

## Status of Recommendations made in the current and previous Offshore Energy Strategic Environmental Assessments

The Department for Business, Energy & Industrial Strategy (BEIS - and its predecessor departments) have undertaken a series of Strategic Environmental Assessments (SEA) relating to plans for offshore energy licensing/leasing since 1999. The most recent Offshore Energy SEA3 (OESEA3) was completed in July 2016 and covered oil and gas, offshore wind, other marine renewables (wave and tidal technologies), hydrocarbon gas import and storage, and carbon dioxide transport and storage.

A series of recommendations have been made as part of the Environmental Reports of each SEA, and the following is a compilation of those from OESEA, OESEA2 and OESEA3. A commentary is given on whether the recommendations have been closed, are in progress or still open. The recommendations are grouped into the broad themes of regulation and management, understanding the baseline, and understanding effects and monitoring. It should be noted that as part of the BEIS offshore energy SEA programme, research priorities are identified in collaboration with the SEA steering group and other relevant stakeholders, and work is commissioned to fill data gaps. These priorities are, in part, informed by the SEA recommendations, and where relevant previous or ongoing SEA funded research is identified in the tables below.

A glossary & abbreviations expansion is appended.

### 1. Regulation and management

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<b>Spatial controls</b>			
1.1	It is recommended that leasing/licensing and any subsequent consenting of activities should ensure the minimisation of disruption, economic loss and safety risks to other users of the sea and the UK as a whole. It is recognised that individual projects will be assessed on a case by case basis through the relevant planning process. However, in advance of formal and spatially explicit marine planning for most UK seas, and recognising the overarching policy of the UK Marine Policy Statement, developments, individually or cumulatively, should aim to: <ul style="list-style-type: none"> <li>a. avoid impingement on major commercial navigation routes, significantly increase collision risk or cause appreciably longer transit times;</li> <li>b. avoid causing alteration to the ease and safety of navigation in port approaches or reduce</li> </ul>	OESEA PCR Section 3  OESEA2 Section 6.1  OESEA3 Section 6.1	Open. A number of the points made are being addressed through the ongoing Marine Planning process.  <b>Current status of marine plans<sup>1</sup></b> Completed – East (England), Scotland's National Marine Plan <sup>2</sup>  Draft – South, South East, South

<sup>1</sup> As of July 2017

<sup>2</sup> <http://www.gov.scot/Topics/marine/seamanagement/national>

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	<p>the commercial attractiveness of the ports e.g. through increases in vessel insurance premiums;</p> <p>c. avoid occupying recognised important fishing grounds in coastal or offshore areas (where this would prevent or significantly impede sustainable fisheries);</p> <p>d. avoid interference with civilian aviation operations necessary to ensure aviation safety, efficiency and capacity, including radar systems, unless the impacts can be mitigated, deemed acceptable, are temporary or can be reversed;</p> <p>e. avoid jeopardising national security for example through interference with radar systems or unacceptable impact on training areas unless the impacts can be appropriately mitigated or are deemed acceptable;</p> <p>f. avoid causing significant detriment to tourism, recreation, amenity and quality of life as a consequence of deterioration in valued attributes such as landscape, tranquillity, biodiversity and hydrographic features.</p> <p>g. explore opportunities for co-location which could mitigate potential spatial conflicts with existing users</p>		West, North East, North West (England) <sup>3</sup> , Welsh National Marine Plan <sup>4</sup> , Northern Ireland <sup>5</sup>
1.2	The importance of territorial waters and adjacent coasts is reflected in numerous, often overlapping designations to protect their scenic, geological, ecological and cultural features, and designations or use for recreational, shellfishery, fishery, navigational, commercial and other activities. The environmental sensitivity of coastal areas is not uniform and the intensity of designations and uses typically declines further offshore away from the coast. All activities and developments covered by the draft plan/programme require site-specific information gathering and stakeholder consultation to inform consenting decisions. In addition to marine spatial plan requirements, the particular sensitivity of the coastal zone must be taken into account during site selection for proposed developments within territorial waters. Some developments may not be compatible with a particular nearshore location.	OESEA3 Section 6.1	Open. Recommendation is taken into consideration during the siting of developments and in consent applications.
1.3	In view of recommendation 1.2 above, extensions to existing wind farm lease areas during the currency of the SEA requires careful site-specific evaluation since significant new information on sensitivities and uses of these areas is now available.	OESEA PCR Section 3  OESEA2 Section 6.1  OESEA3 Section 6.1	Open; however, partly covered by Government decision on OESEA which states that extensions to existing leases "Will require careful, site-specific evaluation through the planning process." <sup>6</sup>
1.4	For the area to the west of the Hebrides (covered in SEA 7) it is recommended that blocks west of 14 degrees west should continue to be withheld from oil and gas licensing for the present. This	OESEA PCR	Closed - no blocks west of 14°W offered in 27 <sup>th</sup> , 28 <sup>th</sup> , 29 <sup>th</sup> or 30 <sup>th</sup>

<sup>3</sup> <http://mis.marinemanagement.org.uk/>

<sup>4</sup> <http://gov.wales/topics/environmentcountryside/marineandfisheries/marine-planning/welsh-national-marine-plan/?lang=en>

