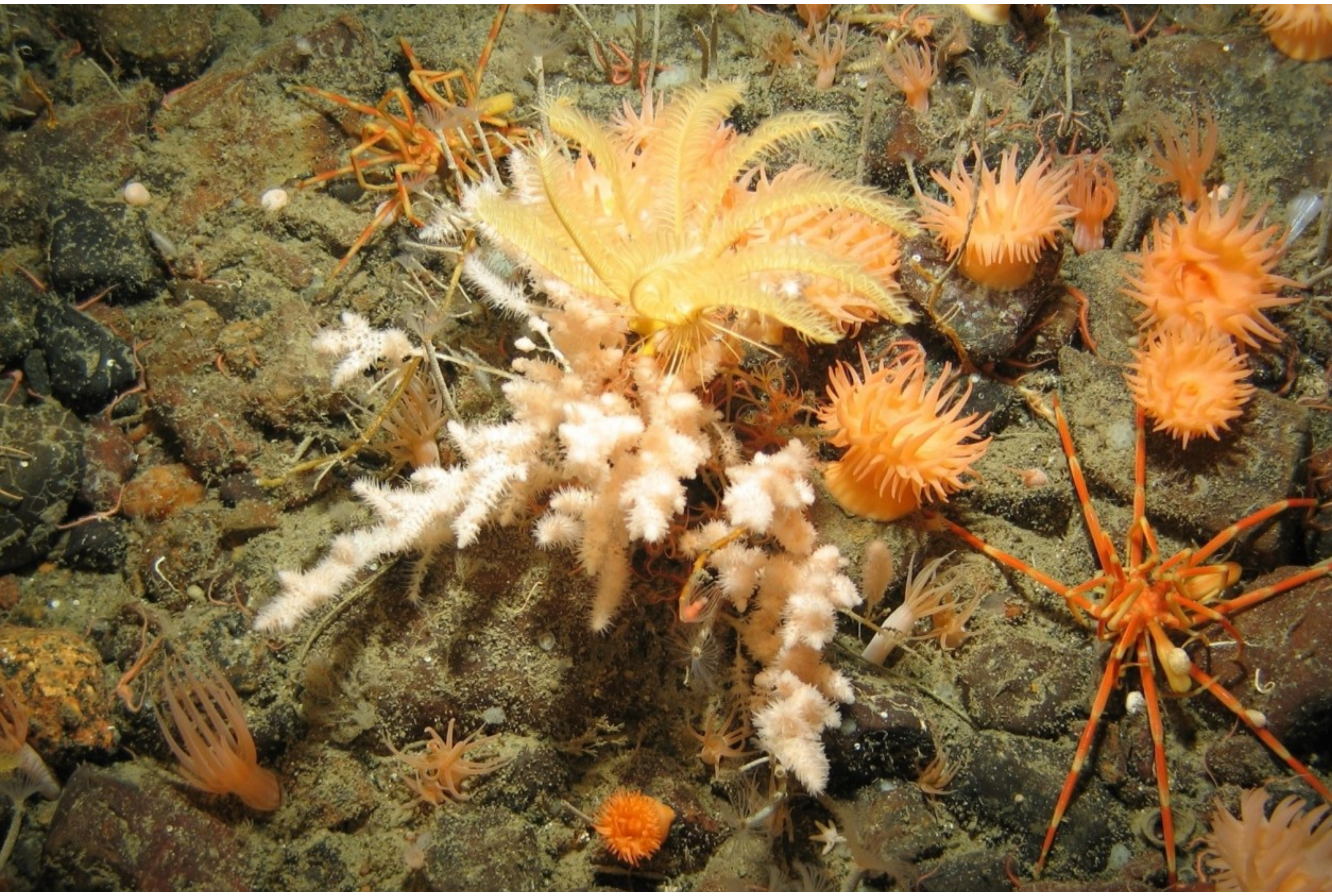
Department for Business, Energy & Industrial Strategy

UK Offshore Energy Strategic Environmental Assessment



OESEA3 Review

October 2018

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1 Introduction

1.1 Document purpose and overview

Continued leasing and licensing in relevant UK waters, enabled by the adoption of the plan/programme assessed in Offshore Energy SEA 3 (OESEA3), relies on the continued currency of the information base of the SEA (environmental baseline and knowledge of effects assessment) and its conclusions. The OESEA3 Environmental Report was published in March 2016, and the plan/programme adopted in July 2016. A review has been undertaken of the basis of the SEA, its conclusions and recommendations, and also those relevant monitoring arrangements required under Article 10 of the SEA Directive. The review is documented as a series of updates to key aspects of the OESEA3 Environmental Report as follows:

- The leasing/licensing context to the plan/programme, and relevant prospectivity and technologies covered in the assessment (Section 2)
- The relationship of the plan/programme with other relevant initiatives (Section 3)
- The environmental baseline: its description, status, relevant environmental problems and likely evolution (Section 4)
- The understanding of potential effects associated with activities which could follow leasing/licensing related to the plan/programme (Section 5)
- The SEA recommendations, monitoring and conclusions (Section 6)

An overall conclusion is provided in Section 7 regarding the continued adequacy of OESEA3.

A draft of this review document was commented on by the Offshore Energy SEA Steering Group[1] and their input is gratefully acknowledged.

[1] https://www.gov.uk/government/groups/offshore-energy-sea-steering-group

2 Leasing/licensing overview

2.1 Key changes to the policy and planning context

The overarching policy context within which OESEA3 was drafted remains unchanged in terms of its obligations and commitments to greenhouse gas emissions reductions and an increasing share of renewables energy production. A number of new initiatives have been published which augment the approach to meeting these, and other related obligations, but for which firm policy in some areas remains to be drafted.

2.1.1 Industrial and Environment Strategy

The Clean Growth Strategy (October 2017) identifies UK progress to date in reducing emissions while maintaining economic growth and sets out, at a high level, how the UK will meet its domestic emissions reduction targets, while doing so at the lowest cost to taxpayers, and maximising the social and economic benefits of the transition (for example skills, jobs and air quality). A number of the policies and proposals in the strategy are of relevance to the SEA, including: to improve renewables route to market and Contracts for Difference (CfD) auctions, the first of which will open by May 2019 with the intention to run these every 2 years using £557 million[2]; to work with industry as they develop a “sector deal” for offshore wind which could lead to an extra 10GW of new capacity to be built in the 2020s; to demonstrate international leadership in Carbon Capture Usage and Storage (CCUS); and to work with industry through a new CCUS Council to meet the ambition of having the option to deploy CCUS at scale (required beyond 2030 to decarbonise industry). The fifth carbon budget was approved by the UK Parliament shortly after the publication of OESEA3, which covers emissions of 1,725 $MtCO_2eq$. for the period 2028 to 2032[3], and the strategy will be updated in response to progress reports by the Committee on Climate Change (CCC) reports before setting the sixth carbon budget in 2021. A review of the strategy by the CCC (2018) recognised the strong commitment of the UK Government to achieve decarbonisation, and the framing of the low-carbon economy in terms of its economic contribution, but identified that policies needed to be firmed up, and that gaps remain to attain the fourth and fifth carbon budgets[4] (which were similarly identified in earlier CCC progress reports, e.g. CCC 2015). This is recognised in the latest energy and emissions projections (BEIS 2018b), in which it is indicated that policies and proposals from the Clean Growth Strategy will be developed more fully and included in future projections[5].

Following on from the publication of the Clean Growth Strategy, the Industrial Strategy was published in November 2017. The strategy identifies four “grand challenges”, with the most relevant to the OESEA programme being to “maximise the advantages for UK industry from the global shift to clean growth”. The strategy emphasises the economic advantages of “clean growth”, including in the energy sector, and that the Government would increase support for innovation to reduce the costs of related technologies (recognising the cost reductions already

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[2] https://www.gov.uk/government/news/energy-minister-claire-perry-hails-success-story-of-offshore-wind-in-newcastle-today
[3] equivalent to an average 57% reduction on 1990 emissions, see the *The Carbon Budget Order 2016*.
[4] Also see BEIS (2018b) Updated energy and emissions projections 2017.
[5] Also note the Environmental Audit Committee report on green finance: https://www.parliament.uk/business/committees/committees-a-z/commons-select/environmental-audit-committee/news-parliament-2017/green-finance-report-published-17-19/

achieved in offshore wind), with the long-term goal to make low carbon technologies cost less than higher carbon alternatives.

Despite the focus of the above strategies on a move to low carbon energy sources, the Industrial Strategy also recognises that the oil and gas sector continues to be highly productive, and also has a role in maintaining the UK's security of supply. The Oil and Gas Authority (OGA) continues to implement the Maximising Economic Recovery (MER) UK Strategy as described in OESEA3, with a number of task forces, and the Technology Leadership Board, working on priority areas overseen by the MER UK Steering Group[6]. The work of the OGA has led to a number of minor changes to the licensing context for offshore oil and gas which is described further in Section 2.2.

The 25 Year Environment Plan, published January 2018, is described as a "sister document" to the Clean Growth Strategy. The plan sets out a number of 25-year goals relating to air, water, flora and fauna, risks from natural disaster, sustainability and the enhancement of cultural aspects of the environment. Six policy areas are identified: using and managing land sustainably, recovering nature and enhancing the beauty of landscapes, connecting people with the environment to improve health and wellbeing, increasing resource efficiency and reducing pollution and waste, securing clean, productive and biologically diverse seas and oceans, and protecting and improving the global environment. The Natural Capital Committee (NCC), established in 2011, provides advice to Government on the sustainable use of natural capital (i.e. that from which ecosystem services flow), and provided advice on the 25 Year Environment Plan whereby the natural capital approach is signalled as the framework within the plan should be set[7], though it recognises the challenges of implementing the approach (e.g. a lack of knowledge in many areas), which is further acknowledged in the Plan. Two marine "pioneer projects" (Devon[8] and Suffolk[9]), amongst other terrestrial projects, have been established to test the approach and also inform best practice.

A number of the policy areas in the 25-year environment plan are relevant to the plan/programme assessed in OESEA3. These include: publishing a new strategy for nature, building on the current Biodiversity 2020 strategy which will be relevant to both the marine and terrestrial environment; the development of a Nature Recovery Network which will provide an additional 500,000 hectares of habitat to better link existing protected sites; reducing litter and littering including of the marine environment; the publishing of a chemicals strategy[10] building on existing approaches; the implementation of a sustainable fisheries policy as the UK leaves the Common Fisheries Policy (CFP) based on the principles of maximum sustainable yield and outlined in a Fisheries White Paper in advance of a new Fisheries Bill; achieve good environmental status of our seas, while allowing marine industry to thrive aided by the creation of a marine online assessment tool (MOAT) to look at pressures affecting the marine environment and the completion of marine planning; the completion of a network of well-managed Marine Protected Areas (MPAs).

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[6] The OGA have published an Activity Plan for 2017/2018 which outlines actions that will be taken to progress their Corporate Plan 2016-2021, within the context of the MER UK strategy. The latest MER UK annual update was published in May 2018: https://www.ogauthority.co.uk/news-publications/publications/2018/mer-uk-annual-update-2017/

[7] The NCC have developed a "How to do it" guide, https://www.gov.uk/government/groups/natural-capital-committee

[8] See: http://www.northdevonbiosphere.org.uk/news/biosphere-becomes-a-defra-pioneer-area

[9] https://marinedevelopments.blog.gov.uk/2018/05/08/marine-pioneer-how-nature-is-integral-to-decision-making/

[10] Recognisisng the implications for the European Regulation on Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) of the UK leaving the EU.

The progress of the plan will be measured through a new set of metrics to be developed in 2018, and it is proposed that oversight of plan progress be handed to an independent statutory body established through an Environmental Principles and Governance Bill, which will also be used to create a new statutory policy statement on environmental principles to be published in autumn 2018. The remit and functions of this body are presently subject to consultation[11].

2.1.2 Marine Spatial Planning

The East Inshore and Offshore Marine Plans and the Scottish National Marine Plan had been adopted at the time of OESEA3 publication, and since then only the South Inshore and Offshore Marine Plans have been adopted. The Marine Management Organisation (MMO) and other marine planning authorities (e.g. of devolved administrations) continue to develop plans for UK waters. A scoping document for the Sustainability Appraisal (SA) of the remaining plans for English waters (north east, north west, south east and south west) was published in July of 2016[12] followed by a Habitats Regulations Assessment (HRA) pre-screening report in February 2017[13]. Consultation workshops are continuing in 2018 to gain input on the remaining plan visions and options for the remaining English plans, and SA outputs on options assessment were published in June 2018. Engagement on "Iteration 3" of the remaining plans is not expected until early 2019, with the related SA and HRA processes progressing in parallel. The schedule for the adoption of the final plans remains 2021.

A consultation draft of the Welsh National Marine Plan, including associated Sustainability Appraisal and HRA, was published in December 2017 and finished on 29th March 2018, and the draft Marine Plan for Northern Ireland and its accompanying SA and HRA assessments were published for consultation on 18th April 2018. The plans, like those adopted or published in draft form for English and Scottish waters, are consistent with the information contained in the Marine Policy Statement, and have taken a similar approach (i.e. strategic and non-spatially explicit), presentation (comprising a vision, objectives and general and sectoral policies) and policy wording. The draft plans are written at a strategic level which largely consolidates and clarifies existing policy with a regional focus, and no spatially explicit planning but rather identification of potential resource and constraint (including through mapping), with policies that seek to balance environment, economic and social considerations in decision making and consent application. While usefully illustrating regional aspects of the UK marine area, informed through consultation, SA exercises tend to reflect through review of individual policies that there is no or minor implications of their implementation, and in turn no to negligible effect on environmental receptors were considered as part of the Marine Plan SA process.

The draft Welsh and Northern Irish marine plans have policies covering offshore energy. The Welsh plan identifies and maps the key resource and/or strategic resource areas for different offshore renewables, including wave, tidal stream, tidal range and wind, and provides accompanying enabling and safeguarding policies. These respectively promote proposals for marine renewables, including furthering understanding of opportunities to exploit resources, and for offshore wind, to support collaboration to collect evidence on constraints to support optimal siting. Though this policy wording implies a more spatially explicit approach to planning, it still relies on further information and it may be acted upon following plan adoption should the next round of wind leasing result in further Welsh proposals. Similarly, enabling and safeguarding proposals for oil and gas (including gas storage and CCUS) are also contained in the draft

[11] https://consult.defra.gov.uk/eu/environmental-principles-and-governance/

[12] https://www.gov.uk/government/publications/sustainability-appraisal-scoping-report-north-east-north-west-south-east-south-west-marine-plans

[13] https://www.gov.uk/government/publications/habitats-regulations-assessments-north-east-north-west-south-east-south-west-marine-plans

Welsh Marine Plan, including recognition of UKMER. The draft Marine Plan for Northern Ireland contains a single energy policy supporting all energy proposals (i.e. renewables and oil and gas) which improve the security and diversity of energy supply, provided that they do not unacceptably impact other activities or the offshore environment generally, and that restoration/decommissioning measures have, where necessary, been agreed. Neither of the draft plans include a specific CCUS or gas storage policy.

The South Marine Plans contain safeguarding policies for tidal energy such that proposals for other activities in areas under agreement should demonstrate how they will avoid, minimise or mitigate adverse impacts, or state a case for proceeding, with the intent and wording largely analogous to that of the East Marine Plans. There is no policy provision for offshore wind energy due to existing national policy and the scale and number of existing projects. Of further relevance to the plan/programme and SEA, the South Plans policy for oil and gas provides safeguarding for existing licences or those applied for, but not prospective areas. The plans make no reference to offshore gas storage or CCUS.

The Crown Estate is considering the potential for new leasing for England, Wales and Northern Ireland[14] and Crown Estate Scotland is preparing for new leasing in Scottish waters[15]. In response to the latter, a screening and scoping report for a Scottish Government Sectoral Marine Plan for Offshore Wind Encompassing Deep Water Options was published in June 2018. The draft plan and SEA are intended to inform spatial aspects of future leasing, and including establishing suitable areas of search. The SEA will build on the information and approach of the 2011 sectoral plan and its 2013 review. A consultation on the draft plan and its related SEA Environmental Report is expected to commence in spring 2019 and be concluded by the year end.

Despite considerable plan-making effort since the publication of OESEA3, most plans remain in preparation or in draft form. It is likely that those draft plans published to date (i.e. for Wales and Northern Ireland) will be adopted within the currency of OESEA3 but the remaining English plans are not expected to be consulted upon until 2019-2020. The current approach to marine planning (non prescriptive), and its broad inheritance of existing policies and approaches, has meant that the plans have had relatively limited impact on the BEIS offshore energy SEA programme to date. Greater regional definition in policies of the plans yet to be published, and future review cycles of plans, may alter this.

2.1.3 The UK's withdrawal from the EU

The 25-year environment plan indicates that there are opportunities for the development of revised management measures following the UK withdrawal from the EU, but at present the form of any such revisions are unknown. The UK Government White Paper on the future relationship between the UK and the EU[16] contains a number of high level proposals of relevance to the SEA, which include: that, the UK and EU should commit to the non-regression of environmental standards, and maintain high standards in combating climate change as set out in existing domestic legislation.

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[14] https://www.thecrownestate.co.uk/en-gb/what-we-do/on-the-seabed/energy/offshore-wind-potential-new-leasing/offshore-wind-potential-new-leasing-july-2018-update/

[15] Crown Estate Scotland (2018). New offshore wind leasing for Scotland - discussion document - http://www.crownestatescotland.com/maps-and-publications/download/172

[16] https://www.gov.uk/government/publications/the-future-relationship-between-the-united-kingdom-and-the-european-union

Sections 2-7 of the *European Union (Withdrawal) Act 2018*, confirm that the body of EU law transposed into UK legislation at the time that the UK exits the EU will be retained, such that it will continue to have effect in domestic law on or after exit day. Section 16 of the Act sets out that within six months of its Royal Assent, the Secretary of State must publish a draft Bill (i.e. an *Environmental Principles and Governance Bill*[17]) on a set of environmental principles, a policy statement on their interpretation and provisions for a public authority with the ability to take proportionate enforcement action.

The provisions of the above Bill, the outcome of the Defra consultation on environmental principles and governance, and any other detail of relevance to the SEA on the UK's withdrawal from the EU will be considered further on their publication.

2.2 Updates to leasing/licensing and review of technologies

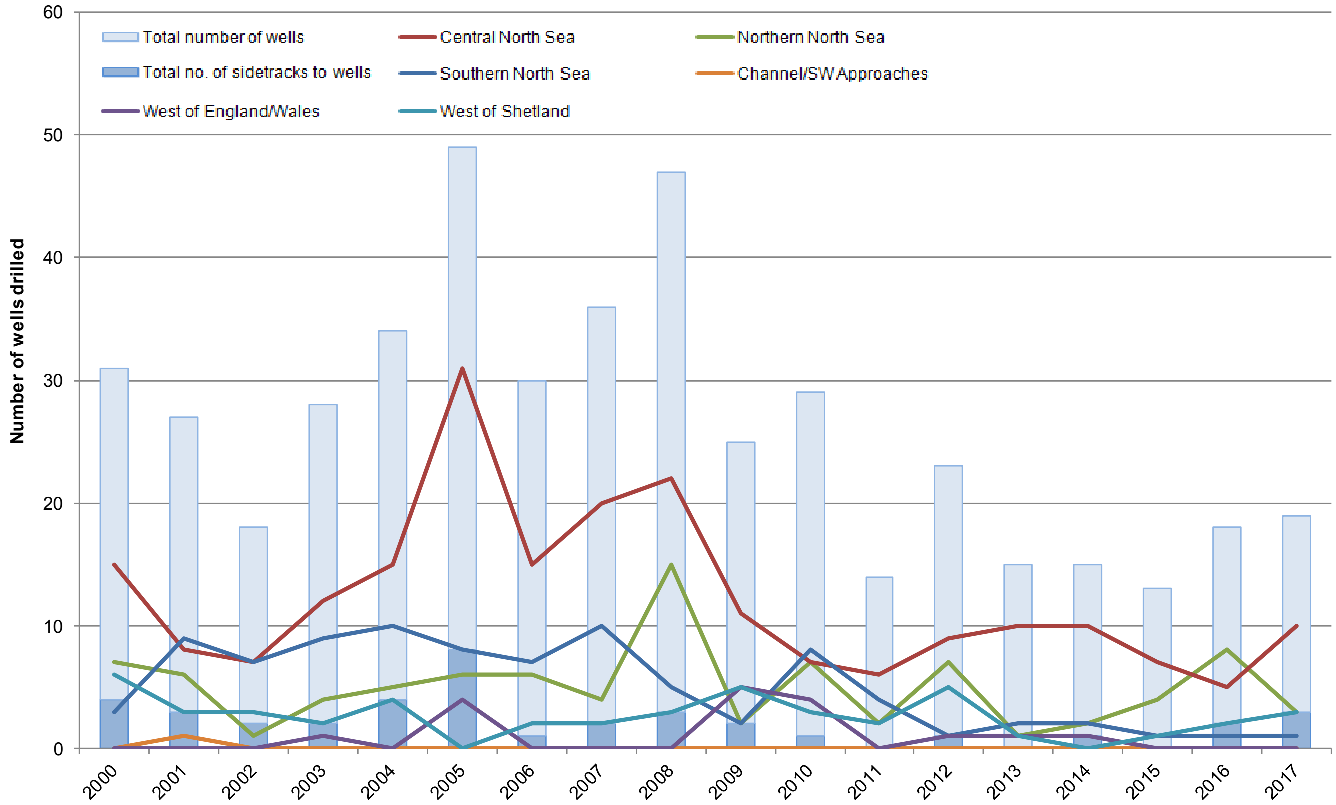
2.2.1 Oil & Gas

Minor updates to Seaward Production licensing for offshore oil & gas have been made since the publication of OESEA3 including the introduction of the "Innovate" licence, with amendments to Model Clauses made under *The Petroleum and Offshore Gas Storage and Unloading Licensing (Amendment) Regulations 2017*. The new licence type does not fundamentally alter the approach to licensing on the UKCS (i.e. the licence is made up of three terms covering exploration, appraisal and field development planning, and development and production), nor does it confer any more rights to operators to undertake activities than previous licence types. OESEA3 has so far supported two Seaward Licensing Rounds (29th and 30th Rounds), and a supplementary round in 2016 and related Habitats Regulations Assessments (HRA). These Rounds are now progressed by the OGA. The number of wells drilled across the major hydrocarbon basins of the UKCS in the period since the publication of OESEA3 remains consistent with previous years (Figure 2.1). The UK remains a net importer of oil and gas (BEIS 2017a).

While the general overview of the prospectivity of UKCS basins provided in OESEA3 largely remains current, the OGA has contributed to improved understanding through the acquisition and release of new seismic survey data[18] for areas of the Rockall Trough, Mid North Sea High, East Shetland Platform and South West Britain, allowing for new interpretations, including for frontier areas. The 21st Century Roadmap (21CXRM) Technical Advisory Committee is responsible for a five year plan to improve understanding to support exploration activities. Since publication of OESEA3 this has included studies into the prospectivity of the East Shetland Platform and South West Approaches in advance of the 31st seaward licensing round. Additionally, OGA have published a set of regional geological maps (incorporating 21CXRM data) for the Central North Sea, Moray Firth and southern North Sea as part of a contract with Lloyds Register to produce a series of maps for the whole of the UKCS.

[17] Refer to the Defra consultation on Environmental Principles and Governance after EU Exit: https://consult.defra.gov.uk/eu/environmental-principles-and-governance/
[18] https://www.ukoilandgasdata.com/dp/controller/PLEASE_LOGIN_PAGE

Figure 2.1: Trends in exploration drilling in different areas of the UKCS, 2000-2017



The technologies involved in exploration, appraisal, development, production and decommissioning of oil & gas on the UKCS have not altered significantly since the publication of OESEA3. Any future SEA would need to consider the potential of emergent technologies to become common practice within its lifetime[19].

The number of decommissioning programmes and related assessments being submitted has increased substantially in recent years; there are currently 11 decommissioning programmes under consideration (April 2018) and 13 decommissioning programmes have been approved since OESEA3. No significant technological advances in this area have come forward in this time, and UK policy and legislation governing decommissioning (e.g. under OSPAR 98/3) remains unchanged.

2.2.2 Gas storage (including CCUS)

At a national scale, no firm proposals have come forward for offshore gas storage projects since the publication of OESEA3, nor have those already proposed (e.g. Whitehills, Gateway) progressed to development. Additionally, Centrica plan to close the Rough gas storage facility on a number of safety and commercial grounds[20].

As noted above, the UK Government commitment to phase out unabated coal electricity generation by 2025 and investment of up to £20 million in carbon capture, usage and storage (CCUS) demonstration has the potential to encourage investment in relevant technologies. The UK is contributing to five projects as part of a consortium of nine European countries to fund innovation in CCUS called Accelerating CCS Technologies (ACT), to which BEIS is committing

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[19] See the latest technology insights report: https://www.ogauthority.co.uk/news-publications/publications/2018/technology-insights-report/
[20] https://www.gov.uk/cma-cases/rough-gas-storage-facility-review-of-undertakings

£4.4 million[21]. The projects include Acorn, a small scale project based in North East Scotland that plans a capture and storage facility at St Fergus that is scalable; Align, which aims to address specific research and design gaps; Detect, which aims to produce tools to reduce risk and costs for operations; Elegancy, which aims to exploit synergies in CCUS and hydrogen energy technology; and Pre-act, to address storage-related challenges (pore pressure distribution). A new ACT funding call was announced by NERC, the Engineering & Physical Sciences Research Council (EPSRC) and BEIS in June 2018 for projects to progress CCUS in the energy and industrial sectors. In addition, Drax and C-Capture plan to undertake several pilot projects towards demonstrating Bioenergy with CCS (BECCS) which has the potential to deliver negative emissions, though the technologies are at an early stage of development.

While no firm demonstration or commercial scale offshore projects are proposed in relevant UK waters covered by OESEA3, the 2017 list of Project of Common Interest (PCI)[22] includes four projects of relevance to the UK. These are aimed at developing CO_2 transport and storage infrastructure between the UK, Member States and neighbouring countries, and demonstrating the commercial viability of the technology. The projects include the Teesside CO_2 Hub[23]; a Statoil project involving CO_2 cross border transport connections between a) emission sources in the Teesside Industrial Cluster; b) the Eemshaven area in The Netherlands and a storage site on the Norwegian Continental Shelf; Pale Blue Dot's Sapling CO_2 sapling project which builds on the small-scale Acorn project (above) utilising existing oil and gas infrastructure; and the Rotterdam Nucleus which proposes to connect Rotterdam Harbour with storage sites in the Dutch and UK North Sea.

OESEA3 covered the transport and storage of CO_2 in relevant waters of the UK, and there has been no substantial technological change in these aspects of the CCUS chain since its publication. OESEA3 would therefore continue to support any further leasing/licensing should projects come forward in advance of further SEA.

Though licensing for gas storage, including carbon capture and storage (CCS) within the EEZ, is still a reserved matter, *The Scotland Act 2016* contained provisions which have led to the transfer of the management and revenues from The Crown Estate in Scotland to an interim body (Crown Estate Scotland), in advance of legislation to make more permanent arrangements – note the *Scottish Crown Estate Bill* was introduced to the Scottish Parliament on 24th January 2018[24]. This transition formalises the control of leasing in the interim body (which is entirely independent of The Crown Estate) for Scottish marine waters out to 200nm. As both a lease and licence are required for carbon storage activities, there may be updated arrangements in the lease application for projects in Scottish waters that need to be clarified for potential applicants.

2.2.3 Offshore wind

As indicated, The Crown Estate and Crown Estate Scotland are presently considering further potential offshore wind leasing. The Crown Estate accepted applications for extensions to existing wind farms (for example an application has been made for a 300MW extension to Thanet wind farm) until May 2018, and announced eight potential extensions in October 2018 covering an

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21 https://www.gov.uk/guidance/funding-for-low-carbon-industry
22 Commission delegated Regulation (EU) 2018/540
23 See the Tesside Collective (http://www.teessidecollective.co.uk/) which seeks to develop a system to capture, transport and store CO_2 from large industrial emitters in the Tees Valley, most likely in a geological store in the southern North Sea. The PCI builds on this work.
24 http://www.parliament.scot/parliamentarybusiness/Bills/107415.aspx

additional 3.5GW of capacity[25]. Agreements for Lease for the extensions could be granted in summer 2019, subject to the outcome of a plan level HRA. Plans for further leasing by The Crown Estate for England, Wales and Northern Ireland are currently being progressed, and it is expected that a fourth round (Round 4) of new offshore wind leasing will be launched in early 2019[26] and intends to consider new leasing areas for offshore wind soon[27]. Under Section 39 of the *Wales Act 2017*, development consenting for offshore renewable energy projects up to 350MW will be devolved to the Welsh Government from April 2019 (note this is applicable to offshore wind and marine renewables covered in Section 2.2.4). Proposed changes to how such infrastructure is to be consented was subject to a recent consultation exercise[28]. A preference for a new consenting regime involving a unified "one stop shop" for onshore and offshore development was presented in the consultation, with a Welsh Infrastructure Consent (WIC) being issued for relevant projects, and a marine licence or Development Consent Order still being required for those under/over certain generating thresholds. The Welsh National Marine Plan is seen as the main policy basis within which decisions in the WIC process would be made. The outcome of the consultation is awaited.

