-surface swept area | OSPAR |

## A.7.3 Potential Interactions with Offshore Wind

Table A.7.3 shows potential interaction pathways between commercial fisheries and offshore wind arrays and export cables. Based on the approach to scoping described in Section 2 in the main report, the table also records whether the interaction:

- Is not likely to result in a significant socio-economic impact on the sector; or
- Is likely to result in a significant socio-economic impact on the sector and hence will require a detailed assessment.

The rationale underlying this expert judgement is provided in the table. Where it is not currently possible to make a judgement regarding the likelihood of a significant socio-economic impact due to insufficient information (for example, in relation to the extent of overlap between a sector activity and the DPO Areas) the table indicates that scoping will be required to be undertaken once sufficient information becomes available. Furthermore, as described in the main report, there is currently no information regarding the likely location of export cable routes/corridors and as such, it is not possible to undertake a meaningful assessment of the potential for any sector activity/export cable interaction to give rise to significant socio-economic effects. Rather, the potential for any interaction will be identified in Regional Locational Guidance.

**Table A.7.3 Potential interaction pathways**

| Potential Interaction | Technology Aspect and Phase | Potential Socio-economic Consequences | Initial Scoping Assessment |
|---|---|---|---|
| Complete loss or restricted access to traditional fishing grounds | Arrays (construction and operation) | Reduction in landings and income, possible impact on viability of fishing businesses. Could impact on GVA of sector and employment. | Any significant impacts would be expected where DPO areas overlap with commercial fishing grounds.<br><br>The location of the DPO areas is not currently available. However, given the widespread nature of important fishing grounds in Scottish waters (for both demersal and pelagic fishing gears) and the socio-economic importance of the commercial fishing sector in Scotland, it has been assumed that avoidance of significant fishing areas may not be achieved through spatial planning alone and that the impact of this interaction will need to be assessed once the location of the DPO areas is available.<br><br>**Scoping assessment to be completed once DPOs defined.** See Section A.7.5.1 for proposed assessment methodology. |

| Potential Interaction | Technology Aspect and Phase | Potential Socio-economic Consequences | Initial Scoping Assessment |
|---|---|---|---|
| | Export cables (operation) | Reduction in landings and income, increase in fishing costs (if vessels need to haul and reset gear to avoid cables), possible impact on viability of fishing businesses. Could impact on GVA of sector and employment. | Any significant impacts would be expected where export cable corridors intersect with important commercial fishing grounds for fisheries which use mobile demersal gear.<br><br>Export cable routes are uncertain. Constraints inshore of DPOs will be identified in the RLG.<br><br>**No detailed assessment possible.** |
| Changes in fishing patterns, including gears used and species targeted (arising from displacement of fishing vessels as a result of loss of traditional fishing grounds; see above interaction) | Arrays (operation) | Change in costs and earnings profile of vessels. May lead to increased conflict over diminishing fishing grounds, and additional environmental impacts if fishing is displaced to different areas. | Any significant impacts would be an indirect effect arising from complete loss of or restricted access to traditional fishing grounds.<br><br>**Scoping assessment to be completed once DPOs defined and this impact to be assessed based on the level of impact from complete loss or restricted access to traditional fishing grounds** (See Section A.7.5.2 for proposed assessment methodology) |
| | Export cables (operation) | Change in costs and earnings profile of vessels. May lead to increased conflict over diminishing fishing grounds, and additional environmental impacts if fishing is displaced to different areas. | Any significant impacts would be an indirect effect arising from displacement of vessels from traditional fishing grounds.<br><br>Export cable routes are uncertain. Constraints inshore of DPOs will be identified in the RLG.<br><br>**No detailed assessment possible.** |

| Potential Interaction | Technology Aspect and Phase | Potential Socio-economic Consequences | Initial Scoping Assessment |
|---|---|---|---|
| Obstruction of fishing vessel navigation routes | Arrays (construction and operation) | Increased steaming times for vessels, increased fuel cost and reduced time available for fishing for vessels with limited at-sea time (e.g. day boats). | The location of the DPO areas is not currently available. Fishing vessels are not included in the shipping assessment, therefore potential impacts on navigation routes should be assessed.<br><br>**Scoping assessment to be completed once DPOs defined.** (see Section A.7.5.3 for proposed methodology). |
| | Export cables (construction) | Increased steaming times for vessels, increased fuel cost and reduced time available for fishing for vessels with limited at-sea time (e.g. day boats). | Export cable routes are uncertain. Constraints inshore of DPOs will be identified in the RLG. However, it can be noted that any potential impact will only occur during the construction phase (export cable laying) and hence will be temporary (see loss or restricted access to fishing grounds interaction above for impacts during operation).<br><br>**No detailed assessment possible.** |
| Disruption to/obstruction of fishing activity | Export cables (construction) | Change in costs and earnings profile of vessels. | Export cable routes are uncertain. Constraints inshore of DPOs will be identified in the RLG. However, it can be noted that any potential impact will only occur during the construction phase (export cable laying) and hence will be temporary.<br><br>**No detailed assessment possible.** |

| Potential Interaction | Technology Aspect and Phase | Potential Socio-economic Consequences | Initial Scoping Assessment |
|---|---|---|---|
| Fouling of fishing gear on cables or seabed infrastructure | Export cables (operation)<br><br>(assumes no fishing within operational arrays) | Loss of fishing gear, increase in gear costs, loss of fishing time and revenue. Safety issues for fishing vessels. | Export cable routes are uncertain. Constraints inshore of DPOs will be identified in the RLG.<br><br>**No detailed assessment possible.** |
| Disturbance of commercially-exploited fish and shellfish populations including disruption or damage to habitats, nursery and spawning grounds | Arrays (construction) | Reduction in Catch per Unit Effort (CPUE), landings and income. | Any potentially significant impacts to fish and shellfish populations would be expected to be minimised in accordance with EIA and HRA requirements and that residual impacts will not have significant impact on fishing sector.<br><br>**No detailed assessment required.** |
| | Export cables (construction) | Reduction in Catch per Unit Effort (CPUE), landings and income. | Any potentially significant impacts to fish and shellfish populations would be expected to be minimised in accordance with EIA and HRA requirements and that residual impacts will not have significant impact on fishing sector.<br><br>**No detailed assessment required.** |
| | Array cables and export cables (operation) | Electromagnetic effects on fish and shellfish populations resulting in changes to CPUE, landings and income | Any potentially significant impacts to fish and shellfish populations would be expected to be minimised in accordance with EIA and HRA requirements and that residual impacts will not have significant impact on fishing sector.<br><br>**No detailed assessment required.** |

| Potential Interaction | Technology Aspect and Phase | Potential Socio-economic Consequences | Initial Scoping Assessment |
|---|---|---|---|
| Consequential impacts to seafood processors | Arrays (construction and operation)<br><br>Export cables (construction and operation) | Loss of profit for fish processors. | Impacts will be a function of the loss of landings supplying the processing sector, and therefore will be a function of the impact 'complete loss or restricted access to traditional fishing grounds', taking into account any displacement effects.<br><br>**Scoping assessment to be completed once DPOs defined and this impact to be assessed at regional level.** |
| Disruption to salmon and sea trout fisheries | Arrays (construction and operation) | Loss of landings. | DPOs will not be in coastal areas where salmon and sea trout fisheries mainly occur, therefore no interaction is expected. Salmon and sea trout are protected under Habitats Regulations legislation, which requires that a HRA is conducted for individual developments. This requires that environmental impacts on salmon and sea trout are avoided.<br><br>**No detailed assessment required.** |
| | Export cables (construction) | Loss of landings. | Export cable routes are uncertain. Constraints inshore of DPOs will be identified in the RLG.<br><br>**No detailed assessment possible.** |

## A.7.4 Scoping Methodology

The Scoping methodology covers the following interactions (see Table A.7.3):

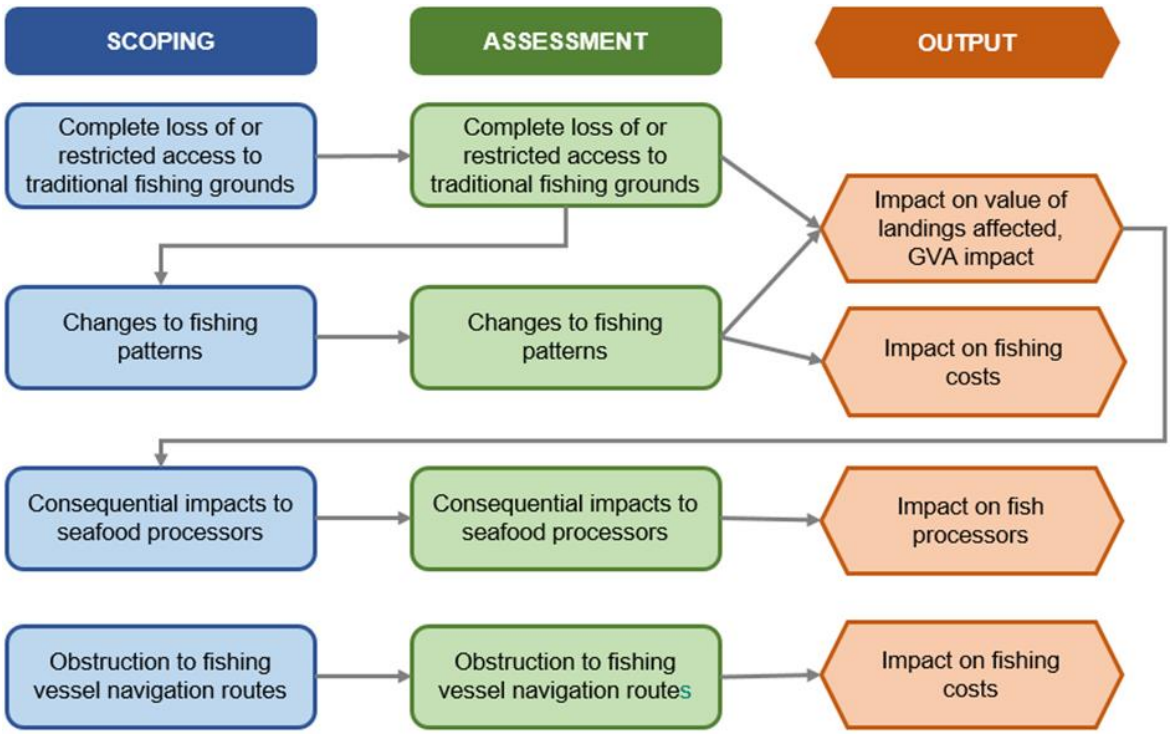
- Complete loss of or restricted access to traditional fishing grounds;
- Changes in fishing patterns, including gears used and species targeted;
- Obstruction of fishing vessel navigation routes;
- Consequential impacts to seafood processors.

The potential for 'changes to fishing patterns, including gears used and species targeted', is a function of the potential loss or restricted access to traditional fishing grounds. The scoping for this interaction therefore needs to take place *subsequent to the assessment* of 'complete loss of or restricted access to traditional fishing grounds'.

Additionally, any changes to fishing patterns will offset some of the loss of the value of landings that would occur through the loss of or restricted access to traditional fishing grounds, and therefore should be taken into account in the final assessment of the potential impact on the value of landings and change to GVA of the sector. It will also therefore influence the landings available to the processing industry, so the scoping for 'consequential impacts to seafood processors' needs to take place *subsequent to the assessment* of 'complete loss of or restricted access to traditional fishing grounds' and 'changes in fishing patterns, including gears used and species targeted'. The process is illustrated in Figure A.7.4.

The draft scoping outputs will be discussed with relevant industry representatives.

**Figure A.7.4 Process for scoping and assessment of commercial fisheries interactions**



A.7.4.1 Complete loss of or restricted access to traditional fishing grounds

To determine where detailed assessments of the interaction may be required when DPO area locations are available, the following scoping criteria are proposed:

- Where DPO areas overlap with fishing grounds (see below), a detailed assessment should be undertaken. The latest five years of data should be used, taking into account both UK vessels and other nationalities where appropriate.

'Fishing grounds' should be identified based on whether there are any reported landings at the scale of ICES rectangle over the five-year period to be assessed (2012-2016).

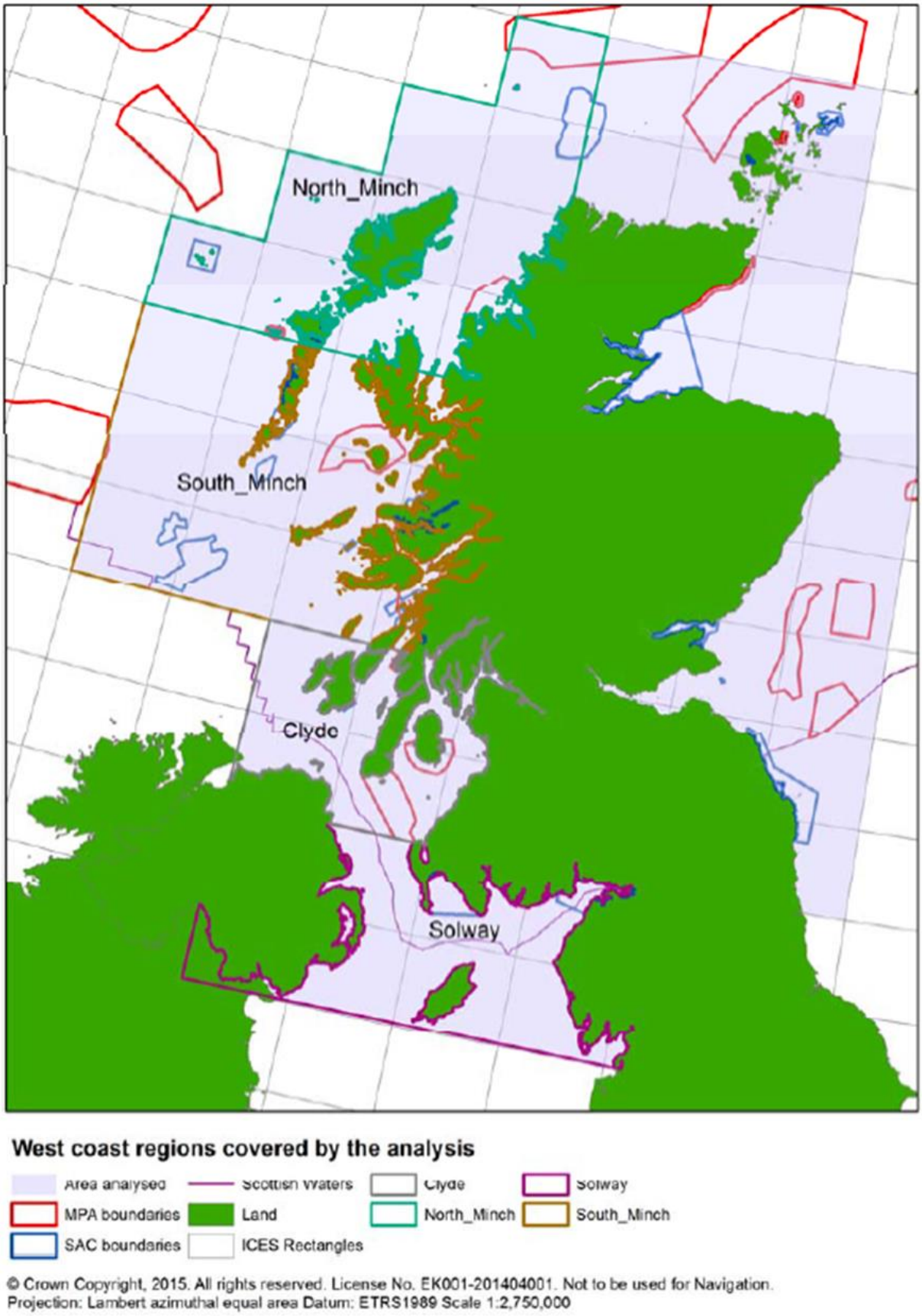
A.7.4.2 Changes in fishing patterns, including gears used and species targeted

This interaction arises from the displacement of fishing vessels as a result of loss of traditional fishing grounds; see above interaction. To determine where detailed assessments of the interaction may be required when DPO area locations are available, the following scoping criteria are proposed:

- Where the assessment of complete loss of or restricted access to traditional fishing grounds indicates that the potential loss of the value of landings exceeds either of the following thresholds, this interaction should be assessed:
    - 10% of the value of landings (for the particular fishing sector) of the ICES rectangle;
    - 1% of the value of landings (for the particular fishing sector) of the region.

Regions on the west coast could follow the regions used for the socio-economic and non-monetary assessment of inshore MPA / SAC management (Marine Scotland, 2015)), see Figure A.7.5, extended further offshore as appropriate. Appropriate regions for the North and East coast should be defined along ICES rectangle boundaries in consultation with Marine Scotland and industry.

Figure A.7.5 West coast regions used in Marine Scotland (2015)



#### A.7.4.3 Obstruction of fishing vessel navigation routes

This interaction arises from the need for fishing vessels to alter their navigation or steaming routes from port to fishing grounds, as a result of the installation and operation of arrays. To determine when detailed assessment of the interaction will be required, the following scoping criteria are proposed:

- Where visual inspection of the location of DPO areas overlain on fishing vessels' 'steaming' pings from vessel monitoring system (VMS) data (speed >6 knots) show that the DPO areas overlap with clear steaming routes, then a detailed assessment should be undertaken when either of the following two scoping criteria are met:
    - The area to be occupied by the array exceeds 5% of the DPO area (under this threshold it is assumed that the interaction can be minimised through spatial planning; this threshold could be re-visited once the DPO areas are known);
    - 'High case' development scenario (8 GW installed capacity within a DPO).

#### A.7.4.4 Consequential impacts to fish processors

This interaction arises from the displacement of fishing vessels as a result of loss of traditional fishing grounds; see earlier interaction. Implementation of arrays will not reduce the final demand for fish, and fish processors may offset any reduction in locally-landed supplies by acquiring a greater volume of imported fish. However, for some processing facilities that are dependent on locally-landed fish and shellfish, this may not be a viable option.

To determine where detailed assessments of the interaction may be required when DPO area locations are available, the following scoping criteria are proposed:

- Where the assessment of complete loss of or restricted access to traditional fishing grounds indicates that the cumulative loss of the value of landings (i.e. taking into consideration all DPO areas), less the value of landings from fishing effort displaced to other areas, exceeds the following threshold, this interaction should be assessed:
    - 10% of the value of landings to a region, assessed either for individual species or for species groups (demersal/pelagic/shellfish).

## A.7.5 Assessment Methodology

The complete loss of or restricted access to traditional fishing grounds will result in the loss of the landings derived from that area. However, some or all of the fishing effort may be displaced spatially to other areas or to other gear types, through changes in fishing patterns, as has been demonstrated in a *Nephrops* fishery in the Irish Sea (Gray *et al*., 2016). Therefore the value of landings lost is likely to be offset to some extent by additional landings from effort that is displaced rather than lost.

The outputs of the assessment of the two interactions 'complete loss of or restricted access to traditional fishing grounds' and 'changes in fishing patters, including gears used and species targeted' therefore need to be combined to determine the value of landings affected. This is described in Section A.7.5.5.

The draft assessment outputs will be discussed with relevant industry representatives.

A.7.5.1 Complete loss of or restricted access to traditional fishing grounds

Potential negative impacts on commercial fisheries may occur principally through the loss of (or displacement from) traditional fishing grounds due to the location of arrays. The loss of fishing grounds would lead to a reduction in catches/landings and income for affected vessels. Where scoping indicates that a detailed impact assessment is required, the value of landings affected by the development and associated GVA impact can be assessed as follows:

- Average annual value of landings from the DPO area, pro-rated by the proportion of the DPO area that would be occupied by the array under the different development scenarios. This should be based on ICES rectangle data using the proportional area technique[13]. In inshore areas, the distribution of effort or value of landings from under 15 m vessels (e.g. from ScotMap data) from within an ICES rectangle can also be used to refine or sense-check the proportional area technique. For larger vessels, VMS data can be used for the same purpose.
- Both UK and non-UK (European Union, EU) vessels should be assessed (data are not available for non-EU vessels at ICES rectangle level).
- Impact should be calculated by fleet segment and gear type, for gear types that will not be able to operate within the arrays. Impact on GVA for UK vessels should be calculated based on fleet segment-specific GVA as a percentage of fishing turnover from Seafish fleet economic performance dataset.

A.7.5.2 Changes in fishing patterns, including gears used and species targeted

(Arising from displacement of fishing vessels as a result of loss of traditional fishing grounds; see above interaction).

Where the scoping and assessment of the value of landings affected (Section A.7.5.1) indicates that a detailed assessment of changes in fishing patterns is required, the potential scope of displacement of fishing effort to alternative areas should be assessed for each DPO area individually. This should take into consideration the activity profile of the vessels involved (e.g. locally operating day boats vs larger-scale and more nomadic vessels) and the availability of alternative fishing grounds within the operating range of the affected vessels. This may consider the location of existing fishing grounds (from ICES rectangle, VMS and ScotMap data, amongst others) as well as suitable habitat types for fisheries with a strong

[13] Based on the potential scale of the DPO areas, and the lack of precise information at this stage of the location of arrays within the DPO areas, data at the scale of ICES rectangles will be adequate for the analysis.

linkage to particular habitats (e.g. *Nephrops* and scallop). From this, a best estimate of the potential for displacement should be developed (for the central case), and a more optimistic estimate for the low case where appropriate.

The potential impacts of changes in fishing patterns should be quantified where possible, and described qualitatively elsewhere. This includes:

- Change in the costs and earning profile of vessels from additional steaming costs to reach alternative fishing grounds, changes in catch rates and target species;
- Additional displacement impacts such as increased conflict between vessels, and different gear types.
- Further information on aspects to consider in, and approaches to, the assessment of displacement is available in ABPmer (2017).

A.7.5.3 Obstruction of fishing vessel navigation routes

Where scoping indicates that a detailed impact assessment is required, the impact of the obstruction of fishing vessel navigation routes can be assessed as follows:

- the estimated potential extra steaming distance and time and average fuel and labour costs for fishing vessels.

This will be based on methods similar to those used to estimate impacts to commercial shipping (see Appendix A.13). For the high, central and low case development scenarios, the following assumptions should be used (unless scoped out):

- High case: 100% of costs as calculated above.
- Central case: 50% of costs as calculated above.
- Low case: 10% of costs as calculated above.

A.7.5.4 Consequential impacts to fish processors

Where this is scoped in for a development scenario, it can be assessed based on the difference in cost of imported vs local raw material, and the difference in price of products from imported vs local raw material, combined with the value of landings affected from UK vessels. This assumes that UK vessels land to the UK and non-UK vessels land elsewhere. It should be assessed at regional scale, based on the landings from ICES rectangles within a region[14]. For specific species where a significant proportion of landings by UK vessels are known to take place overseas (e.g. herring, mackerel, plaice), this should be taken account of in the assessment.

A.7.5.5 Calculating the value of landings lost and GVA impact

Displacement of fishing effort will result in additional landings that may compensate for the loss of landings from the affected area, but may also result in additional costs. The assessment of the two interactions, ‘complete loss of or restricted access to

[14] Data on port of landing are not available in the ICES rectangle dataset.

traditional fishing grounds' and 'changes in fishing patterns, including gears used and species targeted' therefore need to be combined to determine the impact on the value of landings and on fishing costs.