<sup>5</sup> <https://www.daera-ni.gov.uk/articles/marine-plan-northern-ireland>

<sup>6</sup> <http://webarchive.nationalarchives.gov.uk/+/http://www.berr.gov.uk/files/file51989.pdf>

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	recommendation also applies to the deepest parts of the Southwest Approaches, beyond the shelf break, in waters >200m deep. This is in view of the paucity of information on many potentially vulnerable components of the marine environment, and other considerations. Once further information becomes available, the possible licensing in these areas can be revisited. The potential for collaborative investigations in the areas is recognised reflecting the cost and difficulty of studies in distant, deep waters.	Section 3 OESEA2 Section 6.1 OESEA3 Section 6.1	Rounds.
1.5	The offshore wind and marine renewable industry remains relatively young, with appreciable technological development expected in for example, turbine size, rotation speed, foundation structure, spacing and potentially rotational axis. A firm base of information is required to inform risk assessments and adaptive management, and consequently in respect of ecological receptors a precautionary approach to facility siting in areas known to be of key importance to bird and marine mammal populations is recommended unless evidence indicates that impacts can be appropriately mitigated.	OESEA PCR Section 3 OESEA2 Section 6.1 OESEA3 Section 6.1	Open. BEIS and its predecessors has maintained an active SEA research programme, identifying information and commissioning new research where appropriate (see recent projects on gov.uk <sup>7</sup> ). Relevant peer-reviewed papers from BEIS OESEA funded projects are listed on gov.uk <sup>8</sup> .
1.6	Important navigation routes were identified as part of the first marine plans in England, primarily in territorial waters. In view of the projected construction of major offshore wind farms resulting from Round 3 leasing, and that further wind farms may be proposed in these and other areas (for fixed and tethered turbines), it is considered that a wider set of offshore routes be considered and documented. This would help to ensure continuity of efficient and safe shipping traffic between UK national and international ports. Where necessary, important navigation routes could be treated as “Clearways” in the siting and consenting of marine developments. These would require agreement for all waters of the British Isles as well as international coordination for transboundary routes since there are wind farm and other development proposals in the waters of adjacent states.	OESEA2 Section 6.1 OESEA3 Section 6.1	Open. Has been informed by SEA funded project looking at the navigation consequences (excluding fisheries) of installation of offshore wind farms with a review of predictions and actual results – see Section 5.7.2.3 of OESEA2 ER). Addressed in part by MCA guidance and developer liaison on navigation issues.
<b>Sites of conservation importance</b>			
1.7	In areas with vulnerable habitats and species such as maerl beds and cold water coral reefs mitigation may be required for physically damaging activities such as rig/vessel anchoring, discharges of drilling wastes and cable, pipeline or umbilical installation (from hydrocarbon, gas storage or renewable energy related activities). Prior to decisions on activity consenting in such areas, developers should provide a detailed assessment and seabed information so that appropriate site specific mitigation can be defined.	OESEA PCR Section 3 OESEA 2 Section 6.1 OESEA3 Section 6.1	Closed, addressed through EIA and Habitats Regulations Assessment requirements.
1.8	Efforts are underway to identify offshore Marine Conservation Zones/Marine Protected Areas under	OESEA	Open. Implementation will be

<sup>7</sup> <https://www.gov.uk/government/publications/uk-offshore-energy-strategic-environmental-assessment-research-projects>

<sup>8</sup> [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/590728/BEIS\\_Offshore\\_Energy\\_SEA\\_-\\_Recent\\_Papers.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/590728/BEIS_Offshore_Energy_SEA_-_Recent_Papers.pdf)

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	<p>the Marine Strategy Framework Directive, OSPAR and the Marine and Coastal Access Act (and the Marine Act in Scotland and similar Bill in Northern Ireland [now The Marine Act (Northern Ireland) 2013]). Where marine renewable energy and other large footprint developments are proposed that do not conflict with the conservation objectives of an MCZ, opportunities for co-location should be explored which could mitigate potential spatial conflicts with existing users.</p>	<p>PCR Section 3</p> <p>OESEA2 Section 6.1</p> <p>OESEA3 Section 6.1 (see Bulletin in 1.1 above)</p>	<p>integral to the MCZ/MPA designation and offshore wind leasing processes.</p> <p>Policy GOV2 of the East Inshore and Offshore Marine Plans indicates that opportunities for co-existence should be maximised wherever possible<sup>9</sup>. With respect to MPAs, the plan indicates that co-existence will be supported by the MMO where such activity or development is compatible with the conservation objectives for the site features and does not impact on site integrity (para 221).</p> <p>Relevant MMO studies:</p> <ul style="list-style-type: none"> <li>• MMO (2013). Potential for co-location of activities in marine plan areas. MMO Project No: 1010.</li> <li>• MMO (2014). Scoping of a robust approach to the assessment of coexistence of activities in marine plan areas</li> </ul> <p>The Celtic Seas Partnership recently produced best practice guidelines<sup>10</sup> on encouraging harmonious co-existence of marine renewables projects with other marine uses &amp; interests.</p>
1.9	<p>As part of the Natura 2000 and linked initiatives, further offshore SACs, SPAs, MCZs and MPAs (and extensions to them) are being identified. Although in line with the UK Marine Policy Statement, existing and future Natura 2000 and MCZ/MPA sites are not intended or treated as strict no-go areas for other activities, competent authorities have a responsibility to secure compliance with the requirements of the Habitats and the Wild Birds Directives. It is recommended that developers are made aware at the licensing/leasing stage that SAC/SPA or MCZ/MPA designation may, subject to</p>	<p>OE SEA PCR: Section 3</p> <p>OESEA 2 Section 6.1</p>	<p>Ongoing; implemented through the Habitats Regulations Assessment and EIA assessment processes.</p>