Cost reduction in the offshore wind sector is reflected in the levelized cost of energy (LCoE) for projects reaching final investment decision (FID) in 2015/16. This cost was an average of £97/MWh, which is below the UK Government target of £100/MWh by 2020, and 32% below those projects reaching FID in 2010/11. This reduction in cost reflects increased competition, lower capital costs and technological advances including larger turbine sizes (average of 6MW for projects reaching FID in 2015/16, though most to use 7-8MW units)[29]. This cost reduction trajectory is reflected in the strike prices for offshore wind projects as part of the second Contracts for Difference (CfD) allocation outcome, with prices between £74.75/MWh for delivery in 2021/22 and £57.50/MWh for delivery in 2022/23. These compare with costs of £114-120/MWh for offshore wind in the first CfD allocation[30].

OESEA3 did not include any target for offshore wind installed capacity. At present, total installed capacity for operational offshore wind farms in UK waters is 6.36GW (6.14GW in England and Wales and 0.22GW in Scotland[31]), with a further 15.6GW with consent or under construction (11.6GW of which is in English waters) – see Figure 2.2 for an update to progress on offshore wind rollout in UK waters. No further offshore wind farm projects are currently in planning, though a number are due to submit applications this year (Thanet extension, Hornsea Project Three, Norfolk Vanguard) or in 2019 (East Anglia Two, Norfolk Boreas) or 2020 (East Anglia One North). The Clean Growth Strategy noted that the UK Government would work with industry as they develop a "sector deal" for offshore wind which could lead to an extra 10GW of new capacity to be built in the 2020s.

At the time of publication of OESEA3, it was noted that most offshore wind developments deployed from 2016-2020 would utilise turbines of 6-8MW capacity, with larger turbines of 8-

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[25] https://www.thecrownestate.co.uk/en-gb/media-and-insights/news/2018-the-crown-estate-completes-initial-assessment-of-offshore-wind-extension-applications/
[26] https://www.thecrownestate.co.uk/en-gb/media-and-insights/news/2018-the-crown-estate-launches-a-second-phase-of-engagement-on-new-offshore-wind-leasing-following-positive-market-response/
[27] https://www.thecrownestate.co.uk/en-gb/what-we-do/on-the-seabed/energy/offshore-wind-potential-new-leasing/
[28] https://beta.gov.wales/changes-approval-infrastructure-development
[29] Offshore Renewable Energy Catapult (2017). Cost Reduction Monitoring Framework 2016. Summary Report to the Offshore Wind Programme Board, 7pp.
[30] Note that a £557 million Contracts for Difference auction in spring 2019 was announced via The Clean Growth Strategy in 2017.
[31] Based on BEIS Renewable energy planning database: February 2018. https://www.gov.uk/government/publications/renewable-energy-planning-database-monthly-extract

15MW in development and potentially deployed in the lifetime of the draft plan/programme. Turbine sizes presently being considered for new commercial developments are in the order of 7-8MW with rotor diameters of 154-180m, with Vestas now offering turbines with a capacity of up 9.5MW (the V164-69.5) – note this type has been selected for use at the Triton Knoll offshore wind farm. In March 2018, GE Renewables announced the development of a 12MW, 220m rotor diameter turbine[32], which will likely be deployed in demonstration form in 2019 before commercial deployment 2-3 years later. There is an expectation that 13-15MW units may be available by 2025 (Carbon Trust 2018).

A number of demonstration scale tethered offshore wind farm developments have been granted consent, are awaiting construction or are in operation, all of which are in Scottish waters. These include Hywind Scotland located 25km off Peterhead incorporating 5 x 6MW turbines which has been operational since October 2017, and two are awaiting construction: Kincardine Floating Offshore Wind farm located 15km south east of Aberdeen incorporating up to 8 x 6-8MW turbines and the Dounreay Trí Floating demonstration site 9km north west of Dounreay with 2 x 5MW turbines[33]. Cost reduction and technical advancement in this area, and the demonstration of a range of designs, is such that larger scale developments may progress in future leasing rounds.

OESEA3 assumed that floating wind turbines (tension leg, semi-submersible, spar-buoy remain the main concepts) are likely to be deployed in water depths of 50-200m. While their deployment in this water depth range is technically feasible, outputs from the Carbon Trust floating wind Joint Industry Project (Carbon Trust 2018) suggest the potential for a 60-100m “dead zone” for floating wind due to the increased costs of mooring in shallow water, particularly in catenary systems, which may make such depths less attractive. OESEA3 mapped the potential cost constraint on floating wind turbines of the requirement for HVDC (>100km from the coast). An additional criteria indicating water depths <100m might usefully inform this potential constraint in the next assessment.

Carbon Trust’s BLUE Pilot project, which is testing a new hammer design (BLUE hammer, designed by Dutch company Fistuca BV) which may reduce piling noise by up to 20dB (SEL); the new hammer will be tested through installation of a large, commercial monopile foundation in Dutch waters in summer 2018.

Despite the above advances, technological advances in offshore wind have been well within the scope of the those considered in OESEA3.

2.2.4 Renewables

At the time of writing OESEA3, marine licensing for renewables in Scotland was already handled by Scottish Ministers through the *Marine (Scotland) Act 2010* and the *Marine and Coastal Access Act 2009*, though as noted in 2.1.2, all responsibility for leasing has been devolved to the Scottish Government, presently managed by Crown Estate Scotland[34]. To date there has been no commercial deployment of wet renewables technologies in waters relevant to the plan/programme. Tidal stream demonstration continues to take place in Scottish territorial waters (e.g. the 6MW MeyGen Phase 1A project commenced operation in April 2018), with a

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[32] https://www.gerenewableenergy.com/wind-energy/turbines/haliade-x-offshore-turbine
[33] Note that the Dounreay project is struggling to meet the closure of the ROC subsidy closure, is in administration, and is not likely to proceed.
[34] Note the proposals for further Scottish leasing for offshore wind and reference to a new sectoral plan for offshore wind in Scotland therein.

number of potential projects also identified for leasing areas in English (Portland Bill, Perpetuus Tidal Energy Centre), Welsh (Holyhead Deep, West Anglesey Demonstration) and Northern Irish (Fair Head, Torr Head, Strangford Lough) waters.

The Hendry Review[35] assessed the strategic case for tidal lagoons, and reported in January 2017. The review made over 30 recommendations and concluded that tidal lagoons would help deliver security of supply; assist in delivering decarbonisation commitments, and would bring supply chain opportunities for the UK. The review also indicated that a small pathfinder project (<500MW, e.g. the Swansea Bay tidal lagoon proposal) should be commissioned and be operational for a reasonable period (to allow in-depth monitoring to be carried out and research to be conducted to address issues) before a financial decision is reached on a larger-scale project. While recognising the potential of tidal lagoon technology to deliver low carbon energy, following further economic analysis the Swansea Bay project was not considered to represent value for money when compared with other low carbon sources of energy (e.g. offshore wind), and support for the project by the UK Government (e.g. through a contract-for-difference (CfD)) will not be taken forward[36]. It is uncertain whether this, or other tidal range projects (Tidal Lagoon Cardiff, Tidal Lagoon Newport and the West Somerset Tidal Lagoon) will be developed.

While a number of leases/agreements for lease have been made with The Crown Estate for wave and tidal projects in waters relevant to the plan/programme, there remain significant cost challenges to such projects which is recognised as a limiting factor in their potential contribution to decarbonisation of the UK in the Clean Growth Strategy.

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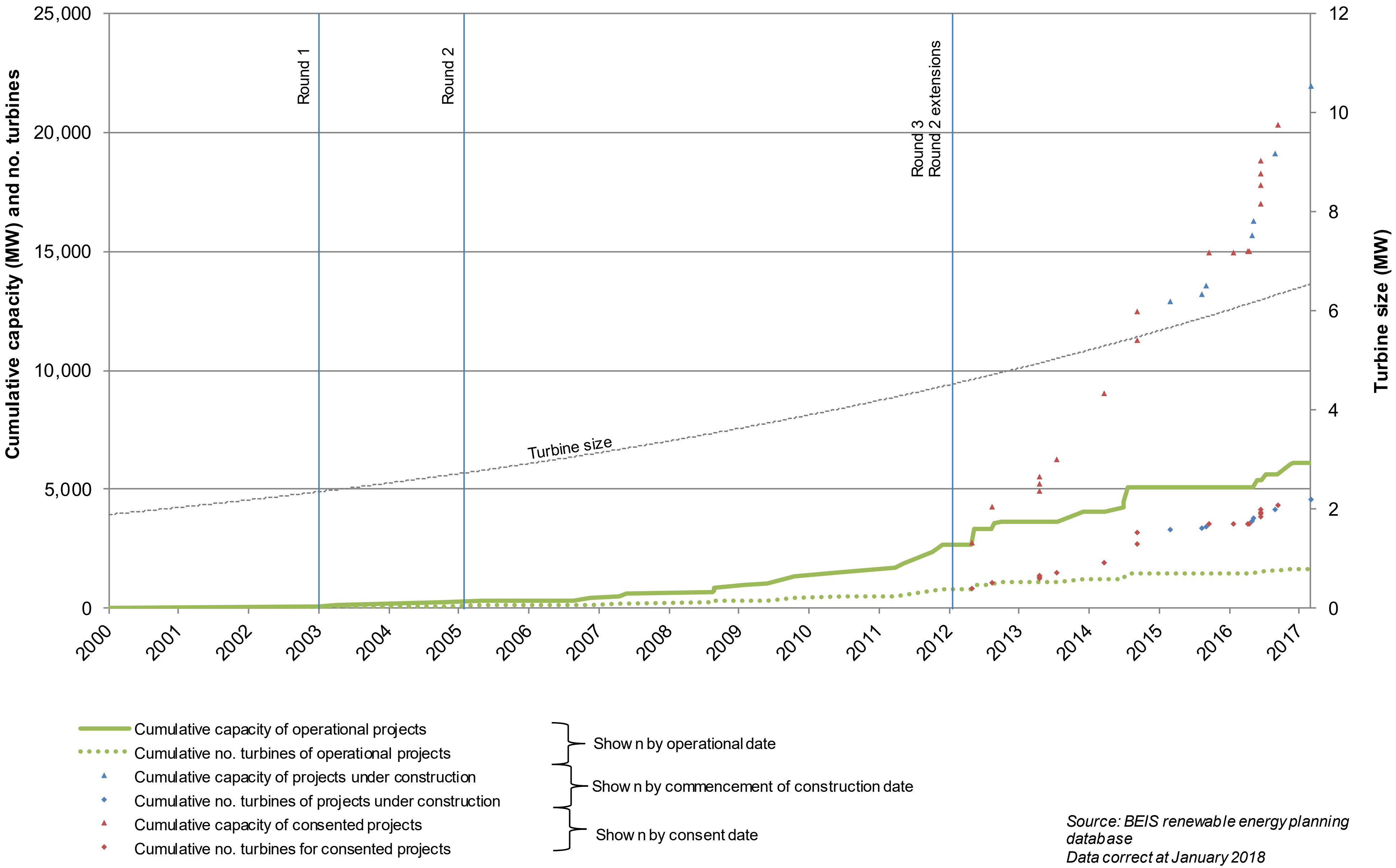
[35] https://hendryreview.wordpress.com/

[36] https://www.gov.uk/government/speeches/proposed-swansea-bay-tidal-lagoon

Figure 2.1: Update on the timeline of offshore wind rollout in UK waters



Source: BEIS renewable energy planning database
Data correct at January 2018

2.3 Summary and conclusion

There have been some minor updates to certain leasing and licensing arrangements, and to the policy context within which OESEA3 was drafted (also see Section 3). These do not change the basis of the SEA in that they remain within the wider UK Government targets relating to renewables deployment, carbon dioxide emissions reductions and the MER UK strategy, all which remain unchanged since the publication of OESEA3, though progress towards achieving these targets has been highlighted. Improved understanding of frontier areas of the UKCS may lead to exploration and production in these areas previously covered by successive SEAs, but with low levels of commercial interest. Continued identification of new areas for offshore wind are anticipated through new leasing rounds, with the scale of future deployment likely in keeping with that noted in the Clean Growth Strategy; cost reduction has already exceeded that anticipated by Government. While floating technologies represent the next area of expansion for offshore wind as shallow water sites suitable for fixed foundations become exhausted, cost reduction remains a requirement for these to become competitive. Commercial deployment of other marine renewables (e.g. wave and tidal) remains unlikely in the timeframe of OESEA3 due to the ongoing nascent nature of technologies and relatively high costs compared to offshore wind.

Technological advances have been well within the scope of the plan/programme assessed in OESEA3, and no significant changes to the technologies covered by OESEA3 are anticipated within its lifetime.

3 Updates to other relevant plans and programmes

The following section highlights updates to the main relevant initiatives (including plans and programmes, and environmental protection measures) and statutory measures established at international, European Community, UK and UK constituent country level, which are relevant to the plan/programme for those topics listed below. The initiatives are arranged by SEA topic area[37]. The outputs of a number of initiatives provide baseline information in terms of the status of certain areas within the SEA topics and their trajectory (e.g. monitoring and reporting outcomes), and a number of plans or programmes are ongoing and are due to provide further outputs at a later date.

[37] As given in Annex I(f) of the SEA Directive.

3.1.1 Biodiversity, habitats, flora and fauna

Biodiversity, Habitats, Flora & Fauna | OESEA3 | Updates

International

Convention on International Trade in Endangered Species of Wild Fauna and Flora (1973)
Ramsar Convention on Wetlands of International Importance especially as Waterfowl Habitat (1971, 1982)
Agreement on the Conservation of African-Eurasian Migratory Waterbirds (1999)
United Nations Convention on Biodiversity (the Rio Convention, 1992)
Convention on the Conservation of Migratory Species of Wild Animals (the Bonn Convention, 1979)
The International Council for the Exploration of the Sea (ICES) Code of Practice for the Introduction and Transfer of Marine Organisms
Strategic Plan for Biodiversity 2011-2020 (UNEP/CBD/COP/DEC/X/2) and the Aichi Biodiversity Targets (UNEP/CBD/COP/10/9)

International Convention for the control of ships ballast water and sediments (adopted 2004, entered into force September 2017)

Regional

Convention for the Protection of the Marine Environment of the North East Atlantic (the OSPAR Convention, 1992)
OSPAR Recommendation 2003/3 on a Network of Marine Protected Areas, and OSPAR Recommendation 2010/2 on amending Recommendation 2003/3 on a network of Marine Protected Areas
OSPAR Agreement 2005-6 on the Agreement on Background Concentrations for Contaminants in Seawater, Biota and Sediment
OSPAR List of Threatened and/or Declining Species and Habitats.
Convention on the Conservation of European Wildlife and Natural Habitats (the Bern Convention, 1979)
Agreement on the Conservation of Small Cetaceans of the Baltic North East Atlantic, Irish and North Seas (1994)
Convention for the Conservation of Salmon in the North Atlantic Ocean (1983)
Council of Europe Strategy on Invasive Alien Species (2003)
OSPAR Quality Status Reports 2000 and 2010

OSPAR Recommendation 2016/3 on furthering the protection and conservation of the Atlantic salmon (*Salmo salar*) in Regions I, II, III and IV of the OSPAR maritime area
OSPAR Recommendation 2016/02 on furthering the protection and conservation of intertidal mudflats in Regions I, II, III and IV of the OSPAR maritime area
OSPAR Recommendation 2016/01 on the reduction of marine litter through the implementation of fishing for litter initiatives
OSPAR Intermediate Assessment 2017

Europe

Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora
Directive 2009/147/EC on the Conservation of Wild Birds
Directive 2004/35/EC on environmental liability (and amendments through 2006/21/EC, 2009/31/EC and 2013/30/EU)
The WFD with respect to achieving good ecological status in transitional and coastal waters.
Marine Strategy Framework Directive 2008/56/EC
EU Regulation 1143/2014 on Invasive Alien Species
EU Biodiversity Communication (2006) and the Action Plan: Halting the loss of biodiversity by 2010 and beyond (2006)
Proposal for the seventh EU Environment Action Programme to 2020, "Living well, within the limits of our planet". (adopted 2013)
Our life insurance, our natural capital: an EU biodiversity strategy to 2020 (2011)
Council Regulation (EC) No 1100/2007 establishing measures for the recovery of the stock of European eel
Regulation (EU) No 1143/2014 of the European Parliament and of the Council on the prevention and management of the introduction and spread of invasive alien species

UK

National Parks and Access to the Countryside Act 1949
The Wildlife and Countryside Act 1981 (as amended - note there are a number of amending Regulations specific to devolved administrations)
Natural Environment and Rural Communities Act 2006
The Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001 (as amended)
Marine and Coastal Access Act 2009 (as amended)
The Marine Strategy Regulations 2010 (as amended)
Review of Marine Nature Conservation (Defra 1999 onwards) and response, Safeguarding Sea Life (2005)
Our Seas - a shared resource. High Level Marine Objectives (2009)
Charting Progress 2 - An Assessment of the State of UK Seas (2010)
Marine Policy Statement (2011)
UK National Ecosystem Assessment (2011) and follow on (2014)
Marine Strategy Part 1: UK Initial Assessment and Good Environmental Status (2012)
Marine Strategy Part 2: UK Marine Monitoring Programmes (2014)
Marine Strategy Part 3: UK Programme of Measures (2015)
The UK Post-2010 Biodiversity Framework (2012)
The Great Britain Invasive Non-native Species Strategy (2015)
Habitats Directive Implementation Review (2012-2013) and the work of the Marine Evidence Group (established 2012)
NERC Marine Environmental Mapping Programme (MAREMAP)

The Conservation of Habitats and Species Regulations 2017
The Conservation of Offshore Marine Habitats and Species Regulations 2017
UK MSFD updated assessment (due 2018)

Local

Countryside and Rights of Way Act 2000 - England and Wales
The Eels (England and Wales) Regulations 2009
The Conservation of Habitats and Species Regulations 2010 (as amended) - England and Wales
National Policy Statements for Energy (2011): - England and Wales
Overarching National Policy Statement for Energy (EN-1)
National Policy Statement for Renewable Energy Infrastructure (EN-3)
National Policy Statement for Gas Supply Infrastructure and Gas and Oil Pipelines (EN-4)
The National Planning Policy Framework (2012) - England
East Inshore and Offshore Marine Plans (2014) - England
Remaining Inshore and Offshore Marine Plans in English waters (North East, South East, South West, North West) (ongoing) - England
Biodiversity 2020: A strategy for England's wildlife and ecosystem services (2011) and progress update (2013)
The Natural Environment White Paper. The natural choice: securing the value of nature (2011) and implementation updates (2011-2014) - England
The Marine Conservation Zone Project (ongoing) - England
Marine Aggregate Levy Sustainability Fund (MALSF) Regional Environmental Characterisations

Environment (Wales) Act 2016 (including Section 7: Biodiversity lists and duty to take steps to maintain and enhance biodiversity)
The Natural Resources Policy Statement (2015) - Wales
The Nature Recovery Plan for Wales (2015)
Technical Advice Note 5: Nature Conservation and Planning 2013 - Wales
Planning Policy Wales, Edition 7 (2014)
Wales Biodiversity Framework (2010)
Environment Strategy for Wales (2006) and annual progress reporting (2012)
One Wales, One Planet: Sustainable Development Scheme of the Welsh Assembly Government (2009)
The Living Wales Programme (2010-2013)
Sustainable development for Welsh seas: Our approach to marine planning in Wales (2011)
Marine Conservation Zone Project Wales (ongoing)

Local

The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) - Scotland
Nature Conservation (Scotland) Act 2004
The Freshwater Fish Conservation (Prohibition on Fishing for Eels) (Scotland) Regulations 2008
The Environmental Liability (Scotland) Regulations 2009 (as amended)
Marine (Scotland) Act 2010
Planning Series Circular 6/2013: Development Planning (2013) - Scotland
Scottish Planning Policy (2014) and the National Planning Framework for Scotland 3 (2014)
Scotland's National Marine Plan (2015)
A Follow up to Seas the Opportunity: A Strategy for the Long Term Sustainability of Scotland's Coasts and Seas (2007)
Scotland's Biodiversity: It's In Your Hands (2004) and 2020 Challenge for Scotland's Biodiversity (2013)
The Scottish MPA Project (ongoing)

Nature Conservation and Amenity Lands (Northern Ireland) Order 1985
Wildlife (Northern Ireland) Order 1985
Conservation (Natural Habitats, etc.) Regulations (Northern Ireland) 1995 (as amended)
The Environmental Liability (Prevention and Remediation) Regulations (Northern Ireland) 2009 (as amended)
Marine Act (Northern Ireland) 2013
Planning Policy Statement 2: Natural Heritage (2013) - Northern Ireland
Strategic Planning Policy Statement For Northern Ireland (2015)
Northern Ireland Biodiversity Strategy (2002)
Strategy for Marine Protected Areas in the Northern Ireland inshore region (2014)

A Green Future: Our 25 Year Plan to Improve the Environment (2018)
Draft revised National Planning Policy Framework (consultation, 2018)
South Inshore and Offshore Marine Plans (2018) - England

State of Wales' Natural Resources report (2016)
The Natural Resources Policy Statement (2017) - Wales
Draft Planning Policy Wales, Edition 10 (consultation, 2018)
Welsh National Marine Plan (consultation, 2018)

National Marine Plan Review 2018: Three Year Report on the implementation of Scotland's National Marine Plan (encompassing inshore and offshore waters) (2018)
Scottish Biodiversity Strategy - Report to the Scottish Parliament on progress (2017)

Report on the implementation of the 2015 Northern Ireland Biodiversity Strategy - Valuing Nature (2017)
MCZ Project Northern Ireland (designations made 2016)
The Marine Plan for Northern Ireland (consultation, 2018)

3.1.2 Geology, substrates & coastal processes

Geology, Substrates & Coastal Processes — OESEA3 | Updates

International

OESEA3:

The Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972 (the London Convention) and 1996 Protocol Thereto (amendment on the storage of CO_2 in geological formations came into force 10 February 2007).

Updates:

GEBCO Seabed 2030 (launched 2017)

Regional

OESEA3:

OSPAR Recommendation 2003/3 on a Network of Marine Protected Areas
OSPAR Agreement 2005-6 on the Agreement on Background Concentrations for Contaminants in Seawater, Biota and Sediment
OSPAR Recommendation 2006/5 on a management regime for offshore cuttings piles
OSPAR Decision 2007/2 on the Storage of Carbon Dioxide Streams in Geological Formations

Updates:

OSPAR Recommendation 2016/02 on furthering the protection and conservation of intertidal mudflats in Regions I, II, III and IV of the OSPAR maritime area
OSPAR Intermediate Assessment 2017

EU

OESEA3:

EC Habitats Directive 92/43/EEC (1992)
Water Framework Directive 2000/60/EC (consolidated version)
Directive 2007/60/EC on the assessment and management of flood risks
Communication from the Commission Report to the European Parliament and the Council: An evaluation of Integrated Coastal Zone Management (ICZM) in Europe 2007. COM(2007)308 final
Marine Strategy Framework Directive 2008/56/EC
Directive 2009/31/EC of the European Parliament and of the Council of 23 April 2009 on the geological storage of carbon dioxide
EMODnet harmonised digital terrain model of the European sea regions

UK

OESEA3:

The Wildlife and Countryside Act 1981
Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007 (as amended)
Marine and Coastal Access Act 2009
The Marine Strategy Regulations 2010
The Storage of Carbon Dioxide (Licensing etc.) Regulations 2010
The Energy Act 2008 (Consequential Modifications) (Offshore Environmental Protection) Order 2010
The Energy Act 2011
The UK Marine Policy Statement (2011)
Geological Conservation Review (GCR)
Local Geological Sites, including Regionally important Geological and Geomorphological Sites (RIGS)
Defra Consultation on Coastal Change Policy (2009), Coastal Change Pathfinder and Review (2012)
National Coastal Erosion Risk Mapping Project (ongoing)
CCS Roadmap: Supporting deployment of Carbon Capture and Storage in the UK (2012) - also see Next Steps in CCS: Policy Scoping Document (2015) - England and Wales
The MCA Civil Hydrography Programme
NERC Marine Environmental Mapping Programme (MAREMAP)
Marine Strategy Part 1: UK Initial Assessment and Good Environmental Status (2012)
Marine Strategy Part 2: UK Marine Monitoring Programmes (2014)
Marine Strategy Part 3: UK Programme of Measures (2015)
River Basin Management Plans for respective administrations, including those which are cross-border
Flood Risk Management Plans in respective administrations

Updates:

The Conservation of Habitats and Species Regulations 2017
The Conservation of Offshore Marine Habitats and Species Regulations 2017
The Clean Growth Strategy (2017), relating to a new approach to CCUS
UK MSFD updated assessment (due 2018)

Local

Coast Protection Act 1949 (as amended) - England and Wales
Countryside and Rights of Way Act 2000 - England and Wales
National Policy Statements for Energy (2011): - England and Wales
Overarching National Policy Statement for Energy (EN-1)
National Policy Statement for Renewable Energy Infrastructure (EN-3)
National Policy Statement for Gas Supply Infrastructure and Gas and Oil Pipelines (EN-4)
East Inshore and Offshore Marine Plans (2014) - England
A Strategy for Promoting an Integrated Approach to the Management of Coastal Areas in England
Making space for water: Taking forward a new Government strategy for flood and coastal erosion risk management in England (2008)
National flood and coastal erosion risk management strategy for England (2011)
Shoreline Management Plans - England and Wales
Marine Aggregate Levy Sustainability Fund (MALSF) Regional Environmental Characterisations including : South Coast, Thames, East Coast and the Humber areas.
The Marine Conservation Zone Project - England (ongoing)

Technical Advice Note 5: Nature Conservation and Planning (2009) - Wales
Technical Advice Note 14: Coastal Planning (1998) - Wales
Technical Advice Note 15: Development and Flood Risk (2004) - Wales
Minerals Planning Policy Wales (2001)
Marine Conservation Zone Project Wales (ongoing)
National Strategy for Flood and Coastal Erosion Risk Management in Wales (2011)

Marine (Scotland) Act 2010
The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) - Scotland
Water Environment and Water Services (Scotland) Act 2003 (as amended)
Flood Risk Management (Scotland) Act 2009
The Storage of Carbon Dioxide (Licensing etc.) (Scotland) Regulations 2011 (as amended)
The Scottish Coastal Forum and Local Coastal Partnerships (established 1996)
Scottish Planning Policy (2014) and the National Planning Framework for Scotland 3 (2014)
Scotland's National Marine Plan (2015)
The Scottish MPA Project (ongoing)

Marine (Northern Ireland) Act 2013
Earth Science Conservation Review (Northern Ireland)
An Integrated Coastal Zone Management Strategy for Northern Ireland 2006-2026 (2006)
Planning Policy Statement 15: Planning and Flood Risk (2014) - Northern Ireland
MCZ Project Northern Ireland (ongoing)

The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017
A Green Future: Our 25 Year Plan to Improve the Environment (2018)
Draft revised National Planning Policy Framework (consultation, 2018)
South Inshore and Offshore Marine Plans (2018) - England
Good practice guidance: extraction by dredging of aggregates from England’s seabed (2017)

State of Wales’ Natural Resources report (2016)
The Natural Resources Policy Statement (2017) - Wales
Draft Planning Policy Wales, Edition 10 (consultation, 2018)
Welsh National Marine Plan (consultation, 2018)

National Marine Plan Review 2018: Three Year Report on the implementation of Scotland's National Marine Plan (encompassing inshore and offshore waters) (2018)
Dynamic Coast: Scotland's Coastal Change Assessment (2017)

Water Environment (Water Framework Directive) Regulations (Northern Ireland) 2017
The Marine Plan for Northern Ireland (consultation, 2018)
MCZ Project Northern Ireland (designations made 2016)