For the high, central and low case development scenarios, the following assumptions should be used:

- High case: Complete loss of the value of landings (no displacement to alternative areas).
- Central case: Loss of a proportion of the value of landings, assuming that additional landings from displacement of fishing activity to other areas compensate for part of the lost landings (see Section A.7.5.2). The proportion would be determined by an assessment of the potential scope for displacement of fishing effort (see Section A.7.5.2), taking the 'best estimate' of the potential for displacement. This should be determined for each DPO area individually.
- Low case: As for the central case, but taking a more optimistic view of the potential for displacement compared to the central case. In some cases, it may be appropriate to use the same proportions across the low and central cases.

Calculation of direct GVA impact should be based on the value of landings lost, using GVA multiplier appropriate for each fleet segment. The Seafish economic performance dataset allows GVA as a percentage of fishing income to be calculated for 30 different fleet segments.

## A.7.6 Data Limitations

The publically available data under-represents fishing effort by the inshore (<15 m in length prior to 2013 and <12 m vessels since 2013), which do not have VMS, and <10 m vessels which do not have to submit logbooks. Some information is available from ScotMap, however, this data represents information relating to fishing activity for the period 2007 to 2011 (collected by interviewing fishermen with 72% vessel coverage overall), and hence may no longer be representative of current inshore fishing effort. Furthermore, the coverage of ScotMap dataset varies by region. ICES rectangle data do not provide information on port of landing, therefore in assessing the consequential impacts to fish processors it is not possible to be specific with regards landings to the UK or to specific ports. Comprehensive data on landings by ICES rectangle by non-EU vessels (e.g. Norwegian, Faroese) are not available.

# A.8. Military Defence

## A.8.1 Sector Definition

This sector relates to military defence activities which directly or indirectly use the marine environment. Within UK waters, in peacetime, military activities comprise practice and training activities, routine patrolling, transporting equipment and personnel in and out of the country, search and rescue operations (in conjunction with HM Coastguard) and communications including using radar.

The marine environment is used predominantly by the Royal Navy (submarine bases, jetties and exercise areas), but is also used by the Army (training camps and firing ranges), Royal Air Force (bases, coastal Air Weapon Ranges and Danger Areas) and Ministry of Defence (MOD) (Defence Test and Evaluation Ranges to trial weapon systems). Defence activities that use the marine environment, directly or indirectly, in support of operational capability are diverse but include operational vessels and aircraft, HM naval bases, surface and sub-surface navigational interests, underwater acoustic ranges, maritime and amphibious exercises, coastal training, test and evaluation ranges (HM Government, 2011).

## A.8.2 Overview of Activity

Military activities occur in both inshore and offshore waters. Coastal military locations and the areas available for military training and other defence activities are shown in Figure A.8.1.

Principal marine-related defence activities include sea transport by naval vessels, mainly associated with naval bases and sea training which is conducted within defined military practice and exercise areas (PEXA). Naval training establishments may also have associated marine activities. The only naval base in Scotland is Her Majesty's Naval Base (HMNB) Clyde, while PEXA are predominantly located off the west coast of Scotland (Figure A.8.1).

Military aviation may also occur over coastal and marine areas. The UK has a military low flying system which supports training below 2000 feet. The UK is divided into 20 separate low flying areas (LFAs), including 2 large areas in Scotland (Area 14 covering mainland Scotland north of the Central Region, the Western Isles, Orkney and Shetland; and Area 16 which includes the Borders region of Southern Scotland, Dumfries and Galloway and other counties up to and including those within the central belt). The LFAs in Scotland include 2 Tactical Training Areas (TTAs) in northern Scotland and the borders area of southern Scotland and northern England where at specific times each day aircraft can fly as low as 100 feet. In addition there are air weapons ranges, which are used for low flying military aircraft and air to ground bombing, at Tain in Ross-shire and Cape Wrath in Sutherland.

The MOD employs people throughout the UK in support of its operations in the marine environment, including HM naval bases, MOD ranges and coastal estates. Gross Value Added (GVA) of UK military activity in the sea was estimated to be

approximately £400 million in 2012 (MSCC, 2014). Marine activities and hence the location of the value to the economy are mainly related to the location of the naval bases and exercise areas. The Royal Navy employs 38,140 military staff (as of 1 January 2016) and 4,450 civilian staff (as of 1 October 2015) (MOD, 2015; 2016b).

With regard to future trends, the primary drivers for the defence sector are political. The UK Government is implementing the recommendations of its strategic review in the period to 2025. It has committed to spending 2% of GDP on defence until 2020. Assuming growth in the UK economy over time, there will be increased expenditure on the defence sector with possible changes in military activity levels.

Figure A.8.1 shows an overview of military defence activity in Scotland. Information sources that can be used in the assessment are listed in Table A.8.1.

Figure A.8.1 Military Defence Activity in Scotland

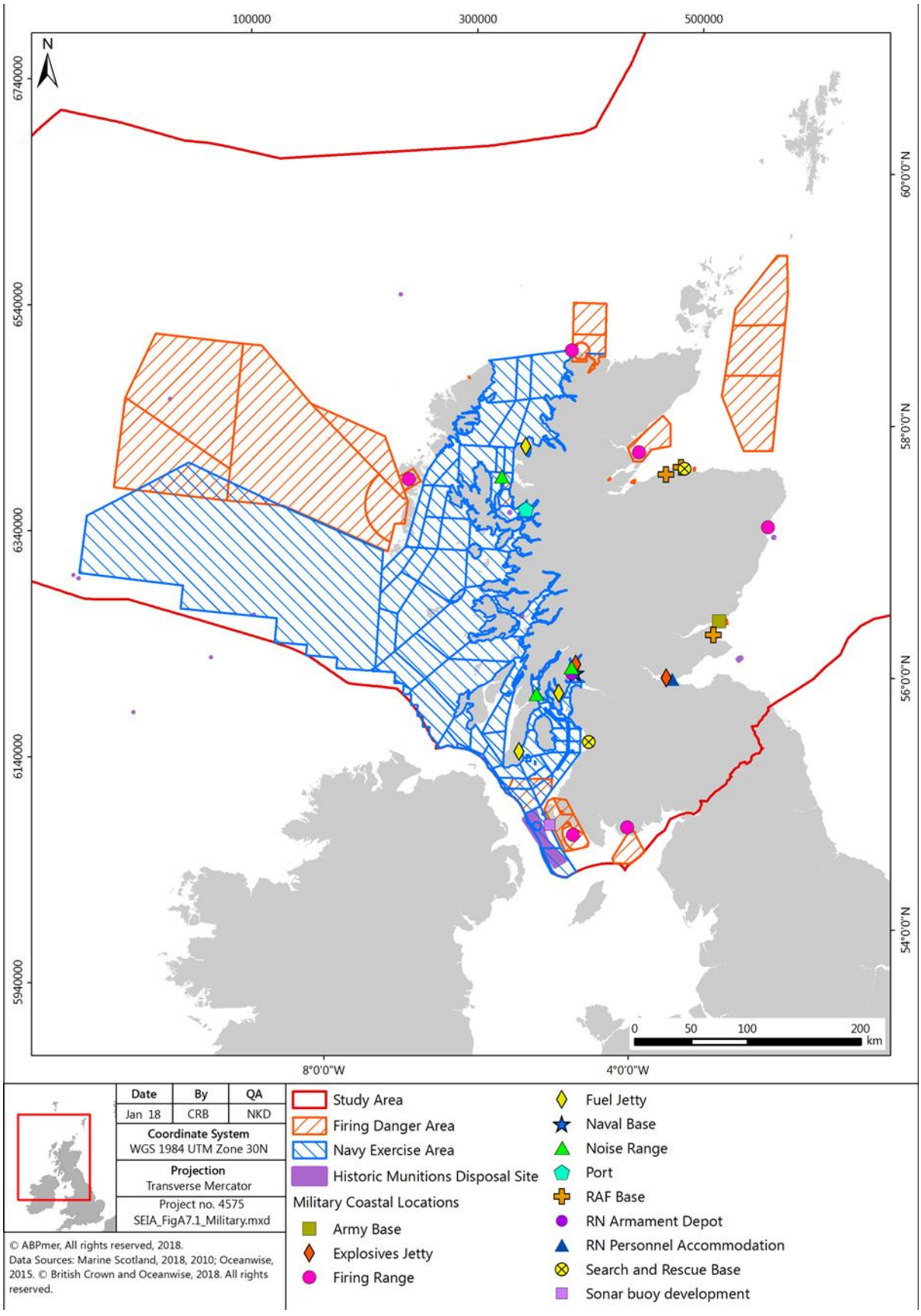


**Table A.8.1 Information sources for the defence sector**

| Data Available | Information Source |
|---|---|
| UK Government's National Security Strategy and Strategic Defence and Security Review (SDSR) 2015 | HM Government, 2015 |
| Military exercise areas and installations | Scottish Government (NMPi), (2016) |
| UK military expenditure | The World Bank, 2017 |

## A.8.3 Potential Interactions with Offshore Wind

Table A.8.2 shows potential interaction pathways between military defence and offshore wind arrays and export cables. Based on the approach to scoping described in Section 2 in the main report, the table also records whether the interaction:

- Is not likely to result in a significant socio-economic impact on the sector; or
- Is likely to result in a significant socio-economic impact on the sector and hence will require a detailed assessment;

The rationale underlying this expert judgement is provided in the table. Where it is not currently possible to make a judgement regarding the likelihood of a significant socio-economic impact due to insufficient information (for example, in relation to the extent of overlap between a sector activity and the DPO Areas) the table indicates that scoping will be required to be undertaken once sufficient information becomes available. Furthermore, as described in the main report, there is currently no information regarding the likely location of export cable routes/corridors and as such, it is not possible to undertake a meaningful assessment of the potential for any sector activity/export cable interaction to give rise to significant socio-economic effects. Rather, the potential for any interaction will be identified in Regional Locational Guidance.

## Table A.8.2 Potential interaction pathways

| Potential Interaction | Technology Aspect and Phase | Potential Socio-economic Consequences | Initial Scoping Assessment |
|---|---|---|---|
| Competition for space | Array (construction and operation) | Displacement/exclusion of activity leading to increased costs to sector | Any potential significant impacts would only be expected where DPO areas overlap with PEXA.<br><br>The location of DPO areas is not currently available.<br><br>**Scoping assessment to be completed once DPOs defined.** |
| | Export cable corridors (construction and operation) | | Any potential significant impacts would only be expected where export cable corridors intersected with PEXA or military installations on the coast (i.e. at landfall sites).<br><br>Export cable routes are uncertain. Constraints inshore of DPOs will be identified in the RLG.<br><br>**No detailed assessment possible.** |
| Interference with radar systems | Array (operation) | Displacement of activity leading to increased costs | Radar mitigation will be required as a condition of consent if there is a potentially significant effect. This cost will be borne by the developer.<br><br>**No detailed assessment required.** |

| Potential Interaction | Technology Aspect and Phase | Potential Socio-economic Consequences | Initial Scoping Assessment |
|---|---|---|---|
| Interference with underwater communications | Array – construction and operation | Displacement of activity leading to increased costs | Any potential significant impacts would only be expected where the location of DPO areas were located close enough to PEXA to interfere with underwater communications.<br><br>The location of DPO areas is not currently available.<br><br>**Scoping assessment to be completed once DPOs defined.** |

## A.8.4 Scoping Methodology

The spatial proximity of DPOs to PEXAs to be assessed, once DPO areas are available. Where DPO areas are within 10 km of any aviation or non-aviation PEXA, further consideration of the potential interaction will be undertaken (ABPmer and RPA, 2013).

## A.8.5 Assessment Methodology

If a potentially significant interaction between DPOs and PEXAs is identified through scoping, further consideration will be given to the potential socio-economic impacts in consultation with the Ministry of Defence.

## A.8.6 Data Limitations

Identifying defence activities is relatively straightforward from national statistics. However, establishing whether defence activities are connected to marine activities is not possible. Furthermore, owing to the confidential nature of military defence activities it is difficult to assess the extent and frequency of activity and future trends within the marine environment. There are uncertainties concerning the exact location of training activities within designated exercise areas and the frequency of use of those areas given the need for a certain amount of security in the information provided. In some instances the exact nature of Government spending changes is also uncertain and thus it is difficult to predict the future intensity of military activity within the marine environment.

# A.9. Oil and Gas

## A.9.1 Sector Definition

This sector relates to the upstream oil and gas industry comprising the exploration and extraction of oil and gas from the environment, largely from offshore reserves. The term 'oil reserve' refers to oil, the condensate gas liquids obtained from gas fields and from the associated gas in oil fields. A 'gas reserve' refers to the quantity of gas expected to be available for sale from dry gas fields, gas-condensate fields and oil fields with associated gas.

## A.9.2 Overview of Activity

Aberdeen is regarded as the UK centre for the oil and gas industry due to its proximity to significant oil deposits in the North Sea. Figure A.9.1 shows licensed blocks, offshore hydrocarbon fields, platforms and pipelines for the oil and gas sector in Scotland.

Information on production, economic value and future trends presented below relate to the UK; disaggregation of this data to regional (Scottish) level is not possible.

In 2016, oil and gas production from the UK Continental Shelf (UKCS) increased to 630 million barrel of oil equivalent (boe), the highest since 2011 (Oil and Gas UK, 2017). In this year, oil and gas provided 76% of the UK's primary energy (60% of which came from production in the UK), making an estimated contribution of £17 billion to the UK's balance of trade.

Statistics produced by the Scottish Government show that in the financial year 2015-16, oil and gas production in Scotland (including Scottish adjacent waters) is estimated to have been 70 million tonnes of oil equivalent (mtoe), which accounted for 81% of the UK total. The approximate sales value of oil and gas produced in Scotland that year is estimated to be £13.4 billion (Scottish Government, 2016).

Information on employment and future trends presented below relate to the UK and disaggregation of this data to regional (Scottish) level was not possible.

In 2016, it was estimated that the oil and gas sector supported over 300,000 jobs of which 29,500 jobs were classified as direct employment (i.e. employed by companies operating in the extraction of oil and gas and associated services). A further 150,600 indirect jobs[15] and 135,300 induced jobs[16] were supported by the sector in 2016.

[15] Employment as a result of supply chain effects caused by oil and gas sector activity. For these companies, extraction of oil and gas and associated services will be one part of a wider business.
[16] Employment supported by the redistribution of income from the oil and gas sector.

With regard to future trends, although renewable energy capacity for electricity production is anticipated to increase and the oil and gas production is projected to gradually decrease between 2017 to 2035, the UK Government forecasts that 66% of the UK's energy mix will still come from oil and gas by 2035 (Oil and Gas UK, 2017).

Information sources that can be used in the assessment are listed in Table A.9.1.

Figure A.9.1 Oil and gas activity in Scotland

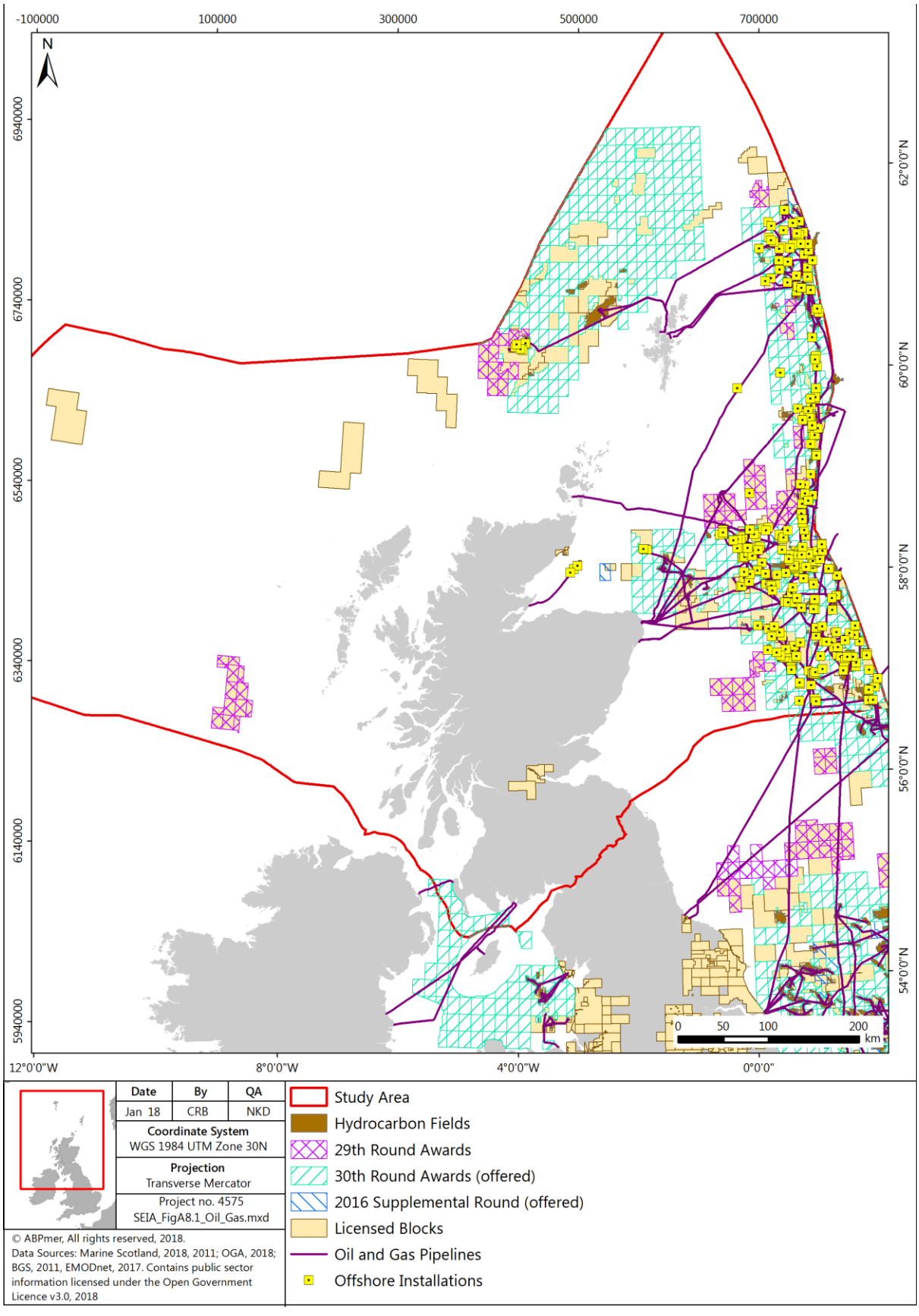


**Table A.9.1 Information sources for the oil and gas sector**

| Data Available | Information Source |
|---|---|
| Oil and Gas production values (UK) | Oil and Gas Authority https://www.ogauthority.co.uk/data-centre/data-downloads-and-publications/production-data/ |
| Oil and Gas economic value and employment (UK) | Oil and Gas UK Economic Report 2017 https://oilandgasuk.co.uk/economic-report-2017.cfm |
| Oil and Gas production statistics and economic value (Scotland) | Scottish Government Oil and Gas Production Statistics 2015-16 http://www.gov.scot/Topics/Statistics/Browse/Economy/oilgas1516 |

## A.9.3 Potential Interactions with Offshore Wind

Table A.9.2 shows potential interaction pathways between oil and gas and offshore wind arrays and export cables. Based on the approach to scoping described in Section 2 in the main report, the table also records whether the interaction:

- Is not likely to result in a significant socio-economic impact on the sector; or
- Is likely to result in a significant socio-economic impact on the sector and hence will require a detailed assessment;

The rationale underlying this expert judgement is provided in the table. Where it is not currently possible to make a judgement regarding the likelihood of a significant socio-economic impact due to insufficient information (for example, in relation to the extent of overlap between a sector activity and the DPO Areas) the table indicates that scoping will be required to be undertaken once sufficient information becomes available. Furthermore, as described in the main report, there is currently no information regarding the likely location of export cable routes/corridors and as such, it is not possible to undertake a meaningful assessment of the potential for any sector activity/export cable interaction to give rise to significant socio-economic effects. Rather, the potential for any interaction will be identified in Regional Locational Guidance.

## Table A.9.2 Potential interaction pathways

| Potential Interaction | Technology Aspect and Phase | Potential Socio-economic Consequences | Initial Scoping Assessment |
|---|---|---|---|
| Competition for marine space - restricted access to seafloor | Arrays (construction and operation) | Increased cost as a result of restrictions on platform construction leading to a decrease in profitability and a lack of investment in sector | Any potential significant impacts would only be expected where DPO areas overlap with, or lie inshore of areas where oil discovered but awaiting development.<br><br>The location of DPO areas is not currently available.<br><br>**Scoping assessment to be completed once DPOs defined.** |
| Competition for marine space-restriction on exploration activities | Arrays (construction and operation) | Decrease in new oil and gas discoveries | Any potential significant impacts would only be expected where DPO areas overlap with, or lie inshore of, areas where oil can be expected to be found but has not yet been explored.<br><br>The location of DPO areas is not currently available.<br><br>**Scoping assessment to be completed once DPOs defined.** |

| Potential Interaction | Technology Aspect and Phase | Potential Socio-economic Consequences | Initial Scoping Assessment |
|---|---|---|---|
| Competition for marine space - obstruction of pipeline routes | Array and export cables (construction and operation) | Increased cost associated with new development activities as a result of re-routing pipelines or cable/pipeline crossings leading to a decrease in profitability and/or investment | Any potential significant impacts would only be expected where DPO areas overlap with, or lie inshore of, existing hydrocarbon fields.<br><br>The location of DPO areas is not currently available.<br><br>**Scoping assessment to be completed once DPOs defined.** |
| Competition for marine space - increased difficulty of access at crossing points | Export cables (construction and operation) | Increased maintenance costs for pipeline owners; loss of revenue for asset owners; loss of revenue for dependent businesses/customers | Renewables development will not be permitted within a given 'corridor' either side of existing infrastructure such as pipelines to enable existing infrastructure maintenance.<br><br>**No detailed assessment required.** |

## A.9.4 Scoping Methodology

The spatial overlap between DPOs and potential oil and gas development locations to be assessed, once DPO areas are available.

## A.9.5 Assessment Methodology

If a significant interaction between DPOs and potential oil and gas development locations is identified through scoping, further consideration will be given to the potential socio-economic impacts in consultation with Oil and Gas UK.

## A.9.6 Data Limitations

No direct employment statistics for the Oil and Gas sector specific to Scotland were sourced (data shown is for the UK).

# A.10. Ports and Harbours

## A.10.1 Sector Definition

This sector relates to ports and harbours which provide the modal interchange points by which goods and people are transported from land to sea. Harbours are by definition, safe havens for vessels to reside in and are often commensurate with port areas. Information on dredge material disposal sites is provided in Appendix A.16 'Waste Disposal'.

## A.10.2 Overview of Activity

Within Scottish waters, the ports and harbours sector supports the largest fishing industry in the UK, provides facilities for a significant offshore Oil and Gas industry, as well as maintaining ferry links to island communities and providing the recreational sector with support services. There is an intrinsic link between ports, harbours and shipping, however the interactions and issues in relation to marine renewable developments are often distinctly different. Information for recreational boating and commercial shipping and are presented in Appendix A.12 and A.13 respectively.

In 2016, 98% of all port traffic in the UK was handled by major ports (ports handling over 1 million tonnes of freight per year), with 2% handled by minor ports (DfT, 2017). Figure A.10.1 shows the location of ports in Scotland and Table A.10.1 shows the total volume of freight handled by the eleven major Scottish ports in 2015. Key fishing ports include Peterhead and Fraserburgh (see also commercial fisheries, Appendix A.7) while important ports for cruise ships (based on the total number of ships calling into port in 2016) include Invergordon, Orkney, Greenock, Edinburgh and Lerwick (Cruise Scotland, 2017).