<sup>9</sup> Note similar provisions are made in policy S-CO-1 of the draft South Marine Plan

<sup>10</sup> [http://www.celticseaspartnership.eu/wp-content/uploads/2016/11/CSP\\_Doc2\\_co-location-of-marine-renewables\\_Final.pdf](http://www.celticseaspartnership.eu/wp-content/uploads/2016/11/CSP_Doc2_co-location-of-marine-renewables_Final.pdf)

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	the conclusions of any Habitats Regulations or MCZ/MPA Assessment, preclude development or necessitate suitable mitigation measures so as to avoid adverse effects on a designated site or species.	OESEA 3 Section 6.1	
<b>Other regulatory controls</b>			
1.10	For areas which contain habitats/species listed in the Habitats Directive Annexes, developers should be made aware that a precautionary approach will be taken and some areas may either not be leased/licensed until adequate information is available, or be subject to strict controls on potential activities in the field.	OESEA PCR Section 3  OESEA2 Section 6.1  OESEA3 Section 6.1	Ongoing in terms of BEIS's (or the designated authority) commitment to undertake screening/HRAs where appropriate for future licensing/leasing rounds – see relevant AA documents on gov.uk <sup>11</sup> .
1.11	Previous SEAs have recommended consideration of the establishment of criteria in relation to underwater noise for determining limits of acceptable cumulative impact and for subsequent regulation of cumulative impact. The advances made in this respect through the establishment of the indicator on low- and mid- frequency impulsive sounds under the Marine Strategy Framework Directive are recognised. While criteria have not yet been defined, the establishment of the Marine Noise Registry database to collate occurrences of 'noisy activities' represents the necessary precursor. It is recommended that these efforts are prioritised to allow effective consideration of the cumulative impacts of underwater noise.	OE SEA PCR Section 3  OESEA2 Section 6.1  OESEA3 Section 6.1	Open. See UK Marine Noise Registry website <sup>12</sup>
1.12	Siting and consenting processes for offshore wind farms must remain flexible to allow for technological innovation, including in mitigation measures.	OESEA PCR  Section 3 OESEA2 Section 6.1	Closed. The Government have accepted this recommendation and it will therefore be implemented through the consents process.
1.13	The volumes of rock used for example in cable armouring, foundation scour protection and pipeline protection and upheaval buckling prevention must be the minimum required to provide the necessary protection in order to minimise permanent habitat change and to ensure areas developed as a result of the current draft plan/programme are left fit for other uses after decommissioning. Alternative methods of protection/control should be considered to minimise the potential for permanent habitat change.	OE SEA PCR Section 3  OESEA2 Section 6.1  OESEA3 Section 6.1	Open. A BEIS study is underway to compare the rock volumes estimated in operator applications (e.g. drilling application) with those actually used (from returns).

<sup>11</sup> <https://www.gov.uk/guidance/offshore-energy-strategic-environmental-assessment-sea-an-overview-of-the-sea-process>

<sup>12</sup> <http://jncc.defra.gov.uk/page-7070>

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1.14	Depending on the outcome of further investigations of seal injuries currently attributed to ducted propeller nozzles or thrusters, mitigation measures may be required in important areas for seals for longer term vessel operations e.g. facilities installation.	OESEA2 Section 6.1	Closed. A number of studies undertaken and a recent SMRU report (2015) <sup>13</sup> provide strong evidence for seal predation as a likely explanation for corkscrew injury patterns.
1.15	Carbon dioxide storage in saline aquifers may result in the production and discharge of aquifer water. The Offshore Petroleum Activities (Oil Pollution Prevention and Control) Regulations 2005 apply to discharges containing reservoir hydrocarbons and although they have been amended to apply to carbon storage, it is not yet clear whether they will apply to aquifer discharges. The quality of water between aquifers is variable and the concentrations of elements and compounds of potential environmental concern are poorly characterised; a permitting mechanism is needed to ensure that such discharges can be controlled.	OESEA2 Section 6.1	Closed. The Energy Act 2008 (Consequential Modifications) (Offshore Environmental Protection) Order 2010 extends the provisions of the regulations to offshore gas unloading and storage operations and offshore carbon dioxide storage operations.
<b>Integrated management</b>			
1.16	In areas of prospective interest to multiple energy technologies (including renewable energies, hydrocarbon production, and hydrocarbon and carbon dioxide gas storage) DECC [now Oil and Gas Authority] and TCE should coordinate licensing and leasing decisions, to facilitate and promote the coexistence of uses where practicable, to minimise potential conflicts and industrial land take of the sea, and the inadvertent “sterilisation” of areas.	OESEA PCR Section 3  OESEA2 Section 6.1  OESEA3 Section 6.1 (Bullet g in 1.1 above)	Open; however, further clarification is provided in the UK Marine Policy Statement and related marine plans where published, and in National Policy Statements. See status information for recommendation 1.8 above.
1.17	The nature and uses of the range of estuaries and embayments in which tidal range developments have been and may be proposed vary widely. Similarly there is a wide diversity in the type and location of installations proposed to exploit tidal range. Consequently it is recommended that site specific assessments are undertaken before decisions can be taken on potential leasing and the desirability and acceptability of individual projects, and that successive tidal range proposals should consider the potential for local, regional and wider far-field effects to be generated cumulatively. Such assessments will require a broad subject, spatial and temporal consideration e.g. coastal defence trends and plans, local and regional nutrient flows and siltation patterns, feasibility of compensatory measures for effects on Natura 2000 sites, effects on endangered diadromous fish, and the importance for waterbirds the UK assumes during extreme cold winters.	OESEA2 Section 6.1  OESEA3 Section 6.1	Open. Whilst consideration of environmental impacts was not part of the terms of reference of the 2016 Hendry review of the role of tidal lagoons <sup>14</sup> , the review noted that comprehensive assessments were an integral part of the development consent process and that rigorous scrutiny should be given to the environmental impacts