3.1.3 Landscape/Seascape

Landscape/Seascape	OESEA3 / Updates
Regional	World Heritage Convention 1972 Tentative list of possible future world heritage nominations (2012-2014)
Europe	Council of Europe: European Landscape Convention 2000 Directive 2014/89/EU on establishing a framework for maritime spatial planning
UK	*Marine and Coastal Access Act 2009* (as amended) UK Marine Policy Statement (2011) An approach to seascape character assessment (2012)
Local	*National Parks and Access to the Countryside Act 1949* - England and Wales *Environment Act 1995* - England and Wales *Countryside and Rights of Way Act 2000* - England and Wales National Policy Statements for Energy (2011): - England and Wales Overarching National Policy Statement for Energy (EN-1) National Policy Statement for Renewable Energy Infrastructure (EN-3) National Policy Statement for Gas Supply Infrastructure and Gas and Oil Pipelines (EN-4) East Inshore and Offshore Marine Plans (2014) - England Seascape Character Assessments associated with Marine Plans European Landscape Convention: guidelines for managing landscapes (2010) The National Character Areas of England (updates ongoing) England Coast Path: improving public access to the coast (ongoing) English Heritage Historic Landscape and Seascape Characterisations Local Seascape Character Assessment (Pembrokeshire Seascape Character Assessment, Landscape and seascapes of Eryri (Snowdonia), Anglesey seascape character assessment) - Wales (2013-onwards) LANDMAP Wales Cadw/ICOMOS Register of Landscapes of Outstanding Historic Interest or Special Historic Interest National Landscape Character Areas - Wales (2015) *Planning etc. (Scotland) Act 2006* *Marine (Scotland) Act 2010* *The Town and Country Planning (National Scenic Areas) (Scotland) Designation Directions 2010* Natural Heritage Futures: A National Assessment of Scotland's Landscapes (2002, updated 2009) SNH's Landscape policy framework (2005) Scottish Planning Policy (2014) and the National Planning Framework for Scotland 3 (2014) Scotland's National Marine Plan (2015) *The Nature Conservation and Amenity Lands (Northern Ireland) Order 1985* *Marine (Northern Ireland) Act 2013* Planning Policy Statement 1: General Principles (1998) - Northern Ireland Landscape Character Areas of Northern Ireland (2006) Planning Policy Statement 18: Renewable Energy and Wind Energy Development in Northern Ireland's Landscapes (2009), and supplementary guidance on Wind Energy (2010) Northern Ireland's Landscape Charter (2014) Northern Ireland Regional Seascape Character Assessment (2014)

Local

A Green Future: Our 25 Year Plan to Improve the Environment (2018)
Draft revised National Planning Policy Framework (consultation, 2018)
South Inshore and Offshore Marine Plans (2018) - England
Historic England's Heritage 2020, and Corporate Plan (2018-2021)
National Historic Seascape Characterisation Consolidation (2018)
Historic Environment Good Practice Advice in Planning Note 3: The Setting of Heritage Assets, 2nd Edition (2017)

State of Wales' Natural Resources report (2016)
Draft Planning Policy Wales, Edition 10 (consultation, 2018)
Welsh National Marine Plan (consultation, 2018)
National Seascape Assessment for Wales
Technical Advice Note 12: Design (Wales) (2016)

National Marine Plan Review 2018: Three Year Report on the implementation of Scotland's National Marine Plan (encompassing inshore and offshore waters) (2018)
Dynamic Coast: Scotland's Coastal Change Assessment (2017)
Landscape and the Historic Environment – A Common Statement (2016)

The Marine Plan for Northern Ireland (consultation, 2018)
MCZ Project Northern Ireland (designations made 2016)

3.1.4 Water environment

Water Environment | OESEA3 | Updates

International

IMO International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 (MARPOL 73/78)
International Convention on Oil Pollution Preparedness, Response and Co-operation (1990)
Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (1972, as amended) 1996 protocol - revision to convention (2006) and amendments to 1996 protocol

International Convention for the control of ships ballast water and sediments (adopted 2004, entered into force September 2017)

Regional

Convention for the Protection of the Marine Environment of the North East Atlantic (the OSPAR Convention 1992)
OSPAR Decision 2000/3 on the use of organic-phase drilling fluids (OPF) and the discharge of OPF-contaminated cuttings
OSPAR Decision 2000/2 on a harmonised mandatory control system for the use and reduction of the discharge of offshore chemicals (as amended by decision 2005/1)
OSPAR Recommendation 2000/5 on a Harmonised Offshore Chemical Notification Format (HOCNF), as amended by OSPAR Recommendation 2005/3 and 2008/2
OSPAR Recommendation 2001/1 for the Management of Produced Water from Offshore Installations as amended by Recommendation 2006/4
OSPAR Recommendation 2003/1 on the Strategy for the Joint Assessment and Monitoring Programme
OSPAR Recommendation 2005/2 on Environmental Goals for the Discharge by the Offshore Industry of Chemicals that are, or Contain Added Substances, Listed in the OSPAR 2004 List of Chemicals for Priority Action
OSPAR Recommendation 2006/3 on Environmental Goals for the Discharge by the Offshore Industry of Chemicals that are, or which Contain Substances Identified as Candidates for Substitution
OSPAR Decision 2007/1 to Prohibit the Storage of Carbon Dioxide Streams in the Water Column or on the Sea-bed
OSPAR Decision 2007/2 on the Storage of Carbon Dioxide Streams in Geological Formations
OSPAR Recommendation 2012/5 for a risk-based approach to the Management of Produced Water Discharges from Offshore Installations
OSPAR North-East Atlantic Environment Strategy
OSPAR Co-ordinated Environmental Monitoring Programme (ongoing)
OSPAR Quality Status Reports (QSRs) of the North Atlantic and its sub-regions (2000 & 2010)

OSPAR Recommendation 2017/01 on a harmonised pre-screening scheme for offshore chemicals
OSPAR Intermediate Assessment 2017

EU

Urban Waste Water Treatment Directive 91/217/EC
Nitrates Directive 91/676/EC
Water Framework Directive 2000/60/EC
Directive 2004/35/EC on environmental liability (and amendments through 2006/21/EC, 2009/31/EC and 2013/30/EU)
Bathing Water Directive 2006/7/EC
European Shellfish Waters Directive 2006/113/EC
Directive 2007/60/EC on the assessment and management of flood risks
Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)
Integrated Pollution Prevention Control Directive (2008/1/EC)
Marine Strategy Framework Directive 2008/56/EC
Environmental Quality Standards Directive (2008/105/EC)
Directive 2013/30/EU on safety of offshore oil and gas operations and amending Directive 2004/35/EC
Directive 2013//39/EU amending Directives 2000/60/EC and 2008/105/EC as regards priority substances in the field of water policy
Environmental Impact Assessment Directive (2011/92/EU - codified version) and amending Directive 2014/52/EU

Urban Waste Water Treatment Directive 91/217/EC (ongoing REFIT evaluation)
Multi-annual work programme 2017-2020: Making the Environmental Liability Directive more fit for purpose

UK

Water Resources Act 1991 (as amended)
The Offshore Chemicals Regulations 2002 (as amended)
UK Marine and Coastal Access Act 2009
The Marine Strategy Regulations 2010
Marine Policy Statement (2011)
Charting Progress 2 (2010)
River Basin Management Plans for respective administrations, including those which are cross-border
Our Seas – a shared resource. High level marine objectives (2009)
Marine Strategy Part 1: UK Initial Assessment and Good Environmental Status (2012)
Marine Strategy Part 2: UK Marine Monitoring Programmes (2014)
Marine Strategy Part 3: UK Programme of Measures (2015)

UK Climate Change Risk Assessment (2017)
National contingency plan for marine pollution from shipping and offshore installations (2017)
A new Chemicals Strategy (as noted in the 25 Year Environment Plan)
UK MSFD updated assessment (due 2018)

Local

The Flood Risk Regulations 2009 - England and Wales
Flood and Water Management Act 2010 - England and Wales
Environmental Damage (Prevention and Remediation) Regulations 2009 (as amended) - England
Flooding in England: A National Assessment of Flood Risk (2009)
National flood and coastal erosion risk management strategy for England (2011)
National Policy Statements for Energy (2011): - England and Wales
Overarching National Policy Statement for Energy (EN-1)
National Policy Statement for Renewable Energy Infrastructure (EN-3)
National Policy Statement for Gas Supply Infrastructure and Gas and Oil Pipelines (EN-4)
National Policy Statement for Ports (2012) - England
East Inshore and Offshore Marine Plans (2014) - England
Marine Pollution Contingency Plan (2014) - England and Wales
Shoreline Management Plans - England and Wales

The Environmental Damage (Prevention and Remediation) (Wales) Regulations 2009
Technical Advice Note 15: Development and Flood Risk (2004, updated advice maps 2015) - Wales
National Strategy for Flood and Coastal Erosion Risk Management (2011) - Wales

Water Environment and Water Services (Scotland) Act 2003
Water Environment (Controlled Activities) (Scotland) Regulations 2011
Flood Risk Management (Scotland) Act 2009
The Environmental Liability (Scotland) Regulations 2009 (as amended)
Marine (Scotland) Act 2010
Flood Risk Management Strategies - Scotland (2015)
Scottish Planning Policy (2014) and the National Planning Framework for Scotland 3 (2014)
Scotland's National Marine Plan (2015)

The Water Environment (Floods Directive) Regulations (Northern Ireland) 2009
The Environmental Liability (Prevention and Remediation) Regulations (Northern Ireland) 2009 (as amended)
Marine Act (Northern Ireland) 2013
An Integrated Coastal Zone Strategy for Northern Ireland 2006-2026 (2006)
PPS 15 Planning and Flood Risk (2014) - Northern Ireland

Local

The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017
A Green Future: Our 25 Year Plan to Improve the Environment (2018)
Draft revised National Planning Policy Framework (consultation, 2018)
South Inshore and Offshore Marine Plans (2018) - England

State of Wales' Natural Resources report (2016)
The Natural Resources Policy Statement (2017) - Wales
Draft Planning Policy Wales, Edition 10 (consultation, 2018)
Welsh National Marine Plan (consultation, 2018)
Technical Advice Note 15 guidance on climate change allowances for planning purposes (2016) and technical evaluation of the advice note (2017)

National Marine Plan Review 2018: Three Year Report on the implementation of Scotland's National Marine Plan (encompassing inshore and offshore waters) (2018)
Dynamic Coast: Scotland's Coastal Change Assessment (2017)
Flood Risk Management in Scotland: Consultation on Potentially Vulnerable Areas (2018)

Water Environment (Water Framework Directive) Regulations (Northern Ireland) 2017
The Marine Plan for Northern Ireland (consultation, 2018)

3.1.5 Air Quality

Air Quality | OESEA3 | Updates

International

Marine Pollution Convention, MARPOL 73/78 (the International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978); 2008 amendment of MARPOL on a revised Annex VI dealing with the reduction in the emission of sulphur from shipping, enacted in 2010
Geneva Convention on Long Range Transboundary Air Pollution (1979)
Vienna Convention for the protection of the ozone layer (1985)
Montreal Protocol on substances that deplete the ozone layer (1987) and subsequent updates and adjustments
Stockholm Convention on Persistent Organic Pollutants (2001)
UNEP Global Mercury Partnership and Proposed Treaty
Consolidated text of the amended Protocol (the Gothenburg Protocol) to Abate Acidification, Eutrophication and Ground-level Ozone (2012)

Initial IMO strategy on the reduction of GHG emissions from ships (2018)
Minamata Convention on Mercury (2017)

Regional

The Convention for the Protection of the Marine Environment of the North East Atlantic (OSPAR) 1998

EU

Directive 2004/107/EC relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air
Directive 2004/35/EC on environmental liability with regard to the prevention and remedying of environmental damage
Directive 2008/50/EC on ambient air quality and cleaner air for Europe (2008)
Regulation 1005/2009 on substances that deplete the ozone layer amended by Regulation 744/2010 on substances that deplete the ozone layer, with regard to the critical uses of halons
The Clean Air Policy Package (2013) building on the EU Thematic Strategy on Air Quality (2005)
Directive 2008/1/EC concerning integrated pollution prevention and control (codified version)
EU Seventh Environmental Action Plan to 2020 (2013)
Directive 2010/75/EU on industrial emissions (integrated pollution prevention and control)
Regulation 517/2014 on fluorinated greenhouse gases
Directive 2015/2193/EU on the limitation of emissions of certain pollutants into the air from medium

Directive 2016/2284/EU on the reduction of national emissions of certain atmospheric pollutants
Directive 2016/802/EU relating to a reduction in the sulphur content of certain liquid fuels
Evaluation of the Ozone Regulation (launched 2017, ongoing)
The Kigali Amendment of the Montreal Protocol (to take effect January 2019)

UK

Clean Air Act 1993 (as amended)
The Offshore Combustion Installations (Pollution Prevention and Control) Regulations 2013 (as amended)
The Merchant Shipping (Prevention of air pollution from ships) Regulations 2008 (as amended)
The Fluorinated Greenhouse Gas Regulations 2015 (as amended)
Greenhouse Gas Emissions Trading Scheme Regulations 2012
The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (2007)

The National Emission Ceilings Regulations 2018

Local

Air Quality (England) Regulations 2000
Air Quality (Standards) Regulations 2010 - England (as amended)
Pollution Prevention and Control (Designation of Directives) (England and Wales) Order 2013

The Air Quality Standards (Wales) Regulations 2010
Environment Strategy for Wales (2006)

Air Quality (Scotland) Regulations 2000 (as amended)
The Air Quality Standards (Scotland) Regulations 2010 (as amended)
Pollution Prevention and Control (Designation of Industrial Emissions Directive) (Scotland) Order 2011
Cleaner Air for Scotland (2015)

The Air Quality Standards Regulations (Northern Ireland) 2010

The Environmental Permitting (England and Wales) Regulations 2016 (as amended)
A Green Future: Our 25 Year Plan to Improve the Environment (2018)
Clean Air Strategy (consultation, 2018)

Well-being of Future Generations (Wales) Act 2015
State of Wales' Natural Resources report (2016)

3.1.6 Climate and meteorology

Climate & Meteorology | OESEA3 | Updates

International

The United Nations Framework Convention on Climate Change
Kyoto Protocol to the UN Framework Convention on Climate Change
The Copenhagen Accord (2009)
Intergovernmental Panel on Climate Change Fifth Assessment Report (2013-2014)
The Paris Agreement (2015)

Initial IMO strategy on the reduction of GHG emissions from ships (2018)
IPPC Sixth Assessment Reporting Cycle (report to be finalised 2022)

EU

European Climate Change Programme I (2000) and II (2005)
Directive 2001/80/EC on the limitation of emissions of certain pollutants into the air from large combustion plants
Directive 2010/75/EU on industrial emissions (integrated pollution prevention and control) (Recast)
Communication COM(2008) 30: 20 20 by 2020 Europe's climate change opportunity
Directive 2009/28/EC on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC
Directive 2009/29/EC amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading scheme
EU Seventh Environmental Action Plan to 2020 (2013)
Communication COM(2013) 216: An EU Strategy on adaptation to climate change (2013)
Directive 2009/31/EC on the geological storage of carbon dioxide
Directive 2003/87/EC establishing a scheme for greenhouse gas emission allowance trading within the Community

Proposal for a Directive of the European Parliament and of the Council on the promotion of the use of energy from renewable sources (2016)
Evaluation of the EU Adaptation Strategy (due for completion 2018)
Communication COM(2015) 337: Proposal amending Directive 2003/87/EC to enhance cost-effective emission reductions and low carbon investments
EU Strategy for Long-Term Greenhouse Gas Emissions Reduction (consultation 2018, proposal due to be put forward before COP24)

UK

Climate Change Act 2008 (as amended)
The Energy Act 2008 (as amended)
The Energy Act 2013
The Climate Change Act 2008 (2020 Target, Credit Limit and Definitions) Order 2009
The Climate Change Act 2008 (Credit Limit) Order 2011
The Carbon Budget Order 2011
Greenhouse Gas Emissions Trading Scheme Regulations 2012 (as amended)
The Emissions Performance Standard Regulations 2015
Marine Policy Statement (2011)
Stern Review of the Economics of Climate Change (2006)
UK Climate Impacts Programme (UKCIP) (update 2009, UKCP09)
Marine Climate Change Impacts Partnership (MCCIP), including annual report cards
Health Effects of Climate Change in the UK (2012)
The National adaptation programme (2013)

The Climate Change Act 2008 (Credit Limit) Order 2016
The Carbon Budget Order 2016
UK Climate Projections 2018 (UKCP18)
UK Climate Change Risk Assessment (2017) - see national summaries for devolved administrations
Clean Growth Strategy (2017)
Industrial Strategy: building a Britain fit for the future (2017)

Local

East Inshore and Offshore Marine Plans (2014) - England
South Inshore and Offshore Marine Plans (ongoing) - England

Environment Strategy for Wales (2006 - under review)
A Low Carbon Revolution: Wales' Energy Policy Statement (2010)
Climate Change Strategy for Wales (2010) and Adaptation Delivery Plan (2010)
Energy Wales: A Low Carbon Transition (2012)

The Climate Change (Scotland) Act 2009
The Climate Change (Annual Targets) (Scotland) Order 2010
The Climate Change (Annual Targets) (Scotland) Order 2011
The Climate Change (Limit on Carbon Units) (Scotland) Order 2011
Scotland's Climate Change Adaptation Framework (2009)
A Low Carbon Economic Strategy for Scotland (2010)
Low Carbon Scotland: The Second Report on Proposals and Policies (2013)
Scottish Climate Change Adaptation Programme (2014)
Scotland's National Marine Plan (2015)

Northern Ireland Greenhouse Gas Action Plan (2011)
The Northern Ireland Climate Change Adaptation Programme (2014)

A Green Future: Our 25 Year Plan to Improve the Environment (2018)
Clean Air Strategy (consultation, 2018)
South Inshore and Offshore Marine Plans (2018)

Well-being of Future Generations (Wales) Act 2015
Environment (Wales) Act 2016
State of Wales' Natural Resources report (2016)
Welsh National Marine Plan (consultation, 2018)

Climate Change Bill
The Climate Change (Annual Targets) (Scotland) Order 2016
The Climate Change (Limit on Use of Carbon Units) (Scotland) Order 2016
The Scottish Government's Climate Change Plan, Third Report on Proposals and Policies 2018-2032 (2018)
National Marine Plan Review 2018: Three Year Report on the implementation of Scotland's National Marine Plan (encompassing inshore and offshore waters) (2018)
Programme for Government (Scotland) 2017-18 (2017)

Proposals for taking forward NI climate change legislation - discussion paper (2016)
The Marine Plan for Northern Ireland (consultation, 2018)

3.1.7 Population and human health

Population & Human Health — OESEA3 | Updates

International

World Summit on Sustainable Development, Johannesburg, 2002
Aarhus Convention (Convention on Access to Information, Public Participation in Decision Making and Access to Justice in Environmental Matters) (1998)
Espoo Convention on Environmental impact Assessment in a Transboundary Context (1991)
Commission on Social Determinants of Health (2008), 'Closing the gap in a generation: health equity through action on the social determinants of health and the Rio Political Declaration on Social Determinants of Health (2011)

Regional

Children's Environment and Health Action Plan for Europe 2004

EU

Together for Health: A Strategic Approach for the EU (2007)
The European Environment and Health Action Plan 2004-2010
EU Sustainable Development Strategy (EU SDS) First issued 2001, Revised 2006 and reviewed in 2009
Directive 2013/30/EU on safety of offshore oil and gas operations and amending Directive 2004/35/EC

UK

Sustainable Communities Act 2007
The Localism Act 2011
The Health and Safety at Work etc Act 1974 (Application outside Great Britain) Order 2013
The Offshore Installations (Offshore Safety Directive) (Safety Case etc.) Regulations 2015
The Offshore Petroleum Licensing (Offshore Safety Directive) Regulations 2015
Marine Policy Statement (2011)
Mainstreaming sustainable development: the government's vision and what this means in practice (2011)
The Strategy for Health and Safety in Great Britain in the 21st Century (2009), and One year On : Being part of the solution (2010)
Our Seas – a shared resource. High level marine objectives (2009)
Equity and Excellence: Liberating the NHS (2010)
Health Effects of Climate Change in the UK (2012)

Helping Great Britain work well: A new health and safety system strategy (2016)

Local

Health and Social Care Act 2012 (as amended) - England
National Planning Policy Framework (2012) - England
East Inshore and Offshore Marine Plans (2014) - England

National Health Service (Wales) Act 2006 (as amended)
Social Services and Well-being (Wales) Act 2014
Well-being of Future Generations (Wales) Act 2015
Planning (Wales) Act 2015
One Wales: One Planet, a new Sustainable Development Scheme for Wales (2009)
Technical Advice Note 16: Sport, Recreation and Open Space (2009) - Wales
The sustainable development charter (2010) - Wales
The Programme for Government: Welsh Assembly Government (2011)
Together for Health A Five Year Vision for the NHS in Wales (2011) and Working differently – working together (2012)
Wales Spatial Plan – People, Places, Futures (2004, updated 2008)

Local

Public Health etc. (Scotland) Act 2008 (as amended)
Public Services Reform (Scotland) Act 2010
Choosing Our Future: Scotland's Sustainable Development Strategy (2005)
The Healthcare Quality Strategy for NHS Scotland (2010)
Scotland's Economic Strategy (2015)
Scottish Planning Policy (2014) and the National Planning Framework for Scotland 3 (2014)
Scotland's National Marine Plan (2015)

Health and Social Care (Reform) Act (Northern Ireland) 2009 (as amended)
PPS 8: Open Space, Sport and Outdoor Recreation (2004) - Northern Ireland
Everyone's Involved: the Northern Ireland Sustainable Development Strategy (2010)
Making Life Better: Strategic Framework for Public Health 2013-2023 (2014) - Northern Ireland

South Marine Plan (2018) - England
North East Inshore and Offshore Marine Plans (ongoing) - England
North West Inshore and Offshore Marine Plans (ongoing) - England
South East Inshore Marine Plan (ongoing) - England
South West Inshore and Offshore Marine Plans (ongoing) - England
Clean Air Strategy (consultation, 2018)
A Green Future: Our 25 Year Plan to Improve the Environment (2018)

The Environment (Wales) Act 2016
The Public Health (Wales) Act 2017
Draft Welsh National Marine Plan (consultation, 2018)

National Marine Plan Review 2018: Three Year Report on the implementation of Scotland's National Marine Plan

Marine Plan for Northern Ireland (consultation, 2018)

3.1.8 Other users of the sea (material assets)

Other Users & Material Assets — OESEA3 | Updates

International

Convention on International Civil Aviation (Chicago Convention) 1944
The London Convention (1972)
Marine Pollution Convention, MARPOL 73/78 (the International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978)
United Nations Convention on the Law of the Sea (1982)
Basel Convention of the control of transboundary movements of hazardous waste and their disposal (1992)
FAO Code of Conduct for Responsible Fisheries (1995)
UN Fish Stocks Agreement (2001)
Nairobi International Convention on the Removal of Wrecks (2007)
The Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships (2009)

Joint Roadmap to accelerate Maritime/Marine Spatial Planning processes worldwide (DG MARE and UNESCO) (2017)

Regional

Convention on the Future Multilateral Cooperation in North-East Atlantic Fisheries (NEAFC) (1982)
Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR) (1992)
OSPAR Decision 98/3 on the disposal of disused offshore installations (1998)
North Seas Countries' Offshore Grid Initiative (2010)

Political declaration on energy cooperation between the North Sea Countries (2016)
OSPAR Recommendation 2016/01 on the reduction of marine litter through the implementation of fishing for litter initiatives
OSPAR Recommendation 2017/1 on a harmonised pre-screening scheme for offshore chemicals

EU

Council Directive 99/31/EC of April 1999 on the landfill of waste (as amended) (the Landfill Directive)
EC Directive on Port Reception Facilities 2000/59/EC
Directive 2005/33/EC amending Directive 1999/32/EC as regards the sulphur content of marine fuels
Freight logistics in Europe - the key to sustainable mobility (2006)
Commission Regulation (EC) No 1013/2006 on shipments of waste and amending Regulation (EC) No 1013/2014
Regulation (EC) No 1692/2006 of the European Parliament and of the Council of 24 October 2006 establishing the second Marco Polo programme for the granting of Community financial assistance to improve the environmental performance of the freight transport system (Marco Polo II) and repealing Regulation (EC) No 1382/2003 (follow-up to Marco Polo II is presently being established)
The Treaty of Lisbon (2007)
EU Integrated Maritime Policy (2007)
Commission Regulation (EC) No 1418/2007 concerning the export for recovery of certain waste listed in Annex III or IIIA to Regulation (EC) No 1013/2006 to certain countries to which the OECD Decision on the control of transboundary movements of wastes does not apply and amending Regulation (EU) No 733/2014
Commission Regulation (EC) No 740/2008 amending Regulation (EC) No 1418/2007 as regards the procedures to be followed for export of waste to certain countries
Directive on Waste 2008/98/EC and Decision 2000/532/EC on hazardous waste
Commission Regulation (EC) No 669/2008 on completing Annex 1C of Regulation (EC) No 1013/2006 on shipments of waste
EU Energy Security and Solidarity Action Plan: Second Strategic Energy Review - Securing our Energy Future (2008)
Communication on Offshore Wind Energy: Action needed to deliver on the Energy Policy Objectives for 2020 and beyond. COM(2008)768
Communication on the Directive 2004/67/EC concerning measures to safeguard security of natural gas supply (2008)
EU Energy Security and Solidarity Action COM(2014) 330
EC Roadmap on Maritime Spatial Planning: Achieving Common Principles in the EU (2008)

EU

Regulation (EC) No 1342/2013 establishing a long-term plan for cod stocks
Directive 2009/28/EC on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC
Energy 2020: A strategy for competitive, secure, and sustainable energy (2010)
Marine and Maritime Agenda for Growth and Jobs, The Limassol Declaration (2012)
Decision No 884/2004/EC amending Decision No 1692/96/EC on community guidelines for the development of the trans-European transport network
Maritime Transport Strategy 2018 (2009)
European Transport Policy (2001-2011)
Roadmap to a Single European Transport Area - Towards a competitive and resource efficient transport system (2011)
Regulation (EU) No 1380/2013 on the Common Fisheries Policy
Directive 2013/30/EU on safety of offshore oil and gas operations and amending Directive 2004/35/EC
Directive 2014/89/EU on establishing a framework for maritime spatial planning
European Maritime and Fisheries Fund (2014)
Innovation in the Blue Economy: realising the potential of our seas and oceans for jobs and growth COM(2012) 494 final, COM(2014) 254 final/2 and Marine Knowledge 2020: roadmap
European Commission Communication: A Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy (2015)
EC Trans-European Transport Network (TEN-T) programme
Projects of common interest (PCI)

Strategic Environmental Assessment North Seas Energy (SEANSE) (2018)
Communication on strengthening Europe's energy networks (COM/2017/0718 final)
Proposal for a Directive of the European Parliament and of the Council on port reception facilities for the delivery of waste from ships, repealing Directive 2000/59/EC and amending Directive 2009/16/EC and Directive 2010/65/EU
EU Regulation 2016/2094/EU: Amending Council Regulation (EC) No 1342/2008 establishing a long-term plan for cod stocks and the fisheries exploiting those stocks
Commission Staff working document on the implementation of the EU Maritime Transport Strategy 2009-2018 (2016)

UK

The Merchant Shipping and Fishing Vessels (Port Waste Reception Facilities) (Amendment) Regulations 2009
Sea Fisheries (Shellfish) Act 1967 (as amended)
Sea Fish (Conservation) Act 1967 (as amended)
Fisheries Act 1981
Energy Act 2008
Marine and Coastal Access Act 2009
The Energy Act 2008 (Consequential Modifications) (Offshore Environmental Protection) Order 2010
Wreck Removal Convention Act 2011
The Exclusive Economic Zone Order 2013
The Territorial Sea (Baselines) Order 2014
The Offshore Installations (Offshore Safety Directive) (Safety Case etc.) Regulations 2015
The Offshore Petroleum Licensing (Offshore Safety Directive) Regulations 2015
Harbours Act 1964 (as amended)
The Renewables Obligation (introduced 2002)
Contracts for Difference (2014)
National Fisheries Policy: Fisheries 2027 (Defra 2007)
The strategic importance of the marine aggregate industry to the UK (2007)
UK Ship Recycling Strategy (2007)
Our Seas - A Shared Resource. High Level Marine Objectives (2009)
Round 3 offshore wind leasing (2009)
The UK Marine Policy Statement (2011)
Creating growth, cutting carbon: making sustainable local transport happen (2011)
Concordat on management arrangements for fishing quotas and licensing in the UK (2012)
CCS Roadmap: Supporting deployment of Carbon Capture and Storage in the UK (2012)
UK renewable energy roadmap (updated 2013)
The Wood Review on maximising economic recovery from the UKCS (2013) and related Government response
Strategy for Maximising Economic Recovery of Offshore UK Petroleum (2016)
27th (2012) and 28th (2014) Seaward Oil and Gas Licensing Rounds
Contracts for Difference (introduced 2015)

UK

National contingency plan for marine pollution from shipping and offshore installations (2017)
UK MSFD updated assessment (due 2018)
Industrial Strategy - Building a Britain fit for the future (2017)
Energy Act 2016
Oil and Gas Authority Decommissioning Strategy and Decommissioning Delivery Programme (2016)
29th (2016), 30th (2017) and Supplementary (2016) Seaward Oil and Gas Licensing Rounds
Concordat on Management Arrangements for Fishing Opportunities and Fishing Vessel Licensing In the United Kingdom (2016)
The Clean Growth Strategy (2017)
The Industrial Strategy (2017)