**Table A.10.1 Total volume of freight handled by the major ports in Scotland in 2015**

| Port | Total tonnage |
|---|---|
| Aberdeen | 4,376 |
| Cairnryan | 2,548 |
| Clyde | 12,484 |
| Cromarty Firth | 262 |
| Dundee | 515 |
| Forth | 27,074 |
| Glensanda | 5,597 |
| Orkney | 3,945 |
| Peterhead | 1,468 |
| Stranraer / Loch Ryan | 2,163 |

Source: Transport Scotland, 2017

The National Renewables Infrastructure Plan (NRIP) identifies potential port locations to support the development of the offshore renewables sector (Highlands & Islands Enterprise and Scottish Enterprise, 2010). A number of ports are already supporting the construction of Beatrice Offshore Wind Farm including Wick, Nigg, Cromarty Firth and Buckie. Peterhead and Aberdeen have also provided important construction support for the European Offshore Wind Deployment Centre. Ports such as Montrose and Dundee have made major investments to support offshore wind construction and O&M activity on the East Coast. Kishorn on the west coast has the largest dry dock in Europe and has an agreement to construct the Kincardine Floating Offshore Wind Farm.

In 2015, GVA directly contributed by the ports industry in Scotland was £1,020 million (representing 13.5% of the UK industry total) and directly supported 14,800 jobs (14.7% of the UK industry total) (Cebr, 2017).

With regard to future trends, due to uncertainty regarding the process of Brexit and the implications for the UK economy and the associated maritime sector, it has been forecast that the maritime industry GVA and turnover will essentially remain flat until 2019, followed by slow growth up to 2022. By 2022 GVA and turnover are forecasted to be around 15% and 13% higher than they were in 2015 (Cebr, 2017b).

Information sources that can be used in the assessment are listed in Table A.10.2.

## Figure A.10.1 Ports and Harbours in Scotland

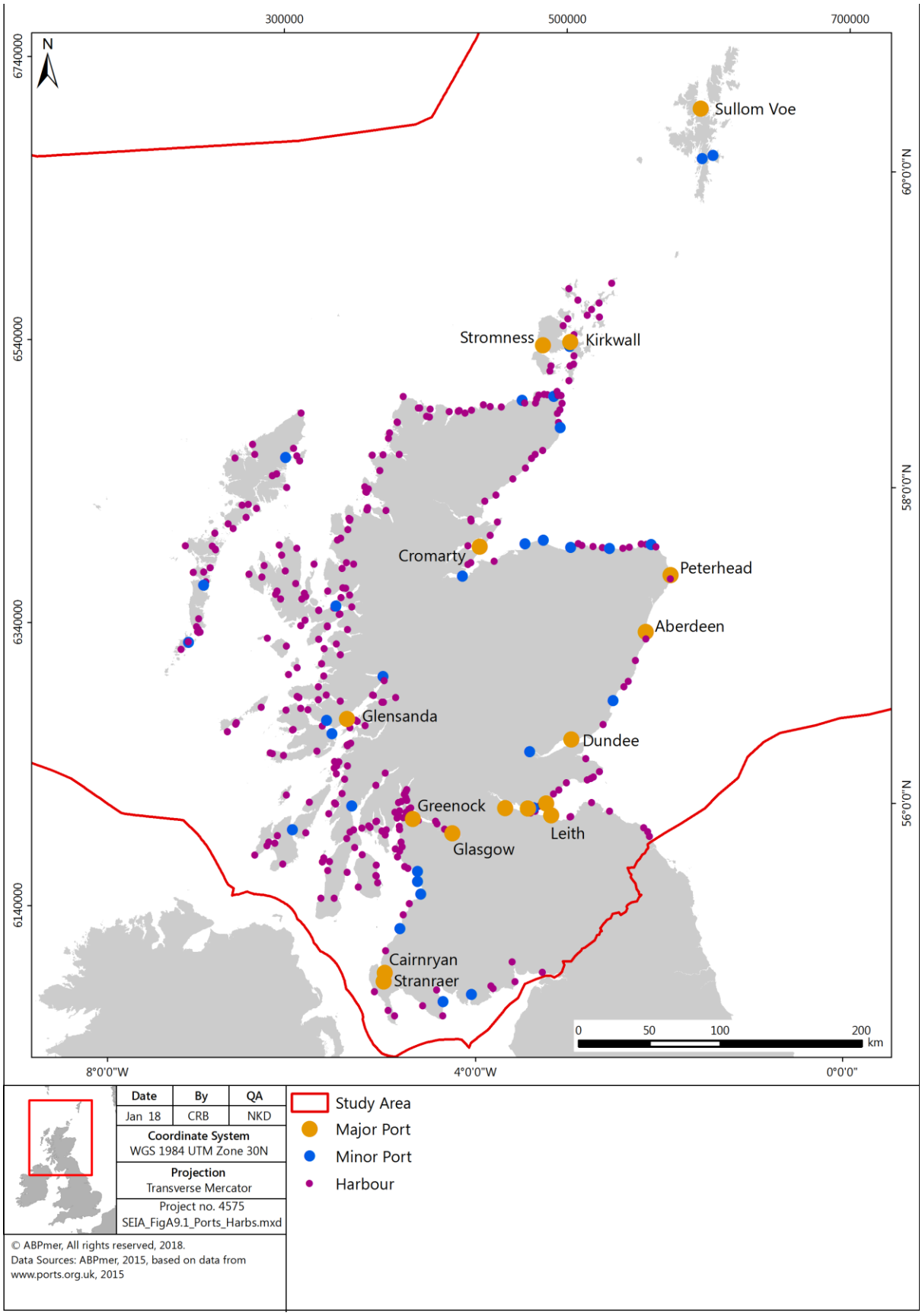


**Table A.10.2 Information sources for the ports and harbours sector**

| Data Available | Information Source |
|---|---|
| Port and harbour locations, port types, port ownership, contact details (UK) | Ports and Harbours of the UK: http://www.ports.org.uk/ |
| Commercial listings of ports in Scotland, service providers, contact details, description of services and current development plans (Scotland) | Ports of Scotland: http://www.portsofscotland.co.uk/ |
| Tonnage of freight handled by major ports (Scotland) | Transport Scotland, 2017: Scottish Transport Statistics (2015 data) https://www.transport.gov.scot/publication/scottish-transport-statistics-no-35-datasets/ |
| Cruise port data (Scotland) | Cruise Scotland - access via Marine Scotland Information website (2016 data): http://marine.gov.scot/data/cruise-port-statistics-2010-2016 |
| UK port demand forecasts, taking into account recession (to 2030) (UK) | Port Infrastructure Development UK. Gail Bradford, MDS Transmodal, 2011 |
| The economic contribution of the ports industry (UK/Scotland) | Cebr, 2017a https://www.britishports.org.uk/system/files/documents/cebr_ports_report.pdf |
| Forecast for UK maritime sector | Cebr, 2017b https://www.britishports.org.uk/system/files/documents/cebr_uk_maritime_sector_report.pdf |

## A.10.3 Potential Interactions with Offshore Wind

Table A.10.3 shows potential interaction pathways between ports and harbours and offshore wind arrays and export cables. Based on the approach to scoping described in Section 2 in the main report, the table also records whether the interaction:

- Is not likely to result in a significant socio-economic impact on the sector; or
- Is likely to result in a significant socio-economic impact on the sector and hence will require a detailed assessment.

The rationale underlying this expert judgement is provided in the table. Where it is not currently possible to make a judgement regarding the likelihood of a significant socio-economic impact due to insufficient information (for example, in relation to the extent of overlap between a sector activity and the DPO Areas) the table indicates that scoping will be required to be undertaken once sufficient information becomes available. Furthermore, as described in the main report, there is currently no information regarding the likely location of export cable routes/corridors and as such, it is not possible to undertake a meaningful assessment of the potential for any sector activity/export cable interaction to give rise to significant socio-economic effects. Rather, the potential for any interaction will be identified in Regional Locational Guidance.

## Table A.10.3 Potential interaction pathways

| Potential Interaction | Technology Aspect and Phase | Potential Socio-economic Consequences | Initial Scoping Assessment |
|---|---|---|---|
| Obstruction of maintained navigation channel(s) (interference with vessel routes to port) | Arrays (construction and operation) | Increase in route steaming times for vessels, increased fuel cost. Potential loss of customers and revenue; increased costs associated with maintaining alternative routes. | Significant impacts would only be expected to occur where DPO areas overlap or intersect with maintained navigation channels.<br><br>The location of DPO areas are not currently available, however, it is assumed that avoidance of an interaction with navigation channels should be possible through marine spatial planning.<br><br>**No detailed assessment required**. |
| | Export cables (construction only) | Temporary increase in route steaming times for vessels, increased fuel cost. Potential loss of port customers and revenue (short term and/or seasonal trade). Could impact on GVA of sector and employment. Loss of customers and revenue; increased costs associated with maintaining alternative routes. | Export cable routes are uncertain. Constraints inshore of DPOs will be identified in the RLG.<br><br>**No detailed assessment possible.** |

## A.10.4 Scoping Methodology

No further scoping required.

## A.10.5 Data Limitations

There are no major data limitations relating to ports and harbours.

# A.11. Power Interconnectors

## A.11.1 Sector Definition

This sector is concerned with the transmission of power through submarine cables, including international, national and inter-island links. This assessment excludes power cables to/from individual developments (e.g. power supplies to oil and gas installations, export cables from offshore wind farms).

## A.11.2 Overview of Activity

Electrical interconnection with other nations contributes to the UKs energy security, affordability and decarbonisation objectives. The UK currently has 3.5 GW of interconnection with other nations, 2 GW with France, 1 GW with the Netherlands and 500 MW with the Republic of Ireland (Ofgem, 2017).

Figure A.11.1 shows the subsea power interconnectors present in Scottish waters. Information sources that can be used in the assessment are listed in Table A.11.1.

There is no agreed methodology for calculating the economic value of subsea power cables. In the absence of information on economic value, the capacity of interconnector cables may be used as an indicator of both value and activity (UKMMAS, 2010).

With respect to future trends in sector activity, the power cable industry is experiencing significant growth, with several new projects currently in the installation and planning phases. While investment in these activities will be affected by the recent downturn in the economy in the short term, long-term drivers for competitive electricity markets and international energy cooperation are likely to maintain the impetus towards increasing the level of interconnector capacity (AECOM and ABPmer, 2015).

## Figure A.11.1 Power interconnectors in Scotland

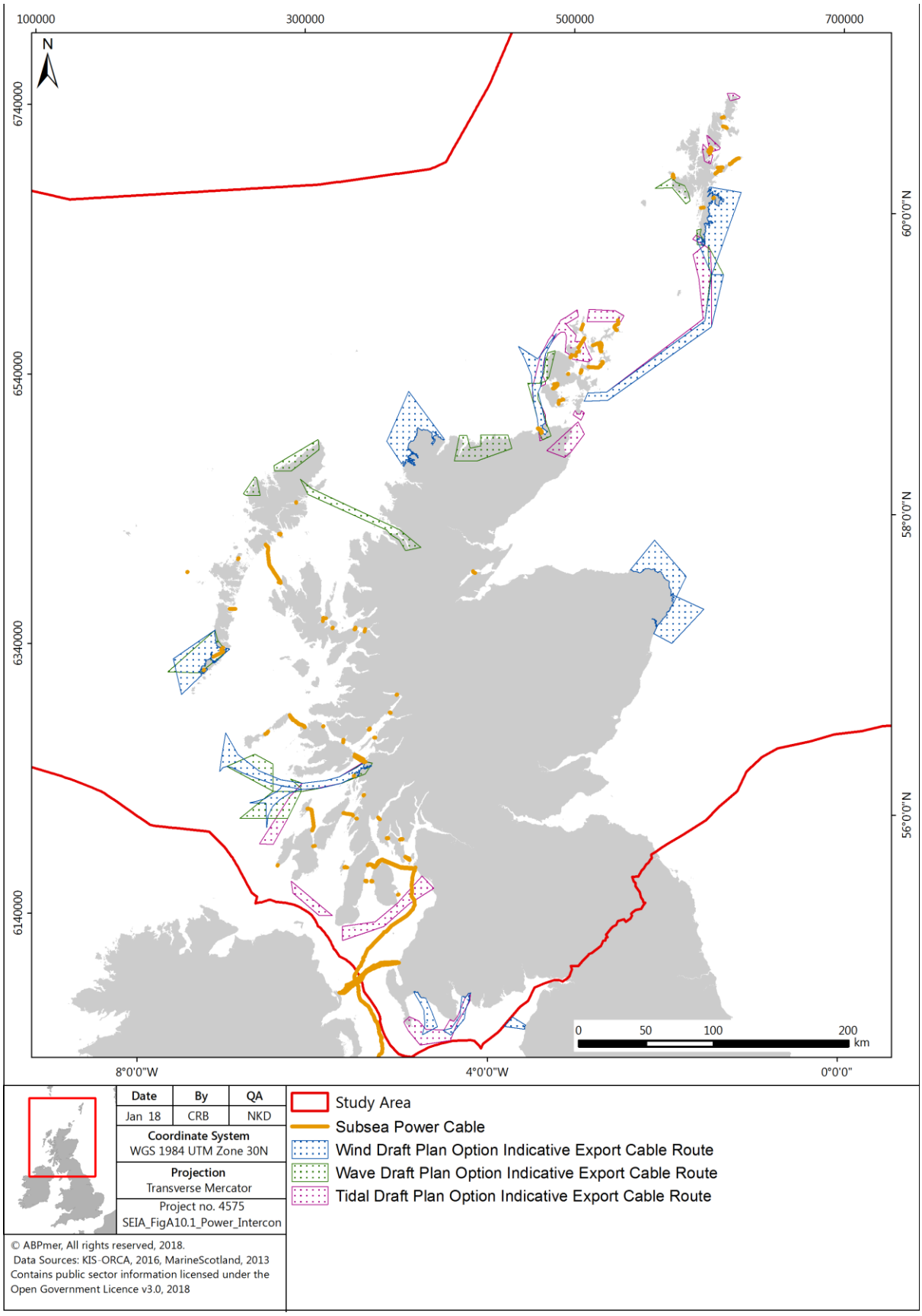


**Table A.11.1 Information sources for the power interconnectors sector**

| Data Available | Information Source |
|---|---|
| Power interconnectors and transmission lines (UK) | KIS-ORCA |
| UK Transmission network, including interconnectors | Ofgem website https://www.ofgem.gov.uk/electricity/transmission-networks/electricity-interconnectors Ofgem reports 2017; 2016 |

## A.11.3 Potential Interactions with Offshore Wind

Table A.11.2 shows potential interaction pathways between power interconnectors and offshore wind arrays and export cables. Based on the approach to scoping described in Section 2 in the main report, the table also records whether the interaction:

- Is not likely to result in a significant socio-economic impact on the sector; or
- Is likely to result in a significant socio-economic impact on the sector and hence will require a detailed assessment;

The rationale underlying this expert judgement is provided in the table. Where it is not currently possible to make a judgement regarding the likelihood of a significant socio-economic impact due to insufficient information (for example, in relation to the extent of overlap between a sector activity and the DPO Areas) the table indicates that scoping will be required to be undertaken once sufficient information becomes available. Furthermore, as described in the main report, there is currently no information regarding the likely location of export cable routes/corridors and as such, it is not possible to undertake a meaningful assessment of the potential for any sector activity/export cable interaction to give rise to significant socio-economic effects. Rather, the potential for any interaction will be identified in Regional Locational Guidance.

## Table A.11.2 Potential interaction pathways

| Potential Interaction | Technology Aspect | Potential Socio-economic Consequences | Initial Scoping Assessment |
|---|---|---|---|
| Competition for space with potential future interconnectors (DPO areas intersect proposed interconnector routes) | Arrays (operation) | Increased costs associated with new cable laying operations and cable crossings | Any potential significant impacts would only be expected to occur where DPO areas overlap/intersect with future planned or proposed power interconnector routes that are likely to be constructed after agreements to lease have been issued in relation to DPO areas.<br><br>The location of DPO areas is not currently available. However, it is considered likely that where there are current planned or proposed interconnectors routes are known, avoidance of this interaction should be possible through marine spatial planning.<br><br>**Scoping assessment to be completed once DPOs defined**. |
| | Export cables (operation) | Increased costs associated with new cable laying operations | Any potential significant impacts would only be expected to occur where export cables intersect with future planned or proposed power interconnector routes that are likely to be constructed after licence applications for array export cable routes have been submitted. |

| Potential Interaction | Technology Aspect | Potential Socio-economic Consequences | Initial Scoping Assessment |
|---|---|---|---|
| | | | Export cable routes are uncertain. Constraints inshore of DPOs will be identified in the RLG.<br><br>**No detailed assessment possible.** |
| Cable crossings with existing interconnectors | Export cables (construction) | Additional costs to construct cable crossings. | Cost of crossings will be borne by the renewables developer.<br><br>**No detailed assessment required.** |
| Increased difficulty of access at cable crossing points with existing/planned interconnectors | Export cables (operation) | Increased maintenance costs for interconnector owners; loss of revenue for asset owners; loss of revenue for dependent businesses/customers | Crossing agreements will generally make offshore energy developers liable for additional costs incurred by the existing asset owner.<br><br>**No detailed assessment required.** |

## A.11.4 Scoping Methodology

The spatial overlap between DPOs and existing/planned/potential power interconnectors to be assessed, once DPO areas are available.

## A.11.5 Assessment Methodology

If a significant interaction between DPOs and existing/planned/potential power interconnectors is identified through scoping, further consideration will be given to the potential socio-economic impacts in consultation with the relevant owner/promoter.

## A.11.6 Data Limitations

As noted above, there is no agreed methodology for calculating the economic value of subsea power cables. The capacity of subsea power interconnector cables may be used as a proxy for the economic value and intensity of activity for this sector.

# A.12. Recreational Boating

## A.12.1 Sector Definition

This sector relates to recreational activities undertaken in medium and large sailing vessels, yachts, powerboats and motorboats. Information on smaller sailing boat activity such as dinghies (usually taken out of the water after use) and other types of water sports is covered separately in Appendix A.17.

There are clear socio-economic interactions between General Tourism and Recreational Boating. Tourism is described separately in Appendix A.15 as the interactions and issues in relation to offshore wind developments are often distinctly different to those associated with recreational boating. There is some possibility of a degree of double counting using this approach but not to the extent that it materially affects the results of the study.

## A.12.2 Overview of Activity

The Scottish Marine Recreation and Tourism Survey (SMRTS) (Land Use Consultants (LUC), 2016) collated information on recreation and tourism activities undertaken at sea or around the Scottish coast. Table A.12.1 shows the total number of survey respondents (out of a total of 2170 individuals and representatives of clubs or similar organisations that completed the survey) who participated in recreational boating activity in 2015, key areas of concentrated activity and an estimate of the total expenditure of each activity[17].

The SMRTS estimated that the annual expenditure on marine recreation and tourism activities in Scotland (including but not limited to the activities listed in Table A.12.1) was worth £3.7 billion to the Scottish economy (although acknowledge this is likely to be an overestimate). Around £2.4 billion of this is associated with general marine recreation and tourism (see Tourism, Appendix A.15) and around £1.3 billion is associated with more specialist activities including wildlife watching (see Tourism) sailing, kayaking, surfing and angling (see also Water sports, Appendix A.17).

In a separate study, it was estimated that sailing tourism in Scotland contributed £67.7 million GVA in 2016 and supported 2,740 FTE jobs (EKOS, 2016). With respect to future trends, the study estimated that with development of the market (e.g. increased berths and facilities), the net additional increase in GVA of this sector could increase by between £9.7 to £11.9 million on the 2016 value, with associated increases in employment of between 394 to 480 FTEs. Scotland's Marine Tourism Strategy 'Awakening the Giant' sets a target to develop and lead the growth of sailing tourism in Scotland from £101 million visitor expenditure in 2015 to £145 million by 2020 (Marine Tourism Development Group (MTDG), 2015).

[17] Based on coastal visits x median trip spend x mean trip length (days) (LUC, 2016)

**Table A.12.1 Participation in marine water sports activities around Scotland in 2015**

| Activity | Number of Respondents Taking Part | Key Areas of Concentrated Activity | Activity Specific Estimate of Trip Based Spending (£) |
|---|---|---|---|
| Sailing cruising including dinghy cruising at sea | 578* | West coast from the Firth of Clyde, through Argyll towards Skye and Torridon. Also showed use of the Crinan, Caledonian and, to a lesser extent, the Forth and Clyde Canals | 51,608,579 |
| Powerboating at sea | 231 | Greatest concentration of activity is within the Firth of Clyde, particularly in the area around Cumbrae, Bute and north of Arran. | 25,731,907 |
| Motor cruising at sea | 180 | Within the Firth of Clyde and around the coast of Argyll, particularly close to Oban and Mull | 11,894,590 |
| Yacht racing at sea | 156 | Particular concentrations of activity around Mull and in the Firth of Clyde around Cumbrae and Bute | 7,799,017 |
| * This activity will also include vessels which are covered under marine water sports in Appendix A.17. | | | |

Source: LUC, 2016

Figure A.12.1 shows an overview of recreational boating activity in Scotland, with respect to the location of RYA clubs and training centres, marinas, general boating areas and indicative offshore routes. The figure also shows AIS intensity (a 'heatmap' of activity), although it should be noted not all recreational vessels have AIS and hence this data is likely to substantially underrepresent the activity of recreational vessels. Information sources that can be used in the assessment are listed in Table A.12.2.