<sup>13</sup> <http://www.smru.st-and.ac.uk/documents/2173.pdf>

<sup>14</sup> <https://hendryreview.files.wordpress.com/2016/08/hendry-review-final-report-english-version.pdf>

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			of these large infrastructure projects. It noted uncertainty on the cumulative consequences of a series of tidal lagoons and recommended that should lagoons be built, a high level of environmental impact monitoring should be required to ensure that mitigation can be put in place as necessary. It recommended sensible caution in moving to a programme of lagoons too quickly, in order to understand their full impact and identify lessons for the future.
1.18	In recognition of the national and international focus on climate change and curbing fossil fuel emissions, DECC [now OGA and BEIS] should seek and give consideration at both the licensing and project consenting stages to CO <sub>2</sub> emission reduction proposals e.g. capture and storage (rather than venting) of CO <sub>2</sub> from gas treatment offshore. In addition, the DECC [BEIS]'s central role in UK energy policy and climate change response policy is recognised and the department may have the opportunity to promote the integration of strategic assessments into plans or programmes across these areas.	OESEA PCR Section 3  OESEA2 Section 6.1	Open. Through the Energy Act 2016, the OGA is required to have regard to the storage of CO <sub>2</sub> when exercising its functions and to consider the reuse of infrastructure in the decommissioning process. The OGA will also examine further the potential of CO <sub>2</sub> -enhanced oil recovery working closely with both the CCS and oil and gas industry <sup>15</sup> .  The OESEA process integrates the assessment of plans on energy policy including offshore oil and gas, CO <sub>2</sub> and gas storage, offshore wind and marine renewables.
1.19	Whilst it is recognised that most developers in the marine environment have Health, Safety & Environmental management systems in place, it is recommended that companies involved in the planning, undertaking and control of marine activities resulting from the current draft plan/programme operate Environmental Management Systems which are consistent with an international standard.	OESEA3 Section 6.1	Open.
1.20	A range of chemicals are used in marine renewables developments and during operations, a proportion of which are discharged to sea. On the UKCS all chemicals used in the exploration and	OESEA3 Section 6.1	Open.

<sup>15</sup> <https://www.publications.parliament.uk/pa/cm201617/cmselect/cmenergy/497/497.pdf>



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	production of offshore hydrocarbons (and de facto CCS) are controlled through the Offshore Chemical Notification Scheme, reflecting the OSPAR Harmonised Mandatory Control Scheme. Since most of the chemicals used by the renewables industry are similar to those used in the oil and gas industry there seems a logic to standardise their control and reporting (including those chemicals listed by OSPAR for priority action or candidates for substitution).		
1.21	To assist developers and the achievement of conservation objectives, DECC and others in Government should encourage the adoption of consistent guidance across the UK on the implementation Habitats Directive requirements, for example disturbance of European Protected Species (EPS, Annex IV species).	OESEA PCR Section 3  OESEA2 Section 6.1	Closed. Guidance on the protection of European Protected Species from injury and disturbance available for the marine area in England and Wales and the UK offshore marine area (JNCC, 2010 – draft) and for Scottish Inshore waters (Marine Scotland 2014). JNCC has also developed guidelines and protocols for minimising the risk of injury and disturbance to marine mammals from seismic surveys, from using explosives and from piling noise.
1.22	A study for the MCA in 2000 assessed incident frequencies and the likelihood of different types of accidental events in causing coastal pollution to guide the placement of tugs (Emergency Towing Vessels) in different locations around the UK coastline. The tugs provide important mitigation of the risk of vessel collision and coastal pollution and the UK arrangements for their provision are due to change from September 2011. Offshore wind farm and other developments over the last decade, and those projected in the near future have, and will, alter the collision and spill risk profile around the UK. Consequently, it is recommended that periodic reviews of the availability of tugs should be undertaken to ensure that adequate response capability is maintained. Specifically, the location of tugs must continue to be based on periodic strategic assessments of risk.	OESEA2 Section 6.1	Closed, although ongoing. The MCA awarded a five-year contract for a new Scottish emergency towing vessel (ETV), which began on 31 December 2016, primarily covering northern and north-western waters <sup>16</sup> .
1.23	The subject of cumulative effects assessment (CEA) is challenging at project, industry and strategic levels, and is frequently raised by stakeholders as an issue. The establishment of a Cross-Government Cumulative Effects Assessment Working Group is welcomed, as is its aim to develop guidance for regulators, advisors and applicants to help increase consistency in application of CEA. At all levels of assessment, guidance on the spectrum of certainty and the point beyond which CEA is considered conjectural would be useful.	OESEA3 Section 6.1	Open.
<b>EIA Improvements</b>			
1.24	Offshore gas storage projects need an EIA under the requirements of the EIA Directive. However, it is unclear at present under which UK regulations EIA for such projects would be undertaken, and early resolution is desirable in light of the drivers for increased UK gas storage capacity.	OESEA PCR Section 3	Closed. Gas and carbon dioxide storage are now included in, <i>inter alia</i> , the Offshore Petroleum