Local

Waste (England and Wales) Regulations 2011 (as amended)
The Scallop Fishing (England) Order 2012
Inshore Fisheries and Conservation Authorities bylaws
Sea Angling 2012 project - England
National Policy Statements for Energy (2011): England and Wales
Overarching National Policy Statement for Energy (EN-1)
National Policy Statement for Renewable Energy Infrastructure (EN-3)
National Policy Statement for Gas Supply Infrastructure and Gas and Oil Pipelines (EN-4)
National Policy Statement for Ports (2012) - England and Wales
The National Planning Policy Framework (2012) - England
Waste prevention programme for England (2013)
East Inshore and Offshore Marine Plans (2014) - England
Next Steps in CCS: Policy Scoping Document (2015) - England and Wales

Inshore Fishing (Scotland) Act 1984
Sea Fisheries (Shellfish) Amendment (Scotland) Act 2000
The Marine (Scotland) Act 2010
The Aquaculture & Fisheries (Scotland) Act 2013
Scottish Marine Regions Order 2015
Strategic Framework for Inshore Fisheries in Scotland (2005) and Inshore Fisheries Groups
National Transport Strategy (2006) - Scotland
A Fresh Start: The Renewed Strategic Framework for Scottish Aquaculture (2009)
Scotland's Zero Waste Plan (2010)
Scottish Government: The Carbon Capture and Storage Roadmap (2010)
Blue Seas - Green Energy: A Sectoral Marine Plan for Offshore Wind Energy in Scottish Territorial Waters (2011)
Scotland's Sectoral Marine Plans for Offshore Wind, Wave and Tidal Energy in Scottish Waters
A Strategic Plan for Scotland's Marine Tourism Sector (2014)
Scotland's National Marine Plan (2015)
Shetland Marine Plan (2015)

Marine Act (Northern Ireland) 2013
The Sea Fishing (Licenses and Notices) Regulations (Northern Ireland) 2014
Tourism Strategy for Northern Ireland to 2020 and the Programme for Government 2011-2015 (2010)
Offshore Renewable Energy Strategic Action Plan 2012-2020 and Offshore Wind and Marine Renewables Energy SEA Environmental Report (2012) - Northern Ireland
Sustainable Energy Action Plan 2012-2015 and beyond (2012) - Northern Ireland
Envisioning the Future: Considering Energy in Northern Ireland to 2050 (2013)
Delivering Resource Efficiency: the revised Northern Ireland Waste Management Strategy (2013)

Technical Advice Note 8: Renewable Energy (Wales) - does not cover offshore elements of a development, but makes mention of any associated infrastructure that takes place on land
Coastal Tourism Strategy for Wales (2008)
Technical Advice Note 13: Tourism (Wales)
Marine Renewable Energy Strategic Framework (2007-2011)
Coastal tourism strategy (2008) - Wales
The Wales Transport Strategy (2008)
Towards Zero Waste: The Overarching Waste Strategy Document for Wales (2010)
Energy Wales: a low carbon transition (2012)
Wales Marine and Fisheries Strategic Action Plan (2013)
Wales Spatial Plan – People, Places, Futures (2004, updated 2008)

Local

South Inshore and Offshore Marine Plans (2018) - England
North East Inshore and Offshore Marine Plans (ongoing) - England
North West Inshore and Offshore Marine Plans (ongoing) - England
South East Inshore Marine Plan (ongoing) - England
South West Inshore and Offshore Marine Plans (ongoing) - England
Sea Angling (2016)
A Green Future: Our 25 Year Plan to Improve the Environment (2018)
Draft revised National Planning Policy Framework (consultation, 2018)

Draft Welsh National Marine Plan (consultation, 2018)
National Development Framework Wales (due, 2020)

The Regulation of Scallop Fishing (Scotland) Order 2017
National Marine Plan Review 2018: Three Year Report on the implementation of Scotland's National Marine Plan
Scottish Energy Strategy: The Future of Energy in Scotland (2017)
Draft sectoral marine plan for offshore wind (due 2018)
National Transport Strategy refresh (2016)
Aquaculture growth to 2030 (2016)
Pilot Pentland Firth and Orkney Waters Marine Spatial Plan (2017)

Industrial Strategy for Northern Ireland (consultation, 2017)
Northern Ireland Draft Programme for Government (consultation, 2016)
Marine Plan for Northern Ireland (consultation, 2018)

3.1.9 Cultural Heritage

Cultural Heritage — OESEA3 | Updates

International

UNESCO Convention Concerning the Protection of the World Cultural and Natural Heritage (1972)
Convention on the Protection of Underwater Cultural Heritage (2001)
United Nations Convention on the Law of the Sea (UNCLOS)

Regional

World Heritage Convention 1972
Tentative list of possible future world heritage nominations (2012-2014)

Europe

Council of Europe, European Convention on the Protection of the Archaeological Heritage 1992, the 'Valetta Convention'
Council of Europe, European Landscape Convention 2000
European Marine Board Continental Shelf Prehistoric Research Position and Policy Brief (2014)
Towards an integrated approach to cultural heritage for Europe COM(2014) 477 final

UK

Protection of Military Remains Act 1986
Ancient Monuments and Archaeological Areas Act 1979
National Heritage Act 2002
Marine and Coastal Access Act 2009
The Protection of Military Remains Act 1986 (Designation of Vessels and Controlled Sites) Order 2009
The Protection of Military Remains Act 1986 (Designation of Vessels and Controlled Sites) Order 2012
Marine Policy Statement (2011)
North Sea Prehistory Research and Management Framework (2009)

The Protection of Military Remains Act 1986 (Designation of Vessels and Controlled Sites) Order 2017

Local

Protection of Wrecks Act 1973 - England, Wales and Northern Ireland
National Heritage Act 1983 (as amended) - England
Treasure Act 1996 - England and Wales
Planning (Listed Buildings and Conservation Areas) Act 1990 - England and Wales
English Heritage: Conservation Principles, Policies and Guidance for Sustainable Management of the Historic Environment (2008)
East Inshore and Offshore Marine Plans (2014) - England
National Planning Policy Framework (2012)
Historic Environment Good Practice Advice in Planning Note 2: Managing Significance in Decision-Taking in the Historic Environment (2015)
DCLG Conserving and enhancing the historic environment (2014) - England
Marine Aggregate Levy Sustainability Fund (MALSF) Regional Environmental Characterisations including : South Coast, Thames, East Coast and the Humber areas.

Conservation Principles for the sustainable management of the historic environment in Wales (2011)
A Research Framework for the Archaeology of Wales (2011)
Historic Environment Strategy for Wales (2013)
Planning Policy Wales Edition 7 (2014)

Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997
Marine (Scotland) Act 2010
The Historic Environment Scotland Act 2014
Scottish Natural Heritage: Natural Heritage Futures (2002, updated 2009)
Scottish Planning Policy (2014) and the National Planning Framework for Scotland 3 (2014)
Scotland's National Marine Plan (2015)

The Planning (Northern Ireland) Order 1991
The Historic Monuments and Archaeological Objects (Northern Ireland) Order 1995
Marine Act (Northern Ireland) 2013
Planning Policy Statement 6: Planning, Archaeology and The Built Heritage (Northern Ireland) (1999) and 2005 addendum

Local

Historic England Climate Adaptation Report (2016)
Historic England Conservation Area Appraisal, Designation and Management (consultation, 2017)
Historic England: Sustainability Appraisal and Strategic Environmental Assessment (2016)
South Inshore and Offshore Marine Plans (2018)
Historic England's Heritage 2020, and Corporate Plan (2018-2021)
National Historic Seascape Characterisation Consolidation (2018)
Historic Environment Good Practice Advice in Planning Note 3: The Setting of Heritage Assets, 2nd Edition (2017)
Draft revised National Planning Policy Framework (consultation, 2018)

Historic Environment (Wales) Act 2016
State of Wales' Natural Resources report (2016)
Welsh National Marine Plan (consultation, 2018)
Draft Planning Policy Wales, Edition 10 (consultation, 2018)

Historic Environment Scotland Policy Statement (2016)
Scotland's Historic Environment Audit (2016)
National Marine Plan Review 2018: Three Year Report on the implementation of Scotland's National Marine Plan (encompassing inshore and offshore waters) (2018)

Guidance on Setting and the Historic Environment (2018)
The Marine Plan for Northern Ireland (consultation, 2018)

4 Review of environmental baseline

4.1 Introduction

Information fulfilling Schedule 2 of *The Environmental Assessment of Plans and Programmes Regulations 2004* (Regulation 12(3)), "…the environmental characteristics of areas likely to be significantly affected, the relevant aspects of the current state of the environment and the likely evolution thereof without implementation of the plan or programme, and any existing environmental problems…" was documented in full as Appendix 1 to OESEA3. The following sections provide a review of updates to the environmental baseline, covering the topics:

- Biodiversity, habitats, flora and fauna
- Geology, substrates and coastal morphology
- Landscape/seascape
- Water environment
- Air quality
- Climate and meteorology
- Population and human health
- Other users, material assets (infrastructure, other natural resources)
- Cultural heritage
- Conservation of sites and species

4.2 Updates to the environmental baseline

New sources of information which characterise the baseline and its likely evolution (in the lifespan of OESEA3, and in the longer term) are summarised in this Section. The cited sources should not be taken as a complete and definite reference of all new publications for each topic, but they are judged to represent the key relevant updates to the baseline.

4.2.1 Biodiversity, habitats, flora and fauna

4.2.1.1 Plankton

The plankton community may be broadly divided into a plant component (phytoplankton) and an animal component (zooplankton). The ecology of the plankton community is strongly influenced by environmental and, potentially, anthropogenic factors. Consequently the plankton acts as an important link between the biological and physical components of the ecosystem.

The on-going work carried out by the Continuous Plankton Survey continues to develop the long-term data series that has been built up since 1958 (Edwards *et al*. 2016). General trends, including a decline in primary production in the North Sea over the past 25 years, with associated reductions in zooplankton abundance and fish stock recruitment (Capuzzo *et al*. 2018) have significant implications for organisms at higher trophic levels.

4.2.1.2 Benthos

Since the publication of OESEA3, much government funded benthic research within the UKCS has continued to focus on the suite of Marine Protected Areas (MPAs) within two main strategic approaches: firstly to enhance the existing habitat descriptions and understanding of the spatial extent of habitats and geophysical features; and secondly, to use this new information for improved species, habitat and predictive modelling techniques to facilitate site management. Within England, offshore MCZ work was part of Defra's programme MB120.

Fourteen offshore MPAs which had cSAC/SCI status at the time of OESEA3 have since received full SAC designation (see Section 4.2.10). For these and many of the existing offshore SCIs additional JNCC/Cefas surveys have been completed (and reported) to confirm or amend the species/habitats details and to inform management plans. It should be noted that a number of species and habitat details have been found to differ from early descriptions which were based on BGS mapping. This has implications for all stakeholders since it emphasises the need for up to date baseline data specific to new offshore developments and operations.

Additional descriptive information – variously acquired, primarily through conservation related surveys (but also by academic, fisheries, and energy and other industry studies) have focussed on site characterisation, epifauna analysis from imagery and benthic community analysis and functioning, has been obtained in Regional Sea 1 (McIlwaine 2015; Murray *et al.* 2016; Eggleton *et al.* 2017a; Gafeira & Long 2015a&b; Rance *et al.* 2017; Ware 2017; O'Connor 2016), Regional Sea 2 (Ware & McIlwaine 2015; Eggleton *et al.* 2017b; Jenkins *et al.* 2015; Vanstaen & Whomersley 2015; McIlwaine *et al.* 2017; Jones *et al.* 2016) and Regional Sea 3 (Barrio Frojan *et al.* 2017; Jones *et al.* 2016). Survey and mapping at Haig Fras in Regional Sea 4 (Callaway 2015; Barrio Frojan *et al.* 2015) indicates that the Annex I reef is larger than originally reported, extending beyond the SAC boundary. Further characterisation of sediment habitats within the Croker Carbonate Slabs (Regional Sea 6) and information on the spatial extent of MDAC has been completed (Wood *et al.* 2016) and data analysis of epifauna at the Solan Bank Reef SAC in Regional Sea 8 (Barrio Frojan 2016; Goudge *et al.* 2016) is now available. It is noted that JNCC are shortly expected to release an update to their Annex I reef spatial data.

Site Management

Good site management is based on a thorough understanding of form and function which includes site/habitat biodiversity, distribution and predictability of epifaunal and megafaunal communities. While evidence of ongoing management of MPAs is provided by monitoring surveys e.g. at Croker Carbonate Slabs (Noble-James *et al.* 2017), Pisces Reef complex (Jenkins & Nelson 2017; Jenkins *et al.* 2017), the Sound of Arisaig, South Skye Sea Lochs, the Sound of Barra & Sound of Mull MPA (SNH 2016a), considerable effort has also recently been put into seabed mapping and spatial modelling tools for predicting the spatial extent of habitats and communities; these have drawn on both new and existing data and have the goal of building on EUSeaMap data to secure better biological characterisation of large areas of seabed. Geographical focus of this is the MPAs. The effectiveness of existing management strategies such as the use of fishing closure boxes within MPAs, as for example at the Darwin Mounds, has been assessed by Huvenne *et al.* (2016) in relation to cold water corals. Features of Conservation Importance (FOCI) habitat – the deep sea habitat – is the focus of Cordes *et al.* (2016) in their review of environmental impacts of the deepwater oil and gas industry, however, they make no new suggestions on specific measures that might be incorporated into current environmental management strategies beyond those already in place for the industry; i.e. regulations of certain aspects of the activity, such as discharge practices and material use, in combination with spatial and temporal restrictions.

Improvements to benthic environmental management tools

Traditional benthic survey comprising the analysis of benthos, contaminants and sediment particle size from seabed samples is now commonly augmented by seabed photography and acoustic data as a means to characterising much larger areas of seabed. Improving the recording of epifauna (Moore *et al.* 2015) is a precursor to the reliable interpretation of subsea images to understand the spatial distribution and functional composition of epibenthic communities in relation to habitat and to fishing effort (Neumann *et al.* 2016; 2017). Considerable effort using both new and existing data has been put into mapping seabed features e.g. Annex I submarine structures made by leaking gases (Duncan 2018) and habitats e.g. rock habitats in the English Channel and Celtic Sea (Diesing *et al.* 2015) and in the North Sea (Downie *et al.* 2016), and biogenic reef habitats in the Irish Sea (Baldock & Goudge 2017, Moore *et al*. 2017). Recent JNCC guidance (Noble-James *et al.* 2018) provides information on developing benthic monitoring programmes to identify change in the benthic environment and inform potential management measures.

Use of existing data has enabled modelling of habitats e.g. rock and mixed sediment habitats (Alexander *et al.* 2015; 2016); mud (Coates *et al.* 2015) and sand (Coates *et al.* 2016), which might then be used to inform the conservation of rare species (Stirling *et al.* 2016). The development of modelling techniques for deep water assemblages on Rockall Bank (Robert *et al.* 2016) for example has made use of data acquired during MAREMAP and CODEMAP projects (which were reported in OESEA3). Techniques include the calculation of landscape indices to describe the spatial arrangement of habitats, which can augment the traditional ‘acoustic data with groundtruthing’ method approach. Four species assemblages defined by four key species (*Parastichopus tremulus*; *Munida sarsi*; *Reteporella*; *Lophelia pertusa*) were described. This builds on earlier work on megafauna of the Rockall Bank (Robert *et al.* 2014).

A range of other studies continues to enhance our knowledge of likely impacts on species and communities from marine exploitation e.g. a number of deep water studies, work on biological traits in relation to habitats, biodiversity, distribution and predictability of epifaunal and megafaunal communities, environmental requirements of seapens, physiological studies and methods of assessing habitat loss at offshore wind farms. Cooper & Barry (2017) provide a faunal baseline and methodology for assessing the ecological significance of sediment change[38], which will be used by the marine aggregates industry to assess the status of the seabed as part of their new Regional Seabed Monitoring Programme (RSMP). The authors indicate this approach could also be relevant for other offshore activities which can affect the composition of seabed sediments (e.g. dredge material disposal, offshore windfarms, pipelines, drilling for oil and gas) (Cooper & Barry 2017).

Work on FOCI species includes a review of the environmental requirements of seapens (Greathead *et al.* 2015); biodiversity of sponge biogenic habitats on coral rubble (Kazandis *et al.* 2015); and potential impact of the oil & gas industry on deep sea sponges and biogenic sponge habitats (Vad *et al.* 2018). More widespread species work (Bolam *et al.* 2017) explores biological traits of benthic infauna and their relation to habitats. This approach increases understanding of biodiversity and community functioning and builds on knowledge of benthos distribution modelling (Reiss *et al.* 2010 and 2015). The JNCC will publish the fourth UK Habitats Directive implementation report, under Article 17 of the Directive, in 2018/19. The report will consider the conservation status of coastal and marine Annex I habitats.

[38] The study was jointly funded by the Department for Environment, Food and Rural Affairs (Defra), the Marine Management Organisation (MMO), the British Marine Aggregate Producers Association (BMAPA), the Crown Estate and the Welsh Government.

4.2.1.3 Cephalopods

Recent work concentrates on the expansions of global cephalopod populations over the past 6 decades (Doubleday *et al*. 2017), with fast, adaptive cephalopod species increasing in abundance over a range of habitats – possibly linked to fishing pressure on finfish and other environmental pressures. Additional work has examined diet composition of cephalopods – the diet of *A. media* and *O. vulgaris* paralarvae, in particular – to reveal seasonal and/or spatial variation, as well as species preferences (Olmos-Perez *et al*. 2017). The pressures that might be exerted on common octopus (*O. vulgaris*) through immune system responses to stress have also been explored (di Cosmo & Polese 2016).

4.2.1.4 Fish and shellfish

Our understanding of the distribution and ecology of UK fish species continues to increase with the continuation of long-term survey efforts such as the International Bottom Trawl Survey (IBTS) programme, as well as regional surveys such as the Celtic Sea herring survey (O'Donnell *et al*. 2016). An ongoing project, yet to be published (Underwater Sound Forum 2018), aims to use ICES herring larvae survey data to produce "heatmaps" of herring larval density and so increase the robustness of assessments based on herring spawning sites (for which Coull *et al*. (1998) is currently still the base source). The recently reported discovery of a $3km^2$ herring spawning site in Gairloch (northwest Scotland) by scallop divers (Wester Ross Fisheries Trust website) illustrates that our understanding of areas of sensitivity for fish species is imperfect and requires regular monitoring.

Further work has been carried out on general abundance and ecology, particularly of "charismatic" or economically valuable species. Papers describing the satellite tagging of basking sharks (Doherty *et al*. 2017a) and the abundance and seasonal distribution of ocean sunfish in the northeast Atlantic (focussing on the Celtic and Irish Seas and wider Irish waters) (Breen *et al*. 2017) have been published. Doherty *et al*. (2017a) showed that sharks tagged and satellite-tracked displayed one of three migratory behaviours: remaining in UK, Irish and Faroese waters, migrating south to the Bay of Biscay, or migrating further south, as far as North Africa. This is similar to results found by analysing historic tagging data of basking sharks along the east coast of the Americas, between Newfoundland and Brazil (Braun *et al*. 2018). The variation of basking shark winter migratory behaviours, and the movement of large proportions of a single population across multiple international boundaries has important consequences for conservation and management strategies. This must be taken into account when designating protected areas, such as the Sea of Hebrides pMPA which, based on the results obtained, may afford summer protection for basking sharks (Doherty *et al*. 2017b). Meanwhile, the recently launched THUNNUS UK project aims to improve understanding of the distribution and ecology of bluefin tuna, a species reported to be increasing in abundance in UK waters (THUNNUS UK website).

The wider ecological impacts on fish populations, and in particular their trophic ecology, have been the subject of studies investigating links between sandeels and feeding seabirds. Carroll *et al*. (2017) found the breeding success of kittiwakes (*Rissa tridactyla*) at Flamborough Head and Bempton Cliffs to be higher in years with higher sandeel spawning stock biomass (SSB), and lower in years immediately following high sandeel fishing mortality in adjacent waters. Lower sea surface temperatures were also associated with higher sandeel SSB, thus providing further evidence of links between climate, human pressure, fish stocks and success of higher predators. Similar links have been identified between sea surface temperature, sandeel SSB and shags in the North Sea (Howells *et al*. 2017). Further work on the impact of fishing pressure has been carried out by, among others, Gascuel *et al*. (2016) and Bentorcha *et al*. (2017). The recovery of the herring stock in the Celtic Sea (which collapsed in 2004) has been described by Clarke & Egan (2017), and management strategies linked, in part, to the recovery, with local engagement highlighted as particularly important.

Rummel *et al*. (2016) found plastic particles to be present in the gastrointestinal tracts of 5.5% of various species (cod, dab, flounder, herring and mackerel), with higher rates of ingestion recorded in the pelagic species. The science underpinning consideration of human impacts (beyond fishing pressure) on fish populations continues to expand. The potential for further development of coastal renewable developments, such as tidal barrages and lagoons, increases the importance of careful consideration of migratory diadromous species in risk assessments. The complicated life-cycle of these species makes their sensitivities difficult to identify. One recent molecular study of salmon from rivers in northeast Scotland, found genetic similarities between rivers that, in some cases, were greater than those within the rivers (Cauwelier *et al*. 2018). This suggests a degree of complexity in salmon population structure that may have implications for assumptions in the genetic techniques used in stock identification.

4.2.1.5 Marine reptiles

Turtle sightings, strandings and instances of bycatch continue to be recorded and compiled in the TURTLE database and collated in yearly reports (Penrose & Gander 2015, 2016, 2017). Data are made public on the National Biodiversity Gateway (http://data.nbn.org.uk/) and reports can be accessed at http://www.strandings.com/Wales.html. Recent data are consistent with what has been described previously.

4.2.1.6 Birds

Species, populations and distribution

The OESEA baseline for birds is compiled using a variety of resources including data from previous census records; North Sea focused publications which utilise data from the European Seabirds at Sea (ESAS) database; recent surveys of breeding seabird colonies, including those collecting data as part of the RSPB-led Seabird Tracking and Research (STAR) and FAME (Future of the Atlantic Marine Environment) projects; and, publications describing sites used by, and counts of, waterbirds during winter. To date, a census of all 25 seabird species that regularly breed in Britain and Ireland has been carried out on three occasions, the results of which were published in Cramp *et al*. (1974), Lloyd *et al.* (1991) and Mitchell *et al*. (2004). Survey work for the fourth census of breeding seabirds (called Seabirds Count) commenced in 2015, with the aim that data is collected annually until the end of the 2019 breeding season.

A number of resources used to establish the baseline are published on an annual basis. These include the Wetland Bird Survey *Waterbirds in the UK* (Frost *et al*. 2018), the *State of the UK's Birds* (a collaborative report by RSPB, BTO, WWT, DAERA, JNCC, NE and NRW, Hayhow *et al*. 2017) and the BTO's *Northern Ireland Seabird Report*, the most recent being 2018 (BTO 2018). And, while no longer in the published format of *Seabird numbers and breeding success in Britain and Ireland*, the JNCC coordinated Seabird Monitoring Programme (SMP)[39] and online Seabird Population Trends and causes of change is updated annually; as at April 2018, the latest update to this was September 2016 (JNCC 2016a).

The overall populations and trends of seabirds breeding in Britain and Ireland remain relatively unchanged since the publication of OESEA3; of those species showing a population decline

[39] http://jncc.defra.gov.uk/page-1550

between the previous census counts and surveys in 2014, only the sandwich tern (*Sterna sandvicensis*) has shown an increase from 2015 data, with the rest, including northern fulmar (*Fulmarus glacialis*), European shag (*Phalacrocorax aristotelis*), Arctic skua (*Stercorarius parasiticus*), little tern (*Sternula albifrons*) and black-legged kittiwake, continuing to show a decline (JNCC 2016a). Conversely, those species which have been increasing, such as northern gannet (*Morus bassanus*), have continued to do so (JNCC 2016a).

The results from several of these colony counts have been published over the intervening period: Davison (2018) describes the numbers of breeding seabirds and productivity from the full colony count of the Flamborough Head and Filey proposed Special Protection Area (pSPA) which showed an increase in populations for all qualifying species of the site, including a small increase for kittiwake; Heubeck & Mellor (2017) describes breeding numbers and productivity from the 2016 breeding season at sites around Shetland; Newell *et al.* (2016) provides details of the 2015 breeding season on the Isle of May for northern fulmar, European shag, kittiwake, common guillemot (*Uria aalge*), Atlantic puffin (*Fratercula arctica*) and razorbill (*Alca torda*); and, annual seabird monitoring reports describe numbers and productivity from the 2017 season on Skomer Island (Stubbings *et al*. 2017) and Skokholm Island (The Wildlife Trust for South and West Wales 2017).

These, and other colonies, have been highlighted in OESEA3, (and previous OESEAs) as being important sites for breeding seabirds and this remains the case. The fifth Northern Ireland Seabird Report (BTO 2018) has also been published in the intervening period and while data from the colonies described in the report feed into the SMP, the report provides more detailed information on specific colonies, which is not always provided in the SMP annual description. Again, from this, while the overall trend remains the same as that previously described, some bird species in NI show marked differences to that seen elsewhere, for example, while the kittiwake and European shag have been and still continue to decline around the British coast, in NI, kittiwake numbers have remained stable or declined at a lower rate than the rest of the UK and the European shag is stable (BTO 2018).

The annual Wetland Bird Survey (Frost *et al*. 2018) monitors non-breeding waterbirds in the UK in order to "*identify population sizes, determine trends in numbers and distribution and identify important sites for waterbirds*" (WeBS website: https://www.bto.org/volunteer-surveys/webs). For wintering waterbirds and as described in OESEA3, The Wash remains the top principal site in the UK (Frost *et al*. 2018) supporting in excess of 400,000 birds. The top five sites have remained relatively the same; Morecambe Bay, the Ribble Estuary, the Thames and the Dee Estuary, which has moved up to fifth, with the North Norfolk Coast dropping to eighth.

The long term and 10 year trends of wintering wetland birds in the UK, as described in the annual publication *The State of the UK's Birds* (Hayhow *et al*. 2017) are derived from bird numbers collected from various sources, such as The Wetland Bird Survey (WeBS), the Non-estuarine Waterbird Survey (NEWS) and the Goose and Swan Monitoring Programme (GSMP). From Hayhow *et al*. (2017), these trends show the same pattern as described in OESEA3, i.e. species showing a decline in number wintering in the UK, continue to decline; for some species, such as the European white fronted goose (*Anser albifrons flavirostris*) and redshank (*Tringa totanus*), this decline is lower than in previous years, while for others, such as Bewick's swan (*Cygnus columbianus*), shelduck (*Tadorna tadorna*), pochard (*Aythya ferina*), grey plover (*Pluvialis squatarola*), knot (*Calidris canutus*) and turnstone (*Arenaria interpres*), the decline is greater. Climate change is a factor contributing to these changes, including milder winters resulting in fewer birds over-wintering in the UK, with projections for reduced breeding ranges of Arctic and sub-Arctic species, which may result in further declines in UK over-wintering populations (Hayhow *et al.* 2017).

Other publications which provide area or site specific information on numbers and distributions of wintering waterbirds include: the results of a survey of the feeding distribution of geese around the Loch of Strathbeg in Scotland (Littlewood & Sideris 2016); a survey of the distribution and number of inshore wintering waterbirds using Belfast Lough to identify possible boundaries around important aggregations (Win *et al.* 2016); the international census of Greenland white-fronted geese, which combines surveys of wintering grounds from Britain and Ireland (Fox & Francis 2017); the 57th consecutive annual census of Greenland/Iceland pink-footed geese (*Anser brachyrhynchus*) and Iceland greylag geese (*Anser anser*), which included count data from the UK and also southwest Norway and Iceland (Mitchell & Brides 2017), and the 7th international census of whooper swans (*Cygnus cygnus*) in Britain, Ireland, Iceland and the Isle of Man (Hall *et al*. 2016). There is also a regular assessment of the abundance, productivity and distribution of the largely sedentary greylag goose (*Anser anser*) population in Scotland, with data from the most recent of these published in 2016 (Mitchell *et al*. 2016, Mitchell 2016).

The annual Defra wild bird populations national statistics release (Defra 2017b) generally reflects the trends described in Defra (2015) and included in OESEA3; with a few exceptions in the short term trends. The short term trend, (i.e. the difference between 2008/2013 (Defra 2015) and 2009/2014 (Defra 2017b)) for the great black-backed gull (*Larus marinus*) changed from “weak decline” to “strong increase” and for waterbirds (which includes data from 2014/15), the short term trends (the difference between 2008/2013 (Defra 2015) and 2009/2015 (Defra 2017b)) changed from “weak increase” to “strong decline” for European white-fronted goose, the Nearctic light-bellied Brent goose (*Branta bernicla hrota*) changed from “strong increase” to “strong decline” and the golden plover (*Pluvialis apricaria*) changed from “strong decline” to “strong increase”.