## Figure A.12.1 Recreational boating activity in Scotland

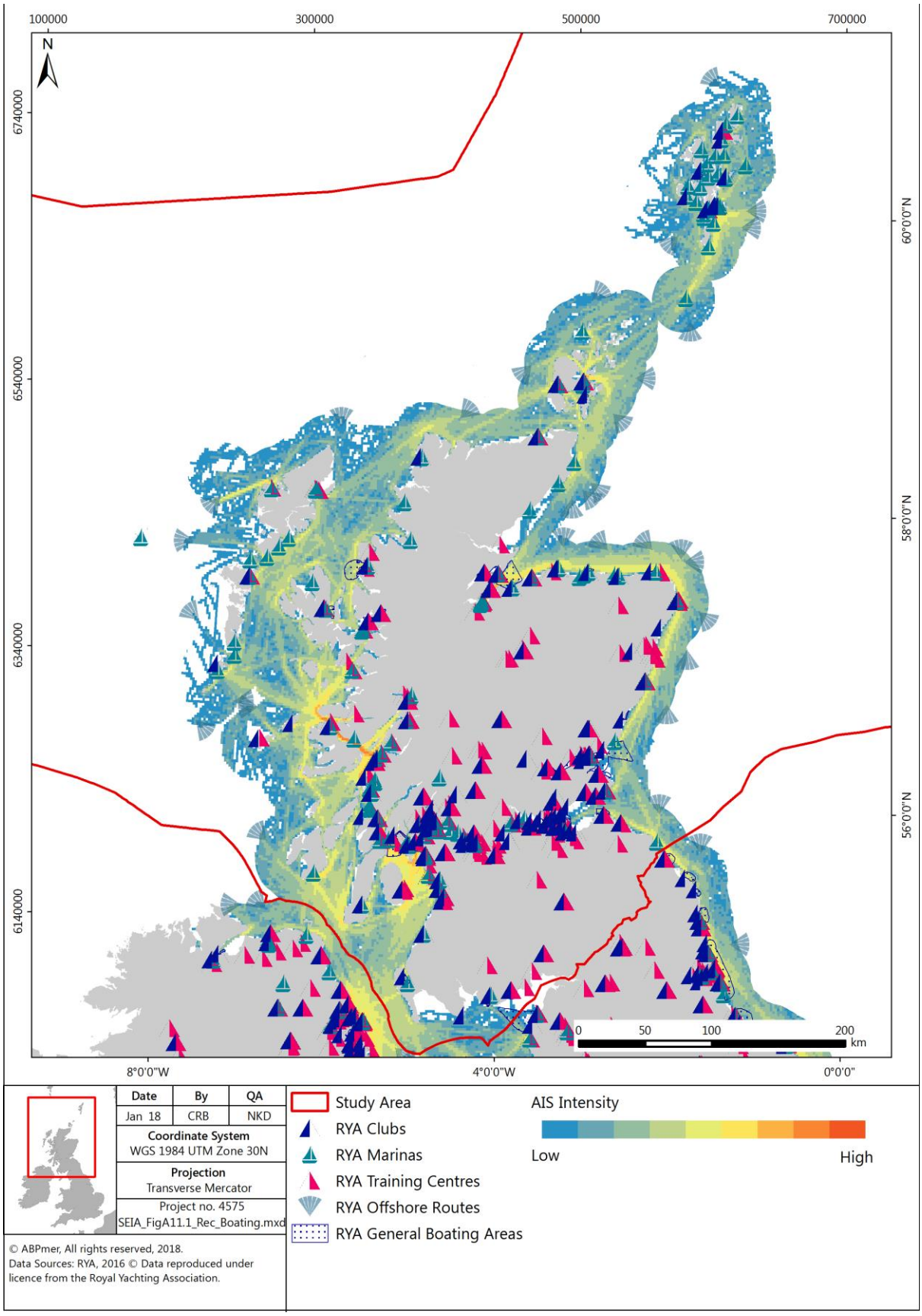


**Table A.12.2 Information sources for the recreational boating sector**

| Data Available | Information Source |
|---|---|
| Activity 'heat map' (AIS intensity), general boating areas, offshore routes, RYA clubs and training centres, marinas (UK/Scotland) | UK Coastal Atlas of Recreational Boating, 2016 http://www.rya.org.uk/knowledge-advice/planning-environment/Pages/uk-coastal-atlas-of-recreational-boating.aspx |
| Watersports participation survey (UK) | Arkenford, 2016 (2016 data) http://www.rya.org.uk/SiteCollectionDocuments/sportsdevelopment/Watersports_Survey_2016%20-%20Summary.pdf |
| Scottish marine recreation and tourism (Scotland) | Scottish marine recreation and tourism survey 2015 http://www.gov.scot/Topics/marine/seamanagement/national/RecandTourism |
| Recreational boating statistics 2016 (UK) | ICOMIA recreational boating statistics 2016 https://www.britishmarine.co.uk/Resources/Publications/2017/November/ICOMIA-Recreational-Boating-Industry-Statistics-2016 (British Marine membership required for access) |
| Economic value of sailing tourism in Scotland | EKOS, 2016 |
| Strategy for future development of sailing tourism and marine tourism in Scotland | MTDG, 2015. |

## A.12.3 Potential Interactions with Offshore Wind

Table A.12.3 shows potential interaction pathways between recreational boating and offshore wind arrays and export cables. Based on the approach to scoping described in Section 2 in the main report, the table also records whether the interaction:

- Is not likely to result in a significant socio-economic impact on the sector; or
- Is likely to result in a significant socio-economic impact on the sector and hence will require a detailed assessment.

The rationale underlying this expert judgement is provided in the table. Where it is not currently possible to make a judgement regarding the likelihood of a significant socio-economic impact due to insufficient information (for example, in relation to the extent of overlap between a sector activity and the DPO Areas) the table indicates that scoping will be required to be undertaken once sufficient information becomes available. Furthermore, as described in the main report, there is currently no information regarding the likely location of export cable routes/corridors and as such, it is not possible to undertake a meaningful assessment of the potential for any sector activity/export cable interaction to give rise to significant socio-economic effects. Rather, the potential for any interaction will be identified in Regional Locational Guidance.

**Table A.12.3 Potential interaction pathways**

| Potential Interaction | Technology Aspect and Phase | Potential Socio-economic Consequences | Initial Impact Assessment |
|---|---|---|---|
| Alterations to informal cruising routes | Arrays (construction and operation) | Increased fuel costs for motorised vessels; possible relocation of vessels leading to loss of revenues for supply chain | Any potential significant impacts would only be expected where DPO areas overlap with areas of medium to high intensity recreational boating use, sailing or racing areas.<br><br>The location of the DPO areas is not currently available. However, given that recreational boating occurs extensively around the coast of Scotland, and the relatively high intensity of this activity in some areas, it has been assumed that avoidance of significant impacts may not be achieved through spatial planning alone. The impact of the interaction between offshore arrays and areas of medium to high intensity boating activity will need to be assessed once the location of the DPO areas is available.<br><br>See Section A.12.5.1 for proposed assessment methodology.<br><br>**Scoping assessment to be completed once DPOs defined**. |

| Potential Interaction | Technology Aspect and Phase | Potential Socio-economic Consequences | Initial Impact Assessment |
|---|---|---|---|
| Deterrent to investment in marinas/supply chain | Arrays – construction and operation | Reduced investment in marina development, for example, where altered cruising routes affect the use of a marina or where the location of arrays may be perceived as increasing difficulty of access to marinas/anchorages and hence its usage. | Any potential significant impacts are likely to relate to the proximity of the array to existing marinas.<br><br>The location of DPO areas is not currently available. However, as the DPO areas are likely to be located offshore, it is not considered likely that the arrays will have a significant impact on marine investment.<br><br>**Scoping assessment to be completed once DPOs defined**. |
| Increase marine risk | Arrays (radar interference during operation) and export cables (increased vessel traffic during construction only) | Increased collision risk | Any potential significant impacts would only be expected where DPO areas or export cable corridors overlap with areas of medium to high intensity recreational boating use.<br><br>The location of DPO areas and export cable routes are currently not known.<br><br>**Scoping assessment to be completed once DPOs defined.** |

## A.12.4 Scoping Methodology

### A.12.4.1 Impacts to sailing/cruising routes

To determine where detailed assessments of the interaction may be required when DPO area locations are available, the following scoping criteria are proposed:

- Where DPO areas overlap with areas of medium to high intensity recreational boating activity (based on RYA AIS data and previously described cruising routes), a detailed assessment should be undertaken;
- However, if the spatial extent of indicative arrays is predicted to occupy less than 5% of the DPO area, it has been assumed that spatial planning within the DPO area can be used to avoid significant impacts and no detailed assessment should be required;
- Where spatial overlap between DPO areas and sailing or racing areas occurs, a detailed assessment should be undertaken;
- However, if the overlap is less than 10% of the combined area of the DPO areas and sailing/racing area, it has been assumed that spatial planning of the DPO areas can be used to avoid significant impacts and no detailed assessment should be required.

## A.12.5 Assessment Methodology

### A.12.5.1 Impacts to sailing/cruising routes

In assessing areas of overlap between DPO areas and areas of medium to high intensity recreational boating activity it is suggested that boating activity is assessed using a combination of AIS data (preferably incorporating the latest available AIS data layers for 2015) and medium to heavy use ‘cruising routes’ previously described by the RYA. This will enable the identification of areas of medium to high intensity activity, particularly at a regional level, with a higher level of confidence compared to using AIS data alone (see data limitations relating to the AIS data).

Where scoping indicates that a detailed impact assessment is required, the potential economic cost of recreational boats having to deviate around offshore arrays can be estimated based on the:

- Number of recreational transits across the area (e.g. from the AIS data), extrapolated to calculate annual recreational transits;
- Estimated extra distance for recreational vessel to deviate around an array; and
- Average fuel costs per nautical mile for recreational vessels.

It can be noted that this will likely overestimate of the cost impact on this sector as it assumes that all vessels deviating around an array are in transit under engine whereas some will be under sail.

## A.12.6 Data Limitations

The recreational boating 'heatmaps' (shown in Figure A.12.1) are based on AIS data. However, the proportion of recreational vessels which have AIS is relatively low. Furthermore, AIS data is monitored from terrestrial receiver stations. Reception range is therefore limited to line of sight and dependant on the power of the transmitting vessel (larger vessels with transmitters mounted higher up are more likely to be received than smaller vessels). Therefore, AIS coverage is more defined closer to shore, and underestimate vessel activity outside of the reception range (i.e. further offshore). AIS reception in Scotland may be poor due to the steep terrain.

# A.13. Commercial Shipping

## A.13.1 Sector Definition

This sector relates to the transport of freight and passengers both within Scottish waters and internationally. Shipping routes can be split into two distinct types; transiting vessels passing through Scottish Waters and vessels with either their origin or destination port within Scotland. This section also considered anchorages.

## A.13.2 Overview of Activity

AIS density grid data (Figure A.13.1) indicates that, in general, vessels move up the west coast of Scotland through the North Channel (or Straits of Moyle), the Minches, and east-west between the northern coast of the mainland and Orkney, from where vessels access the North Sea. Some of the areas showing the highest intensity of vessel movement include ferry routes (e.g. between Northern Ireland and Loch Ryan, between the outer Hebrides and the mainland via the Sound of Mull and between the Shetland Islands, Orkney and the Scottish mainland) and around the Clyde. There is also an area of particularly high intensity of vessel movements around Fraserburgh, Peterhead and Aberdeen, related to the offshore oil and gas sector. To minimise collision risk, some heavily used areas have Traffic Separation Schemes (TSS) which divides opposing traffic into lanes (see Figure A.13.1). Anchorages are located all around the Scottish coastline in inshore waters (Figure A.13.2) but are located in highest densities along the west coast, Orkney, the Moray Firth and the Firth of Forth.

In 2013, shipping contributed an estimated £200 million GVA (17% of the UK total) and it was estimated 11,200 of the UK nationals employed in the shipping industry (31% of the UK total) were based in Scotland (Oxford Economics, 2015).

With regard to future trends, shipping volumes bear a direct relationship to the global economic market. As markets react to the changing financial situation, shipping lines respond with services to move goods and people. The most notable variable to affect the volume and intensity of shipping into the future will be the technology and innovations used to design future shipping. Ship design seeks for bigger, faster and more economic transhipment of goods and people (ABPmer and RPA, 2013).

Figure A.13.1 shows an overview of commercial shipping activity in Scotland. Information sources that can be used in the assessment are listed in Table A.13.1.

## Figure A.13.1 Commercial shipping activity in Scotland

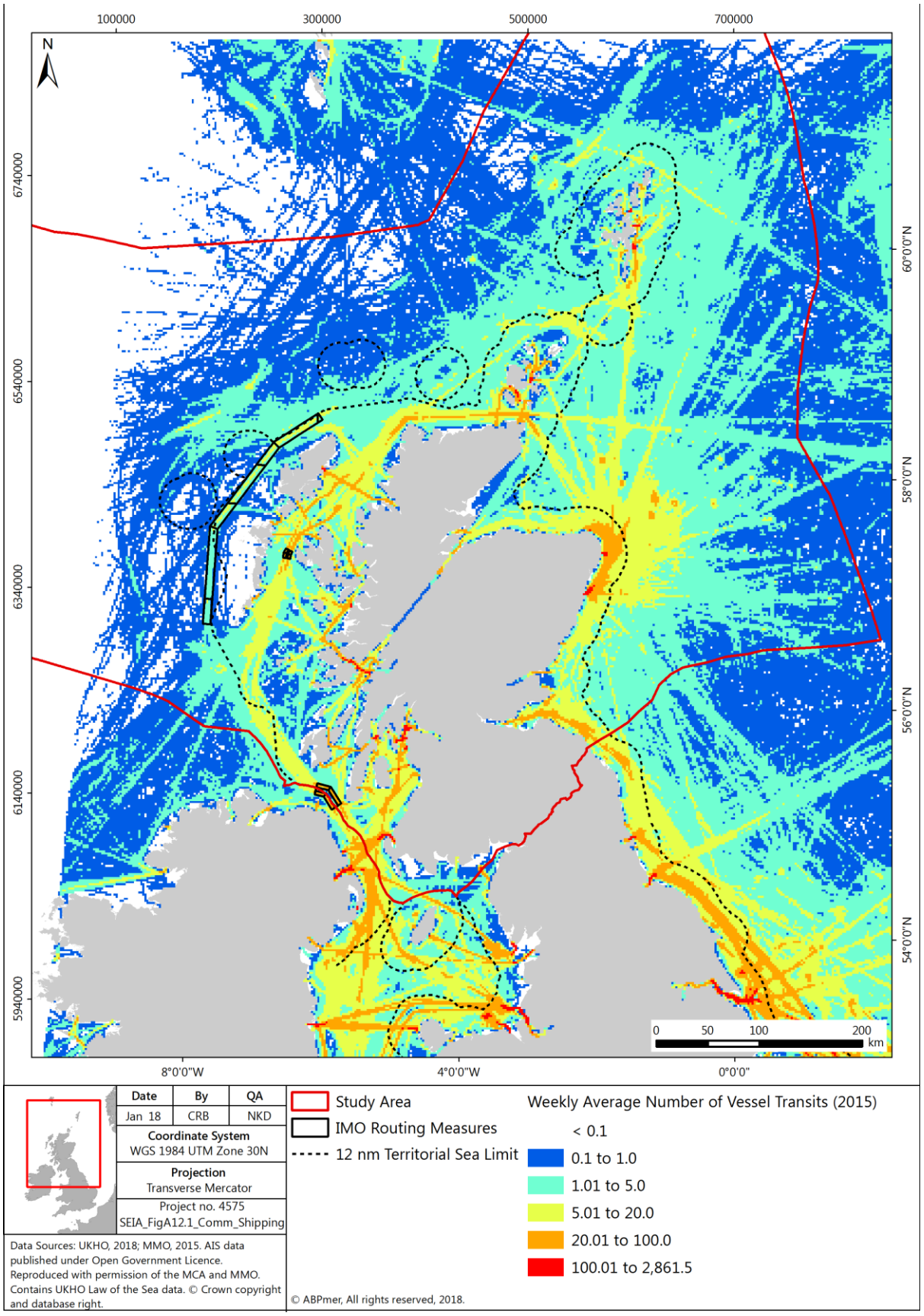


Figure A.13.2 Anchorages

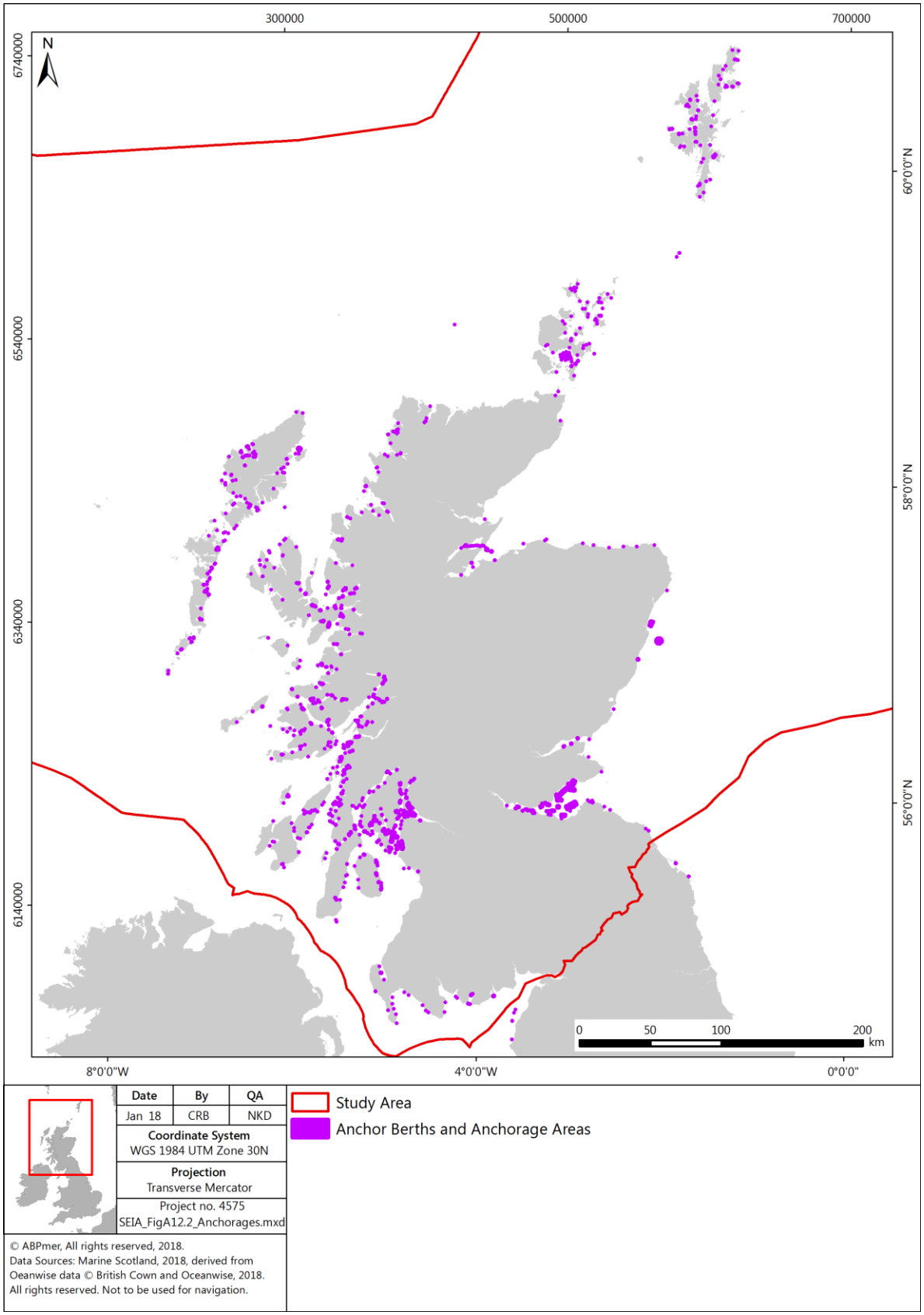


**Table A.13.1 Information sources for the commercial shipping sector**

| Data Available | Information Source |
|---|---|
| UK port and shipping statistics (UK) | Department for Transport |
| AIS data | Maritime and Coastguard Agency (MCA) released under open Government licence by the Marine Management Organisation |
| Admiralty charted formal anchorages | Admiralty charts |
| Economic value of shipping (UK/Scotland) | Oxford Economics, 2015 |

## A.13.3 Potential Interactions with Offshore Wind

Table A.13.2 shows potential interaction pathways between commercial shipping and offshore wind arrays and export cables. Based on the approach to scoping described in Section 2 in the main report, the table also records whether the interaction:

- Is not likely to result in a significant socio-economic impact on the sector; or
- Is likely to result in a significant socio-economic impact on the sector and hence will require a detailed assessment;

The rationale underlying this expert judgement is provided in the table. Where it is not currently possible to make a judgement regarding the likelihood of a significant socio-economic impact due to insufficient information (for example, in relation to the extent of overlap between a sector activity and the DPO Areas) the table indicates that scoping will be required to be undertaken once sufficient information becomes available. Furthermore, as described in the main report, there is currently no information regarding the likely location of export cable routes/corridors and as such, it is not possible to undertake a meaningful assessment of the potential for any sector activity/export cable interaction to give rise to significant socio-economic effects. Rather, the potential for any interaction will be identified in Regional Locational Guidance.

**Table A.13.2 Potential interaction pathways**

| Potential Interaction | Technology Aspect and Phase | Potential Socio-economic Consequences | Initial Scoping Assessment |
|---|---|---|---|
| Obstruction of transiting vessel and/or ferry routes; increased steaming distances and time. | Arrays (construction and operation) | Increased costs, effect on regular route (ferry) competitiveness, potential for increased insurance costs. | Any significant impacts would be expected where DPO areas overlap with commercial shipping or ferry routes.<br><br>The location of the DPO areas is not currently available, however, given the high intensity of vessel transit routes in some areas, and the critical importance of ferry routes, it has been assumed that avoidance of significant impacts may not be achieved through spatial planning alone and that the impact of this interaction will need to be assessed once the location of the DPO areas is available.<br><br>**See Section A.13.5.1 for proposed assessment methodology.** |

| Potential Interaction | Technology Aspect and Phase | Potential Socio-economic Consequences | Initial Scoping Assessment |
|---|---|---|---|
| | Export cables (construction only) | Increased costs | Any significant impacts would be expected where export cable corridors intersect commercial shipping or ferry routes.<br><br>Export cable routes are uncertain. Constraints inshore of DPOs will be identified in the RLG. However, it can be noted that any potential impact will only occur during the construction phase (export cable laying) and hence will be temporary.<br><br>**No detailed assessment possible.** |
| Displacement of formal (commercial) anchorage areas | Arrays (construction and operation) | Increased costs through increased steaming distance from the port to the relocated anchorage, plus the associated cost with lifting and laying ship mooring buoys (should these be part of the displaced anchorage). | Any significant impacts would be expected where DPO areas overlap with formal (commercial) anchorages.<br><br>The location of DPO areas is not currently available. However, as the DPO areas will be located offshore, it is not considered likely that significant overlaps between anchorages and DPO areas will occur. Where any overlap does occur, it is considered that there is scope to avoid any significant impact through marine spatial planning.<br><br>**No detailed assessment required.** |

| Potential Interaction | Technology Aspect and Phase | Potential Socio-economic Consequences | Initial Scoping Assessment |
|---|---|---|---|
| | Export cables (construction and operation) | Increased costs through increased steaming distance from the port to the relocated anchorage, plus the associated cost with lifting and laying ship mooring buoys (should these be part of the displaced anchorage). | Any significant impacts would be expected where export cables corridors intersect with formal (commercial) anchorages.<br><br>Export cable routes are uncertain. Constraints inshore of DPOs will be identified in the RLG.<br><br>**No detailed assessment possible.** |
| Increased marine risk | Arrays (construction and operation) | Increased marine risk (e.g. risk of collision between vessels or vessels and infrastructure) relating to radar interference from offshore wind installations, with implications for costs to sector | Radar mitigation will be required as a condition of consent if there is a potentially significant effect. This cost will be borne by the developer.<br><br>**No detailed assessment required.** |
| | Export cables (construction) | Temporary increased marine risk (e.g. risk of collision between vessels) along cable corridors whilst cabling is being laid, with implications for costs to sector | Developers are responsible for ensuring appropriate Navigational Risk Assessments are provided for their marine works.<br><br>**No detailed assessment required.** |

## A.13.4 Scoping Methodology

### A.13.4.1 Impacts to shipping/ferry routes

To determine where detailed assessments of the interaction may be required when DPO area locations are available, the following scoping criteria are proposed:

- Where DPO areas are transected by commercial navigation route(s) or ferry routes, the density of traffic should be assessed. If the average density of traffic is 5 or more vessel movements per day, a detailed assessment should be undertaken;
- If the DPO area is transacted by an IMO recognised “ship routeing system”, a detailed assessment should be undertaken;
- However, if the spatial extent of indicative arrays is predicted to occupy less than 5% of the DPO area it has been assumed that spatial planning within the DPO area can be used to avoid significant impacts and no detailed assessment should be required.