<sup>16</sup> <https://www.gov.uk/government/news/new-emergency-towing-vessel-for-scotland>



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			Production and Pipe-lines (Assessment of Environmental Effects) Regulations 1999 through amendment under The Energy Act 2008 (Consequential Modifications) (Offshore Environmental Protection) Order 2010.
1.25	There is wide scale existing use of CO <sub>2</sub> for industrial and other applications. However, it is likely that transport of CO <sub>2</sub> to offshore storage facilities will be as dense phase or supercritical fluid. The HSE note the limited operating experience in the handling of supercritical CO <sub>2</sub> offshore (in comparison to hydrocarbon processing), the current lack of internationally recognised standards and codes of practice specific to dense phase or supercritical CO <sub>2</sub> plant and equipment, substantial operational experience, understanding and validated models of the behaviour of CO <sub>2</sub> when released from dense phase. Similarly, the environmental implications of subsea accidental releases of dense phase or supercritical CO <sub>2</sub> are poorly understood. A range of research is underway (under various auspices) on these issues and it is recommended that the results of these studies are periodically synthesised to provide guidance for consideration of development applications and to allow gap identification.	OESEA2 Section 6.1	Open. BEIS (as DECC) contributed to a study of dense phase CO <sub>2</sub> subsea release behaviour and continues to monitor new research in this area.

## 2. Understanding the baseline

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<b>General</b>			
2.1	<p>There remain a number of subject areas for which the information base is limited and will need to be enhanced to support future marine spatial planning as well as project-specific consenting. These information gaps include aspects of the natural world and human uses, with regional context and long-term trend data notably lacking. These gaps include:</p> <ol style="list-style-type: none"> <li>Recent information on the distribution of fish eggs and larvae, and variability in space and time</li> <li>Detail of bird migration patterns, and variability in space and time including flight heights in different weather conditions</li> <li>Further understanding of the marine areas routinely used by breeding birds for foraging, in particular those adjacent to SPAs</li> <li>Better understanding of the ecology of most marine mammal species and in particular important areas for breeding, foraging and resting</li> <li>Understanding of variations in ambient noise, and other anthropogenic noise sources, must be improved to assess likely effects of additional noise from geophysical survey and</li> </ol>	<p>OESEA PCR Section 3</p> <p>OESEA2 Section 6.1</p>	<p>Open, the SEA programme continues to fund and coordinate research to improve the information base on which assessments are made. New research projects will be discussed amongst key stakeholders including the SEA Steering Group. This research will be coordinated with that of other research initiatives to ensure the best use of available resources.</p> <p>Relevant SEA funded research includes<sup>18</sup>:</p>

<sup>18</sup> [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/590728/BEIS\\_Offshore\\_Energy\\_SEA\\_-\\_Recent\\_Papers.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/590728/BEIS_Offshore_Energy_SEA_-_Recent_Papers.pdf)