At sea distribution

Spatial distribution and density of birds in the marine environment varies throughout the year as described in OESEA3 for both inshore waters and offshore. This draws information from a number of well-known resources, such as Skov *et al*. (1995), Tasker *et al.* (1987), Tasker & Pienkowski (1987) and WWT Consulting (2008), some of which are becoming dated.

Latterly, this has been added to by information from tagging studies examining foraging ranges during the breeding season, and migration movements during the non-breeding season. Relevant studies include: looking at the movement and behaviour of immature and breeding adult northern gannets from Bass Rock and time spent within installed or proposed wind farm sites (Hamer *et al*. 2017); using models to estimate the distribution at sea of European shags, kittiwakes, common guillemot and razorbill from samples of individual spatial usage and how this can be used to aid and target conservation measures (Wakefield *et al*. 2017, Cleasby *et al.* 2018); the rafting behaviour of northern gannets associated with foraging trips from the Grassholm SPA and where this behaviour was concentrated, confirming a significant portion of the rafting activity was carried out within the SPA seaward extension (Carter *et al*. 2016); the home ranges and maximum foraging ranges of lesser black-backed gulls (*Larus fuscus*) and time spent within the Bowland Fells SPA (Clewley *et al*. 2017, an update to the 2016 report); finding variability in foraging ecology and at-sea distribution in species such as northern gannet (Warwick-Evans *et al*. 2016) and lesser black-backed gull (Ross-Smith *et al*. 2016) and looking at factors which may influence migration routes taken by for example northern gannet (Garthe *et al*. 2016) and Atlantic puffin (Fayet *et al*. 2017).

In 2017, as part of Operation Puffin, the RSPB used GPS tags to track puffins at two sites in Scotland, Mary Island in the Shiants, located in the Minch and Hermaness in Shetland (six birds from each colony[40]). Initial results showed differences between the puffins from the Shiants, the tracks of which show localised, short duration trips, and those from Shetland, at least two of which appear to travel much further afield – with one bird travelling over 400km off the north east coast of Scotland. From initial analyses, it is thought food availability/quality may be accounting for differences in foraging distances as already suggested in OESEA3 for other species such as northern fulmar and northern gannet.

Cox *et al*. (2016) looked at the diving behaviour of northern gannets from Grassholm (2012-2013 breeding season), in relation to shelf-sea fronts (in this case the Celtic Sea Front); they found northern gannet did preferentially dive in regions of persistent frontal activity, adding to the evidence documenting the importance of these features as foraging areas.

As part of the NERC/DEFRA-funded Marine Ecosystem Research Programme (MERP), scientists have collated, standardised and analysed existing at-sea seabird data in order to produce distribution maps across seasons of twelve seabird species (and 12 cetacean species) in the north-east Atlantic. This information has not yet been published but the aim is that it will form the basis of risk maps, currently being developed, of cumulative effects of anthropogenic pressures on individual species. Similarly, other MERP-funded projects include working with the RSPB to develop an energetics modelling framework for mapping predation pressure from UK seabird breeding colonies. It is hoped these maps will enable assessment of key habitat areas used by breeding seabirds, which can be overlaid with maps of other marine pressures, to identify regions and areas where strong trade-off occurs between competing human and wildlife activities (MERP website[41]).

4.2.1.7 Marine and other mammals

Since publication of OESEA3, additional data on the distribution and abundance of marine mammals in the north-east Atlantic have been collected and/or become available, including that acquired from: broad- and local-scale surveys of cetaceans and other marine megafauna; compilations and analyses of existing data; and, further seal tagging and counts at monitored breeding colonies and haul-out sites. For details of updates to marine protected areas for cetaceans, see Section 4.2.10.

Cetaceans

SCANS-III survey

The SCANS-III survey[42] completed in the summer of 2016, with results reported in 2017 (Hammond *et al*. 2017), provides the third broad-scale survey of European Atlantic waters (previous surveys in 1994 and 2005, Hammond *et al*. 2013), including all UK shelf waters, and the second such survey of deep waters to the west of Britain and Ireland (following the CODA (Cetacean Offshore Distribution and Abundance) survey in 2007, Hammond *et al*. 2009). The latest survey provided abundance estimates for all species for which sufficient data were collected, including: harbour porpoise, bottlenose dolphin, Risso's dolphin, white-beaked dolphin, white-sided dolphin, common dolphin, striped dolphin, pilot whale, all beaked whale species combined, sperm whale, minke whale and fin whale.

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[40] https://rspb.maps.arcgis.com/apps/Cascade/index.html?appid=2733e23a70fe460fa8f4ecf9ce7af0c6
[41] http://www.marine-ecosystems.org.uk/Research_outcomes/Top_predators
[42] https://synergy.st-andrews.ac.uk/scans3/

The SCANS-III report also provides a reanalysis of shipboard data for some species/years from the previous SCANS surveys, where appropriate, using a more robust approach to estimating detection probability. This reduces the probability of bias in abundance estimates due to responsive movement of animals and creates a comparable time series of estimates from 1994, 2005 and 2016 for harbour porpoise, white-beaked dolphin, bottlenose dolphin and minke whale. Additionally, the 2016 survey provided, for the first time, estimates of g(0): the proportion of animals on the trackline which were detected by aerial observers. g(0) was estimated for harbour porpoise, dolphins (all species) and minke whale, and applied to aerial survey data for 2016 and 2005, providing further refinements to abundance estimates for those species from 2005.

Revised abundance estimates from ship surveys were similar for minke whale but 20-50% larger for harbour porpoise and three times larger for white-beaked dolphin. These results confirm that abundance was previously underestimated for harbour porpoise and, especially, for white-beaked dolphin. Revised abundance estimates for aerial surveys using the SCANS-III estimates of g(0) were similar for dolphin species but smaller for minke whale.

Following SCANS-III, there are now three comparable estimates of abundance for harbour porpoise, white-beaked dolphin and minke whale in the North Sea, supplemented by additional estimates for minke whale from Norwegian surveys[43]. Consequently, trends in abundance over time were investigated, with trend lines fitted across the three estimates of abundance for harbour porpoise and white-beaked dolphin, and the eight estimates for minke whale. Estimated annual rates of change were small and with wide confidence intervals: +0.8% (95%CI: -6.8% to +9.0%) for harbour porpoise; -0.5% (95%CI: -18% to +22%) for white-beaked dolphin; and, -0.25% (95%CI: -4.8% to +4.6%) for minke whale. Giving consideration to the very low statistical power to detect anything other than large changes in abundance[44] (a widespread issue in cetacean abundance monitoring), these results show that there is no statistical support for a change in abundance over the period covered by the surveys for any species/region (Hammond *et al*. 2017).

A large southerly shift in the distribution of harbour porpoise was reported across the North Sea during the 10 years between 1994 and 2005 when the two SCANS surveys took place (Hammond *et al.* 2013), a shift also reported from land-based observations (Evans *et al.* 2015). There is no evidence of further major shifts in harbour porpoise distribution since 2005, with the SCANS-III survey in 2016 also reporting higher densities in the southern North Sea than areas further north (Hammond *et al*. 2017).

Other relevant broad-scale surveys

Irish waters adjacent to the area covered by SCANS-III, including Irish and Celtic Seas and continental margin, have recently been surveyed for cetaceans and seabirds under the ObSERVE programme. This included summer and winter aerial surveys from 2015-2016[45] complemented by ship-based visual surveys and a series of bottom-mounted acoustic loggers deployed along the Irish shelf edge from 2015-2016[46]. Maps of sightings locations of the most frequently observed species have been made available online[47], but abundance estimates and

[43] Norwegian Independent Line Transect Surveys (see Hammond *et al*. 2017 for data sources).
[44] Power analysis showed that the annual rate of change that could be detected by the available data with 80% power was 1.8% for harbour porpoise, 5% for white-beaked dolphin and 0.5% for minke whale.
[45] http://www.observe-aerial.ie/
[46] http://www.observe-acoustic.ie/
[47] http://www.observe-aerial.ie/results

analyses of distribution are not yet available. Preliminary analysis of acoustic data suggests that beaked whales are more common in this area than previously known, with Sowerby's and Cuvier's present during all monitoring periods (Berrow *et al*. 2017, Kowarski *et al*. 2017).

Results are also now available from French aerial surveys named SAMM (Aerial Census of Marine Megafauna), which covered the English Channel and Bay of Biscay in winter 2011-2012 and summer 2012, allowing seasonal comparisons of cetacean distribution and abundance (Laran *et al*. 2017). The surveys included both English and French waters of the English Channel; sightings of harbour porpoise were more numerous in this area than during the SCANS-II survey of summer 2005 (SCANS-II 2008), but were comparable to those of the more recent SCANS-III survey in summer 2016 (Hammond *et al*. 2017). The relevant survey strata for SCANS-III and SAMM 2011-2012 surveys cover almost the same area and both recorded similar total abundance estimates for harbour porpoise, at approximately 18,000 (CV ~0.3) in both summer and winter.

Broad-scale analyses of existing data

There have been efforts over the past decade to update the widely-used Atlas of cetacean distribution in north-west European waters (Reid *et al*. 2003), with the third phase of development of the JNCC-led Joint Cetacean Protocol (JCP) data resource published in 2016 (Paxton *et al*. 2016). The JCP project has provided a platform for the integration of cetacean sightings, which comprise the largest collation ever attempted in Europe (1994-2010); 38 data sources with data from at least 542 distinct survey platforms (ships and aircraft) representing over 1.05 million km of effort over a large region encompassing shelf waters around the UK and Ireland and the vast majority of the greater North Sea to the Kattegat in the east. In Phase III, these effort-linked sightings data were standardised and used to estimate spatio-temporal patterns of abundance for seven species[48] of cetacean. The main JCP outputs are species maps depicting long-term average spatial distribution patterns; it is recognised that these can add value to industry impact assessments and marine spatial planning efforts by providing density estimates at medium to large spatial scales that are likely to be more realistic than what could be obtained from small scale surveys during one or two years. However, it is also important to recognise its limitations; the validity of some assumptions made in standardising data from multiple sources and other potential sources of bias have not been examined in detail. Further, the temporal and spatial paucity of the data has meant abundance estimates for many areas and time periods have wide confidence intervals, and the power to detect trends in population size remains low even for species with reasonably good time-series of data (Paxton *et al*. 2016).

The harbour porpoise modelled density layers presented in Heinanen & Skov (2015) that informed the selection of SACs still provide the primary source of information on important areas for harbour porpoise in UK waters. For the southern North Sea, seasonal habitat-based density models have been produced by Gilles *et al*. (2016); the analysis combined data from systematic aerial visual surveys from Belgium, the Netherlands, Germany and Denmark, collected year round over the period 2005-2013, with SCANS II data (summer only). The resulting predictive abundance maps are the first to highlight seasonal changes in distribution, but results within the UK sector should be treated with caution due to wide confidence intervals and very limited survey coverage, especially from spring and autumn.

[48] Species included: harbour porpoise, minke whale, bottlenose dolphin, common dolphin, Risso's dolphin, white-beaked dolphin and Atlantic white-sided dolphin.

Deep-diving species

Anthropogenic underwater noise is a concern for deep-diving species, particularly beaked whales which appear to be especially sensitive to certain sonar (review in Southall *et al*. 2016). However, their typically offshore distribution and long dive times make them difficult to study and they remain poorly understood. Using data from SCANS-II (2005), CODA (2007) and North Atlantic Sightings Surveys (NASS) (2007), Rogan *et al*. (2017) investigated the distribution, abundance and habitat use of deep-diving cetaceans (beaked whales, sperm whale, pilot whale) in the NE Atlantic, including deep waters west of the UK and Ireland. Results include the most robust summer abundance estimates for these species to date and highlight the importance of certain areas, including the edges of the Rockall Trough for pilot whales and the northern Rockall Trough for beaked whales. While these results improve upon previous understanding, more recent data are available and low numbers of sightings precluded species-specific estimates of beaked whale habitat use.

A recently initiated project, funded by the OESEA Research Programme and being conducted by SMRU, will extend the work of Rogan *et al.* (2017) to compile and analyse newer and more comprehensive data on deep-diving species, including: the 2005 and 2016 SCANS surveys; CODA (2007, including previously unanalysed acoustic detections); Faroes blocks of the 2015 NASS, ObSERVE surveys in Irish waters (2015-2016); and, previously unanalysed sightings from the European Seabirds at Sea Database (ESAS, managed by JNCC). These are expected to add several hundred data points to existing analyses for each of beaked, sperm and pilot whales, and will result in more robust estimates of species distribution and abundance in deep water west of the UK and Ireland, including species-specific beaked whale estimates where possible.

Updated regional- and local-scale information

In 2013, Marine Scotland initiated the East Coast Marine Mammal Acoustics Study (ECOMMAS): a long-term, on-going study into the occurrence of dolphins and porpoises off the Scottish east coast and how that might be influenced by offshore industry, such as windfarm construction[49]. This region covers the range of the coastal east Scotland bottlenose dolphin management unit associated with the Moray Firth SAC, for which the population estimates and SAC usage presented in Cheney *et al*. (2013, 2014) remain the most recently available. Acoustic recorders (C-PODs[50] and SM2Ms[51]) are deployed at 10 locations at approximate intervals of 50km of coastline between Latheron in the outer Moray Firth to St Abbs in Berwickshire. At each location, three C-PODS are deployed at sites approximately 3, 10 and 15km from shore, with an accompanying SM2M at one site per location. The recorders collect data for up to seven months per year, starting in spring, recording broadband underwater noise (SM2Ms) and counting dolphin and porpoise echolocation clicks (C-PODS). Further methodological details are available in Palmer *et al*. (2017). Summary data from 2013-2016 are now available, illustrating that over this period, harbour porpoise were detected on ≥90% of days at all but two sites - the Cromarty and Spey Bay nearshore site, which are known for regular sightings of bottlenose dolphins. By contrast, dolphins (all species) were generally detected on a much lower proportion of days and with greater variability between sites (Figure 4.1); for all but one site (Cromarty nearshore, 94% days) dolphins were detected on ≤37% of days.

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[49] http://marine.gov.scot/information/east-coast-marine-mammal-acoustic-study-ecommas
[50] C-PODs (Chelonia Ltd) are porpoise/dolphin echolocation click recorders.
[51] SM2Ms (Wildlife Acoustics Ltd) are loggers which can provide continuous acoustic recording across a wide frequency range.

While efforts to differentiate between dolphin species from click data are ongoing, the development of a click categorisation model on the 2013 ECOMMAS C-POD data showed a high level of accuracy in differentiating between broadband dolphin clicks (characteristic of bottlenose dolphins and common dolphins) and frequency banded clicks (characteristic of white-beaked and Risso's dolphins) (Palmer *et al*. 2017). When considered alongside data from visual surveys in the region, these results suggest that bottlenose dolphins were primarily responsible for the detection rates of dolphins at Cromarty (which were the highest recorded) and Spey Bay nearshore sites, while the Latheron, Helmsdale, Fraserburgh and Cruden Bay sites were dominated by white-beaked dolphin-type clicks. At Stonehaven and locations further south a combination of the two were recorded, with bottlenose dolphin clicks dominant at nearshore sites and white-beaked dolphins dominant at the two more offshore sites (Palmer *et al*. 2017).

Abundance estimates of harbour porpoise and bottlenose dolphins in the Cardigan Bay SAC and surrounding coastal waters in summer 2016 were presented by Lohrengel & Evans (2017, cited in ICES 2017a). These add to previous estimates as part of ongoing monitoring efforts. For the wider Cardigan Bay area, line-transect surveys estimated harbour porpoise abundance at 828 (CV=0.19) and bottlenose dolphin abundance at 289 (CV=0.23) individuals. Closed population estimates for bottlenose dolphins from capture-recapture photo-identification analysis were 147 (95%CI=127-194) in the SAC, and 174 (95%CI=150-246) in the wider Cardigan Bay. For both species, these estimates for the wider bay are within the range of those from previous years (2011-2013, Feingold & Evans 2014); considerable inter-annual variability in bottlenose dolphin abundance has been reported, likely due to the population ranging beyond the study area with year-round presence now observed off the north Wales coast and occasional sightings elsewhere in the Irish Sea (Evans *et al*. 2015). NRW (2018) notes that an initial trend analysis on bottlenose dolphin photographic identification data indicates a decline in the last 10 years, but no significant trend in the SAC between 2001 and 2016 (Lohrengel *et al*., in prep). Further work is underway to better analyse trends in the data set (NRW 2018). Additionally, passive acoustic monitoring data from a series of T-POD deployments in the Cardigan Bay SAC from 2005-2009 were recently published (Nuuttila *et al*. 2017). Results provide information on spatio-temporal partitioning of harbour porpoise and bottlenose dolphins within the site, including peak detections of harbour porpoise in winter (December-February) and of bottlenose dolphins in summer (June-August).

Regular sightings of small numbers of bottlenose dolphins in coastal waters around Cornwall have been previously reported (e.g. Evans *et al*. 2015). However, a recent compilation and analysis of photo identification data from a variety of sources over the period 2007-2016 suggests that a community of approximately 30 individuals show strong fidelity to the area[52]. Further dedicated research is required to determine the status of this potentially resident community.

Seals

Abundance and at-sea distribution in the UK

The most recent annual advice from the Scientific Committee on Seals is for 2016 (SCOS 2017), providing updated information on a number of topics, including population abundance and trends for grey and harbour seals in the UK.

[52] http://www.cornwallwildlifetrust.org.uk/living-seas/bottlenose-dolphin-project

The most recent grey seal pup production estimate available, for 2014, is 60,500 (95% CI 53,900-66,900); the population estimate for 2016 is 141,000 (approximate 95% CI 117,500-168,500), representing an increase of 26% over the 2013 estimate presented in OESEA3 (SCOS 2017). The upwards trend in grey seal populations is continuing for the UK overall, although rates of increase vary among colonies and regions of the UK. Potential Biological Removal[53] estimates for grey seals have increased by 50-67% due to revised population estimates and local population increases. For example, initial findings of a 2017 grey seal pup census in North Wales (NRW unpublished data) indicate an approximate doubling of pup production and expansion of pupping site distribution since the last censuses in 2003 and 2004 (NRW response to OESEA3 review).

The estimated total harbour seal population for the UK in 2016 was 43,500 (approximate 95% CI: 35,600-58,000, SCOS 2017), representing a 17.8% increase over the 2014 estimate presented in OESEA3; the vast majority of this increase is attributable to colonies on the Scottish west coast and southeast England. Overall, the UK population has increased since the late 2000s and is close to the 1990s level. However, there are significant differences in the population dynamics between regions. As reported in previous assessments, there have been general declines in counts of harbour seals in several regions around Scotland (Orkney, Shetland, east coast) over the past two decades, but the declines are not universal with some populations either stable or increasing (Scottish west coast and Western Isles) (SCOS 2017). The PBR for harbour seals in Orkney has been reduced by approximately 30% due to recent survey results.

BEIS and its predecessors have contributed to funding an extensive programme of seal tagging research over the past two decades, including the collection of new data since 2013 (as was presented in OESEA3 from Jones *et al*. 2015). These include the tagging of 21 grey seals at Donna Nook and Blakeney on the English east coast in 2015, and a further 40 grey seals among sites in Orkney, western Scotland and north Wales in 2017 (data not yet available). Additional new available data include that from 40 harbour seals tagged between 2014-2016 in the Moray Firth, Orkney and north coast of Scotland and west coast of Scotland, and two grey seals tagged in southeast Scotland in 2016. Consequently, updated and more robust seal usage maps are available, with the most recent presented in Russell *et al.* (2017)[54]. Key updates include: (i) additional telemetry data as described above, with maps now including data from 1991-2016 representing a 23% and 39% increase in sample size for grey and harbour seals respectively; (ii) incorporation of effort data associated with counts and usage scaled to the estimated population size in 2015; and, (iii) clustering of haul out sites to increase the proportion of sites for which there are associated telemetry data and thus increased accuracy of estimated distribution (Russell *et al*. 2017). The general pattern of usage is similar to that estimated previously. Reductions in harbour seal usage are apparent in many regions, particularly around Orkney and Shetland and the outer Firth of Tay. The most notable changes for grey seals are greater usage off eastern England between Flamborough Head and north Norfolk, particularly off the Humber Estuary, and waters off Cornwall now representing an area of low-level usage (no data previously). It is noted that the latest maps presented in Russell *et al*. (2017) are exclusively for animals tagged on UK shores, and do not include data from

[53] Potential Biological Removal (PBR) is a metric developed to provide advice on the levels of removals from a marine mammal population that would still allow the population to approach a defined target, namely optimum sustainable growth. In the case of harbour seals, regionally-varying recovery factors are applied to reflect different degrees of population declines in recent years; values range from 0.1 (areas of greatest decline) to 0.7. Grey seals have experienced sustained growth in pup production for the last 30 years and they appear to be close to carrying capacity in many regions; consequently, the recovery factor is set at 1 for all regions (SCOS 2017).

[54] Data available to download from: http://marine.gov.scot/information/seal-usage-maps

animals tagged in the Republic of Ireland and France (39 grey seals and 39 harbour seals) which were included in Jones *et al*. (2015).

Data from continental Europe

New abundance and movement data are available on grey and harbour seals on the European continental coast of the southern North Sea and English Channel. Results of the most recent harbour seal aerial counts in the Wadden Sea, including Danish, German and Dutch coastlines, are reported in Galatius *et al.* (2017). When accounting for animals in the water, the total population size at the time of the 2017 August moult was estimated as 38,100. Despite ongoing increase in annual pup production, the total population size appears to have stabilised in recent years following an increasing trend from 2003-2012.

Small, but increasing, numbers of grey seals occur along the European continental coast of the southern North Sea and English Channel, the vast majority of which are recorded in the Dutch Wadden Sea, with counts during the 2017 spring moult totalling 5,445 and an average annual increase of 16% observed from 2008-2016 (Brasseur *et al*. 2017). Such rapid growth of the Dutch breeding population is fuelled by the annual immigration of grey seals from the UK (Brasseur *et al*. 2014). Rapid increases have also been observed on the French coast over the past decade, particularly in the eastern English Channel, although numbers are low compared those occurring further north in the UK, with a combined maximum count from the five regularly monitored sites in 2015 of approximately 600 grey seals (Vincent *et al*. 2017).

Telemetry data from grey seals tagged at sites in the Netherlands between 2005 and 2014 has become available, showing 21 of the 62 tagged animals spend time in the UK southern North Sea, including visits to Donna North, Blakeney Point and Horsey colonies (Brasseur *et al.* 2015). These data indicate considerable exchange of grey seals between colonies and haul-outs with the UK, although few of the seals tracked from the UK have visited Dutch waters. Movement data from 45 grey and 28 harbour seals tagged on the French coast of the English Channel between 1999 and 2014 has recently been published (Vincent *et al*. 2017). Grey seals travelled widely, visiting haul-outs and colonies (data partially overlapped the breeding season) throughout the English Channel, south west England, west Wales, south west Scotland and Ireland, and also into the North Sea, including eastern England and Scotland and the Dutch coast. By contrast, harbour seals largely stayed within the bays where they were tagged (data were from outwith the breeding season).

Aarts *et al*. (2016) present data on the movement and habitat use of over 200 harbour seals tagged on the Dutch Wadden Sea and west coasts Dutch coast between 2007 and 2015. While some tagged individuals made trips >80km from haul-outs, the highest densities were within a few kilometres of haul-outs and the vast majority of their time spent at-sea was within 40-50km of shore. Seals spent less time on land and ventured further from haul-out sites during winter months (Dec-Feb). Very few tagged animals entered UK offshore waters of the southern North Sea, and models predicted only low densities of animals close to the UK-Netherlands median line.

Predatory behaviour of grey seals

The predator-prey interactions between grey seals and other marine mammals was the subject of an ICES workshop in April 2017 (ICES 2017b). Reported cases of grey seal predation events have been detected throughout much of the grey seal range, although information is lacking from some key areas and identification of such cases remains challenging. For example, grey seal predation on harbour porpoise has been observed in Wales (Stringell *et al.* 2015) and grey seal carcasses stranded in Wales also suggest predation by grey seals (NRW unpublished data). A total of 737 cases of predation on harbour porpoise, harbour and other grey seals have been reported to date, with a steady increase over the last 10 years and peaking in 2016. It is not known if this trend represents a true increase in prevalence, reflects the steady increase in European grey seal numbers, or is due to an increase in effort and reporting. It was noted that if previously high rates of harbour seal mortality due to grey seal predation were sustained, they could potentially account for observed declines in some populations. When combined with the increase in grey seal numbers, this could become the most important driver of local harbour seal extinctions in already depressed populations.

Otters and bats

No significant new information on the status of otters has become available since publication of OESEA3.

The Nathusius' pipistrelle bat is considered at high risk of collisions with wind turbines (Mathews *et al*. 2016) and is the only UK species to undertake significant migratory movements over marine areas. The species is rare in the UK, and has long been considered underreported, although records have increased in recent years. The Bat Conservation Trust coordinate surveys and collate records for the UK and Ireland, and published an updated distribution map in June 2017, which includes results of the systematic Nathusius' pipistrelle survey (2009-2014) where the species presence was verified at 84 of the 261 sites surveyed, with possible presence at a further 94 sites. Records are widely distributed throughout much of the UK and Ireland. The National Nathusius' Pipistrelle Project[55], launched in 2014 to determine the status and migratory origins of the species in Great Britain, has also identified the long-distance movement of individual bats (through ringing) between the south of England and mainland Europe, including the coast of the Netherlands, Latvia and Lithuania (Bat Conservation Trust 2017). Maternity colonies have now been discovered in Kent and Northumberland, in addition to those few previously reported in Northern Ireland and eastern England, further reinforcing the theory that the UK and Ireland may represent a transitional area where resident bats mix with those migrating (to overwinter) from continental Europe[56].

Hüppop & Hill (2016) present acoustic data on bat echolocation calls at the FINO 1 platform, located 57km off the German mainland coast in the southeastern North Sea. The vast majority of data, which spanned over 10 years, was for the Nathusius' pipistrelle bat, which was exclusively recorded during spring and autumn migration periods. The authors conclude that the migrating bats were attracted by the brightly lit platform and/or sought refuge there, with most detections coinciding with dense cover of clouds, fog/low stratus and/or rain.

The results of the FINO 1 monitoring and recent ringing provide further evidence of the use of the southern North Sea as a migration pathway for Nathuisus' pipistrelle, with consequent potential for interactions with offshore wind farms and other illuminated surface structures.

4.2.2 Geology, substrates & coastal processes

The broadscale characterisation of the UKCS geology, substrates and coastal geomorphology, including updates to trends relevant to evolution of the baseline, which were presented in OESEA3 remain unchanged. Sediment (e.g. through regional environment characterisation or developer-led activities) and bathymetric data (e.g. through the civil hydrography programme,

[55] http://www.bats.org.uk/pages/national_nathusius_pipistrelle_project.html
[56] http://www.nathusius.org.uk/Life_History.htm

MAREMAP[57]) continue to add to the characterisation of the UKCS. A comprehensive high resolution map of these is not yet available and there remains a lack of coordination (for example in the re-use of data from commercial programmes) which means that studies are not necessarily contributing to a single national dataset, despite initiatives to make data at least discoverable (e.g. via the MEDIN initiative). In recent years, a European scale bathymetric dataset has become available through the European Marine Observation and Data Network (EMODnet), which is now in a third development phase (2017-2020) with the aim of developing a ¼ arc minute resolution DTM, with data gaps to be filled by satellite derived bathymetry and extended coverage for coastal zones.

The creation of a harmonised map of seabed sediments is challenging due to differences in sediment sampling and measurement methods, and a lack of metadata for legacy data detailing the methods used in sample collection and measurement (see Bockelmann *et al*. 2018, Hartley Anderson *in prep*). A number of regional summaries of the geology of areas of the UKCS (e.g. the 2017 Journal of Quaternary Science Special Issue: The Quaternary of the North Sea Basin), of specific features (e.g. see Cotterill *et al.* 2017a, b, Hjelstuen *et al. in press*, Phillips *et al.* 2018, Owen *et al.* 2018, Roberts *et al.* 2018), or modelling of sediments/features (e.g. Bockelmann *et al.* 2018, Heath *et al.* 2017) have been published.