## A.13.5 Assessment Methodology

### A.13.5.1 Impacts to shipping/ferry routes

Where scoping indicates that a detailed impact assessment is required, the cost of displacement of commercial shipping/ferry routes can be assessed based on the number of vessels potentially displaced (based on AIS data), the estimated potential extra steaming distance and time and average fuel and labour costs for commercial vessels.

## A.13.6 Data Limitations

AIS A transmission is mandatory for commercial vessels above 300 GT and all passenger ships regardless of size. As a result, some vessel classifications are underrepresented in the AIS data, including: commercial vessels below 300 GT; recreational vessels (see Appendix A.12), fishing vessels (See Appendix A.7) and naval vessels on deployment (see Appendix A.8). AIS B is optional and may be carried by smaller vessels including recreational, fishing and smaller commercial craft.

AIS data collected by the Maritime and Coastguard Agency is monitored from terrestrial receiver stations. Reception range is therefore limited to line of sight and dependent on the power of the transmitting vessel (hence, larger vessels with transmitters mounted higher up are more likely to be received than smaller vessels). Therefore, AIS coverage is more defined closer to shore, and underestimated for vessel activity outside of the reception range (i.e. further offshore).

# A.14. Telecommunication Cables

## A.14.1 Sector Definition

This sector relates to fibre optic submarine telecommunication cables, which carry telephone calls, internet connections and data as part of national and international data transfer networks utilised for the majority of international communication transmissions. The telecoms and communications activity of relevance to this report is the laying, operation and maintenance of submarine telecommunication cables and their associated facilities such as sub-stations.

## A.14.2 Overview of Activity

A total of 92 individual telecommunications cables are present in Scottish waters, 88 of which are active and 4 of which are no longer operating and classed as disused (Marine Scotland, NMPi). Figure A.14.1 shows the telecoms cables which pass through Scottish waters, which include international cable links and domestic inter-island cables. Information sources that can be used in the assessment are listed in Table A.14.1.

The overall UK telecoms and communications sector has recently been estimated to contribute approximately £45 billion to the economy and employ approximately 250,000 people across 8,000 companies (MMO, 2016). A further preliminary estimate of the economic value of the UK telecommunications subsea cables industry to the digital economy values it at £62.8 billion per annum (Elliott *et al*., 2016). Defining the employment of the telecommunication sector within the marine environment alone is difficult given that that much of the sector is related to onshore activity (MMO, 2016a). However, the only known estimate that has been published estimates that about 26,750 jobs in the UK telecommunications sector are marine-related (Pugh, 2008).

With regard to future trends, increasing use of the internet and in e-commerce has led both to an increasing demand for communication cables and for faster services which has meant that the capacity of cables has also grown (AECOM and ABPmer, 2013). According to the UK Cable Protection Committee (UKCPC, now Subsea Cables UK) around 95% of international trans-ocean traffic is carried by cable, hence, submarine cables will be vital for the foreseeable future (Baxter *et al*, 2011). However, there is little information available on how this sector may change in the future.

## Figure A.14.1 Subsea telecommunication cables in Scotland

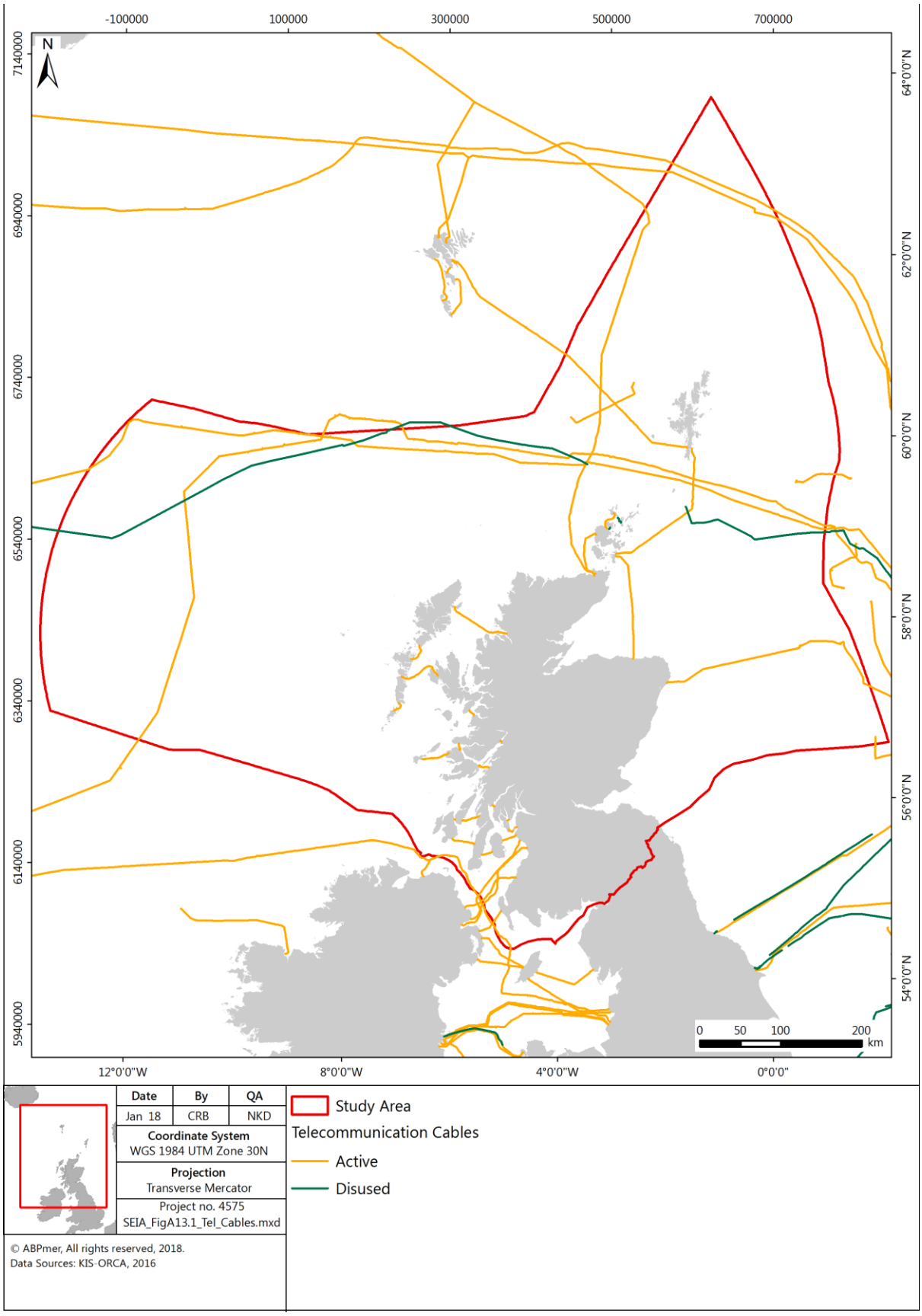


**Table A.14.1 Information sources for the subsea telecommunication sector**

| Data Available | Information Source |
|---|---|
| An economic and social evaluation of the UK Subsea Cables Industry | Elliott *et al*., 2016 |
| Information on subsea telecommunication cables in Europe | European Subsea Cables Association website http://www.escaeu.org/ |
| Telecom cables laid on seabed or buried underwater | KIS-ORCA http://www.kis-orca.eu/ |

## A.14.3 Potential Interactions with Offshore Wind

Table A.14.2 shows potential interaction pathways between subsea telecommunication cables and offshore wind arrays and export cables. Based on the approach to scoping described in Section 2 in the main report, the table also records whether the interaction:

- Is not likely to result in a significant socio-economic impact on the sector; or
- Is likely to result in a significant socio-economic impact on the sector and hence will require a detailed assessment;

The rationale underlying this expert judgement is provided in the table. Where it is not currently possible to make a judgement regarding the likelihood of a significant socio-economic impact due to insufficient information (for example, in relation to the extent of overlap between a sector activity and the DPO Areas) the table indicates that scoping will be required to be undertaken once sufficient information becomes available. Furthermore, as described in the main report, there is currently no information regarding the likely location of export cable routes/corridors and as such, it is not possible to undertake a meaningful assessment of the potential for any sector activity/export cable interaction to give rise to significant socio-economic effects. Rather, the potential for any interaction will be identified in Regional Locational Guidance.

## Table A.14.2 Potential interaction pathways

| Potential Interaction | Technology Aspect and Phase | Potential Socio-economic Consequences | Initial Scoping Assessment |
|---|---|---|---|
| Competition for space with potential future telecom cables (DPO areas intersect proposed subsea telecommunication routes) | Arrays (operation) | Increased costs associated with new cable laying operations and cable crossings | Any potential significant impacts would only be expected to occur where DPO areas overlap/intersect with future planned or proposed power interconnector routes that are likely to be constructed after agreements to lease have been issued in relation to DPO areas.<br><br>The location of DPO areas is not currently available. However, it is considered likely that where there are current planned or proposed interconnectors routes are known, avoidance of this interaction should be possible through marine spatial planning.<br><br>**Scoping assessment to be completed once DPOs defined**. |
| | Export cables (operation) | Increased costs associated with new cable laying operations | Any potential significant impacts would only be expected to occur where export cables intersect with future planned or proposed power interconnector routes that are likely to be constructed after licence applications for array export cable routes have been submitted. |

| Potential Interaction | Technology Aspect and Phase | Potential Socio-economic Consequences | Initial Scoping Assessment |
|---|---|---|---|
| | | | Export cable routes are uncertain. Constraints inshore of DPOs will be identified in the RLG.<br><br>**No detailed assessment possible.** |
| Cable crossings with existing interconnectors | Export cables (construction) | Additional costs to construct cable crossings. | Cost of crossings will be borne by the renewables developer.<br><br>**No detailed assessment required.** |
| Increased difficulty of access at cable crossing points with existing/planned telecom cables | Export cables (operation) | Increased maintenance costs for telecom cable owners/operators; loss of revenue for asset owners; loss of revenue for dependent businesses/customers | Crossing agreements will generally make offshore energy developers liable for additional costs incurred by the existing asset owner.<br><br>**No detailed assessment required.** |

## A.14.4 Scoping Methodology

The spatial overlap between DPOs and existing/planned telecom cables to be assessed, once DPO areas are available.

## A.14.5 Assessment Methodology

If a significant interaction between DPOs and existing/planned telecom cables is identified through scoping, further consideration will be given to the potential socio-economic impacts in consultation with the relevant telecom cable owner/promoter.

## A.14.6 Data Limitations

As noted above, there is little information available on how this sector may change in the future.

# A.15. Tourism

## A.15.1 Sector Definition

This sector relates to tourism which has been defined by Visit Scotland as 'a stay of one or more nights away from home for holidays, visits to friends or relatives, business/conference trips or any other purposes excluding activities such as boarding education or semi-permanent employment'. In this assessment, day trips have also been included. Marine and coastal tourism can be defined as any recreational activity that makes use of the marine environment and intertidal coastal zones (Benfield and McConnell, 2007). This can include a range of activities such as walking along the sea-front to sea-side based horse riding. Both non-motorised (walking/picnicking) and motorised (boat-based tourism e.g. wildlife viewing) activities are also considered here. Benefits derived from the wild landscape may also be considered under tourism, indeed McMorran *et al* (2006) state that the most appropriate valuations of the natural landscape come from tourist expenditure.

Other marine recreational activities, undertaken in or on the sea such as recreational boating and marine water sport activities (e.g. surfing, SCUBA diving, sea angling etc.) are covered separately in Appendices A.12 and A.17 respectively, as the interactions and issues in relation to offshore wind developments are often distinctly different.

## A.15.2 Overview of Activity

In 2016, 14.45 million tourism trips[18] were undertaken in Scotland (Visit Scotland, 2017a). In 2015, full time equivalent employment in the Scottish sustainable tourism[19] sector was 217,200 and in 2014 the GVA of the sustainable tourism sector was £3,675 million (Visit Scotland, 2017b). It is not possible to disaggregate this data to establish the number of tourism trips and the economic value which can be attributed to coastal and marine tourism. However, the Scottish Marine Recreation and Tourism Survey (SMRTS) (Land Use Consultants (LUC), 2016) collated information on recreation and tourism activities undertaken at sea or around the Scottish coast in 2015, including 'general marine and coastal tourism'[20], 'general marine and coastal recreation'[21] and 'walking at the coast (over 2 miles)'[22].

[18] A tourist trip is defined as a stay of one or more nights away from home for holidays, visits to friends or relatives, business and conference trips or any other purpose except such as boarding education or semi-permanent employment.
[19] The definition of sustainable tourism represents the SIC07 industry classifications for tourism used within the Scottish Government's growth sector (Visit Scotland, 2016)
[20] Defined as: general marine and coastal tourism activities such as scenic drives or bus tours (LUC, 2016)
[21] Defined as: General marine and coastal recreation includes beach games, beach combing, rock pooling, painting, kite flying, sunbathing, naturism, picnicking, yoga, paddling, walking less than 2 miles, general sightseeing, fossil hunting, beach team sports, body boarding, general swimming and snorkelling, coastal cycling, horse riding and dog walking (LUC, 2016)
[22] Shorter walks are included in the 'General marine and coastal recreation' category.

Table A.15.1 shows the total number of survey respondents (out of a total of 2170 individuals and representatives of clubs or similar organisations that completed the survey) who participated in these activities in 2015, the key areas of concentrated activity and an estimate of the total expenditure from each activity.

**Table A.15.1 Participation in marine water sports activities around Scotland in 2015**

| Activity | Number of Respondents Taking Part | Key Areas of Concentrated Activity | Activity Specific Estimate of Trip Based Spending (£) |
|---|---|---|---|
| General marine and coastal recreation | 1743 | Concentrations of activity along the east coast, particularly the Firth of Forth and Fife coastline and close to Aberdeen. Other concentrations include the Inner Firth of Clyde and the Ayrshire coastline and specific locations throughout Argyll and the Highlands, including Oban, Tobermory, Ullapool and Iona. | 2,143,428,206 |
| Walking at the coast (over 2 miles) | 1461 | Concentrations of activity visible along the Lothian and Fife coastlines, around Aberdeen and along the coast of the Moray Firth. Activity on the west coast is more fragments, reflecting the character of the coastline, though concentrations can be seen in Ayrshire (including Cumbrae and Arran), around Oban, Iona, Arisaig and the far north west around Sandwood Bay. | 566,868,272 |
| General marine and coastal tourism | 840 | This activity occurred along much of the mainland coastline with concentrations within the Firth of Clyde, Argyll, Loch Linne and the Great Glen, Moray Firth, Firth of Forth and east coast | 133,471,792 |
| * This activity will also include vessels which are covered under marine water sports in Appendix A.17. | | | |

Source: LUC, 2016

The SMRTS estimated that the annual expenditure on marine recreation and tourism activities in Scotland (including but not limited to the activities listed in Table A.15.1) was worth £3.7 billion to the Scottish economy (although acknowledged this is likely to be an overestimate). Around £2.4 billion of this is associated with general marine recreation and tourism while around £1.3 billion is associated with more specialist activities including wildlife watching (categorised as tourism for this assessment), sailing, kayaking, surfing and angling (covered under Water sports in Appendix A.17).

In 2010, the net economic impact of marine wildlife tourism in Scotland was estimated to be £15 million, with 633 additional FTE jobs and the economic impact of coastal wildlife tourism was estimated to be £24 million with 995 additional FTE jobs (International Centre for Tourism and Hospitality Research and Bournemouth University, 2010). Visit Scotland (2017c) reported that 494,000 domestic visits to Scotland included bird or wildlife watching, generating a total of £54 million in expenditure (year not stated, but data source cited from 2015). No information was available regarding the proportion of visits or expenditure that related specifically to coastal or marine wildlife watching trips.

With regard to future trends, Deloitte and Oxford Economics (2010) presented forecasts for the future contribution of the Visitor Economy to the UK and constituent nations. The study highlighted that the forecasts for each nation are driven by the UK level trends, however, the impact of these trends will differ depending on the nation. For Scotland, the study forecast that the Visitor Economy will contribute £8.5 billion in value added in 2020, equating to 5.1% of total Scottish GDP (up from 4.9% in 2009). It is projected that in 2020 the Visitor Economy will directly support 157,000 jobs, representing 5.7% of Scottish total employment (AECOM and ABPmer, 2015).

Figure A.15.1 shows the concentration of general marine and coastal tourism around the Scottish coast (representing activities such as scenic drives or bus tours). Information sources that can be used in the assessment are listed in Table A.15.2.

**Figure A.15.1 General Marine and Coastal Tourism activity in Scotland**

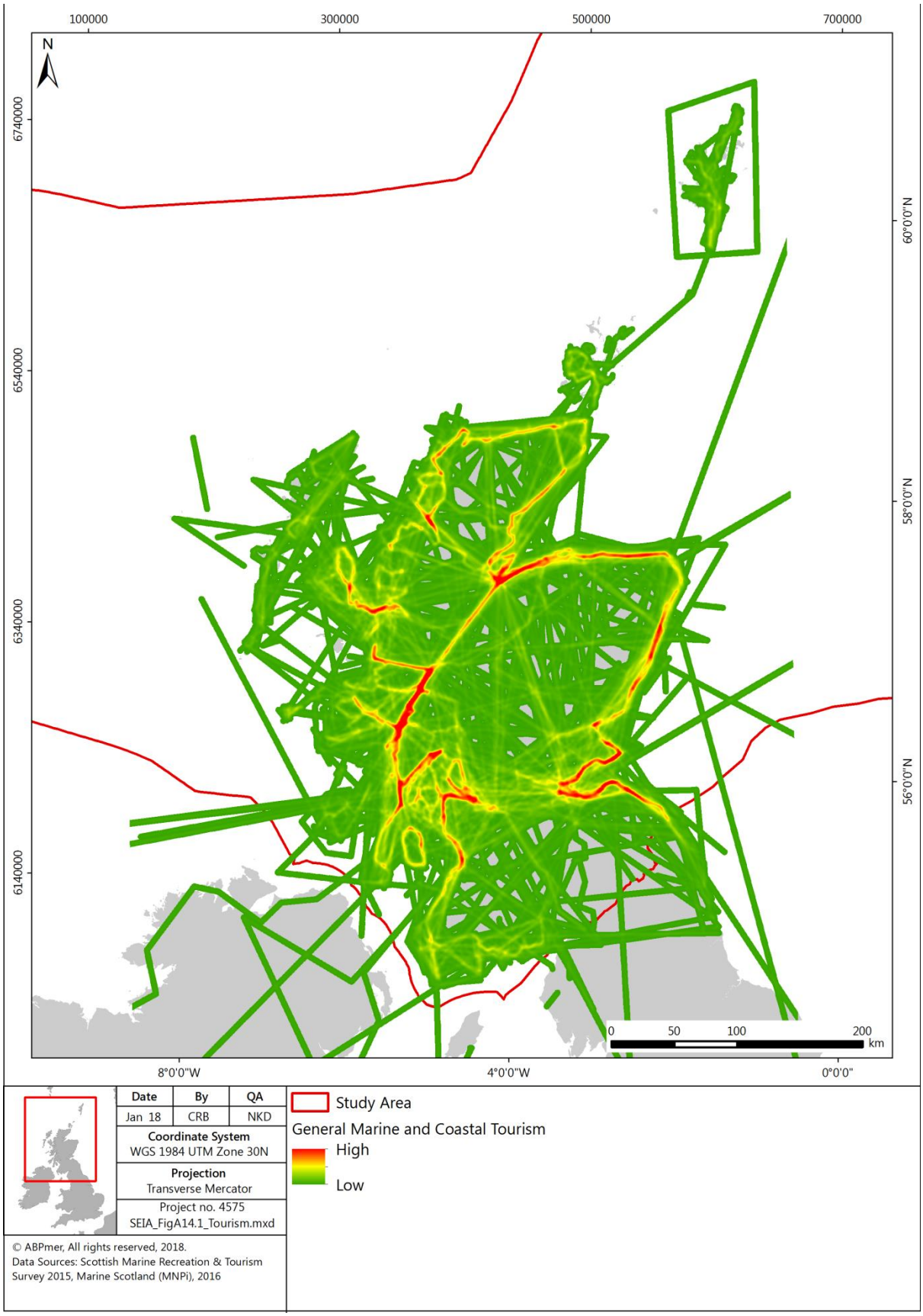


**Table A.15.2 Information sources for the tourism sector**

| Data Available | Information Source |
|---|---|
| Economic impact of wind farms | Riddington *et al*. 2008 |
| Tourism statistics (Scotland) | Visit Scotland research and statistics website: http://www.visitscotland.org/research_and_statistics/tourismstatistics/latest_statistics.aspx |
| Visitor volume and value (Scotland) | Visit Scotland, 2017 http://www.visitscotland.org/pdf/2016_Stats_Summary_v2.pdf |
| Tourism employment (Scotland) | Visit Scotland, 2016 http://www.visitscotland.org/pdf/InsightTopicPaperTourismEmployment2015.pdf |
| Scottish marine recreation and tourism (Scotland) | Scottish marine recreation and tourism survey 2015 http://www.gov.scot/Topics/marine/seamanagement/national/RecandTourism |
| Tourism Development Framework | Visit Scotland, 2013 http://www.visitscotland.org/what_we_do/tourism_development_plan.aspx |
| Tourism Scotland 2020 - Tourism industry strategy | Highlands and Islands Enterprise, 2012 http://timeline.hie.co.uk/media/1351/tourism_scotland_2020.pdf |

## A.15.3 Potential Interactions with Offshore Wind

Table A.15.3 shows potential interaction pathways between tourism and offshore wind arrays and export cables. Based on the approach to scoping described in Section 2 in the main report, the table also records whether the interaction:

- Is not likely to result in a significant socio-economic impact on the sector; or
- Is likely to result in a significant socio-economic impact on the sector and hence will require a detailed assessment.

The rationale underlying this expert judgement is provided in the table. Where it is not currently possible to make a judgement regarding the likelihood of a significant socio-economic impact due to insufficient information (for example, in relation to the extent of overlap between a sector activity and the DPO Areas) the table indicates that scoping will be required to be undertaken once sufficient information becomes available. Furthermore, as described in the main report, there is currently no information regarding the likely location of export cable routes/corridors and as such, it is not possible to undertake a meaningful assessment of the potential for any sector activity/export cable interaction to give rise to significant socio-economic effects. Rather, the potential for any interaction will be identified in Regional Locational Guidance.

The impact of construction and operation of OWFs on seascapes and landscapes is assessed during EIAs via a seascape and landscape visual impact assessment (SLVIA). The significance of any impact relates to a range of factors including the sensitivity of the seascapes and landscapes in the area, the size and arrangement of turbines in the arrays and the distance of the arrays offshore (and hence from receptors). The significance of any seascape and landscape visual impacts (SLVI)

from arrays within DPOs (once available) will need to be assessed at project level via the EIA process and it is anticipated there is scope to minimise any visual impacts through marine spatial planning.

Two recent EIAs, which assessed the visual impact on seascapes and landscapes in the vicinity of proposed floating offshore wind turbines, located between 13 km and 50 km offshore concluded that there would be no significant visual impacts (Atkins, 2016; Statoil, 2015). However, a third EIA for a proposed floating OWF 6 km offshore did conclude that there would be a significant impact in one area due to the very high sensitivity of the coastline, the high proportion of the array within the zone of theoretical visibility (ZTV) and due to the minimum distance between the development and coast being only 6 km at one location (Aquatera *et al*, 2016).