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	<p>construction or operation of marine installations</p> <p>f. Finer scale distribution of fishing effort, gears and catches for smaller vessels (&lt;15m). A study of fishing effort in Round 3 wind farm zones funded by The Crown Estate and DECC [now BEIS] may partially address this<sup>17</sup>.</p> <p>g. Effects (both short and longer term) on fishing activity in and immediately adjacent to constructed wind farms.</p> <p>h. The ecological significance of field responses of fish to electromagnetic fields associated with cables; it is recommended that the research needs identified by Gill <i>et al.</i> (2009), and Bochert &amp; Zettler (2006) are considered in the context of the Defra review of Round 1 and 2 wind farm monitoring. Similarly, research is needed on the behavioural response of seals to electromagnetic fields (extrapolating from the unexpected results of Forrest <i>et al.</i> 2009), to understand if there is a potential for exclusion from the footprints of developments with a network of electric cables such as large marine renewable energy arrays.</p>		<ul style="list-style-type: none"> <li>• satellite tracking of different seabird species from SPA sites to better understand marine usage and foraging behaviour</li> <li>• seal tagging studies in the southern North Sea indicating how seals use the marine area<sup>19</sup>. A similar study is underway on the west and north coasts of the UK.</li> </ul>
<b>Marine mammals</b>			
2.2	<p>In view of the potential interest in deepwater hydrocarbon exploration to the west of the Hebrides, improved understanding of the ecology and location of important areas for beaked whales should be obtained to underpin assessments of effects and identification of mitigation measures. The forthcoming SCANS III survey [now completed] is noted but specific research on beaked whales in deepwater areas of the UK is also required.</p>	OESEA3 Section 6.1	Open. University of St Andrews study on beaked whales in UK waters: ecology, effects of noise and options for mitigation completed to inform the OESEA process (Aguilar de Soto <i>et al.</i> 2016). BEIS has also supported the SCANS III survey with first results published May 2017 <sup>20</sup> .
2.3	<p>A number of conservation sites have been recently proposed for harbour porpoise in parts of the UK. To support the assessment of potential effects of proposed activities (in sites and beyond), improved understanding of their ecology is needed, along with that of their prey and interspecific interactions (such information will assist in the management of the population(s) in UK waters). The forthcoming SCANS III survey [now completed] is noted, the data from which will inform efforts to understand the underlying causes of temporal variability in harbour porpoise distribution evident from the results of the SCANS I and II surveys.</p>	OESEA3 Section 6.1	Closed. Five harbour porpoise SACs consulted on in 2016 were given Ministerial clearance and were submitted to the European Commission for approval to designate on 30 January 2017. First results from SCANS III indicate that the observed distribution of harbour porpoises in 2016 was similar to that observed in SCANS-II in 2005 (Hammond <i>et</i>

<sup>17</sup> <http://www.thecrownestate.co.uk/media/502008/ei-changes-to-fishing-practices-around-the-uk-as-a-result-of-the-development-of-offshore-windfarms.pdf>

<sup>19</sup> <https://www.gov.uk/guidance/offshore-energy-strategic-environmental-assessment-sea-an-overview-of-the-sea-process#offshore-energy-sea-research-programme>

<sup>20</sup> <https://synergy.st-andrews.ac.uk/scans3/files/2017/05/SCANS-III-design-based-estimates-2017-05-02-final.pdf>

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			<i>al.</i> 2013) with one notable difference that more sightings were made throughout the English Channel in 2016 than previously.
<b>Birds</b>			
2.4	Although there has recently been significant boat based and aerial survey effort in coastal waters, there is a general lack of modern survey data on waterbirds in offshore areas. Adequate data on waterbird distribution and abundance is a prerequisite to effective environmental management of activities, for example, in timing of operations to avoid periods of particular sensitivity. A comprehensive analysis of the European Seabirds at Sea (ESAS) database was undertaken to identify possible marine SPAs but gaps in spatial coverage necessitated the use of interpolation to estimate values for un-surveyed areas. The development of high-precision tracking devices has led to a recent upsurge in bird tracking studies, and for some species several hundreds of individuals have been tracked from numerous colonies around the UK, allowing the marine distribution of some species to be predicted from tracking data. It is recommended that the results of cross-validations of models of marine distribution derived from tracking individual birds with those from at-sea survey are assessed to inform decisions on the nature and location of waterbird distributional research.	OESEA PCR Section 3  OESEA2 Section 6.1  OESEA3 Section 6.1	Open. Offshore bird data has been collected in some areas through SEA programme-funded surveys on chartered vessels and vessels of opportunity. Seabird surveys undertaken as part of Round 3 projects provide useful information on selected offshore areas. The SEA research programme has funded satellite tracking of a number of seabird species over a number of years <sup>21</sup> as well as an RSPB project which looked at cross-validation of at-sea survey and GPS tracking methods to determine marine distribution of seabirds.
<b>Landscape and seascape</b>			
2.5	The increasing footprint of offshore renewables (and potential future expansion of gas storage facilities) could result in significant incremental and cumulative visual effects from the shore and at sea. A characterisation and sensitivity study for England's seascapes would complement those completed for Wales and Scotland in relation to offshore renewables, and aid the assessment of possible impacts at a strategic level, particularly cumulative impacts. It is recommended that such a study be undertaken in order to inform subsequent offshore SEAs, future Marine Plans, and other programmes which require a high level consideration of seascape.	OESEA2 Section 6.1	Closed in part. Relevant methodological information published by Natural England in 2012 – “An approach to seascape character assessment” and character data in the seascape character assessments prepared for the East inshore and offshore marine plan areas as well as for the South inshore and offshore areas (Marine Management Organisation). A similar study covering the other Marine Plan

<sup>21</sup> <https://www.gov.uk/guidance/offshore-energy-strategic-environmental-assessment-sea-an-overview-of-the-sea-process#offshore-energy-sea-research-programme>

ID#	Recommendation	Location	Status
			areas is due to report in 2017. The studies do not consider potential implications of different technologies at a regional scale, but could inform strategic level assessment, and in time following marine plan review, the trajectory and type of changes in seascape character could inform monitoring.
<b>Seabed and benthic habitats</b>			
2.6	For some areas there is excellent data on seabed topography and texture from multibeam mapping undertaken under various auspices including by the MCA, BGS and the SEA programme. The NERC Marine Environmental Mapping Programme (MAREMAP) and the scoping study for a UK National Seabed Mapping Programme are noted. However, significant gaps in coverage remain, and continued effort should be focussed on developing comprehensive coverage of the UKCS, prioritising areas of industrial and conservation interest.	OESEA3 Section 6.1	Open.
2.7	There is a need for enhanced, strategic level understanding of biodiversity and its patterns in UK waters, in particular for the species (e.g. the bivalve <i>Arctica</i> ) and features (e.g. habitats characterised as seapens and burrowing megafauna communities or burrowed mud) used as the bases for MCZ/MPA identification and designation, to inform considerations of site integrity and the assessment of proposed activities impinging on sites.	OESEA3 Section 6.1	Open. SEA funded project to develop British bivalve identification tool with National Museum of Wales <sup>22</sup> .