Updated methods to the monitoring of the coastal zone and predicting change are becoming available, for example data collection using unmanned aerial vehicles (Elsner *et al.* 2018), potentially satellites (e.g. Pardo-Pascual *et al.* 2018, Hagenaars *et al.* 2018) which is more likely in the near future (see Cazenave *et al.* 2017), marine radar (Bird *et al.* 2017) and passive seismic (Payo-Garcia *et al.* 2017) for greater understanding of shore platform sediment depths and future erosion rate projections. Though none yet provide the resolution, accuracy and precision associated with GPS or LiDAR, their cost-effective and relatively rapid data collection make them attractive. A combination of these techniques, combined with updated observation and *in situ* metocean information (see Section 4.2.4) is more likely to be required to provide monitoring and prediction for sensitive areas of the UK coast. Coastal observatories (e.g. national network of regional coastal monitoring programmes of England - https://www.channelcoast.org/) provide a consistent regional approach to coastal process monitoring, informing the development of strategic shoreline management plans, coastal defence strategies and operational management of coastal protection and flood defence.

There have been updates to relevant climate change related projections, for example sea-level rise (e.g. see Haigh & Nicholls 2017, Mengal *et al.* 2018), and the potential response of coasts to this (Earlie *et al.* 2017) (see Section 4.3). These represent one of the principal driving forces in the evolution of the baseline for geology, substrates and coastal processes.

There is still a paucity of geological conservation of offshore sites compared to those for nature conservation, despite the accumulation of geological and geomorphological data, for example, as part of the identification of Marine Protected Areas/Marine Conservation Zones in UK waters (e.g. Gordon *et al.* 2018), and the ability through the *Marine and Coastal Access Act 2009* and *Marine (Scotland) Act 2010* to designate sites on the basis of such features. No further designations or proposed designations for geological sites have been made since the publication of OESEA3.

[57] Also see the EMODnet harmonised Digital Terrain Model (DTM) for European Seas (http://www.emodnet-bathymetry.eu/), and the larger Nippon Foundation-GEBCO Seabed 2030 project to map the world's oceans at high resolution (https://seabed2030.gebco.net/).

4.2.3 Landscape/seascape

Additional seascape characterisation is ongoing for the remaining marine plan areas in England, with no additional reports having been made available since the publication of OESEA3. The extensions to the Lake District and Yorkshire Dales National Parks which were noted in Appendix A1c of OESEA3 took effect in August 2016, and the Lake District was also designated as a World Heritage Site in July 2017. There have been no other changes to the status of designated landscapes, or of national character areas, since the publication of OESEA3.

The drafting of the remaining Marine Plans for English waters, Wales and Northern Ireland is ongoing, and each will contribute to the characterisation of seascapes around the UK that will also form the basis for monitoring pressures on these, for example from marine and coastal development. Land Use Consultants have been commissioned to complete the final set of seascape assessments for the South West Inshore and Offshore Marine Plan areas, thereby having complete coverage of English and Welsh waters[58]. The publication of relevant seascape assessments is likely to take place on the same timetable as the publication of the draft marine plans, which are due for completion by 2021.

The landscape/seascape baseline of OESEA3 noted the completion of all Historic Seascape Characterisation (HSC) studies for English inshore and offshore waters, through eight separate projects undertaken between 2008 and 2015 following the same methodological approach (English Heritage and Cornwall County Council 2008). Land Use Consultants (LUC 2017) were commissioned to consolidate the data from the eight projects into a single, consistent National HSC database, comprising both narrative and GIS outputs which are freely available for use in planning through the Archaeological Data Service website[59].

The Government's 25-year environment plan includes a policy on conserving and enhancing natural beauty, which has the action of reviewing National Parks and Areas of Outstanding Natural Beauty (AONB), how they deliver their responsibilities, are financed, and whether there is scope for expansion. A review of National Parks and AONBs was launched in May 2018 which will consider, amongst other things, how effectively their statutory purposes are being met and whether there is a case for extension or the creation of new areas. The review is expected to report in 2019.

4.2.4 Water environment

Although the overall characterisation of the water environment of the UKCS, detailed in OESEA3, remains unchanged, there are recent studies and new data which provide updates and additional detail. Some studies / data repositories (e.g. Huthnance *et al.* 2016, van Schuckmann *et al.* 2017, UKDMOS, Bundesamt für Seeschifffahrt und Hydrographie) provide new data and discussion for multiple aspects including temperature, salinity, circulation, sea level and water chemistry, which add to the discussion on past and ongoing cycles and changes in UK waters and especially the North Sea. Others focus on singular aspects and locations, e.g. Guillou *et al.* (2016) which presents spatial and temporal variabilities in suspended sediment concentration and correlations with evolution of tides and waves in the English Channel; Queste *et* al. (2016) which investigates drivers of summer oxygen depletion in the central North Sea, and Masselink *et al.* (2016) which discusses extreme wave activity during winter 2013/2014 along the Atlantic coast of Europe.

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58 https://landuse.co.uk/services/heritage-environment/luc-wins-seascape-character-assessment-for-the-south-west-of-england/
59 http://archaeologydataservice.ac.uk/archives/view/seascape_he_2018/

Longer term records have also been published for: sea surface temperature fluctuations in the English Channel over a 6 year period (Derot *et al.* 2016); spatial and temporal data for extreme sea level and surge events around the UK coast over the past 100 years (Haigh *et al.* 2016); climatic trends over the past 100 years and their impacts on estuarine bio-physical processes (Robins *et al.* 2016); high frequency sea level variations in the Solent over a 14 year time period (Ozsoy *et al.* 2016) and; storm and extreme wave heights in the North Sea over a 20 year period (Bell *et al.* 2017), a 53 year period for the North Sea and northeast Atlantic (Santo *et al.* 2016) and 15 year period for the Outer Bristol Channel (Rangel-Buitrago *et al*. 2016). All of these studies add to the current understanding of the range and extremes of different aspects of the UKCS water environment.

In addition, there is a particular focus on improved understanding of current regimes in UK waters, particularly transport from the Atlantic into the North Sea. Marsh *et al.* (2017) provide data from a 10 year period on variations in pathways, timescales and transports of the European Slope Current between the Hebridean shelf break to the west of Scotland, around northern Scotland and into the North Sea. Sheehan *et al.* (2017a, 2017b) also investigate Atlantic inflow into the North Sea, providing both annual data for 1989-2015 and weekly data for 2 month period in 2013. They provide evidence and discussion on transport estimates, stratification, drivers and thermohaline forcing of inflow to the North Sea from Orkney to the central North Sea. There are also a number of newly published studies focusing on tidal stream resource assessments at specific locations, which include detailed data and improvements on current velocities and temporal and spatial flows (e.g. Thiébaut *et al.* (2016) for Dover Strait, Coles *et al.* (2017) for Channel Islands, Pérez-Ortiz *et al.* (2017) for Rathlin Sound).

Following Steering Group review, NRW noted that with regards to wave data there remains a lack of long-term monitoring data available to characterise the Welsh wave climate, particularly for inshore areas. The CEFAS WaveNet site[60] confirms the relatively small number of monitoring buoys in Welsh waters although the focus of the WaveNet network is on areas at risk of coastal flooding. However, given the tidal and wave projects that are progressing in Welsh waters (see Section 4.2.8.3), the metocean data coverage for specific locations will likely improve in the future.

Internal waves were an area identified as requiring further research in OESEA3. Kurekin *et al.* (2017) have subsequently published data and maps of internal wave occurrence in UK waters for 2006-2012 including monthly and annual occurrence and impact on the seabed. This provides an information base upon which future research can be focused.

4.2.5 Air quality

The general sources, trends and distributions of pollutant emissions across the UK for the year 2012 described in OESEA3 are similar to the most recent 2015 updates provided by the National Atmospheric Emissions Inventory (NAEI)[61]. The methodology used to map the most recent emissions (Tsagatakis *et al.* 2017) accords with previous years, however, existing estimates for domestic shipping emissions in the NAEI were based on a model that used a database of ship movements from 2007. This was recently reviewed and a new shipping emissions model developed using 2014 terrestrial AIS data supplied by the Maritime and Coastguard Agency (Scarborough *et al.* 2017). The domestic fuel consumption estimate in the new model is approximately two and a half times that in the existing NAEI for 2014, attributable primarily to improved activity coverage, both of existing vessel categories (e.g. fishing vessels)

[60] http://wavenet.cefas.co.uk/Map
[61] http://naei.beis.gov.uk/overview/ap-overview

and of new vessel types not previously estimated (e.g. offshore industry vessels) (Scarborough *et al.* 2017).

The latest UKCS oil and gas installation emissions reported for 2014 (OSPAR 2016) indicated approximate decreases of 12.5% (to 2,241 tonnes) for SO_2 emissions, 4% (to 12.6 million tonnes) for CO_2 emissions and 2% (to 46,000 tonnes) for NO_x emissions compared to 2012 figures reported in OESEA3. Emissions of non-methane volatile organic compounds (NMVOC) in 2014 were relatively stable (38,100 tonnes) compared to 2012 (37,960 tonnes) (OSPAR 2016).

Emissions monitoring may be facilitated by the recent launch in 2017 of the Sentinel-5 Precursor (Sentinel-5P) satellite which will provide observations of trace gases such as nitrogen dioxide, ozone, formaldehyde, sulphur dioxide, methane, carbon monoxide and aerosols[62]. Global coverage will be provided daily and this is likely to significantly contribute to emissions monitoring at a useable resolution, and could be used to verify country emission inventories, though note those modelled by the NAEI in the UK remain at a greater resolution (primarily 1x1km) than that from Sentinel-5P (7x3.5km).

With respect to the current system of air quality monitoring and assessment of compliance with relevant European directives (ambient air quality directive (2008/50/EC) and the fourth air quality daughter directive (2004/107/EC), Defra (2017a) provides the most recent assessment of UK air quality in 2016. Similar general patterns of compliance were observed in 2016 as described for 2013 in OESEA3. Continued exceedances of the limit value for annual mean NO_2, primarily as a result of road transport emissions is a significant environmental issue in a number of areas (see Section 4.3.11). While the major source of NO_2 (including that secondarily derived from NO) is from road transport, other contributing sources include domestic, industrial and other transport such as aviation and shipping. The North Sea and English Channel are designated as Emissions Control Areas (ECAs) for NOx under MARPOL Annex VI, which will enter into force in 2019 and have effect from 2021. This relates to limits in NOx emissions from ships and is linked to construction date. To operate in these areas, ships constructed on or after 1st January 2021 must comply with more stringent “tier III” NOx limits, which require a reduction of ~75% on “tier II” limits. These limits will in time reduce the shipping contribution to UK NO_2 pollution, but may take some time as the current stock of ships/engines are replaced. Additionally, the UK Government notes that it encourages existing ports, and new port facilities through national policy, to provide shoreside electricity connections to reduce emissions when in port (Defra & Department for Transport 2017).

4.2.6 Climate and meteorology

There have been no significant changes to the baseline describing the general climate and meteorology of the UKCS since the publication of OESEA3, including those trends resulting from climate change impacts (see Hughes *et al.* 2017). The ICES Working Group on Ocean Hydrography continues to provide an annual update on the ocean climate (though most is relevant to oceanic rather than atmospheric conditions), including long-term trends and those most recent climate and meteorological conditions affecting the North Atlantic and shelf seas (see González-Pola *et al.* 2018). UKCP18 is due to report in 2018 which will include observational data providing an update to knowledge on the current trends on the contribution of climate change to the UK (primarily over land) and also projections for certain components of the marine environment including sea-level rise and storm surges (see Section 5).

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62 https://m.esa.int/Our_Activities/Observing_the_Earth/Copernicus/Sentinel-5P/Introducing_Sentinel-5P

There has been a continued decline in UK greenhouse gas (GHG) emissions in the context of estimated globally stable level of CO_2 emissions between 2013 and 2016 (though there is a projected 2% increase for 2017, see: Jackson *et al.* 2017). The most recent final figures are for 2016 (BEIS 2018a), showing an 8.4% decline in the basket of seven GHGs covered by the Kyoto Protocol on 2014 figures reported in OESEA3, to 467.9 million tonnes carbon dioxide equivalent ($MtCO_2eq$). Transport became the dominant source of GHGs in 2016, with energy sector emissions continuing to decline (57% on 1990 levels and accounting for 25% of all UK GHG emissions) in response to a change in the mix of fuels used (shift from coal to gas) and renewables deployment, including offshore wind. BEIS (2018b) project a total build-out of all renewables to 44GW by 2035 based on central estimates of economic growth and all agreed policies currently in place. Government policy relevant to renewables in the electricity supply industry (e.g. Contracts for Difference) is projected to result in savings of 231$MtCO_2eq$ in the fourth carbon budget period (2023-2027), but a new policy could alter this estimate (BEIS 2018b).

4.2.7 Population and human health

OESEA3 provided information on the population, employment and health at national level and with respect to relevant coastal local authorities within the Regional Sea areas. The most recently available population data at such a scale are estimates for mid-2016 (e.g. Office for National Statistics 2017a) which indicate similar patterns of change as described in OESEA3 with England (0.9%) and the UK (0.8%) as a whole showing the greatest annual increase to 55.3 million and 65.6 million people respectively, and Wales (0.5% increase to 3.1 million people), the least. The UK population is projected to increase by 3.6 million (5.5%) over the next 10 years to 69.2 million in mid-2026. England is projected to grow more quickly than the other UK nations: 5.9% between mid-2016 and mid-2026, compared with 4.2% for Northern Ireland, 3.2% for Scotland and 3.1% for Wales (Office for National Statistics 2017b). Statistics on the employment structure and health of the population are provided by the 2011 Census which also formed the basis of the information provided in OESEA3 and is therefore still relevant. The next UK-wide census will be carried out in 2021.

4.2.8 Other users of the sea, material assets (infrastructure, and natural resources)

4.2.8.1 Ports and shipping

The most recent data on volumes and patterns of freight traffic are similar to those described by OESEA3.

The most recently available (2015) average weekly shipping density (from ship Automatic Identification System (AIS)) data[63] reflected similar patterns to the 2012 data provided in OESEA3. With respect to shipping routes and navigational safety, the Maritime and Coastguard Agency (MCA 2016) note MGN 543 (replaces MGN 371) provides guidance on UK navigational practice, safety and emergency response issues with regard to Offshore Renewable Energy Installations (OREIs).

4.2.8.2 Oil and gas activity

Oil and gas production has increased slightly since 2014 (e.g. crude oil production went from 37.47 to 43.14 million tonnes in 2017 with net gas increasing from 31.83 to 35.74 million tonnes oil equivalent). Exploration and appraisal expenditure has decreased from £1.5 billion in 2014

[63] https://data.gov.uk/dataset/vessel-density-grid-2015

to £0.64 billion in 2017 and is projected to remain at this level over the medium term. Similarly, capital expenditure has decreased significantly from £15.4 billion in 2014 to £5.6 billion in 2017 and is expected to continue to fall for the foreseeable future. Operating costs have fallen from £10 billion in 2014 to £7 billion in 2017 and are projected to continue to fall with production in the medium term. Decommissioning costs have decreased from £1.8 billion in 2014 to £1.3 billion in 2017 but are expected to return to 2014 levels over the medium term (OGA 2018a).

4.2.8.3 Offshore renewable energy activity

A summary of changes to the status of UK offshore wind farms since the publication of OESEA3 is given in Table 4.1.

Table 4.1: Current status of UK offshore wind farms (September 2018) compared to OESEA3 (October 2015)

Wind farm	Round	Capacity (MW)	Status (October 2015)	Status (September 2018)
Regional Sea 1				
Beatrice	STW	588	Consented	Construction
Moray East alternative design (was Telford, Stevenson & MacColl)	3	1,116	Consented (original developments)	Pre-planning (alternative design)
Moray West	3	750	-	In planning
Hywind Scotland Pilot Park	Demonstration	30	Consented	In operation
Aberdeen Demonstration (European Marine Energy Centre)	Demonstration	66	Consented	Construction
Kincardine	Demonstration	50	Pre-planning	Consented
Seagreen Phase 1 (was Seagreen Alpha and Bravo)	3	1,050	Consented (original development)	Pre-planning (alternative design)
Inch Cape revised design	STW	784	Consented (original development)	Pre-planning (revised design)
Neart na Gaoithe revised design	STW	448	Consented	In planning (revised design)
Methil Demonstration Project - 2B Energy	Demonstration	14	Pre-planning	Consented
Blyth Demo	Demonstration	41.5	Consented	In operation
Regional Sea 2				
Hornsea Project One (was Heron Wind and Njord)	3	1,200	Consented	Construction
Hornsea Project Two (was Optimus and Breesea)	3	1,800	Awaiting consent	Consented
Hornsea Project Three	3	2,400	-	In planning
Hornsea Project Four	3	1,200	-	Pre-planning
Race Bank	2	573	Consented	In operation
Dudgeon	2	402	Under construction	In operation
East Anglia One	3	714	Consented	Construction
East Anglia One North	3	800	-	Pre-planning
East Anglia Two	3	900	-	Pre-planning
East Anglia Three	3	1,200	Pre-planning	Consented
Norfolk Vanguard (was East Anglia Four)	3	1,800	-	In planning
Norfolk Boreas	3	1,800	-	Pre-planning
Galloper Extension	Extension	353	Consented	In operation
Kentish Flats Extension	Extension	49.5	Under construction	In operation
Regional Sea 3				

Wind farm	Round	Capacity (MW)	Status (October 2015)	Status (September 2018)
Rampion	3	400	Consented	In operation
Regional Sea 4				
WaveHub PelaStar deployment	Demonstration	6	Pre-planning	Cancelled
Regional Sea 6				
Burbo Bank Extension	Extension	259	Under construction	In operation
Walney Extension	Extension	659	Consented	In operation
Regional Sea 8				
Dounreay Trì Floating Wind Demonstration Project	Demonstration	12	Pre-planning	Consented*

Source: Marine Scotland website (accessed September 2018, http://www.gov.scot/Topics/marine/Licensing/marine/scoping, http://marine.gov.scot/marine-projects, The Crown Estate website (accessed September 2018, https://www.thecrownestate.co.uk/media/2661/offshorewindprojectlisting.pdf)
Notes: while consented, this project is not expected to proceed

Electricity generated by offshore wind increased *ca*. 27% from 16,406GWh in 2016 to 20,885 GWh in 2017 (provisional figure). The 2017 figure represents a *ca*. 56% increase on the 2014 figure provided in OESEA3. Generation for the most recent quarter (Q4 2017) was 7,797GWh (provisional figure) representing a 76% increase over the same quarter in 2016 (4,419GWh). Cumulative installed capacity increased by *ca*. 32% between 2016 (5,294MW) and 2017 (6,975MW), representing a *ca*. 55% increase on the 2014 figure provided in OESEA3 (BEIS & National Statistics 2018).

With respect to tidal stream (Table 4.2) and wave (Table 4.3) developments, progress has been slower reflecting the pre development stage of these technologies (the tables only include those projects where status has changed since OESEA3). Tidal technologies have reached a precommercial state, culminating with the installation of the first tidal energy array in the Shetland islands (Bluemull Sound), followed by the four 1.5MW rated turbines deployed as part of the Meygen project in the Pentland Firth (Magagna *et al.* 2016). The development of wave energy has been hindered by various setbacks in recent years, due to the slow progress made in developing viable technologies with research and development still required to ensure the survivability and reliability of key components (Magagna *et al.* 2016).

Table 4.2: Current status of UK tidal stream developments (September 2018) compared to OESEA3 (October 2015)

Project	Type of project	Installed capacity (MW)	Status (October 2015)	Status (September 2018)
Regional Sea 3				
Perpetuus Tidal Energy Centre (PTEC)	Managed test facility	20	In planning	Consented
Regional Sea 4				
Ramsey Sound	Engineering demonstration	1.2	Pre-construction	Suspended
Regional Sea 6				
Nova Enlli Tidal Energy Scheme (Bardsey Island)	Commercial demonstration	-	-	Pre-planning
Nova Enlli Tidal Energy Scheme (Bardsey Island)	Commercial demonstration	-	-	Pre-planning

Project	Type of project	Installed capacity (MW)	Status (October 2015)	Status (September 2018)
Holyhead Deep	Commercial demonstration	10	In development	Under construction
Morlais Anglesey Tidal Demonstration Zone	Commercial demonstration		-	Pre-planning
Skerries	Commercial demonstration	10	Pre-construction	Suspended
Seagen Strangford Lough	Engineering demonstration	1.2	Operational	To be decommissioned
Sanda Sound	Engineering demonstration	0.035	Under construction	Decommissioned
Regional Sea 7				
Mull of Kintyre Tidal Array	Engineering demonstration	0.5	In planning	Pre-construction
West Islay Tidal Energy Park	Commercial	30	In planning	Pre-construction
Regional Sea 8				
Meygen – Pentland Firth	Commercial	400	Under construction	Phase 1A operational
Brims Tidal Array	Commercial	200	In development	In planning
Bluemull Sound	Engineering demonstration	0.5	Under construction	Operational

Table 4.3: Current status of UK wave developments (September 2018) compared to OESEA3 (October 2015)

Project	Type of project	Potential capacity (MW)	Status (October 2015)	Status (September 2018)
Regional Sea 4				
WaveHub Pembrokeshire Wave Demonstration Zone	Commercial demonstration	-	-	Pre-planning
Marine Energy Test Area (META) Pembrokeshire	Commercial demonstration	-	-	Pre-planning
Regional Sea 8				
Galson, Isle of Lewis	Commercial demonstration	10	Pre-construction	On hold
North West Lewis	Commercial	30	Pre-construction	On hold
Brough Head	Commercial	200	In development	On hold

The Hendry Review[64] which assessed the strategic case for tidal lagoons and whether they represented value for money for the consumer, reported in January 2017. The review made over 30 recommendations and concluded that tidal lagoons would help deliver security of supply; assist in delivering decarbonisation commitments, and would bring supply chain opportunities for the UK. The review also indicated that a small pathfinder project (e.g. Tidal Lagoon Power's Swansea Bay project) should be commissioned and be operational for a reasonable period (to allow in-depth monitoring to be carried out and research to be conducted to address issues) before financial close is reached on the first larger-scale project.

[64] https://hendryreview.wordpress.com/

Assessment of the potential environmental impacts of lagoons was not part of the review's terms of reference[65]. The outcome of further economic analysis of the Swansea Bay project by the UK Government indicated that the project did not represent value for money, and it was therefore decided that support through a contract-for-difference (CfD) could not be offered. A number of other tidal range projects (Tidal Lagoon Cardiff[66], Tidal Lagoon Newport[67] and the West Somerset Tidal Lagoon[68]) remain at a pre-application stage.

4.2.8.4 Electricity network

The Future Energy Scenarios (FES) described in OESEA3 which underpin the National Grid's System Operator publications (e.g. Electricity Ten Year Statement 2017 (National Grid 2017), Network Options Assessment (NOA) 2017/2018 (National Grid 2018b)), have been revised (National Grid 2018a). The scenarios are aligned to two new axes: 'speed of decarbonisation' and 'level of decentralisation'. There are now two scenarios that meet the 2050 carbon reduction target[69]: **Two Degrees**, based on centralised and transmission connected technology; and **Community Renewables**, based on more decentralised technology.

All scenarios anticipate growth in wind capacity largely from offshore wind due to significant cost reductions in recent years as a result of factors such as larger turbines, maturing supply chains and new financing arrangements. Installed offshore capacity increases from 6GW in 2017 to between 17GW (under the **Consumer evolution** scenario - more decentralised and makes progress towards, but does not meet, the 2050 decarbonisation target) and 30GW (**Two degrees**) in 2030. The other two scenarios, **Community renewables** and **Steady progression** (more centralised and makes progress towards, but does not meet, the 2050 target) had 2030 capacities of 24 and 25GW, respectively.

Carbon capture usage and storage (CCUS), as a large scale technology, features in the two more centralised scenarios of **Two degrees** and **Steady Progression**. Both the FES and the *Future of Gas* report (National Grid 2018c) indicate that significant infrastructure decisions and CCUS research and development will have to take place in the 2020s to support large scale CCUS. Under **Two degrees**, CCUS reaches commercial viability in 2030 and by 2050 there is 12GW of CCUS gas-fired generation with the **Steady progression** supporting 8GW by 2050.

Marine generation (such as tidal and lagoon) features primarily in the **Two degrees** and **Community renewables** scenarios, reaching 6GW of installed capacity by 2050 under **Two degrees**.

In assessing the capability of the National Electricity Transmission System (NETS) against the requirements derived from the future energy scenarios, the latest ETYS (National Grid 2017) indicates that the NETS will potentially face capacity deficits in a number of regions due to the following factors:

- Increasing quantities of wind generation connected across the Scottish networks will double north-to-south transfer requirements within ten years from Scotland to England.

[65] https://hendryreview.wordpress.com/tor/
[66] https://infrastructure.planninginspectorate.gov.uk/projects/wales/tidal-lagoon-cardiff/?ipcsection=advice
[67] https://infrastructure.planninginspectorate.gov.uk/projects/wales/tidal-lagoon-newport/
[68] https://infrastructure.planninginspectorate.gov.uk/projects/south-west/the-west-somerset-tidal-lagoon/
[69] The Climate Change Act 2008 legally binds the UK to reduce greenhouse gas emissions by at least 80 per cent from 1990 levels by 2050.

- At times of low wind output, more network capacity could be required to meet the south-to-north transfer requirements for demand in the north of England and Scotland.
- Large growth of around 5GW in low carbon generation and interconnectors in the north of England, combined with increased Scottish generation, will increase export requirements into the English Midlands.
- High growth in the next decade of up to 10GW in generation coming from offshore wind on the east coast connecting to East Anglia. Transfer of power from this region to the south of England will risk stressing this region of the network.
- New interconnections coming in will potentially place increased stress on the southern English network when these interconnectors export power out of Great Britain.

Since the establishment of the North Seas Countries' Offshore Grid Initiative (NSCOGI) in 2009, the cost of offshore wind energy has decreased as the technologies used to generate it have matured, and in June 2016 the countries in the North Seas region[70] signed a Political Declaration[71] to reaffirm their commitment to cooperation with respect to:

- facilitating the cost-effective deployment of offshore renewable energy, in particular wind
- promoting interconnection between the countries in the region.

Within the North Seas region there are certain areas where regional coordination in the development of offshore energy generation and transmission infrastructure may have significant added value, compared to isolated national developments. Four geographical areas (German Bight, mid-North Sea (area close to the Dogger Bank), Belgium-Netherlands-UK, Ireland-UK) have potential to become clusters, due to the fact that a coordinated approach to the development of the offshore infrastructure being planned there could lead to efficiencies and cost savings. Due to limited resources, it was agreed to give the BE-NL-UK cluster the first priority. Annex I of the North Seas Energy Clusters scoping paper[72] provides information on the current activities, the prospects and key challenges associated with each of the clusters.

4.2.8.5 Aggregate extraction and disposal of dredged material

With respect to aggregate extraction, the area of seabed dredged decreased from 97km^2 in 2012 (the latest year reported in OESEA3) to 88km^2 in 2015 with much of the activity taking place in the east coast (23km^2) and Humber (18km^2) regions (The Crown Estate & BMAPA 2017). OSPAR (2017a) reports that the UK deposited at sea a total of 12.2 million tonnes of dredged material in 2015, a decrease on the 14.1 million tonnes deposited in 2012 (reported in OESEA3).

4.2.8.6 Tourism and recreation

In 2016, the British public made a total of 119.5 million overnight trips and spent £23.1 billion (Visit England *et al*. 2017a), compared to 114 million overnight trips in 2014 and spend of £22.7

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[70] UK, Ireland, Germany, Denmark, France, the Netherlands, Belgium, Luxembourg, Sweden and Norway
[71] https://ec.europa.eu/energy/sites/ener/files/documents/Political%20Declaration%20on%20Energy%20Cooperation%20between%20the%20North%20Seas%20Countries%20FINAL.pdf
[72] https://ec.europa.eu/energy/sites/ener/files/documents/energy_cluster_paper_-_final_with_date.pdf

billion as reported in OESEA3. This represents a 0.7% increase on the average volume of trips in the past 6 years. The volume of trips reached their peak in 2011 at 126.6 million trips, and their low point in 2014 at 114.2 million trips (VisitEngland *et al*. 2017a). During 2016, GB residents took a total of 1,834 million tourism day visits to destinations in England, Scotland or Wales; and around £64 billion was spent during these trips. The number of day visits has fluctuated slightly over the last 6 years from a 2012 high of 1,969 million to a 2015 low of 1,754 million. In 2016, there were 170 million day visits made by the British public to the seaside/coast (9% of all day trips, the same percentage as in 2014 described in OESEA3), generating 5.2 billion spend (VisitEngland *et al*. 2017b). There were 37.6 million visits by overseas residents to the UK in 2016 (4% more than in 2015) spending £22.5 billion. This was the sixth successive increase and the highest figure recorded (Office for National Statistics 2017c). Visit Britain forecast that overseas visits may increase to 39.9 million in 2017 and 41.7 million in 2018 although it cites that the impact of the UK's withdrawal from the EU remains a key source of uncertainty[73].