It can be noted that in a consultation response to the Environmental Scoping Opinion related to the SLVIA for the proposed Kincardine OWF (to be located 13 km offshore), Scottish Natural Heritage (SNH) stated that "*It is insufficient to conclude prior to assessment that a distance of 12.8 km offshore will result in a minimal [visual] impact. Albeit outside of the study area for [the Kincardine] EIA, assessors should be aware of two existing Beatrice Demonstrator Turbines (BDT), 151 m to blade tip located on average 25 km offshore from Caithness. Both the BDT and five offshore platforms (that rise to a height of 106 m) are visible from many points along the east coast*."

Regardless of the outcomes of the project level SLVIAs, in general, because tourism depends on an attractive environment, attitudes towards OWFs may include fears that offshore arrays and/or large turbines may affect the leisure zone and subsequent recreational value and demand for tourism in an area (i.e. have impacts on the landscape; German Offshore Wind Energy Foundation, 2013). Whilst the initial scoping assessment above recommends that the potential for socio-economic impacts on tourism are considered at project level, the following section provides a brief summary of existing evidence relating to the attitude and perception of OWFs and of any subsequent indirect effects on tourism, to help inform development of the assessment methodology if required once DPO areas are available.

Numerous studies have assessed the attitude and reactions of visitors to wind farms in the UK and Europe and reviews of these studies are provided by Riddington *et al*. (2008), The Tourism Company (2012), Aitchison (2012) (all mainly onshore wind farms) and the German Offshore Wind Energy Foundation (2013). The Tourism Company (2012) concluded that the evidence is mixed on the proportion of tourists who may choose to stay away from areas with wind turbines in the future and while it may be a relatively small minority of visitors who do, it could potentially be quite damaging to markets in certain locations. Examples of studies which have assessed the attitudes and perception specifically to offshore arrays include:

- Germany - Hilliweg and Kull (2005) reported that 9% of interview respondents would be disturbed by offshore wind farms regardless of their location, while over 50% of the respondents would not be disturbed even if the OWF was visible (summarised in German Offshore Wind Energy Foundation, 2013);

- Denmark – a DEA (2006) study of attitudes to Nysted OWF and Horns Rev OWF (located 10 km and 14-20 km offshore respectively) indicated that whilst local and national populations were generally positive towards windfarms there was a significant willingness to pay to locate future OWFs at distances offshore where visual effects on the coastal landscape are reduced. 40% of the respondents stated they would prefer windfarms to be moved out of sight (DEA, 2006 summarised in German Offshore Wind Energy Foundation, 2013);
- Denmark - studies have suggested that people who use the coastal zone more frequently (i.e. tourists or residents living close by) associate higher visual disamenities with offshore wind farms than people who have 'weaker' connections to coastal areas (Ladenburg, 2010). Hence, potential reductions in capital costs from locating OWFs closer to shore may be outweighed by reductions in visual amenity benefits in coastal areas with high recreational activity – in these areas the optimal location of OWFs may be further offshore compared to coastal areas with lower recreational activity (Ladenburg & Dubgaard, 2009; Ladenburg, 2010);
- The Netherlands - a study reported that wind turbines off the Dutch coast will have minimal if any effects on tourism, estimating a reduction in tourism numbers of between 0% to 10% if the turbines are visible on the horizon and that tourists who stay away will spend their time in other tourist areas (a Decisio report, cited unseen[23]). This report contradicted an earlier study which estimated that 17% to 20% of tourists would stay away and 6,000 jobs would be lost;
- North Carolina, USA - a study which surveyed people who rented vacation properties on the coast found that whilst there was a lot of support for wind energy, if offshore turbines were located 5 miles (8 km) offshore, most respondents stated they would choose a different vacation destination, which the authors estimated could have an economic impact of $31 million over 20 years. However, if the turbines were built over 8 miles (12.9 km) offshore, the visual impacts would diminish substantially for many of the respondents, such that the turbines would not be likely to have a negative impact on coastal vacation property markets (Lutzeyer *et al*, 2017);
- Delaware, USA - Blades Lilley *et al*. (2010) found that 74% of tourists reported they would visit the same beach if a wind farm existed 10 km from shore, while 26% said they would avoid that beach. It was noted that the level of 'avoidance' of a beach with a windfarm 10 km offshore was smaller than the percentage of tourists who would be attracted to a beach with offshore wind turbines (66%) and the proportion stating they would pay to take a boat tour of the wind farm (44%).

Despite the above studies on attitudes towards OWFs, there is very little actual evidence relating to the impacts of wind farms on tourism performance (i.e. tourism volume and value further to the construction and operation of OWFs). In Denmark, Kuehn (2003) found neither a decrease in the community's tourism levels nor any reduction in the price of summer house rentals one year following construction of the Horn Rev offshore wind farm (summarised in Blades Lilley *et al*. 2010). In the UK, a

[23] http://www.dutchnews.nl/news/archives/2016/01/offshore-wind-farms-to-have-little-impact-on-tourism-report/

public attitude survey towards the operational North Hoyle OWF in North Wales reported that two thirds of residents (67%) stated the presence of the OWF had no effect on the number of people visiting or using the area, with people more likely to state there had been an increase rather than a decrease in numbers (11% stated increase compared with 4% who stated decrease). 82% of visitors did not see any effect on visitor numbers[24]. From reviewing the literature, The Tourism Company (2012) concluded that *"The negative effect on tourism performance where wind farms have already been established may not be as great as some people fear. However, far too little firm longitudinal evidence on this is available."* Overall, research from the UK has demonstrated that (mainly onshore) wind farms are very unlikely to have any adverse impact on tourist numbers (volume), tourist expenditure (value) or tourism experience (satisfaction) (Riddington *et al*., 2008; Aitchison, 2004). Moreover, to date, there is no evidence to demonstrate that any wind farm development in the UK or overseas has resulted in any adverse impact on tourism (Aitchison, 2012).

However, despite the lack of evidence to show that OWFs have an indirect negative impact on tourism, it is acknowledged that landscape and visual issues are often the most prominent reason for public objection to both land-based (DTI, 2005) and offshore wind farms. A high profile example was the proposed Navitus Bay OWF which was proposed to be located a minimum of 14 km off an area of the south England coastline which was designated as an Area of Outstanding Natural Beauty (AONB) and a UNESCO World Heritage Site. The proposed OWF was refused a Development Consent Order (DCO), including due to concerns regarding a potential significant impact on local tourism arising from the visual impacts of the array[25].
A further potential concern relates to the potential for OWFs to adversely affect investment in new resort development where such developments are promoted on the basis of a rural location and uncluttered seascapes, for example, golfing or water sports resorts. The Tourism Company (2012) stated that while few tourism enterprises are opposed to wind energy generation in principle, many have concerns about the future effect of wind turbines on their business. However, evidence relating to 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.

[24] Taken from summary provided on the Parliament UK Website: http://www.publications.parliament.uk/pa/cm200708/cmselect/cmdius/216/216we96.htm
[25] https://www.gov.uk/government/news/navitus-bay-wind-park-decision-refused-development-consent

## Table A.15.3 Potential interaction pathways

| Potential Interaction | Technology Aspect and Phase | Potential Socio-economic Consequences | Initial Scoping Assessment |
|---|---|---|---|
| Impacts to landscape or seascape – long term | Arrays (construction and operation) | Reduction in tourism income and investment (through visitors being deterred by the physical presence of an OWF) | There is the potential for significant impacts to landscapes, seascapes and viewpoints where offshore wind turbines are visible to receptors (i.e. people) and hence the potential for subsequent indirect impacts on tourism if this leads to avoidance of the area (i.e. arising from the perception that the recreational or visual amenity of an area is reduced).<br><br>The significance of any landscape and visual impacts of arrays will be assessed as part of the EIA process and will relate to numerous factors including the location of turbines, their visibility from shore and the sensitivity of the landscape and seascape to change. Any potentially significant impacts would be expected to be minimised through the application of mitigation measures as part of the licensing process (e.g. minimising impacts to sensitive areas of coastline, use of marine spatial planning within DPO areas etc.). The location of DPO areas are not currently available. |

| Potential Interaction | Technology Aspect and Phase | Potential Socio-economic Consequences | Initial Scoping Assessment |
|---|---|---|---|
| | | | Although various studies have indicated that some people may avoid visiting an area where land-based or offshore arrays are visible (see Section A.15.3 below), there is a lack of evidence that existing offshore windfarms (in the UK or globally), have had a negative impact on tourism numbers or expenditure through deterring visitors. Hence, it is considered unlikely that there will be any significant impact on tourism arising indirectly from any landscape and visual impacts associated with the offshore arrays.<br><br>However, as landscape and visual issues are often the most prominent reason for public objection to both land-based (DTI, 2005) and offshore wind farms, it is suggested that the **scoping assessment be completed once DPOs are defined.** |

| Potential Interaction | Technology Aspect and Phase | Potential Socio-economic Consequences | Initial Scoping Assessment |
|---|---|---|---|
| Impacts to landscape or seascape – temporary | Export cables (construction in the intertidal/inshore area) | Perceived reduction on amenity value, temporary reduction in tourism income | Any potential significant impacts would only be expected in inshore areas/intertidal areas adjacent to where the export cables make landfall.<br><br>Export cable routes are uncertain. Constraints inshore of DPOs will be identified in the RLG. However, it can be noted that any potential impact will only occur during the construction phase (during cable laying) and hence will be temporary.<br><br>**No detailed assessment possible.** |
| Disturbance or injury to coastal or marine wildlife | Arrays (construction and operation) | Reduction in income for ecotourism businesses | Any potentially significant impacts to marine ecotourism species would be expected to be minimised through the application of mitigation measures as part of the licensing process. The consequential impacts to dependent ecotourism businesses are therefore considered to be negligible.<br><br>**No detailed assessment required.** |

| Potential Interaction | Technology Aspect and Phase | Potential Socio-economic Consequences | Initial Scoping Assessment |
|---|---|---|---|
| Disturbance or damage to heritage assets | Arrays and export cables (construction only) | Reduction in visitor attraction income; reduction in wider tourism income | Significant direct impacts will be avoided through mitigation measures incorporated within licence conditions. Indirect impacts (such as the effect on the setting of heritage assets) are captured within landscape and seascape impacts above.<br><br>**No detailed assessment required.** |

## A.15.4 Scoping Methodology

The proximity of DPOs to the coastline will be assessed, once DPO areas are available. To determine where detailed assessments of the interaction may be required when DPO area locations are available, the following scoping criteria are proposed:

- Where more than 10% of a DPO is within 15 km of a seascape unit with a low 'Capacity Index'[26], based on Scott *et al*. 2005, it will be scoped in for more detailed assessment;
- However, where less than 10% of a DPO is within 15 km of a seascape unit with a low Capacity Index, it has been assumed that spatial planning within the DPO area can be used to avoid significant impacts.

## A.15.5 Assessment Methodology

Where DPOs are scoped in for more detailed assessment, consideration will be given to the potential for offshore wind developments to affect relevant tourism receptors in adjacent coastal areas within 18 km of the DPO.

Where scoping indicates that a detailed impact assessment is required, the potential economic cost of the indirect interaction between offshore arrays and tourism may be estimated based on:

- The area of land that falls within the 18 km buffer zone around the array (referred to as the Zone of Influence (ZOI));
- The potential value of lost tourism expenditure within the ZOI, calculated as:
    - Land area within the ZOI ($km^2$) / total land area within the relevant VisitScotland region (i.e. the proportion of the VisitScotland region within the ZOI);
    - The total VisitScotland regional tourism value (tourism expenditure; £) x the proportion of the VisitScotland region within the ZOI;
    - The value of tourism expenditure within the ZOI x the indicative percentage reduction in tourism spend in the ZOI (1.3%; based on Riddington et al. 2008).

## A.15.6 Data Limitations

As described above there is limited evidence relating to the impact of OWFs on local or regional tourism.

[26] The Capacity Index of a seascape indicates the ability of a seascape to absorb or accommodate development without a fundamental change in character (Scott et al. 2005). The Capacity Index considers a seascape's sensitivity, visibility and value.

# A.16. Waste Disposal (Dredge Material)

## A.16.1 Sector Definition

This sector relates to the disposal of material dredged from ports, harbours and marinas, into the marine environment. This type of waste disposal is only allowed where the material cannot be used beneficially, for example to replenish beaches or in construction projects.

## A.16.2 Overview of Activity

To facilitate continuous trade into and out of ports, dredging is often required. This involves the removal of sediment and the subsequent disposal of spoil. A total of 118 disposal sites are present in Scottish waters. At present, 32 disposal sites are open and the remaining are either closed or disused (Marine Scotland, NMPi). In 2012, a total of 3.6 million tonnes of dredge spoil was disposed of at open disposal sites in Scotland. The revenue generated from this disposal in 2012 (from licences) was £71,750 (Marine Scotland, 2016).

With regard to future trends, the quantities of spoil material for disposal will primarily be related to maintenance dredge requirements for approach channels to ports and harbours, and port or harbour developments (e.g. construction of new berths), which may require capital dredging to be undertaken.

Figure A.16.1 shows open, closed and disused waste disposal sites in Scotland. Information sources that can be used in the assessment are listed in Table A.16.1.

## Figure A.16.1 Waste disposal sites in Scotland

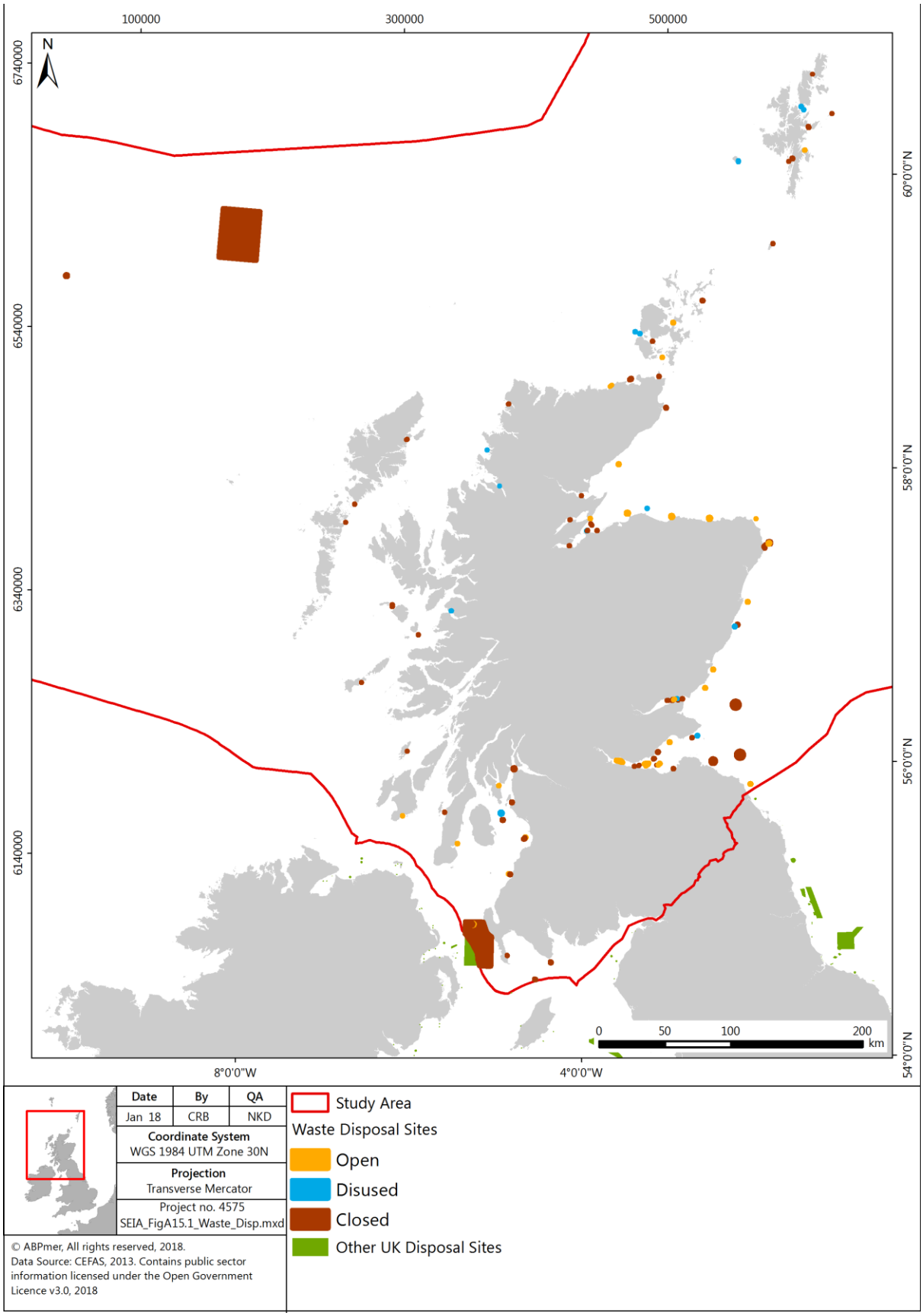


**Table A.16.1 Information sources for the waste disposal sector**

| Data Available | Information Source |
|---|---|
| Location of marine waste disposal sites (Scotland) | Marine Scotland NMPi https://marinescotland.atkinsgeospatial.com/nmpi/ |
| Tonnages at open disposal sites (Scotland, to 2012 only) | Marine Scotland http://marine.gov.scot/node/12619 |

## A.16.3 Potential Interactions with Offshore Wind

Table A.16.2 shows potential interaction pathways between waste disposal and offshore wind arrays and export cables. Based on the approach to scoping described in Section 2 in the main report, the table also records whether the interaction:

- Is not likely to result in a significant socio-economic impact on the sector; or
- Is likely to result in a significant socio-economic impact on the sector and hence will require a detailed assessment;

The rationale underlying this expert judgement is provided in the table. Where it is not currently possible to make a judgement regarding the likelihood of a significant socio-economic impact due to insufficient information (for example, in relation to the extent of overlap between a sector activity and the DPO Areas) the table indicates that scoping will be required to be undertaken once sufficient information becomes available. Furthermore, as described in the main report, there is currently no information regarding the likely location of export cable routes/corridors and as such, it is not possible to undertake a meaningful assessment of the potential for any sector activity/export cable interaction to give rise to significant socio-economic effects. Rather, the potential for any interaction will be identified in Regional Locational Guidance.

## Table A.16.2 Potential interaction pathways

| Potential Interaction | Technology Aspect and Phase | Potential Socio-economic Consequences | Initial Scoping Assessment |
|---|---|---|---|
| Loss or reduced use of dredge material disposal sites | Arrays (construction and operation) | Increased costs of disposal (e.g. through requirement to use alternative disposal site) | Any potential significant impacts would only be expected where DPO areas overlap with open disposal sites.<br><br>The location of DPO areas is not currently available. However, depending on the proportion of the DPOs occupied by arrays, there may be scope to avoid impacts through spatial planning.<br><br>**Scoping assessment to be completed once the DPOs defined.** |
| | Export cables (construction and operation) | Increased costs of disposal | Any potential significant impacts would only be expected where export cable routes overlap with open disposal sites.<br><br>Export cable routes are uncertain. Constraints inshore of DPOs will be identified in the RLG.<br><br>**No detailed assessment possible.** |

| Potential Interaction | Technology Aspect and Phase | Potential Socio-economic Consequences | Initial Scoping Assessment |
|---|---|---|---|
| Obstruction of access to dredge material disposal site | Arrays | Increased costs of disposal (through increased vessel steaming times) | Any potential significant impacts would only be expected where DPO areas lie directly inshore of open disposal sites.<br>Given that all DPOs are likely to be offshore, this is considered very unlikely.<br><br>**No detailed assessment required.** |

## A.16.4 Scoping Methodology

The spatial overlap between DPOs and dredge material disposal sites to be assessed, once DPO areas are available.

## A.16.5 Assessment Methodology

If a significant interaction between DPOs and any dredge material disposal site is identified through scoping, further consideration will be given to the potential socio-economic impacts in consultation with the relevant port and harbour authority.

## A.16.6 Data Limitations

Data relating to tonnages of dredge spoil disposed of at marine disposal sites (i.e. intensity of usage) in Scotland only available up to 2012.

# A.17. Water Sports

## A.17.1 Sector Definition

This sector relates to recreational activities undertaken on or immersed in the sea including angling, surfing, windsurfing, sea kayaking, scuba diving and small sail boat activities (defined as dinghies, day boat or other small keelboats, usually taken out of water at the end of use).

Recreational boating activity in larger vessels such as yachts is covered separately in Appendix A.12 and general marine and coastal tourism is described in Appendix A.15, as the interactions and issues in relation to marine renewable developments are often distinctly different.

## A.17.2 Overview of Activity

The Scottish Marine Recreation and Tourism Survey (SMRTS) (Land Use Consultants (LUC), 2016) collated information on recreation and tourism activities undertaken at sea or around the Scottish coast. Table 17.1 shows the total number of survey respondents (out of a total of 2170 individuals and representatives of clubs or similar organisations that completed the survey) who undertook marine watersports activity in 2015, key areas of concentrated activity and an estimate of the total expenditure of each activity[27].

**Table A.17.1 Participation in marine water sports activities around Scotland in 2015**

| Activity | Number of Respondents Taking Part | Key Areas of Concentrated Activity | Activity Specific Estimate of Trip Based Spending (£) |
|---|---|---|---|
| Sailing cruising including dinghy cruising at sea | 578* | West coast from the Firth of Clyde, through Argyll towards Skye and Torridon. Also showed use of the Crinan, Caledonian and, to a lesser extent, the Forth and Clyde Canals | 51,608,579 |
| Canoeing or kayaking in the sea | 447 | The Firth of Clyde, Argyll Coast, Arisaig, Loch Broom and the Summer Isles, parts of the north coast, Moray Firth and sections of the Firth of Forth | 16,697,121 |

[27] Based on coastal visits x median trip spend x mean trip length (days) (see LUC, 2016)

| Activity | Number of Respondents Taking Part | Key Areas of Concentrated Activity | Activity Specific Estimate of Trip Based Spending (£) |
|---|---|---|---|
| Sea angling from the shore | 390 | The Lothian, Fife, Angus and Aberdeenshire coasts in the east and Inverclyde, Ayrshire and Dumfries and Galloway coasts in the west | 51,930,216 |
| Sea angling from a boat | 380 | Luce Bay and around the Mull of Galloway and in places along the Ayrshire and Argyll coasts | 105,862,470 |
| Rowing and sculling in the sea | 279 | Firth of Forth, Moray Firth and Loch Broom | 2,763,528 |
| Climbing, bouldering and coasteering at the coast | 249 | The coastline south of Aberdeen, locations within the Firth of Forth, an area around Oban and the Coigach coast | 76,217,048 |
| Surfing, surf kayaking, or paddleboarding in the sea | 220 | The north Caithness coast, the coastline between Banff and Aberdeen, the Lothian coast and parts of Argyll, including Machrihanish Bay and the Isle of Tiree | 6,666,199 |
| SCUBA diving in the sea | 179 | Scapa Flow, the Sound of Mull, sea lochs in Argyll, the southern coast of Arran and Lothian coastline | 13,429,376 |
| Dinghy racing at sea | 107 | The inner Firth of Clyde and the Firth of Forth | 2,248,770 |
| Long distance swimming in the sea | 87 | - | 19,821,524 |
| Windsurfing and kite surfing at the coast | 56 | Tiree | 1,919,419 |
| Water skiing and wakeboarding in the sea | 27 | - | 597,330 |
| Personal watercraft at sea | 13 | - | 597,330 |
| * This activity will also include vessels which are covered under Recreational Boating (medium to large vessels) in Appendix A.12 and hence does not reflect the number of participants undertaking marine watersports as defined in this section. | | | |

Source: LUC, 2016

The SMRTS estimated that the annual expenditure on marine recreation and tourism activities in Scotland (including but not limited to the activities listed in Table A.17.1) was worth £3.7 billion to the Scottish economy (although acknowledged that this is likely to be an overestimate). Around £2.4 billion of this is associated with general marine recreation and tourism (see Tourism, Appendix A.15) and around £1.3 billion is associated with more specialist activities including wildlife watching (see Tourism) and the marine watersport activities of sailing, kayaking, surfing and angling.