### 3. Understanding effects and monitoring

ID#	Recommendation	Location	Status
<b>Marine mammal impacts</b>			
3.1	The effects of noise on marine mammals particularly from piling and seismic survey remain an issue of debate. A range of mitigation measures are available and their adoption is normally required through consenting. However, there is a need for cross-industry coordination of what noisy activities are planned, where and when, to facilitate the assessment of cumulative effects and implementation of temporal/spatial mitigation actions. The approach would require a mechanism to facilitate the exchange of information, for example through a web-based forum hosted by DECC [now BEIS], JNCC or the future MMO.	OE SEA PCR Section 3	Partly closed, a noise registry has been developed and is being coordinated by JNCC – see recommendation 1.11 above.  Most activities creating sounds such as pile driving and seismic survey must be licensed or notified and conducted under strict conditions. Licences are issued

<sup>22</sup> <http://naturalhistory.museumwales.ac.uk/britishbivalves/>

ID#	Recommendation	Location	Status
			by a range of bodies including BEIS, MMO, MS, DOENI and NRW. As part of the licensing process, details of noise-generating activities are recorded and lodged in the noise registry.
3.2	Whilst the information base has improved in recent years, further data are required on the spatial scale at which marine mammals and their prey respond to well characterised noise sources, and whether this varies according to individual characteristics, behavioural state or other environmental variables, and whether the scale of effects is sufficient to cause significant adverse effects at an individual or population scale.	OESEA3 Section 6.1	Open. Relevant SEA commissioned research: <ul style="list-style-type: none"> <li>tracking of harbour seals during piling operations in the southern North Sea</li> <li>monitoring cetaceans during piling operations in the Moray Firth</li> <li>comparing the performance of Interim PCoD and the Moray Firth Seal Assessment Framework</li> </ul>
3.3	Site surveys for marine developments can identify unexploded ordnance (UXO), which is either left <i>in situ</i> or rendered harmless through attachment and detonation of an explosive charge. Human safety is paramount in such decisions, but the potential to minimise the cumulative effects of the percussive noise on marine mammals should be explored, in particular in relation to conservation sites established or proposed for seals or cetaceans in areas of relatively high UXO occurrence e.g. the southern North Sea.	OESEA3 Section 6.1	Open.
<b>Bird impacts</b>			
3.4	The Offshore Vulnerability Index (OVI) to surface pollutants developed by the JNCC should be reviewed in the light of results from recent aerial and boat based bird survey data, and updated if necessary. The potential application of a Species Sensitivity Index (SSI) for wind farms (Garthe & Hüppop 2004) is noted; and it is recommended that consideration is given to the practicality and utility of the development of UK-specific individual SSI and their mapping in UK waters. The recent aerial bird survey data should be incorporated in the distributional database used to map the SSI and an updated version of the OVI to surface pollutants. The existing initiatives to develop Population Viability Analysis for sensitive species should also be progressed, including, if necessary, research to improve the accuracy of inputs to the models.	OESEA PCR Section 3  OESEA2 Section 6.1	Open, although there have been a number of Population Viability Analyses undertaken primarily in relation to UK offshore wind farms, as well as significant new information on seabird distribution from aerial and boat based surveys.  The data used to inform the Oil Vulnerability Index (OVI) has been updated and a new Seabird Oil Sensitivity Index (SOSI) has now