4.2.8.7 Fisheries

In general, the number of fishermen, vessels and their landings decreased slightly between 2014 (presented in OESEA3) and 2016 (most recent data). In 2016, there were 11,757 working fishermen in the UK (88 fewer than in 2014), operating 6,191 vessels (192 fewer than in 2014 and made up of 4,876 <10m vessels and 1,315 >10m vessels, MMO 2017a). These vessels landed 701,000 tonnes of sea fish (including shellfish) into the UK and abroad with a value of £936 million (446,000 tonnes into UK ports with a value of £689 million which is 4,000 tonnes less than 2014 but £74 million more in terms of value). The increase in value is due to large increases in market prices, in particular, for key pelagic and shellfish species (see Seafish 2017). Scottish vessels accounted for 65% of the weight and 59% of the value of landings by UK vessels. English vessels accounted for 29% of the weight and 33% of the value. The Northern Irish fleet caught 4% of landings by weight and value. Welsh vessels caught 1% of the landings and 2% of the value. In terms of quantity, around two thirds of the Scottish fleet's landings were pelagic fish. The Welsh and Northern Irish landed mainly shellfish. Demersal fish formed the largest component of landings by the English fleet in 2016. The North Sea (areas IVa, IVb and IVc) provided almost 60% of the demersal fish landed by the UK fleet, while the northern North Sea and the west of Scotland were the source of 82% of pelagic fish landed by UK vessels in 2016. The Irish Sea (area VIIa), the West of Scotland and the English Channel provided 60% of the shellfish landed by the UK fleet. Peterhead, Lerwick and Fraserburgh accounted for 49% by quantity and 36% by value of all landings by UK vessels into the UK (MMO 2017a).

In general, the average annual density of UK vessels >15m in length (as measured by VMS data) in 2015 provides a similar pattern to that described for 2013 (in OESEA3). Both show that shelf areas to the north and west of Scotland, along with the western English Channel and the Irish Sea waters around the Isle of Man to be amongst the most heavily fished in the UK. At a strategic level, the ongoing development by OSPAR[74],[75] and ICES[76] of indicators to measure the distribution and intensity of pressure from bottom-contact fishing activity (and other marine activities) and the associated sensitivity and disturbance of benthic habitats at a regional scale will inform future SEAs but for the moment is at a relatively early stage. There is continued

[73] https://www.visitbritain.org/forecast

[74] https://oap.ospar.org/en/ospar-assessments/intermediate-assessment-2017/biodiversity-status/habitats/extent-physical-damage-predominant-and-special-habitats/

[75] https://oap.ospar.org/en/ospar-assessments/intermediate-assessment-2017/biodiversity-status/habitats/condition-of-benthic-habitat-defining-communities/

[76] http://www.ices.dk/sites/pub/Publication%20Reports/Advice/2017/Special_requests/eu.2017.13.pdf

development of monitoring and mapping techniques, such as the ScotMap project – a participatory mapping of inshore fishing activity to inform marine spatial planning in Scottish waters (Kafas *et al*. 2017). These new data layers will provide further information on the distribution of inshore fishing effort and value and will be concentrated on those vessels <15m for which information has previously been limited.

The interaction of fishing activity with other users is a key issue in marine spatial planning. Fishing interactions with oil and gas pipelines in the North Sea (36% of fishing trips were found to have fished within 200m of pipelines over a five year period), and the associated considerations for decommissioning strategy were examined by Rouse *et al*. (2017).

4.2.8.8 Mariculture

In general, the information presented in OESEA3 on the distribution of mariculture sites around the UK and the relative weight and value of finfish and shellfish production remains valid. As indicated in OESEA3, UK mariculture is dominated by Scottish salmon production which in 2016 was 162,817 tonnes, down on the 2014 figure of 179,022 tonnes reported in OESEA3.

4.2.9 Cultural heritage

The cultural heritage baseline presented in OESEA3 remains largely current, but a number of recent publications have contributed to the synthesis of progress on the understanding of submerged archaeology and its methods (e.g. Flemming *et al.* 2017, Bailey *et al.* 2017) of relevance to the UK including the North Sea (Cohen *et al.* 2017), Northern North Sea (Dawson *et al.* 2017), Celtic Sea and the Channel (Farr *et al.* 2017) and the Irish Sea and Atlantic margin (Westley & Edwards 2017). The publications highlight the number of known sites in European continental shelf waters (>2,600), and the potential for additional sites to be found based on technological advances and a better understanding of the offshore environment (e.g. Sturt *et al. in press*).

Further research on the palaeolandscapes of the southern North Sea is being progressed through the ERC-funded “Europe’s Lost Frontiers” project set to run until 2020, building on the North Sea Palaeolandscapes Project (e.g. Gaffney *et al.* 2007). The project aims to transform our understanding of the flora, fauna and human development of Doggerland using new topographic maps, conventional palaeoenvironmental data and ancient DNA extracted from cores along two submerged river valleys, and to explore the Mesolithic landscape and identify Neolithic signals (see: Gaffney *et al.* 2017).

A number of other authors have contributed to an understanding of the history of the occupation of the North Sea, including the potential social consequences of the last marine transgression on the so-called “Doggerland” (Ballin 2017), and the combined effects on Mesolithic settlement of northeast Britain from the combined effect of the 8.2ka cold event, and the Storegga tsunami, for which a significant population collapse was probable (Waddington & Wicks 2017).

4.2.10 Conservation sites and species

4.2.10.1 SACs

At the time of publication of OESEA3 (2016), five proposed SACs for harbour porpoise in Welsh, Northern Ireland, English and offshore waters were undergoing consultation; these have since received ministerial approval and were submitted to the EU in January 2017[77]. Similarly,

[77] http://jncc.defra.gov.uk/default.aspx?page=7059

a site in Scottish inshore waters, the Inner Hebrides and Minches, was proposed as an SAC for harbour porpoise and submitted to the EU in September 2016. All of these sites are currently listed as SCIs. OESEA3 described the ongoing process behind the identification of these sites[78] and therefore gave consideration to their importance in the assessment of the plan/programme.

From August-November 2017, JNCC held a public consultation on proposed amendments to the boundaries of two offshore SACs designated for the Annex I habitat: 'Submarine structures made by leaking gases'; these are Braemar Pockmarks and Scanner Pockmark, both of which lie in the northern North Sea in Scottish offshore waters[79]. It was proposed that boundaries be extended to reflect an improved understanding of the distribution of the qualifying habitat and inclusion of a buffer, scaled to the local water depth, to reduce the risk of damage from human activities. JNCC are currently reviewing comments and a post-consultation report will be made available in due course.

In November 2017, changes were announced to 27 relevant[80] SACs in Northern Ireland, Scotland, Wales, England and UK offshore waters. For individual sites, these included revised site boundaries, amendments to the extent of qualifying habitat and/or updates to their designation status (Table 4.4). Since OESEA3, JNCC has updated the conservation advice for all offshore SACs[81] based on the approach set out by Cornick (2016).

Table 4.4: Overview of updates to SACs in Northern Ireland, Scotland, Wales, England and UK offshore waters announced in November 2017.

Update	Site
Change of status from Site of Community Importance (SCI) to SAC	**Northern Ireland:** Red Bay SAC, Skerries & Causeway SAC, The Maidens SAC **Scottish offshore waters:** Pobie Bank Reef SAC, Solan Bank Reef SAC **English offshore waters:** Haisborough, Hammond & Winterton SAC, Inner Dowsing, Race Bank & North Ridge SAC **England:** Lands End and Cape Bank SAC, Lizard Point SAC, Lyme Bay and Torbay SAC, Margate and Long Sands SAC, Shell Flat and Lune Deep SAC, Stud Point to Plymouth Sound & Eddystone SAC, Studland to Portland SAC **UK offshore waters:** North West Rockall Bank SAC, Wyville Thomson Ridge SAC, East Rockall Bank SAC, Anton Dohrn Seamount SAC, Bassurelle Sandbank SAC, North Norfolk Sandbanks & Saturn Reef SAC[82], Dogger Bank SAC, Pisces Reef Complex SAC, Wight-Barfleur Reef SAC

[78] See http://jncc.defra.gov.uk/default.aspx?page=7059 and documents therein.
[79] http://jncc.defra.gov.uk/page-3995
[80] Containing coastal or marine qualifying features and/or a recognised pathway of potential effect from offshore energy development.
[81] http://jncc.defra.gov.uk/default.aspx?page=6849
[82] Also see: Parry, M., Flavell, B., and Davies, J. (2015) The extent of Annex I sandbanks in North Norfolk Sandbanks and Saturn Reef CSAC/SCI, 16pp. Available at: http://jncc.defra.gov.uk/page-6537

Update	Site
Revised site boundaries	**Northern Ireland:** Red Bay SAC, Skerries & Causeway SAC, The Maidens SAC **Wales:** Afon Eden - Cors Goch Trawsfynydd SAC, Afonydd Cleddau/ Cleddau Rivers SAC **UK offshore waters:** Croker Carbonate Slabs SCI
Amendments to qualifying features: Improved 'raised bog' habitat area coverage figures due to updated National Vegetation Classification	**Wales:** Afon Eden - Cors Goch Trawsfynydd SAC, Afonydd Cleddau/ Cleddau Rivers SAC

4.2.10.2 SPAs

Since early 2016, several amendments to existing SPAs have occurred and a small number of new SPAs have been designated (Table 4.5). Amendments include boundary extensions, amalgamation of adjacent sites, name changes, changes to qualifying features and/or updates to pressures/threats information[83]. Sites which have received full designation since publication of OESEA3 include:

- Irish Sea Front SPA: 18,000ha of offshore waters in the Irish Sea between Anglesey and the Isle of Man which support up to 12,000 Manx shearwaters in the breeding season.
- Northern Cardigan Bay SPA: 82,607ha of Welsh inshore waters supporting over 1,000 wintering red-throated diver.
- Northumberland Marine SPA: 88,498ha of English inshore waters which supports internationally important numbers of five tern species, puffin and guillemot, in addition to a qualifying seabird assemblage. The site abuts the existing Coquet Island SPA and Farne Islands SPA.
- Falmouth Bay to St Austell Bay SPA: 25,898ha of English inshore waters supporting internationally important numbers of wintering black-throated diver, great northern diver and Slavonian grebe.

Consultations on fifteen draft SPAs in Scottish inshore and offshore waters closed in late 2016 and early 2017 with SNCBs currently working towards final submission to Government in 2018[84]. In Northern Ireland, a consultation by DAERA closed in April 2016 on two sites: the designation of the new East Coast Marine pSPA, a large area of 96,668ha adjoining five existing coastal SPAs and supporting a number of non-breeding waterbirds and seabird species during the breeding season[85]; and, an extension to Carlingford Lough SPA. More recently, the Greater Wash SPA was designated following consultation. The site includes English offshore and inshore waters supporting important numbers of non-breeding red-throated diver, common scoter, little gull, and three species of breeding tern. There are draft proposals for a seaward

[83] http://jncc.defra.gov.uk/page-3517
[84] https://www.nature.scot/professional-advice/safeguarding-protected-areas-and-species/protected-areas/international-designations/2016-17-marine-bird-proposed-special
[85] https://www.daera-ni.gov.uk/consultations/east-coast-northern-ireland-marine-special-protection-area-consultation

extension to the Isles of Scilly SPA, and to add the European shag and great black-backed gull as site features[86].

Table 4.5: Overview of updates to designated SPAs in Northern Ireland, Scotland, Wales, England and UK offshore waters since January 2016 (Tranches 51, 53, 55 and 56)[19].

Update	Site
New sites	**Wales:** Northern Cardigan Bay SPA **England:** Falmouth Bay to St Austell Bay SPA; Northumberland Marine SPA, Greater Wash SPA **UK offshore waters:** Irish Sea Front SPA
Amended sites	**England:** Morecambe Bay and Duddon Estuary SPA (previously two individual sites; extended) **Wales:** Skomer, Skokholm and the Seas off Pembrokeshire SPA (previously named Skokholm and Skomer SPA; now extended and partly in UK offshore waters); Anglesey Terns SPA (previously named Ynys Feurig, Cemlyn Bay and the Skerries; now extended); Hamford Water SPA (extended)
Site extensions and feature updates	**Wales/England:** Liverpool Bay SPA (also UK offshore waters) **England:** Poole Harbour SPA; Outer Thames Estuary SPA (also UK offshore waters); Dungeness, Romney Marsh and Rye Bay SPA
Feature updates	**England:** Farne Island SPA; Coquet Island SPA; Chesil Beach and The Fleet SPA

4.2.10.3 MCZs/MPAs

As of July 2014, two tranches of MCZ designation had resulted in a total of 50 MCZs designated in English and Welsh inshore waters and English offshore waters from an initial list of 127 recommended MCZs (rMCZs) - all of which were mapped and tabulated in OESEA3. A third tranche is currently underway, within which: (i) further sites will be selected for consultation from the remainder of the 127 sites that have not already been designated or removed from consideration; (ii) several new site options will be put forward as recommended MCZs from Areas of Search; and, (iii) additional features will be added for some existing designated MCZs. Efforts to this end are ongoing by JNCC and Natural England, including a Tranche 3 MCZ workshop in November 2016. A consultation on third Tranche proposals to designate 41 new Marine Conservation Zones (MCZs) and to add new conservation features for 12 existing MCZs closed July 2018[87].

Following a consultation process which commenced in December 2015, the four proposed sites in Northern Ireland (Rathlin, Waterfoot, Outer Belfast Lough and Carlingford Lough) have now been fully designated as MCZs[88]. The four sites[89] in Scottish territorial waters proposed as Nature Conservation MPAs as of 2015 remain as such; however, in February 2018 the Scottish government announced funding to progress their development and the four sites will now be subject to consultation towards joining the existing 30 NCMPAs in Scottish waters.

86 http://publications.naturalengland.org.uk/publication/6573576605401088
87 https://consult.defra.gov.uk/marine/consultation-on-the-third-tranche-of-marine-conser/
88 https://www.daera-ni.gov.uk/articles/marine-conservation-zones
89 North-east Lewis pMPA, Sea of the Hebrides pMPA, Southern Trench pMPA, Shiant East Bank pMPA

The consultation processes have been informed by recent assessments of progress in the development of an ecologically coherent network of MPAs in UK waters (Carr *et al*. 2016a, b, Cornthwaite *et al.* 2018, Cunningham *et al.* 2015), which indicate that significant progress has been made but that gaps remain in the coverage of certain habitats or species.

4.3 Relevant existing environmental problems

The SEA Directive requires consideration of any existing environmental problems which are relevant to the plan or programme including, in particular, those relating to any areas of particular environmental importance, such as areas designated pursuant to Directives 2009/147/EC and 92/43/EEC (the Birds and Habitats Directives). As noted in OESEA3, the principal problems in UK waters have been reviewed and considered in relation to MSFD descriptors of GES, and set against relevant targets and monitoring programmes with a view to meeting the requirements of the MSFD[90]. These inputs, amongst others not specifically related to conservation or environmental protection, were reviewed and considered in OESEA3. Updates to environmental problems of relevance to the plan/programme assessed in OESEA3 are summarised in Table 4.6.

Table 4.6: Updates to relevant environmental problems

Eutrophication
The OSPAR Intermediate Assessment 2017 provides an assessment of the eutrophication status of NE Atlantic waters, drawing on data from 2006-2014 (OSPAR Commission 2017). Results for UK waters are very similar to previous assessments, with the vast majority (> 99.9% by area) assessed as non-problem areas for eutrophication, and those problem (n = 20) and potential problem (n = 12) restricted to small inshore and coastal areas. This contrasts with much of the continental coast of the southern North Sea, where large problem areas remain. Nonetheless, eutrophication can remain a significant issue at local scales, particularly where habitats and species occur that are sensitive and/or of conservation importance. For example, recent studies of 11 seagrass (*Zostera marina*) meadow habitats around the British Isles assessed all but one (off the Isles of Scilly) to be in moderate or poor health, 10 of which were within SACs and contained evidence of contamination by nutrients of a human and livestock waste origin (Jones & Unsworth 2016, Jones *et al*. 2018).
Hazardous substances
The OSPAR Intermediate Assessment 2017 provides recent data on concentrations of a variety of monitored hazardous substances in marine sediments, water and some shellfish and fish species within the OSPAR maritime area[91]. While the assessment period varies between monitored substances, trends are typically presented for an approximately 20-year period from the mid-1990s to 2014 or 2015. In general, at monitored sites, concentrations of heavy metals, PAHs and PCBs show a decreasing trend or no significant change; levels are often above background concentrations, but rarely exceed EC limits for foodstuffs or levels at which ecological effects are known to occur. Exceptions include concentrations of lead and mercury in sediments at several locations (including North Sea, English Channel and Irish Sea) which remain above levels at which adverse ecological effects cannot be ruled out. Rising cadmium concentrations (~2% pa) have also been reported in a few North Sea and Irish Sea locations, the reasons for which are unknown as cadmium inputs via air and water have both reduced by two-thirds during the reporting period. Mercury and lead inputs via water and air have approximately also reduced by between one and two thirds between 1990–1995 and 2010–2014. The OSPAR Commission’s (2016) fourth periodic evaluation of radioactive substances in the North-east Atlantic showed substantial reductions in discharges of radioactive substances in 35 of the 53 assessments across the nuclear sub-sectors between 2007 and 2013 when compared to the baseline period (1995-2001); furthermore, none of the other 18 assessments showed any evidence of increased discharges. With regard to discharges from oil and gas production over the period 2009-2014, a series of OSPAR recommendations have driven downward trends in the amount of oil in produced water (18% reduction) and the use and discharge of both priority action chemicals (LCPAs) and those with substitution warnings. The number and quantity of oil or chemical spills is generally small but varies widely due to the unpredictable nature of such events; no trends are apparent.

[90] See Charting Progress 2, Marine Strategy Part 1 and Part 2.
[91] https://oap.ospar.org/en/ospar-assessments/intermediate-assessment-2017/pressures-human-activities/

Table 4.6: Updates to relevant environmental problems

There has been a marked improvement in the reproductive condition of marine snails (impacted by TBT) since the 2010 OSPAR Quality Status Report; however, levels of imposex are not yet at background levels and remain high in some areas (e.g. Celtic Sea). Concentrations of TBT in sediment have reduced to below the limit of detection in most areas and are no longer monitored. Levels of PBDEs (flame retardants) in fish and shellfish across the OSPAR assessment area are highest in the English Channel and Irish Sea, although are declining at an average of 10% per year in all regions within UK waters. While known to have effects on the nervous, immune and endocrine systems of birds and mammals, in the absence of assessment criteria for PBDEs, it is not possible to assess the environmental significance of current levels. PCBs remain in the sediment for long periods; despite reducing concentrations in the marine environment overall, their biomagnification in marine food webs continues to result in high concentrations in the tissues of top predators in European seas (Jepson *et al*. 2016). Recent scientific evidence suggests that the levels of PCBs in European populations of some marine mammals (including dolphins and killer whales) are sufficiently high as to damage the reproductive organs and immune systems of these marine predators (Jepson *et al*. 2016, Gajdosechova *et al*. 2016). This includes a widely publicised finding of PCB concentrations in the blubber of a killer whale at levels >100 times higher than the accepted toxicity threshold for marine mammals[92]. The adult female, which died as a result of entanglement in a creel rope, was found to have never reproduced, despite being much older than the average age for maturity in the species. This raises concerns for the long-term viability of some populations of cetaceans, particularly those which number only tens to a few hundred individuals. There is a growing body of evidence on contaminants that are not commonly monitored entering the marine environment, e.g. personal care products and pharmaceuticals (see Hutchinson 2017). Based on the limited data, some of these may have developmental and reproductive impacts in marine life, but more information is needed to understand their long-term impacts and the potential cumulative impacts of complex chemical mixtures.
Marine litter
The issue of marine plastics (which represent ~70% of all marine litter) has attracted increasing scientific, media and societal attention in recent years (Thompson *et al*. 2017). The potential negative consequences to marine fauna of entanglement and ingestion of macro-plastic (i.e. >5mm in size) in the North-east Atlantic continue to be reported (e.g. Unger *et al*. 2016, Lusher *et al*. 2018), while there is a growing body of evidence on the global prevalence of microplastic pollution (<5mm in size, including fibres and particles). In brief, microplastics have become ubiquitous - being observed in almost all marine environments and organisms where investigated, often in high concentrations (Galloway *et al*. 2017). Campaigning by several pressure groups and growing public concern is now being met with new government strategies to reduce plastic pollution and marine litter (e.g. HM Government 2018, European Commission 2018). However, due to their persistence and increasing global annual production, levels of plastic in the marine environment are presumed to be rising and likely to do so for years to come, albeit with trends varying geographically and by type of plastic (e.g. Maes *et al*. 2018). In particular, the quantity of microplastic is likely to increase, as existing marine litter is eroded into increasingly small fragments and accumulations in river systems are flushed into the sea (e.g. Hurley *et al*. 2018). The biological consequences of microplastic ingestion and their entry into the human food chain are largely unknown, and are the subject of increasing research. Concerns relate to their physical presence in smaller organisms, which has been shown to impede feeding (e.g. Cole *et al*. 2015), that plastics may contain chemical additives which cause endocrine disruption, and that harmful contaminants may bind to the surface (Galloway *et al*. 2017). A review of evidence from modelling studies, laboratory experiments, and quantitative assessments revealed a current consensus that the net contribution of plastics to the bioaccumulation of hydrophobic contaminants by marine organisms is likely to be small in comparison with direct uptake from water (Koelmans *et al*. 2016). While the quantities of microplastics in seafood are typically low, more work is needed to establish the potential human health risks from microplastics (Thompson *et al*. 2017).
Ocean acidification
Recent reviews for the MCCIP 2017 Report Card (Williamson *et al*. 2017) and Future of the Sea series (Birchenough *et al*. 2017) provide a summary of current information on ocean acidification effects and issues. Previous assessments and projections remain valid, with increased confidence for some aspects due to the availability of

92 https://www.sruc.ac.uk/news/article/1860/scottish_killer_whale_contained_one_of_the_highest_concentrations_of_pcb_pollutants_ever_recorded_in_marine_mammals

Table 4.6: Updates to relevant environmental problems

longer time series and increased research. Global ocean pH continues to decrease and is forecast to do so throughout this century; the magnitude of which varies according to different CO_2 emissions scenarios. Observed pH decreases at monitoring sites in the North Sea (over 30 years) and Irish Sea (over 6 years) seem more rapid than in the North Atlantic as a whole. However, shelf sea and coastal data sets show high variability over a range of timescales, and factors affecting that variability need to be much better understood. While there is generally high confidence in likely chemical changes associated with ocean acidification, the nature and severity of biological and biogeochemical impacts are much less certain. Nonetheless, there is evidence that the overall effect on marine ecosystems will be deleterious. Experimental studies and meta-analyses over the past few years have revealed that certain taxa are very sensitive to changes in pH whilst other taxa seem unlikely to experience any effects. Molluscs, echinoderms and corals are generally considered more sensitive than crustaceans and finfish, although vulnerabilities may be life-stage dependent (e.g. finfish les sensitive overall but larval fish more sensitive). There is a risk of substantial reductions in commercial shellfish growth/harvest within the next 50 years, with some species and habitats of conservation interest also particularly at risk (e.g. *Lophelia pertusa* and *Modiolus modiolus*). Interactions between ocean acidification and other stressors (e.g. temperature, toxic metals, oxygen & food supply) and species-specific responses require further consideration and research to better understand impacts on ecosystems.
Biological effects of ocean warming
Among a large number of studies on the effects of warming seas on marine biota, Genner *et al*. (2017) provide a recent review of evidence for the Future of the Sea series, focussing on fisheries, aquaculture and biodiversity conservation. Chapters of the North Sea Region Climate Change Assessment provide reviews of the environmental impacts of climate change on coastal (Bakke *et al*. 2016) and marine (Brander *et al*. 2016) ecosystems, although they draw upon studies which pre-date OESEA3. Summary reviews for seabirds (Daunt *et al*. 2017), non-native species (Cottier-Cook *et al*. 2017) and intertidal species and habitat (Burrows 2017) are also available in contribution to the MCCIP 2017 Report Card. Overall patterns are unchanged from those described in OESEA3. Genner *et al*. (2017) list key observed warming-induced trends as: (i) poleward shifts in species distributions; (ii) advancements of breeding seasons; increased abundance of warm water species; and (iv) decline in the abundance of cold water species. Research continues to find strong links between the warming of UK seas and declines in seabird populations, mediated via changes in the abundance, distribution and energetic value of lower trophic level species (Daunt *et al*. 2017). For example, Howells *et al*. (2017) documented a shift in the offspring diet composition of a North Sea population of shag which has experienced a considerable long-term decline. The proportion and size of sandeels in the diet significantly declined over the 30 year study period, concurrent with an increase in diet diversification. Low sea surface temperatures in the previous year were significantly correlated with a greater proportion of adult to juvenile sandeels and lower diet diversity. Similarly, availability of sandeel has been related to kittiwake decline, and a negative association with increased temperature and kittiwake over-winter survival has been noted (though the precise mechanisms are not known), with predictions for significant further declines on the basis of breeding success and range related to climate change effects by 2100 (see Daunt *et al.* 2017 and references therein). Further, evidence continues to accumulate on the negative effects on seabird survival and breeding success of increased wind speed and storminess which are forecast to increase over this century (e.g. Mölter *et al*. 2016). Over the 25-year period of 1988-2013, Capuzzo *et al*. (2018) revealed a decline in primary production in the North Sea, associated with reductions in zooplankton abundance and fish stock recruitment; continuation of such a trend can be expected to result in knock-on effects in the productivity of fisheries. Interactions between ocean warming and other stressors (e.g. ocean acidification, rising sea levels, eutrophication, fisheries) remain poorly understood but will play a key role in predictions of future impacts (Genner *et al*. 2016). Warming seas continue to promote the occurrence and establishment of non-native species in UK waters, which generally follow a south-to-north gradient of decreasing prevalence (e.g. Bishop *et al*. 2015). While the distribution and dispersal rates of many non-native species are now better understood, predicting the influence of climate change on their spread and likely environmental impacts remains challenging (Cottier-Cook *et al*. 2017).
Pressures on fish stocks
The ICES Greater North Sea fisheries overview published December 2017[93] indicates that most of the North Sea stocks (25 of 32) assessed are exploited at rates at or below maximum sustainable yield (MSY)[94]. Overall, fishing

93 http://www.ices.dk/sites/pub/Publication%20Reports/Advice/2017/2017/GreaterNorthSeaEcoregion_FisheriesOverviews_December.pdf

Table 4.6: Updates to relevant environmental problems

mortality for shellfish, demersal, and pelagic fish stocks has substantially declined since the late 1990s. Spawning-stock biomass for most of these stocks has increased since 2000 and is above or close to their individual biomass reference points[95]. However, several North Sea stocks have current fishing mortality rates above the MSY (e.g. cod, whiting, haddock, mackerel, and blue whiting). The ICES ecosystem overview for the Celtic Seas ecoregion published May 2016[96] indicates a similar reduction in overall fishing mortality for shellfish, demersal, and pelagic fish stocks since the late 1990s; of 26 stocks evaluated, 15 are now fished at or below MSY. The relative spawning-stock biomass has also increased since the late 1990s although a number of stocks still have very low stock biomasses, namely cod, haddock and whiting to the west of Scotland, cod and sole in the Irish Sea, and herring to the west of Scotland and Ireland, and in the Irish Sea. The ICES ecosystem overviews for both the Greater North Sea[97] and Celtic Seas indicate that cetacean bycatch, particularly of harbour porpoise in bottom-set gillnets and common dolphin in the pelagic fishery for bass, is still an issue although it may have reduced in recent years due to less fishing activity and the use of acoustic alarms attached to fishing gear as a mitigation technique.
Declines in bird numbers
In the northern North Sea, some seabirds have suffered a decade of poor breeding or failure, possibly due to the combined effects of climate change and fishing on key prey species (e.g. sandeel). Additionally, a reduction in fish discards may have resulted in the decline of some scavenging species such as northern fulmar, with the implementation of the discard ban expected to further impact seabirds – though evidence is still limited for this. The long-term picture for some species, such as northern fulmar, European shag, Arctic skua and kittiwake is still one of serious concern, with wider seabird population trends for 1998-2002 to 2015, continuing to show a general decline for these species[98]. Conversely, other species, such as northern gannet, black-headed gull, Mediterranean gull and roseate tern are showing a continued increase. Declines in seabird breeding numbers have also been observed to the west of the UK although in the case of some species, such as kittiwake, the decline has not been as severe as that seen elsewhere around the UK, with some colonies remaining largely stable or in some cases increasing (Northern Ireland colonies). On islands where declines have been associated with predation by introduced mammals, eradication programmes of introduced predators on some islands is providing respite for seabirds vulnerable to predation. In the southern North Sea, some waterbird populations have declined and this has been linked to reduced food availability possibly due to pressure from shellfisheries. In the Irish Sea, the number of waterbirds, such as waders, has decreased as more birds are now wintering in east coast estuaries, potentially as a result of a changing climate.
Damage to seabed habitats
As noted in OESEA3, significant damage has occurred to shallow sediment habitats and reefs as a result of bottom fishing practices especially beam trawling (OSPAR 2010, 2017). Around the UK, coastal and offshore seabed sediment habitats such as sands and muds are impacted by a range of activities; the spatial extent of damage from bottom trawling activity, which may also damage ecosystem functioning, is still considered to the main source of pressure on many benthic environments.
Conservation of species and habitats
Anthropogenic pressures to marine and coastal habitats are described throughout Section 4.3, which provide information that is applicable to those of habitats and species of conservation importance. Updates to designated conservation sites are summarised in Section 4.2.10, while information on trends in species abundance, where available, is provided throughout Section 4.2. The status of habitats and species protected under the Habitats Directive was reported under Article 17 in 2013, results from which informed OESEA3. The next Article 17 documentation will be available in late 2018/2019, and will

[94] The largest average catch or yield that can continuously be taken from a stock under existing environmental conditions.