With regard to future trends, in general, levels of participation in water sport activities reflect the economic cycle but are generally expected to increase in the long-term. The key locations at which watersports are undertaken around the Scottish coast are likely to remain the same as, in general, location is determined by access and facilities (e.g. slipways, marinas etc.) or by where the necessary sea conditions occur (e.g. for surfing, windsurfing etc.).

Figure A.17.1 shows the concentration of general marine and coastal recreation[28] around the Scottish coast. Information sources that can be used in the assessment are listed in Table A.17.2.

[28] Marine and coastal recreation includes beach games, beach combing, rock pooling, painting, kite flying, sunbathing, naturism, picnicking, yoga, paddling, walking less than 2 miles, general sightseeing, fossil hunting, beach team sports, body boarding, general swimming and snorkelling, coastal cycling, horse riding and dog walking.

**Figure A.17.1 General Marine and Coastal Recreation activity in Scotland**

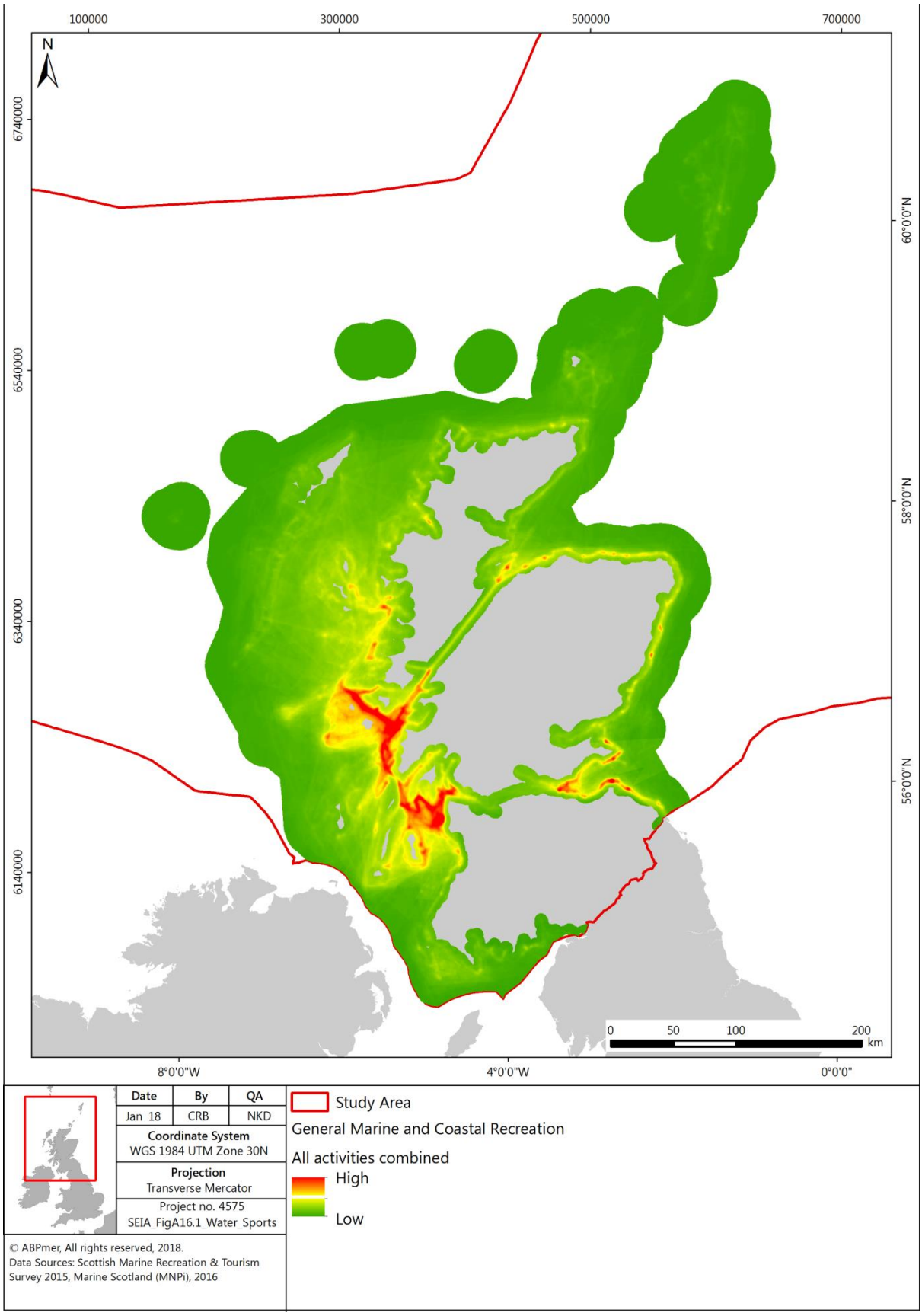


**Table A.17.2 Information sources for the water sports sector**

| Data Available | Information Source |
|---|---|
| Relative intensity of watersport activities | Strava Metro heatmaps: https://labs.strava.com/heatmap/#10.00/-2.04148/55.46990/hot/water |
| Sea angling activity, expenditure and economic impact (Scotland) | Scottish Government, 2009 http://www.gov.scot/resource/doc/280648/0084568.pdf |
| Sea angling –catches and expenditure (UK) | Sea angling survey 2017 (ongoing – data not yet available) http://www.gov.scot/Topics/marine/Salmon-Trout-Coarse/seaangling/survey2016 |
| Watersports participation survey (UK) | Arkenford, 2016 (2016 data) http://www.rya.org.uk/SiteCollectionDocuments/sportsdevelopment/Watersports_Survey_2016%20-%20Summary.pdf |
| Scottish marine recreation and tourism (Scotland) | Scottish marine recreation and tourism survey 2015 http://www.gov.scot/Topics/marine/seamanagement/national/RecandTourism |

## A.17.3 Potential Interactions with Offshore Wind

Table A.17.3 shows potential interaction pathways between water sports and offshore wind arrays and export cables. Based on the approach to scoping described in Section 2 in the main report, the table also records whether the interaction:

- Is not likely to result in a significant socio-economic impact on the sector; or
- Is likely to result in a significant socio-economic impact on the sector and hence will require a detailed assessment;

The rationale underlying this expert judgement is provided in the table. Where it is not currently possible to make a judgement regarding the likelihood of a significant socio-economic impact due to insufficient information (for example, in relation to the extent of overlap between a sector activity and the DPO Areas) the table indicates that scoping will be required to be undertaken once sufficient information becomes available. Furthermore, as described in the main report, there is currently no information regarding the likely location of export cable routes/corridors and as such, it is not possible to undertake a meaningful assessment of the potential for any sector activity/export cable interaction to give rise to significant socio-economic effects. Rather, the potential for any interaction will be identified in Regional Locational Guidance.

**Table A.17.3 Potential interaction pathways**

| Potential Interaction | Technology Aspect | Potential Socio-economic Consequences | Initial Scoping Assessment |
|---|---|---|---|
| Displacement due to spatial overlap between array and water sport activity | Array (construction and operation) | Reduction in activity levels leading to loss of revenue for water sport business. | Any potential significant impacts would only be expected where either DPO areas overlapped with areas of watersport activity.<br><br>The location of DPO areas is not currently available. However, as DPO areas will likely be located offshore, it is considered unlikely that DPO areas will overlap with areas where watersports such as surfing, windsurfing, shore-based angling or kayaking are undertaken at high intensity, which is mainly inshore (although it is acknowledged that experienced kayakers may undertake the activity further offshore e.g. when crossing between a headland and an island). In addition, small boat sailing activity is expected to occur within RYA racing or sailing areas in the vicinity of sailing clubs while scuba diving is generally undertaken at discreet diving sites such as wrecks or areas with interesting and rich marine life or seascapes. As such it is considered that any potential |

| Potential Interaction | Technology Aspect | Potential Socio-economic Consequences | Initial Scoping Assessment |
|---|---|---|---|
| | | | interaction with the above watersport activities could be avoided through the use of marine spatial planning.<br><br>There is the potential for DPO areas to overlap with recreational angling sites (the majority of which occur within 11 km of the coast (Radford et al, 2009), The impact of the interaction between arrays and areas of boat-based sea angling activity will need to be assessed once the location of the DPO areas is available.<br><br>See Section A.17.5.1 for proposed assessment methodology for recreational sea angling activities. |
| Decrease in recreational quality of the environment (e.g. arising indirectly from visual/noise disturbance) | Array (construction and operation), | Reduction in activity levels leading to loss of revenue for water sport business. | Any potential significant impacts would only be expected where DPOs resulted in significant landscape and visual impacts or significant above water noise impacts for watersport participants.<br><br>The location of DPO areas is not currently available. However, as DPO areas are likely to be located offshore to minimise visual impacts, and in general |

| Potential Interaction | Technology Aspect | Potential Socio-economic Consequences | Initial Scoping Assessment |
|---|---|---|---|
| | | | most watersports are undertaken in inshore waters (see above). Hence it is considered unlikely that the DPO areas will give rise to any significant landscape and visual impacts or above water noise, which will decrease the recreational quality for participants.<br><br>**No detailed assessment required** (see Tourism in Appendix A.15 for assessment of any potential landscape and visual impacts on general tourism). |
| | Export cables (construction only, including in area of landfall) | Temporary reduction in activity levels leading to loss of revenue for water sport business. | Export cable routes are uncertain. Constraints inshore of DPOs will be identified in the RLG. However, it can be noted that any impact will be temporary.<br><br>**No detailed assessment possible.** |
| Displacement due to spatial overlap between cable corridors and water sport activity | Export cables (construction only) | Temporary reduction in activity levels due to displacement during construction leading to loss of revenue for water sport business | Export cable routes are uncertain. Constraints inshore of DPOs will be identified in the RLG. However, it can be noted that any impact will be temporary.<br><br>**No detailed assessment possible.** |

| Potential Interaction | Technology Aspect | Potential Socio-economic Consequences | Initial Scoping Assessment |
|---|---|---|---|
| Impacts to wave quality (surfing) | Array (construction and operation) | Reduction in surfing activity leading to loss of revenue for water sport business | Evidence from existing offshore renewables developments indicates that there have been negligible or only very minor significant changes in wave quality at the shoreline as a result of developments (ABPmer and RPA, 2013). However, to date research and EIA studies have concerned the impacts of offshore renewable energy developments that are considerably smaller in scale than proposed future developments.<br><br>While it remains unlikely that many future developments will significantly affect wave quality, applying broad assumptions and criteria at a Sectoral level is likely to provide inaccurate results. Instead it is recommended that the economic consequences of impacts to wave quality are discussed at project-level. This should be based on the output of wave modelling studies and in consultation with relevant stakeholders as part of the EIA scoping and consultation process.<br><br>**Detailed assessment not required at sectoral level**. |

## A.17.4 Scoping Methodology

### A.17.4.1 Impacts to recreational sea angling activities

To determine where detailed assessments of the interaction may be required when DPO area locations are available, the following scoping criteria are proposed:

- Where the spatial extent of indicative arrays is predicted to occupy less than 1% of the DPO area that lies within 6 nm of the coast, it has been assumed that spatial planning within the DPO area can be used to avoid significant impacts and no detailed assessment should be required;
- Where the spatial extent of indicative arrays is predicted to occupy more than 1% of the DPO area that lies within 6 nm, a detailed assessment should be undertaken.

### A.17.4.2 Impacts on wave quality

Any potential impact on wave quality should be assessed at project level via EIA.

## A.17.5 Assessment Methodology

### A.17.5.1 Impacts to recreational sea angling

Where scoping indicates that a detailed impact assessment is required, the potential economic cost of the loss of marine space for recreational sea angling can be estimated based on:

- The total reduction in expenditure/loss of income, calculated by multiplying the percentage loss of area (to arrays) within 6 nm, by the estimated value of boat-based sea angling in the relevant region (derived from Radford et al, 2009).

## A.17.6 Data Limitations

In general, data on the distribution and intensity of marine watersport activities is limited. In the SMRTS outputs described above, the authors noted that low response rates to the survey for a minority of activities mean that some spatial information is incomplete. Furthermore, the smaller number of responses covering remoter parts of Scotland means that spatial information for areas such as the Western Isles and Shetland is also likely to be partial (LUC, 2016).

# A.18. References

## A.18.1 Introduction

References by section are listed below.

## A.18.2 Aquaculture

Black, K. and Hughes, A. 2017. Future of the sea: Trends in aquaculture. Foresight – Future of the sea evidence review. Foresight Government Office for Science. Available online: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/635209/Future_of_the_sea_-_trends_in_aquaculture_FINAL_NEW.pdf

Celtic Seas Partnership (2016). Future Trends in the Celtic Seas, Scenarios Report, ABPmer Report No. R.2584d. A report produced by ABPmer & ICF International for Celtic Seas Partnership, August 2016. Available online: http://futuretrends.celticseaspartnership.eu/downloads/R2584d%20Future%20Trends_Final%20Scenarios%20Report_5Aug2016_High_res.pdf

HIE and SAIC, 2017. The value of aquaculture to Scotland. A report for the Highlands and Islands Enterprise and Marine Scotland. June 2017.

Marine Scotland, 2016. Marine Scotland Science: Scottish shellfish farm production survey 2016.

Scotland's Aquaculture, 2015. Natural Scotland, Scottish Government website: Scotland's Aquaculture. Available online: http://aquaculture.scotland.gov.uk/

Scottish Government, 2016. Marine Scotland Maps NMPI: https://marinescotland.atkinsgeospatial.com/nmpi/

## A.18.3 Aviation

ABPmer and RPA, 2013. Developing the socio-economic evidence base for offshore renewable sectoral marine plans in Scottish Waters. Report R.2045, June 2013. Appendix B.

Department for Transport, 2017. GOV.UK website: UK aviation forecasts 2017. Available online at: https://www.gov.uk/government/publications/uk-aviation-forecasts-2017 [accessed 01.12.17]

Glasgow Airport, 2011. Our Vision: Glasgow Airport Draft Master Plan 2011. Available online: http://publications.naturalengland.org.uk/file/6490305064337408

Transport Scotland, 2017. Transport Scotland website: Scottish Transport Statistics No 35 – Datasets. Available online at: https://www.transport.gov.scot/publication/scottish-transport-statistics-no-35-datasets/ [accessed 01.12.17]

York Aviation, 2010. Glasgow International Airport Economic Impact Assessment, York Aviation, 2010.

York Aviation, 2012. The Economic Impact of Glasgow Prestwick Airport, York Aviation, November 2012.

## A.18.4 Carbon Capture and Storage

House of Commons Energy and Climate Change Committee. (2016). Future of carbon capture and storage in the UK. Second Report of Session 2015–16. HC 692. February 2016. Available online at: https://www.publications.parliament.uk/pa/cm201516/cmselect/cmenergy/692/692.pdf

Deloitte. (2016). A need unsatisfied. Blueprint for enabling investment in CO2 storage. Report for The Crown Estate. February 2016. Available online at: https://www.thecrownestate.co.uk/media/502093/ei-a-need-unsatisfied-blueprint-for-enabling-investment-in-co2-deloitte.pdf

National Audit Office. (2017). Carbon capture and storage: the second competition for government support. Department for Business, Energy and Industrial Strategy. HC 950. Session 2016-17. January 2017. Available online at: https://www.nao.org.uk/wp-content/uploads/2017/01/Carbon-Capture-and-Storage-the-second-competition-for-government-support.pdf

Pale Blue Dot Energy. (2016). Progressing Development of the UK's Strategic Carbon Dioxide Storage Resource. A Summary of Results from the Strategic UK CO2 Storage Appraisal Project. April 2016. Pale Blue Dot Energy, Coastain, Axis Well Technology, Energy Technologies Institute. Available online at: https://s3-eu-west-1.amazonaws.com/assets.eti.co.uk/legacyUploads/2016/04/D16-10113ETIS-WP6-Report-Publishable-Summary.pdf

## A.18.5 Coast Protection and Flood Defence

Baxter, J.M., Boyd, I.L., Cox, M., Cunningham, L., Holmes, P. and Moffat, C.F. 2008. Scotland's Seas: Towards Understanding their State. Fisheries Research Services, Aberdeen.

EUROSION, 2004. Living with coastal erosion in Europe: Sediment and Space for Sustainability. PART II – Maps and statistics. 29 May 2004.

Foresight, 2004. Foresight flood and coastal defence project http://www.foresight.gov.uk/OurWork/CompletedProjects/Flood/index.asp

Masselink, G. and Russell, P. 2013. Impacts of climate change on coastal erosion. MCCIP Science Review 2013: 71-86.

UKMMAS, 2010. Charting Progress 2 Feeder Report: Productive Seas. Available online at http://chartingprogress.defra.gov.uk/productive-seas-feeder-report. UK Marine Monitoring and Assessment Strategy.

## A.18.6 Energy Generation

4COffshore, 2017: 4COffshore website: http://www.4coffshore.com/windfarms/tidal-shetland-tidal-array-united-kingdom-tidalid153.html [accessed 8 December 2017]

Atlantic Resources, 2017. Atlantic Resources website: https://www.atlantisresourcesltd.com/ [accessed 8 December 2017]

Celtic Seas Partnership, 2016. Future trends in the Celtic Seas: Baseline Report. A report for the Celtic Seas Partnership by ABPmer and ICF International.

Crown Estate Scotland, 2017. Crown Estate Scotland website: http://www.crownestatescotland.com/media-and-notices/news-media-releases-opinion/preparation-starts-for-new-offshore-wind-leasing-in-scotland [Accessed 15.12.17]

Marine Scotland, 2013. Sectoral Marine Plans for Offshore Wind, Wave and Tidal Energy in Scottish Waters Consultation Draft. The Scottish Government, Edinburgh 2013. Available online at: http://www.gov.scot/Resource/0042/00428241.pdf, accessed on 10 January 2018.

Scottish Government, 2017. Scottish Energy Strategy: The future of energy in Scotland. December 2017. Available online: http://www.gov.scot/Resource/0052/00529523.pdf

SOEC (2007) The case for establishing an evaluation and research centre for ocean energy technologies on the Isle of Wight. November 2007. Solent Ocean Energy Centre.

South West Marine Energy Park (2012) [Online] Available at: http://www.wavehub.co.uk/downloads/Marketing_Leaflets/South_West_Marine_Energy_Park_Prospectus.pdf

WES, 2017. Wave Energy Scotland (WES) website: http://www.waveenergyscotland.co.uk/ [accessed 8 December 2017].

## A.18.7 Commercial Fisheries

ABPmer, 2017. Displacement of Fishing Effort from Marine Protected Areas, ABPmer Report No. R.2790. Commissioned Reports, Number 241. York. Available online at http://publications.naturalengland.org.uk/file/6490305064337408.

Gray, M., Stromberg, P-L., Rodmell, D. 2016. 'Changes to fishing practices around the UK as a result of the development of offshore windfarms – Phase 1.' The Crown Estate, 121 pages. ISBN: 978-1-906410-64-3. Available online at https://www.thecrownestate.co.uk/media/502008/ei-changes-to-fishing-practices-around-the-uk-as-a-result-of-the-development-of-offshore-windfarms.pdf. Accessed 11 January 2018.

MMO, 2017. UK sea fisheries statistics 2016. Marine Management Organisation. Available online at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/647482/UK_Sea_Fisheries_Statistics_2016_Full_report.pdf. Accessed 8 January 2018.

Marine Scotland, 2015. Inshore MPA / SAC management. Socio-economic and non-monetary assessment. 2015 Report. Scottish Government. 26 pages. Available at: www.gov.scot/Resource/0049/00491401.pdf. Accessed 29 January 2017.

Scottish Government, 2017. Scottish Sea Fisheries Statistics 2016. Edinburgh: The Scottish Government. Available online at http://www.gov.scot/Resource/0052/00524991.pdf. Accessed 8 January 2018.

## A.18.8 Military Defence

HM Government, 2015. National security strategy and strategic defence and security review 2015. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/478933/52309_Cm_9161_NSS_SD_Review_web_only.pdf

Scottish Government, 2016. Marine Scotland Maps NMPI: https://marinescotland.atkinsgeospatial.com/nmpi/

The World Bank (2017). UK military expenditure (% of GDP). Available online at: http://data.worldbank.org/indicator/MS.MIL.XPND.GD.ZS?end=2015&locations=GB&start=1997&view=chart.

## A.18.9 Oil & Gas

Oil and Gas UK, 2017. Economic report 2017. Available online: https://oilandgasuk.co.uk/economic-report-2017.cfm

Scottish Government, 2016. Oil and Gas production statistics: 2015-16. An official statistics publication for Scotland. 14 September 2016. Available online at: http://www.gov.scot/Resource/0050/00505657.pdf

## A.18.10 Ports and Harbours

Centre for Economics and Business Research (Cebr), 2017a. The economic contribution of the UK ports industry. A report for Maritime UK. Available online: https://www.britishports.org.uk/system/files/documents/cebr_ports_report.pdf

Centre for Economics and Business Research (Cebr), 2017b. The economic contribution of the UK Maritime Sector. A report for Maritime UK. Available online: https://www.britishports.org.uk/system/files/documents/cebr_uk_maritime_sector_report.pdf

Cruise Scotland, 2017. Cruise ship calls in Scotland – 2010 – 2016. March 2017. Accessed via Marine Scotland Information website: http://marine.gov.scot/data/cruise-port-statistics-2010-2016 [Accessed 11.12.17]

Dft, 2017. Transport statistics Great Britain 2017. 2017 edition. November 2017.

Highlands and Islands Enterprise and Scottish Enterprise, 2010. National Renewables Infrastructure Plan. Available online: http://www.hie.co.uk/growth-sectors/energy/n-rip.html

Transport Scotland, 2017: Scottish Transport Statistics (2015 data) https://www.transport.gov.scot/publication/scottish-transport-statistics-no-35-datasets/

## A.18.11 Power Interconnectors

AECOM and ABPmer, 2015. ISLES spatial planning and sustainability appraisal. Irish Scottish links on energy study: ISLES II: Towards implementation.

Ofgem (2017) Electricity interconnectors [Online] Accessed at: https://www.ofgem.gov.uk/electricity/transmission-networks/electricity-interconnectors

Ofgem (2016) Cap and floor regime: unlocking investment in electricity interconnectors [Online] Accessed at: https://www.ofgem.gov.uk/system/files/docs/2016/05/cap_and_floor_brochure.pdf

## A.18.12 Recreational Boating

EKOS, 2016. Sailing tourism in Scotland. Report for The Crown Estate, Highlands and Islands Enterprise and Scottish Canals. December 2016.