ID#	Recommendation	Location	Status
			been published on the JNCC website <sup>23</sup> .
<b>Environmental effects monitoring</b>			
3.5	The information collected by offshore renewables and oil industry site surveys and studies is valuable in increasing the understanding of UK waters. The initiatives such as the UKOilandGasData, Marine Data Exchange and UKBenthos databases to ensure that such information is archived for potential future use should be continued and actively promoted during the consenting processes. Similarly, there should be encouragement for the analysis of this information to a credible standard and its wider dissemination.	OESEA PCR Section 3  OESEA2 Section 6.1  OESEA3 Section 6.1	Open. In part covered by ongoing initiatives including UKOilandGasData (previously DEAL and CDA DataStore), UKBenthos, the Crown Estate Marine Data Exchange, and individual data archiving centres under the MEDIN initiative. BEIS continue to make a contribution to the MEDIN initiative through the SEA research programme.
3.6	There is little empirical data on the impacts of wave and tidal stream technologies in particular on the array scale effects of energy removal on the physical environment and biotopes; further research is needed into the effects and cumulative impacts of arrays of these devices	OESEA2 Section 6.1	Open. Initiatives such as SMARTtide <sup>24</sup> have developed a UK scale model which may provide useful information.
3.7	There is little information available on the interaction of birds, marine mammals and fish with surface and submerged wave and tidal devices. It is recommended that for the deployment of single devices and small arrays, appropriately focussed surveys of animal activity and behaviour should be undertaken to inform commercial scale deployment risk assessments and consenting. A strategic and coordinated approach to such research is recommended since the results will be of wider application; research results should be made publicly available wherever possible.	OESEA2 Section 6.1  OESEA3 Section 6.1	Open. A number of SEA funded studies have contributed to this, the trialling of sonar systems for detection and monitoring of large fauna in vicinity of tidal turbines, tagging of seals, investigations of fish behaviour at the WaveHub site, and contributions to the environmental monitoring, analysis and reporting at the MeyGen site.
3.8	Beaked whales are very sensitive to anthropogenic noise (particularly to powerful sonar but potentially also to seismic survey) and their behaviour makes them difficult to observe visually or acoustically as part of implementation of standard seismic survey mitigation procedures. In recognition of this, it is recommended that opportunities to enhance mitigation measures for beaked whales beyond those in the JNCC guidelines for minimising the risk of injury and disturbance to marine mammals from seismic surveys should be considered during deep water seismic survey planning and implemented during operations.	OESEA3 Section 6.1	Open. SEA commissioned University of St Andrews study on beaked whales in UK waters: ecology, effects of noise and options for mitigation.

<sup>23</sup> <http://jncc.defra.gov.uk/page-7373>

<sup>24</sup> <http://www.hrwallingford.com/projects/smarttide>

## 4. Glossary & Abbreviations

BEIS	Department for Business, Energy and Industrial Strategy
BGS	British Geological Survey - public sector organisation responsible for advising the UK government on all aspects of geoscience as well as providing impartial geological advice to industry, academia and the public.
CEA	Cumulative Effects Assessment
CO <sub>2</sub>	Carbon dioxide
DECC	Department of Energy and Climate Change – formerly BERR and DTI, and now BEIS
DOENI	Department of Environment Northern Ireland
EIA	Environmental Impact Assessment
EPS	European Protected Species – a species protected under the EC Habitats or Birds Directives.
ESAS	European Seabirds At Sea
ETV	Emergency Towing Vessel
GPS	Global Positioning System
HRA	Habitats Regulations Assessment – assessment undertaken where a proposed development has the potential to adversely affect the integrity of a Natura 2000 site, i.e. a site designated under the EC Habitats or Birds Directives
HSE	Health and Safety Executive
JNCC	Joint Nature Conservation Committee
MAREMAP	Marine Environmental Mapping Programme – a joint initiative developed to improve the understanding of the seabed environment of the UK.
MCA	Maritime and Coastguard Agency – executive agency of the Department for Transport working to prevent the loss of life on the coast and at sea. Produces legislation and guidance on maritime matters, and provides certification to seafarers.
MCZ	Marine Conservation Zone – created under the Marine and Coastal Access Act 2009. Referred to as Marine Protected Areas (MPAs) in Scottish waters under the Marine (Scotland) Act 2010.
MEDIN	Marine Environment Data and Information Network
MMO	Marine Management Organisation
MS	Marine Scotland
MSFD	Marine Strategy Framework Directive
NERC	Natural Environment Research Council
NRW	Natural Resources Wales
OESEA	Offshore Energy SEA – refers to the last three offshore energy SEAs, undertaken for the whole UKCS and territorial waters of England & Wales, relating to offshore wind, wave and tidal, oil and gas, and natural and carbon dioxide gas storage.
OGA	Oil and Gas Authority
OSPAR	Oslo and Paris Conventions for the protection of the marine environment of the North-East Atlantic, with 15 Contracting Parties and the European Commission, representing the European Union.



OVI	Offshore Vulnerability Index – a monthly index of seabird vulnerability to surface pollution (e.g. oiling) developed by JNCC, covering the UKCS blocks used for offshore oil & gas licensing.
OWF	Offshore Wind Farm
PCoD	Population Consequences of Disturbance
PCR	Post Consultation Report – report documenting feedback received during formal public consultation on the SEA and responses as to how the feedback was considered.
PVA	Population Viability Analysis
RSPB	Royal Society for the Protection of Birds
SAC	Special Area of Conservation – protected sites designated under the EC Habitats Directive.
SAMS	Scottish Association for Marine Science
SCANS	Small Cetacean Abundance in the North Sea – surveys undertaken by observers on research ships and aircraft in the North Sea, Kattegat, Skagerrak, western Baltic, English Channel and Celtic Sea. Two surveys (SCANS and SCANS II) undertaken in 1994 and 2005 respectively.
SEA	Strategic Environmental Assessment
SMRU	Sea Mammal Research Unit – based at the University of St Andrews
SOSUS	Sound Surveillance System – originally intended to track submarines, these hydrophones have been used to track whales.
SPA	Special Protection Areas – protected sites classified in accordance with Article 4 of the EC Birds Directive
SSI	Species Sensitivity Index
TCE	The Crown Estate
UKCS	United Kingdom Continental Shelf - comprises those areas of the sea bed and subsoil beyond the territorial sea over which the UK exercises sovereign rights of exploration and exploitation of natural resources.
UXO	Unexploded ordnance