Land Use Consultants (LUC), 2016. Scottish marine recreation and tourism survey 2015. Final report prepared by LUC, March 2016.

Marine Tourism development Group (MTDG), 2016. A strategic framework for Scotland's marine tourism sector: awakening the giant. Available online: http://www.hie.co.uk/growth-sectors/tourism/marine-tourism-strategy/deafult.html

## A.18.13 Commercial Shipping

ABPmer and RPA, 2013. Developing the socio-economic evidence base for offshore renewable sectoral marine plans in Scottish Waters. Report R.2045, June 2013. Appendix B.

Oxford Economics, 2015. The economic impact of the UK maritime services sector: Shipping. May 2015

## A.18.14 Telecommunication Cables

AECOM and ABPmer, 2015. ISLES spatial planning and sustainability appraisal. Irish Scottish links on energy study: ISLES II: Towards implementation.

Elliott, C., Al-Tabbaar, O., Semeyutin, A., and Tchouamou Njoya, E. (2016). An Economic and Social Evaluation of the UK Subsea Cables Industry. A report commissioned by The European Subsea Cables Association and The Crown Estate. Available at: http://www.escaeu.org/news/?newsid=59

## A.18.15 Tourism

AECOM and ABPmer, 2015. ISLES spatial planning and sustainability appraisal. Irish Scottish links on energy study: ISLES II: Towards implementation.

Aitchison, 2012. Tourism Impact Assessment Report. Appendix 8.1. Llanbrynmair Wind Farm, Volume II - Supplementary Environmental Information: Supporting Appendices.

Aitchison, C. (2004) The Potential Impact of Fullabrook Wind Farm Proposal, North Devon: Evidence Gathering of the Impact of Wind Farms on Visitor Numbers and Tourist Experience, Bristol: University of the West of England/Devon Wind Power.

Aquatera, Caledonian Conservation, HiDef, RES and SMRU Consulting, 2016. Environmental Statement: Dounreat Tri Floating Wind Demonstration Project. September 2016.

Atkins, 2016. Kincardine Offshore Windfarm: Environmental Statement. March 2016.

Benfield, S and McConnell, S (2007): Marine and Coastal Visitor Management, Public Engagement and Interpretation in Argyll and the Islands: the way forward. Marine and Coastal Development Unit, Argyll & Bute Council, 2007, pp1-145.

Blaydes Lilley, M., Firestone, J., Kempton, W. 2010. The effect of wind power installations on coastal tourism. Energies, 3, 1-22.

DEA, 2006. Danish Energy Authority (DEA). Offshore wind farms and the environment – Danish experience from Horns Rev and Nysted.

Deloitte and Oxford Economics, 2010. The economic contribution of the visitor economy: UK and the nations. June 2010.

Department of Trade and Industry (DTI), 2005. Guidance on the assessment of the impacts of offshore wind farms: Seascape and visual impact report. Available online: http://webarchive.nationalarchives.gov.uk/+/http://www.berr.gov.uk/files/file22852.pdf

German Offshore Wind Energy Foundation, 2013. The impact of offshore wind energy on tourism: Good practices and perspectives for the south Baltic region. April 2013.

International Centre for Tourism and Hospitality Research and Bournemouth University, 2010. The economic impact of wildlife tourism in Scotland. Scottish Government Social research 2010. Available online at: http://www.gov.scot/Resource/Doc/311951/0098489.pdf

Kuehn, S. Sociological Investigation of The Reception of Horns Rev and Nysted Offshore Wind Farms In the Local Communities; Annual Status Report 2003; Elsam Engineering: Fredericia, Denmark, 2005; pp. 1-25.

Ladenburg, J & Dubgaard, A. 2009. Preferences of coastal zone user groups regarding the siting of offshore wind farms. Ocean & Coastal Management, 52(5), 233-242.

Ladenburg, J, 2010. Attitudes towards offshore wind farms - the role of beach visits on attitude and demographic and attitude relations. Energy Policy, 38(3). 1297-1304.

Land Use Consultants (LUC), 2016. Scottish marine recreation and tourism survey 2015. Final report prepared by LUC, March 2016.

Lutzeyer, S., Phaneuf, D. J., and L. O. Taylor (2017). The Amenity Costs of Offshore Windfarms: Evidence from a Choice Experiment. (CEnREP Working Paper No. 17-017). Raleigh, NC: Center for Environmental and Resource Economic Policy

McMorran, R., M. F. Price, and A. McVittie. A review of the benefits and opportunities attributed to Scotland's landscapes of wild character. Scottish Natural Heritage, 2006.

Riddington, G., Harrison, T., McArthur, D., Gibson, H., Millar, K. The economic impacts of wind farms on Scottish tourism. A report for the Scottish Government. March 2008.

Scott, K.E., Anderson, C., Dunsford, H., Benson, J.F. and MacFarlane, R. (2005). An assessment of the sensitivity and capacity of the Scottish seascape in relation to

offshore windfarms. Scottish Natural Heritage Commissioned Report No.103 (ROAME No. F03AA06).

Statoil, 2015. Hywind Scotland Pilot Park: Environmental Statement. April 2015.

The Tourism Company, 2012. The impact of wind turbines on tourism - a literature review. Prepared for Isle of Anglesey County Council, February 2012. Available online: http://www.anglesey.gov.uk/Journals/2012/10/30/the-impact-of-wind-turbines-on-tourism.pdf

Visit Scotland, 2017a. Insight Department: Scotland. The key facts on tourism in 2016. Available online: http://www.visitscotland.org/pdf/Tourism_in_Scotland_2016.pdf

Visit Scotland, 2017b. Insight Department: Scotland. Tourism in Scotland's Regions 2016. Available online: http://www.visitscotland.org/pdf/Tourism_in_Scotland_Regions_2016.pdf

Visit Scotland, 2017c. Insight Department: Scotland. Wildlife tourism. June 2017. Available online: http://www.visitscotland.org/pdf/VisitScotlandInsightWildlife2017.pdf

## A.18.16 Waste Disposal (Dredge Material)

Marine Scotland, 2016. Marine Scotland Information webpage, available at: http://marine.gov.scot/data/waste-disposal-dredge-spoil-2005-2012 [accessed 19.12.17].

## A.18.17 Water Sports

Land Use Consultants (LUC), 2016. Scottish marine recreation and tourism survey 2015. Final report prepared by LUC, March 2016.

Radford, A., Riddington, G. and Gibson, H., 2009. Economic Impact of Recreational Sea Angling in Scotland. Prepared for the Scottish Government. July 2009. ISBN: 978-0-7559-8130-4

# Appendix B Methods to assess impacts on GVA and employment and for the distributional analysis

## B.1. Introduction

This Appendix sets out the method proposed for assessment of Gross Value Added (GVA) and employment effects associated with the quantification and monetisation of significant impacts identified with impact pathways from installation of deep water wind. In addition, the section describes the approach to undertaking the distributional analysis, i.e. which groups would be affected.

# B.2. GVA and Employment Effects

## B.2.1 Types of Impacts

Impacts on sectors are based on one of:

- The material reduction in level of outputs from an activity, measured as reduction in GVA;
- Increase in operating costs of an activity but which do not result in a reduction in output; or
- An increase in uncertainty. Such impacts are identified and noted but are not quantified.

Appendix B.2 therefore, focuses on the first two bullets, providing descriptions of the detailed approaches to enable significant impacts on GVA or operating costs to be monetised.

## B.2.2 Assessing Impacts Based on Reduction in Outputs from an Activity

Impacts on output can be assessed by taking the change in output (turnover) and converting it to GVA. This is done by taking a GVA ratio to ensure intermediate consumption is excluded. GVA ratios can be estimated based on data in the Scottish Annual Business Statistics[29]. This involves dividing GVA at basic prices by total turnover. For example, the total turnover associated with water transport in 2016 was £520 million and GVA at basic prices was £196.3 million. This gives a GVA ratio of around 38%. Thus the GVA impacts of a change in outputs on water transport would be estimated by multiplying the change in output by 38%. For example, if impacts on commercial shipping are estimated at £320,000, the change in GVA would be £320,000 x 38% = £121,600.

Knock-on impacts on GVA and employment can also be assessed. A threshold of 5% of turnover for a sector is used to identify the point at which it is considered meaningful to quantify the knock-on effects. Since this threshold reflects impacts at the national or UK level, consideration should also be given as to whether the impacts would be important at the local level. Where impacts are considered to be significant at the local level, they should be monetised. In this case, what is considered significant is likely to be subjective so the decision to monetise (or not monetise) the impacts should be accompanied by a brief qualitative description explaining why the impacts have (or have not) been quantified. The basis for assessing if impacts are likely to exceed the threshold is based on the classes in the UK Standard Industrial Classification of Economic Activities 2007. Where the impacts on turnover are greater than the 5% threshold, it is considered appropriate and proportionate to assess the knock-on impacts on GVA and employment. This

[29] Scottish Annual Business Statistics 2015, released August 2017, available at: http://www.gov.scot/Topics/Statistics/Browse/Business/SABS/SABS-PDF

threshold is based on the assumption that costs of less than 5% of turnover could be absorbed without causing knock-on effects on GVA or employment.

The Type I and Type II GVA multipliers[30] are used to assess the knock-on effects for GVA. The Scottish Input-Output multipliers for 1998-2014 were published in July 2017[31] and are the most recent available and, therefore, are suggested as the best data available to enable knock-on effects to be captured. Use of the GVA multipliers requires information on the change in GVA for a sector. The change in GVA estimated to occur as a result of the impacts is multiplied by the Type I and Type II GVA multiplier to provide an estimate of the knock-on effects. It is important to use the GVA multiplier and not the GVA effect where the change is expressed in GVA. If the change is expressed as output (or turnover) then the GVA effect can be used to calculate the change in GVA for the economy as a whole. For example:

- If the impacts on commercial shipping have been estimated as a reduction in GVA of £121,600 then the GVA multiplier for water transport would be used. This is shown as 1.7 for Type I multiplier and 2.0 for the Type II multiplier. The overall impacts would then be £121,600 x 1.7 = £206,720 (Type I) and £121,600 x 2.0 = £243,200 (Type 2)
- If the impacts on commercial shipping have been estimated as a reduction in output (but have not been converted to GVA), then the GVA effect for water transport can be used. In most cases, it is expected that changes in output will have been estimated in terms of GVA, by adjusting for intermediate consumption as described above so the GVA effect should not need to be used.

Knock-on employment impacts are assessed using the Type I and Type II employment effects. These require information on the direct change in output for a sector. The Type I and Type II employment effects are used where the impact is measured as a change in direct output in £millions. There is also an employment multiplier but this can only be used where the number of jobs affected by the change is known (or has been estimated). It is important to remember that the employment effects are applied to the change in output (not change in GVA); hence, the change in turnover is needed before it is adjusted for intermediate consumption:

- The change in turnover for commercial shipping is estimated as £320,000 (£0.32 million). The Type I employment effect for water transport is 8.4 and the Type II employment effect is 10.2. The change is turnover is £320,000 so the number of full-time equivalent jobs supported directly and indirectly (Type I multiplier) by the Scottish economy is £0.32 million x 8.4 = 2.7 and the direct, indirect and induced employment change is £0.32 million x 10.2 = 3.3 jobs.

Impacts on commercial fisheries focus on the direct reduction in GVA linked to the potential reduction in the value of landings. The Seafish Fleet Economic

[30] Type I multipliers provide an estimate of the direct and indirect effects. Type II multipliers also include the induced effects, i.e. those additional impacts caused by changes in spending on final goods and services that results from the direct and indirect effects on household income. Therefore, the Type II multipliers are always greater than the Type I multipliers.
[31] Scottish Input-Output multipliers for 1998 to 2014 are available at (latest data is for 2014): http://www.gov.scot/Topics/Statistics/Browse/Economy/Input-Output/Downloads/IO1998-2014Latest

Performance Dataset (2006-2016) is the basis for the calculations[32]. This provides data for 30 fleet segments from which GVA as a percentage of fishing income can be calculated. For each UK vessel size category and gear type assessed in each MPA, an average GVA ratio will be calculated from relevant fleet segments, and applied to the value of landings affected to obtain the direct GVA impact. GVA impact will not be calculated for non-UK vessels. The GVA multiplier is then used to assess the knock-on impacts across the economy. Knock-on employment impacts are based on the value of landings and use the Type I and Type II employment effects. The multipliers can be taken from the Scottish Input-Output multipliers for 1998-2014 for fishing:

- GVA multiplier:
  - Type I GVA effect for fishing: 1.4
  - Type II GVA effect for fishing: 1.6
- Employment effect:
  - Type I GVA effect for fishing: 15.2
  - Type II GVA effect for fishing: 16.4

Where quantified estimates of changes in GVA and knock-on impacts are made they should be converted to Present Value (PV) estimates using a discount rate in line with the HM Treasury Green Book. The discount rate to be applied depends on the year in which the impacts are expected to occur, as shown in Table B.2.1. The total impacts are estimated by summing all of the annual impacts across the whole assessment period.

**Table B.2.1 Long-term discount rates (Green Book)**

| Period of years | Discount rate | | | | | |
|---|---|---|---|---|---|---|
| | 0-30 | 31-75 | 76-125 | 126-200 | 201-300 | 300+ |
| Standard rate as published in the Green Book | 3.50% | 3.00% | 2.50% | 2.00% | 1.50% | 1.00% |

Source: HM Treasury (2008): Intergenerational wealth: transfer and social discounting, Supplementary Green Book Guidance, July 2008, available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/193938/Green_Book_supplementary_guidance_intergenerational_wealth_transfers_and_social_discounting.pdf

## B.2.3 Assessing Impacts Based on Increase in Operating Costs

These impacts are based on the operating costs themselves, converted to PV estimates in the same way that GVA estimates are converted to PV estimates, i.e. identify the year(s) in which the costs would be incurred and apply the discount rates set out in Table B.2.1 to future costs. The total costs are then the sum of costs across the full assessment period.

[32] Seafish Fleet Economic Performance dataset covering 2006 to 2016 available at: http://www.seafish.org/media/publications/October_2017_Seafish_Fleet_Economic_Performance_Dataset_2006-16.xlsx

# B.3. Distributional Analysis

The approach to undertaking the social impact analysis (SIA) is set out in Section 2.10. The distributional analysis forms part of the social impact analysis and involves identifying how any impacts would be distributed across different groups within society.
The first step within the distributional analysis is to identify the social impacts and their likely significance:

**Step 1:** Identify if there is an impact on each of the value clusters and, if so, which sectors or activities would be affected and provide a description of the direct effects. Table B.3.1 provides the table template that can be used to record this part of the assessment; it is used to record the information from Steps 1 to 3.

**Step 2:** Consider who would be most affected by the costs associated with a change in GVA, costs or knock-on effects that exceed 5% of turnover, and impacts that have been identified as being significant at the local level and that have been quantified and monetised. The costs are allocated to the value clusters that most closely represent the impacts that would be caused as a result. These can be recorded in Table B.3.1 as quantified/ monetised impacts. Any mitigation in place that would reduce the impacts should also be recorded.

**Step 3:** Identify the non-quantified impacts (qualitative assessment) and record both magnitude and direction in Table B.3.1 using the definitions set out in Table B.3.2. These range from significant through to minimal effect (positive or negative). A typical (average) impact should be identified and recorded.

**Table B.3.1 Table for recording typical impacts by social value cluster**

| Value clusters | Impact | | | | |
|---|---|---|---|---|---|
| | **Sector/activities affected** | **Description of direct effects** | **Quantified/ monetised impacts** | **Mitigation** | **Qualitative assessment** |
| Family/family life/intergenerational issues | | | | | |
| Jobs/career/employment | Fish processing | Knock-on effects from loss of traditional fishing grounds | Not monetised as not expected to be greater than 5% of output | Possibility for increased imports, but may be limited by location | - |
| Money/cost of living | | | | | |
| Local jobs/local industry/ community sustainability | | | | | |
| Transport connections/technology connections | | | | | |
| Education | | | | | |
| Shops/housing | | | | | |
| Socialising/recreation/parks/ leisure | | | | | |
| Friends/being involved/supporting others | | | | | |
| Local identity/cultural heritage/ Gaelic | Fish processing | Knock-on effects from loss of processing opportunities in town | Not monetised as not expected to be greater than 5% of output | Possibility for increased imports, but may be limited by location | - |
| Healthcare | | | | | |
| Connection to nature/landscape | | | | | |
| Local political and decision-making systems | | | | | |
| Landscape/seascape/wildlife/ environmental change | | | | | |
| National and EU level political and decision-making systems | | | | | |

**Table B.3.2 Definitions for application to the qualitative assessment**

| Direction and magnitude | | Definition |
|---|---|---|
| Significant negative effect | - - - | Where it is **probable** that an impact is sufficiently significant so as to be noticed |
| Possible negative effect | - - | Where it is **possible** that an impact is sufficiently significant so as to be noticed |
| Minimal negative effect, if any | - | Where it is probable than an **impact is unlikely** to be sufficiently significant so as **to be noticeable**, but that some possibility exists that a negative impact could occur |
| No noticeable effect | 0 | No noticeable effect expected |
| Minimal positive effect, if any | + | Where it is probable than a **benefit is unlikely** to be sufficiently significant so as **to be noticeable**, but that some possibility exists that a positive impact could occur |
| Possible positive effect | ++ | Where it is **possible** that a benefit is sufficiently significant so as to be noticed |
| Significant positive effect | +++ | Where it is **probable** that a benefit is sufficiently significant so as to be noticed |

**Step 4:** identify the distributional consequences of each of the social impacts. Table B.3.3 lists the different groups of people that might be affected. Two tables are used to record these impacts to provide sufficient space for justifications to be included (the example for knock-on effects from loss of traditional fishing grounds is continued in Tables B.3.4 and B.3.5 to illustrate how the tables could work):

- Table B.3.4 is used to record impacts relating to location, age and gender. Where the impact is expected to be larger on a particular group than average, the rating is increased. So, for example, loss of traditional fishing grounds that impacts on fish processing is assigned a '-' in Table B.3.1 against jobs/career/employment. Table B.3.4 requires consideration of where and who might be affected by that impact. Where impacts are more likely to occur in rural areas because that is where the fishing ports are mainly located, the impact is increased to '- -'. The rating is reduced where an impact is less than average for a particular location or group (for urban locations the rating in the example in Table B.3.4 is 0 as no noticeable effects are expected). Impacts that are expected to be the same as average retain the original rating. Where a change to the average impact is made, the tables include a brief reason describing why the change has been made.
- Table B.3.5 is used to record impacts relating to different income groups and particular social groups: crofters, ethnic minorities, those with a disability or who are long-term sick, special interest groups and other (those not picked up elsewhere). Again, the ratings from the first table are used as the basis for the assessment, with ratings increased to reflect that a particular group is likely to be impacted more significantly. The extent of the increase is used to reflect how concentrated the impact would be on a particular group and, hence, how noticeable it is likely to be to them. Reference can be made back to the value clusters of local importance identified in specific areas (Table 1 in Section 2.10) when completing these tables to ensure that local priorities are taken into account.

**Table B.3.3 Groups considered in the distributional analysis**

| **Groups distinguished by** | | |
|---|---|---|
| **Location** | **Age** | **Gender** |
| • Datazone<br>• Local Authority<br>• Region<br>• Urban/rural classifications[33] | • Children<br>• Working age<br>• Pensionable age | • Male<br>• Female |
| • **Income** | • **Minority** | • **Other** |
| • 10% most deprived<br>• 10% most affluent<br>• Remaining 80% | • Crofters<br>• Ethnic minorities<br>• Religion<br>• Sexual orientation | • With disability or long-term sick<br>• Special Interest Groups<br>• Other |

[33] The 3 fold urban rural classification is likely to be most relevant here and fits well with the social value clusters. The classification covers remote rural, accessible rural and reset of Scotland: http://www.gov.scot/Topics/Statistics/About/Methodology/UrbanRuralClassification

## Table B.3.4 Distributional analysis: location, age and gender

| Value clusters | Groups distinguished by | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Impact | Location | | | Age | | | Gender | | |
| | | Urban | Rural | Remote rural | Children | Working age | Pensionable age | Male | Female | Other |
| 1. Family/family life/intergenerational issues | | | | | | | | | | |
| 2. Jobs/career/employment | Possible loss of jobs due to reduction in fish processing, felt in rural areas, especially remote rural due to tradition of processing; females more affected as job is traditionally undertaken by women in the area | 0 | - | - - | - | - | - | - | - - | - |
| 3. Money/cost of living | | | | | | | | | | |
| 4. Local jobs/local industry/community sustainability | | | | | | | | | | |
| 5. Transport connections/technology connections | | | | | | | | | | |
| 6. Education | | | | | | | | | | |
| 7. Shops/housing | | | | | | | | | | |
| 8. Socialising/recreation/parks/ leisure | | | | | | | | | | |
| 9. Friends/being involved/supporting others | | | | | | | | | | |

| Value clusters | Groups distinguished by | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Impact | Location | | | Age | | | Gender | | |
| | | Urban | Rural | Remote rural | Children | Working age | Pensionable age | Male | Female | Other |
| 10. Local identity/cultural heritage/Gaelic | Possible loss of identity of remote rural area from loss of local products (traditional production) | - | - | - - | - | - | - | - | - | - |
| 11. Healthcare | | | | | | | | | | |
| 12. Connection to nature/landscape | | | | | | | | | | |
| 13. Local political and decision-making systems | | | | | | | | | | |
| 14. Landscape/seascape/ wildlife/environmental change | | | | | | | | | | |
| 15. National and EU level political and decision-making systems | | | | | | | | | | |

## Table B.3.5 Distributional analysis: income and social group

| Value clusters | Groups distinguished by | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Impact | Income | | | Minority | | | | Other | | |
| | | 10% most deprived | Middle 80% | 10% least deprived | Crofters | Ethnic minorities | Religion | Sexual orientation | With disability or long-term sick | Special interest groups | Other |
| 1. Family/family life/intergenerational issues | | | | | | | | | | | |
| 2. Jobs/career/employment | Possible loss of jobs may affect lower incomes due to low skill of processing work undertaken; crofters using processing as extra income may also be affected more | - - | - | - | - - | - | - | - | - | - | - |
| 3. Money/cost of living | | | | | | | | | | | |
| 4. Local jobs/local industry/community sustainability | | | | | | | | | | | |
| 5. Transport connections/technology connections | | | | | | | | | | | |
| 6. Education | | | | | | | | | | | |
| 7. Shops/housing | | | | | | | | | | | |
| 8. Socialising/recreation/parks/ leisure | | | | | | | | | | | |
| 9. Friends/being involved/supporting others | | | | | | | | | | | |

| Value clusters | Groups distinguished by | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Impact | Income | | | Minority | | | | Other | | |
| | | 10% most deprived | Middle 80% | 10% least deprived | Crofters | Ethnic minorities | Religion | Sexual orientation | With disability or long-term sick | Special interest groups | Other |
| 10. Local identity/cultural heritage/Gaelic | Possible loss of identity from loss of local products (traditional production) may affect crofters more than average | - | - | - | - - | - | - | - | - | - | - |
| 11. Healthcare | | | | | | | | | | | |
| 12. Connection to nature/landscape | | | | | | | | | | | |
| 13. Local political and decision-making systems | | | | | | | | | | | |
| 14. Landscape/seascape/ wildlife/environmental change | | | | | | | | | | | |
| 15. National and EU level political and decision-making systems | | | | | | | | | | | |



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