[95] http://ices.dk/sites/pub/Publication%20Reports/Advice/2017/2017/12.04.03.01_Reference_points_for_category_1_and_2.pdf

[96] http://www.ices.dk/sites/pub/Publication%20Reports/Advice/2016/2016/Celtic_Sea_Ecoregion-Ecosystem_overview.pdf

[97] http://www.ices.dk/sites/pub/Publication%20Reports/Advice/2016/2016/Greater_North_Sea_Ecoregion-Ecosystem_overview.pdf

[98] http://jncc.defra.gov.uk/page-3201

Table 4.6: Updates to relevant environmental problems

be used to inform future SEA.
Changes to landscape and seascape
Those issues and their trends outlined in OESEA3 remain current (i.e. continued coastal development, and the implications of nearshore siting of renewable technologies). While OESEA3 indicated that new offshore wind developments in UK waters were following a similar locational trend as elsewhere in Europe of being proposed further from shore, there exists the possibility that deployment tethered wind turbines could lead to some developments closer to shore, as areas previously considered too deep now become viable. OESEA3 included the possibility that further extensions to existing wind farms were possible, including those which are visible from the shore, and this is either happening (e.g. Thanet offshore wind farm) or remains a possibility for former Round 3 areas.
Air quality, human health and the environment
The issues relating to poor air quality and its impacts on human health (see Defra & Department for Transport 2017) and the environment remain unchanged since OESEA3. There has been a long-term decline in UK air pollutants (e.g. ammonia, nitrogen oxides, non-methane volatile organic compounds, particulate matter (2.5 and 10) and sulphur dioxide), though there remain issues, primarily in relation to terrestrial roadside NO_2. There is a UK-level statutory air quality plan setting out how the UK will reduce roadside NO_2 concentrations (Defra & Department for Transport 2017). However, this draft plan has been the subject of legal challenge and will require further revision. A draft clean air strategy for England was published in May 2018, which includes proposals for new legislation to help address air quality issues. Shipping makes a substantial contribution to air pollutant concentrations in the UK and elsewhere (Air Quality Expert Group 2017), with shipping expected to expand in the coming decades. Reductions of certain emissions is regulated at an international level through the IMO, in particular in relation to sulphur dioxide (and by association $PM_{2.5}$), NOx (see Section 4.2.5), and carbon dioxide (the latter a contribution to wider CO_2 reduction efforts[99]), and more generally through efficiency obligations. Emissions of NOx are expected to remain high for some time, and are projected to equal land-based sources in Europe by 2020. Emissions from this sector make a significant contribution to UK and wider air pollution, and improvements are required in accounting for these, including: better *in situ* monitoring combined with improved vessel movement data, fuel composition information and emission factors (Air Quality Expert Group 2017). Some remote sensing approaches, including use of satellite data as demonstrated through Sentinel 5P data, may help to improve inventories in the future.
Sea-level rise, coastal erosion and flooding
It was noted in OESEA3 that a large proportion of the UK coastline is suffering from erosion, with England (*ca*. 30%) and Wales (*ca*. 23%) having the greatest proportion of eroding coast, and that sea-level rise has the potential to exacerbate existing erosion problems and also lead to enhanced flooding and both related economic losses (including ports), social and cultural issues (including both the discovery and loss of heritage assets), and environment effects (for example the loss of important habitat which may also be subject to designation – see above). Future flooding is most likely to be driven by sea-level rise changes rather than more frequent storm surges (Humphrey & Murphy 2016), though there remains considerable uncertainty in how storms will alter in response to climate change (Haigh & Nicholls 2017), and in also the potential responses of coasts to erosion (see: Edwards 2017). Uncertainties mean that there is scope for improvements to the UK Climate Change Risk Assessment (Sayers *et al.* 2015), and while comprehensive, Sayers *et al.* (2015) omit several factors (e.g. coastal erosion, changes due to storm surges) that may, or do, lead to systematic underestimates the total risk from flooding and coastal erosion (Edwards 2017). This must be considered in the context of wider knowledge gaps noted by Edwards (2017), including on future changes to storm surge, poor understanding of coastal erosion, indirect economic loss and effects on wellbeing, and the exposure and vulnerability of infrastructure.
Changes to metocean conditions and wider secondary effects
There is increasing evidence for a weakening of the Atlantic meridional overturning circulation (AMOC), which may lead to cooling of North Atlantic waters over the next century, with consequent changes to metocean conditions and knock-on biological effects (e.g. Bakker *et al*. 2016, Liu *et al*. 2017, Caesar *et al*. 2018, Thornalley *et al*. 2018). While such weakening of the AMOC may be attributable to multi-decadal variability, evidence now suggests the AMOC to have been anomalously weak over the past 150 years compared to the preceding 1,500 years (Thornalley *et al.*

[99] The IMO has legally binding energy-efficiency targets for new ships, and a GHG initial strategy was recently adopted, which has specific reference to emissions reductions consistent with meeting the Paris Agreement temperature goals (http://www.imo.org/en/MediaCentre/PressBriefings/Pages/06GHGinitialstrategy.aspx)

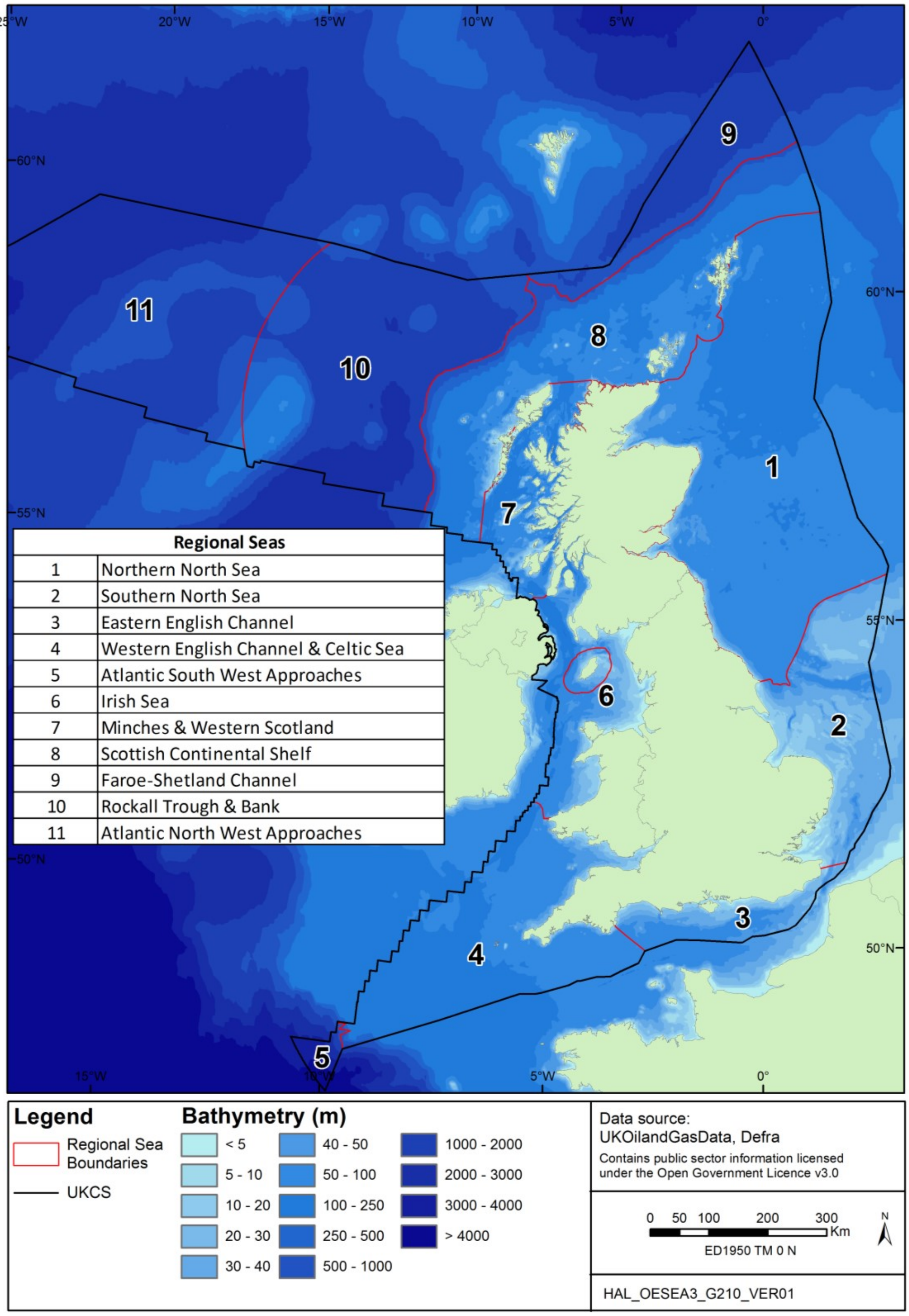
Table 4.6: Updates to relevant environmental problems

2018), with one study reporting a 15% weakening since the mid-20th century, concurrent with increasing atmospheric CO_2 concentrations (Caesar *et al*. 2018).

4.4 Regional Seas

The previous Offshore Energy SEAs (OESEA and OESEA2) used the draft Regional Sea boundaries defined by JNCC (2004) as a means of considering the broad scale biogeographical regions within UK waters. Following a review of these and other boundaries during scoping for OESEA3, a modified version of the Charting Progress 2 boundaries were used (Figure 4.1) to distinguish several important areas including: the Atlantic South West Approaches (Regional Sea 5), and the Faroe-Shetland Channel (Regional Sea 9), Rockall Trough and Bank (Regional Sea 10), and Atlantic North West Approaches (Regional Sea 11). It is considered that the basis for these Regional Seas has not altered in the period since the publication of OESEA3.

Figure 4.1: Regional Sea subdivisions used in OESEA3



4.5 Implications of updates to the environmental baseline of OESEA3

The environmental baseline review has provided a synthesis of relevant updates since the publication of OESEA3, and a consideration has been made, with respect to Schedule 2 of *The Environmental Assessment of Plans and Programmes Regulations 2004* (Regulation 12(3)), as to whether any updates significantly alter the understanding of: the current state of the environment and how it is likely to evolve; the environmental characteristics of areas likely to be affected by implementation of the plan, and existing environmental problems relevant to the plan.

The updates on the biological and physical aspects of the baseline presented in Sections 4.2.1-4.2.6 and 4.2.10, primarily describe recent studies and new data which further augment knowledge of the current state of the environment and how it may evolve, or reflect minor changes to conservation site features or status. These are generally in line with the broad characterisations provided in OESEA3 although there may be localised changes in understanding associated with more specific information. For example, further BEIS funded tagging of grey and harbour seals has allowed the development of more robust seal usage maps. From these, whilst the general pattern of usage for both species was similar to that estimated previously, reductions in harbour seal usage were apparent around northern Scotland with greater grey seal usage off eastern England. Similarly, the apparent increase of grey seal predation on harbour seals in light of increasing grey seal numbers could represent an important factor determining local harbour seal populations.

With respect to the social and cultural aspects of the baseline (4.2.3 and 4.2.7-4.2.9), the updates indicate a baseline not significantly different to that presented in OESEA3, possibly reflecting the relatively short-time period since the publication of OESEA3. Trends in the nature, scale and location of UK marine activities has not changed appreciably, and is in line with that expected in OESEA3 (e.g. offshore renewables and shipping), and the related landscape/seascape baseline, and also pressures on these, remain as previously described.

The environmental problems associated with the baseline also remain largely current from OESEA3 until present, however, a number of updates and known concerns place emphasis on certain issues. Although considered in OESEA3, greater information is now available on marine litter (particularly the issue of marine plastics) and effects of climate change across a broad range of receptors. The latter has now been split out into separate sources of effect including ocean acidification, ocean warming, sea-level rise and changes to metocean conditions.

Overall, the updates described do not change the baseline of the UKCS environment to such a degree that the basis of OESEA3 may be undermined, but do indicate a broad range of new information that should be considered in ongoing and future plan-level HRA and project-level assessment and decision making.

5 Updates to information on potential sources of effect from plan activities

The potential sources of environmental effect associated with activities of relevance to the plan/programme have not altered since the publication of OESEA3, however, new literature has been published of relevance to these potential sources of effect, including methodological approaches to assessment and further understanding of the nature and scale of effects. The key advances to specific assessment areas are summarised in Table 5.1, but these should not be taken as a definitive list of all new sources of relevant information. The sources of new information are listed and summarised against those major sources of effect identified in OESEA3, which includes any new guidance. A number of guidance documents of relevance to activities associated with the plan/programme, or else environmental assessment in general, have been published which cut across all of those topics tabulated below. These include updated EIA guidance from SNH (2018), offshore EIA guidance associated with oil and gas developments (BEIS 2018c), draft of oil and gas decommissioning guidance (BEIS 2018d), and updated European Commission guidance reflecting the amended EIA Directive (EC 2017). JNCC have also updated the activity-pressure database to better align it with Natural England's advice on operations and Marine Scotland/SNH's FeAST tool (Robson *et al.* 2018)[100], see also the MarESA tool (Tyler-Walters *et al*. 2018).

Table 5.1: Overview of updates to the sources of effect relevant to the OESEA3 plan/programme

High level summary of update	Relevant publications
Noise	
International standards have been published for underwater acoustics terminology and for the measurement of underwater sound from ships (Part1) and pile driving. It is now important to adopt these routinely, in all noise risk assessments and relevant underwater noise monitoring studies. Further standardisation work is ongoing; potential new work includes the development of standards for measurement of particle velocity and of seabed vibration.	ISO (2016, 2017a, b)
Technical guidance has been published for assessing the effects of underwater anthropogenic sound on the hearing of marine mammals under the jurisdiction of the National Marine Fisheries Service in the USA. This includes a new set of acoustic thresholds for auditory injury and frequency weighting functions reflecting current state of scientific knowledge and representing *de facto* a more up-to-date version of the approach by Southall *et al*. (2007) previously universally adopted. Southall is also working on a revision (likely to be similar but not identical to NMFS), expected for publication by the end of 2018. It is noted that application of the MNFS (2016) thresholds has resulted in EPS licensing becoming routine for UXO clearance, for example associated with offshore development including wind farms.	NMFS (2016)
Additional measurements of underwater sound associated with relevant industry activities have been collected, including from some sub-bottom profilers (field testing results expected by Autumn 2018), conductor piling events and diamond-wire cutting. However, field measurements remain limited for several activities, including those linked to decommissioning.	Crocker & Fratantonio (2016), Jiang *et al*. (2015), Pangerc *et al*. (2016), MacGillivray (2018)

100 http://jncc.defra.gov.uk/default.aspx?page=7136

Table 5.1: Overview of updates to the sources of effect relevant to the OESEA3 plan/programme

High level summary of update	Relevant publications
Further studies on the auditory response to impulsive and broadband sounds on harbour porpoise and other marine mammals have been undertaken; they contribute to improved understanding of the different factors involved in TTS onset and provide insight into the development of more targeted mitigation measures. The higher auditory sensitivity of harbour porpoise relative to other odontocetes has been confirmed.	Kastelein *et al*. (2016, 2017a,b), Nachtigall *et al*. (2016a,b, 2018), Reichmuth *et al*. (2016)
Behavioural responses of marine mammals to underwater sound have been further explored in wild and captive animals. The continuing improvements in tracking and tagging technology are a game-changer in this field, providing direct evidence on fine-scale movement, vocalisation and feeding efficiency while comparing normal behaviour to that in response to various sources of noise, including airgun pulses, vessels, sonar and playbacks from an operational tidal turbine. Probability of a response is a function of species, individual and context; variability can be high and received sound level may not be a reliable predictor. For harbour porpoise, tags have confirmed high feeding rates are the norm; exposure to airgun pulses results in short-term reductions in echolocation activity; normal foraging behaviour can be interrupted by high vessel noise events (coinciding with passage of fast ferry) but otherwise maintained even in heavily trafficked areas (e.g. Great Belt). Captive individuals have shown avoidance of artificially elevated sound levels (e.g. preference for quiet vs noisy pool) while no effect on echolocating performance could be established. Overall, though, the field of behavioural response studies is still at an early stage of development and much more targeted field work is needed to significantly reduce uncertainty in assessments. Nonetheless, recent studies are demonstrating a way forward, including with respect to monitoring marine mammal behaviour at tidal energy sites.	Van Beest *et al.* (2018), Kok *et al.* (2017), Kastelein *et al.* (2018), Wisniewska *et al.* (2016, 2018), Harris *et al.* (2017), Southall *et al.* (2016), Falcone *et al.* (2017), Malinka *et al.* (2018), Blair *et al.* (2016), Gomez *et al.* (2016), Dunlop *et al*. (2016, 2017), Russell *et al*. (2016), Hastie *et al*. 2018
More evidence on harbour porpoise displacement and subsequent recovery times have come from studies at German and Belgian offshore wind farms. It has been clearly demonstrated that significant reductions in disturbance are brought about when sound dampening mitigation measures such as bubble curtains are successfully deployed. Increasing wind speed has also been linked to a reduction in disturbance effects. In the development of effective mitigation measures, frequency weighting is recommended; for example, the effectiveness of bubble curtains in reducing impact for harbour porpoises appears to be related to the fact that bubble curtains perform particularly well above 1kHz i.e. the part of the spectrum that harbour porpoise are most sensitive to.	Dähne *et al.* (2017), Brandt *et al.* (2016, 2018), Dragon *et al.* (2016), Nehls *et al.* (2016), Tougaard & Dähne (2017), Rumes *et al*. (2017)
The efficacy acoustic deterrent devices (ADDs, ADH or seal scarers) has been explored further with comparative studies showing for example striking differences in response between harbour seal and harbour porpoise (the latter being much more sensitive to a commonly deployed device), and confirming they are effective in deterring minke whales (low-frequency cetaceans). During deployment as mitigation against injury during wind farm construction, the reaction distance of harbour porpoise to ADDs can be comparable and even exceed reactions to subsequent pile-driving in the presence of bubble curtains. Choice of deterrent device and type/duration of deployment needs to be evaluated carefully to best balance the need to avoid auditory injury and to reduce disturbance effects.	McGarry *et al.* (2017), Dähne *et al.* (2017), Mikkelsen *et al.* (2017), Götz & Janik (2016).
The marine mammal populations of the Moray Firth continue to be the focus of monitoring efforts and impact studies, especially with respect to the consequences of windfarm developments (reports expected soon).	http://www.gov.scot/Topics/marine/Licensing/marine/scoping/mfrag/marine-mammals

Table 5.1: Overview of updates to the sources of effect relevant to the OESEA3 plan/programme

High level summary of update	Relevant publications
Further studies on the response of fish, invertebrates and plankton to exposure to underwater sound have been undertaken. Of particular relevance those testing the effects of airgun pulses exposure in the field, including the first study on a tropical coral reef (no effect measured) and on zooplankton (decreased abundance and increased mortality). However, fundamental knowledge gaps remain (e.g. no study on elasmobranchs) and inference on ecological consequences of reported observations is not straightforward. Ongoing projects that are expected to report within the next four years include: Joint Industry Programme experiments on Atlantic cod in the North Sea; Environmental Studies Research Fund (Canadian Government) proposed experiments on impacts of seismic surveys on zooplankton and Atlantic cod; and the Australian Institute of Marine Science's North West Shoals to Shore Research Program, proposed experiments on demersal fish and pearl shell (*Pinctada maxima*) in north western Australia.	McCauley *et al.* (2017), Heyward *et al.* (2018), Fitzgibbon *et al.* (2017), Day *et al.* (2016, 2017), McCauley & Duncan (2017), Carroll *et al.* (2017), De Backer *et al.* (2017), Simpson *et al.* (2016), Kastelein *et al.* (2017c), Solé *et al.* (2016, 2017).
Some studies on marine birds have been undertaken including measurements of auditory sensitivity and a study on the movements of penguins during seismic survey activities; however, uncertainty remains regarding the potential effect of underwater noise from anthropogenic activities across the UKCS.	Pichegru *et al*. (2017), Hansen *et al*. (2017), Maxwell *et al*. (2017).
The likelihood of significant effects needs ultimately to be assessed in terms of long-term population consequences. The Interim Population Consequences of Disturbance (iPCoD) and Disturbance Effects of Noise on the Harbour Porpoise Population in the North Sea (DEPONS) have emerged as the two most promising approaches to assess impulsive noise effects on marine mammals. Work is ongoing, including efforts to improve the expert elicitation elements of iPCoD through a BEIS-funded project (expected to report by end of 2018).	Nabe-Nielsen & Harwood (2016), Thompson *et al.* (in prep), van Beest *et al*. (2015)
BEIS is funding several studies to improve the knowledge base with respect to noise related effects. These include: analysis to inform how pulsed sounds lose their impulsive characteristics with range; the development of dose-response functions for harbour seals (behaviour measured from tagging data) exposed in the field to offshore renewable activities (ADDs, operational tidal turbines and pile-driving); modelling of received sound levels by marine mammals during geophysical surveys; and, development of novel seal tag to measure physiological and energetic changes in response to underwater sound exposure.	
Telemetry and land-based observations revealed the responses of harbour seals to simulated tidal turbine sound in a narrow channel off western Scotland. Playback state (on/off) was not a significant predictor of the overall number of seals sighted in the channel. However, tagged seals exhibited spatial avoidance of the sound: there was a reduction in the usage by seals of between 11-41% at the playback location and the significant decline in usage extended to 500m from the playback location.	Hastie *et al*. (2018)
Physical damage/change to features and habitats	
Gates *et al*. (2017) provides a review of the outputs of the SERPENT project. Of note is the summary of ROV surveys of drilling disturbance around deep sea wells, although OESEA3 reported the results of relevant studies (e.g. Gates & Jones 2012).	Gates *et al.* (2017) See: http://www.serpentproject.com/
JNCC commissioned project to improve understanding of the impacts of rock dump from oil and gas decommissioning on Annex I mobile sandbanks, using the North Norfolk Sandbanks and Saturn Reef SAC as a case study. Desk-based review of existing literature rather than new information. The report concluded that there was currently insufficient information to quantify or qualify the implications of rock dump in the NNSSR SAC from a physical and biological perspective. A study has been commissioned by BEIS to review the returns from deposit consents (including rock, mattresses and other deposits) for UKCS offshore oil	Pidduck *et al.* (2017)

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and gas activities, in terms of their location and quantity.	
Summarises scientific findings of the Belgian offshore wind farm monitoring programme, based on data collected up to 2016. Relevant sections on the differences of natural (e.g. gravel beds) versus artificial (e.g. turbine foundations and scour protection) hard substrates.	Degraer *et al* (2017).
Numerous modelling studies on the potential physical impact of marine renewable energy devices but as yet little information from the field.	Gallego *et al*. (2017), Heath *et al.* (2017), Kregting *et al.* (2016), Neill *et* al. (2017), O'Carroll *et al.* (2017a, b)
Numerous studies on the nature and extent of physical damage to benthic habitats from benthic trawling provide contextual information. Some of these have informed the ongoing development of ICES and OSPAR indicators with respect to MSFD habitats and those considered by OSPAR to be of concern.	Buhl-Mortensen & Buhl-Mortensen (2018), Eigaard *et al.* (2016), Hiddink *et al*. (2017), ICES (2017c), Lambert *et al.* (2017), Neumann *et al.* (2017), Rijnsdorp *et al.* (2016) OSPAR: https://oap.ospar.org/en/ospar-assessments/intermediate-assessment-2017/biodiversity-status/habitats/extent-physical-damage-predominant-and-special-habitats/
Consequences of energy removal	
Further evidence of the potential for impacts over large spatial scales from tidal arrays is presented in relation different scenarios in the Pentland Firth. Modelling of the realistic scenarios show minor effects on the tidal range and speed in the Pentland Firth and Scapa Flow. Yet massive channel wide 8GW and 10GW scenarios suggest both significant nearfield and far field effects. An estimation of 38% decrease in volume transport in the Pentland Firth and up to 75% reduction in water elevation in Scapa Flow and up to 10% for tidal and ecosystem variables over hundreds of kilometres away, primarily in the area of the Wash.	Molen *et al.* (2016), O'Hara Murray & Gallego (2017).
Enhanced modelling capabilities has allowed for extended model domains and investigation of far field hydrodynamic impacts from a Severn barrage in greater detail. Impacts range from a 1m reduction in peak water levels in parts of the Bristol Channel to smaller impacts as far-field as the west coast of Scotland.	Bray *et al.* (2016).
Further to the discussion on impacts of scaling up tidal devices to array scales, there is renewed focus on the optimisation of tidal stream farm layouts in order to both maximise output and minimise environmental impacts, especially the reduction in flow velocity. An increase in the complexity and potential of models allows complex installation constraints to be included as well as investigating the interplay / impacts of different tidal farms in close proximity. Increased modelling capabilities also allow the higher resolution investigation of the impacts of tidal turbines on the hydrodynamics of an area. Guillou & Chapalain (2017) present a study including the impacts of tidal turbines on the Langrangian circulation offshore Brittany, including the position of recirculations and the resulting evolution on seabed features.	Funke *et al.* (2016), du Feu *et al.* (2017), Guillou & Chapalain (2017).
Similarly, increasingly complex models are used to investigate the impact that different operational characteristics of tidal barrages and lagoons have on flow structures and local hydrography. This includes sluice gate and turbine specifications, as well as two-way generation regimes.	Angeloudis & Falconer (2016), Angeloudis *et al.* (2016).

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There is the emergence of a few studies of environmental impact based on real life deployment of devices. One such study is based on wave devices at test centres across Europe, from EMEC and Wave Hub in the UK to sites in Spain, France, Ireland and Sweden. Whilst it is a high level review it shows that impact on hydrodynamics ranges from compatible (no long term impact) to severe (needs protective and corrective measures, and time, to return to pre environmental conditions) depending on location.	Greaves *et al.* (2016).
Importance of location for minimising impacts is also discussed in further modelling studies on specific wave and tidal stream locations. Slight changes to the siting of an array (<1km) in Sanda Sound, Kintyre approximately doubles the velocity deficit and water level differences in the area surrounding the tidal array, amplified up to a factor of 4 during peak flood/ebb spring tides. Further discussions on siting and impacts of different energy extraction scenarios in Puget Sound USA, with turbines operating concurrently in two connected narrow inlets.	Pacheco & Ferreira (2016), Wang & Yang (2017).
Greaves *et al* (2016) also discuss impact that different regulatory bodies throughout Europe and level of assessment required have on outputs of impact assessments. This is supplemented by a 'toolbox' of datasets and methods from the TerraWatt project, focused on Pentland Firth and Orkney waters, which are designed to be used to quantify effects of wave and tidal stream developments at differing scales. These discussions of methodologies is important for energy extraction impacts, which currently heavily relies on modelling studies based on a wide range of input parameters.	Greaves *et al.* (2016), Side *et al.* (2017), outputs of TerraWatt project - http://www.masts.ac.uk/media/35656/position_papers_terawatt_e-book.pdf
Physical presence – ecological effects	
Birds	
Understanding of the interactions between seabirds and OWFs is increasing; with accumulating post-construction monitoring data and new GPS telemetry studies providing greater insight into potential displacement/barrier effects and the risk of collisions. These include results of OESEA Research Programme-funded studies of herring and lesser black-backed gull movements in relation to OWFs, and several years of monitoring bird movements at the Thanet offshore windfarm (southern North Sea) which estimated empirical avoidance rates for several species at different spatial scales of avoidance. These and other data on seabird flight heights and avoidance behaviour continue to improve, including for key species of concern such as kittiwake (e.g. see Cook *et al.* 2018, Skov *et al.* 2018) which will contribute to improvements in the assessment of effects from offshore wind farms. As previously noted in OESEA3, uncertainty in collision risk modelling remains (e.g. in relation to avoidance behaviour and related rates used in modelling) which has the potential to impact upon development-level consenting, including when considered as part of an in-combination effects assessment where such uncertainty may be compounded (e.g. by methodological challenges and confidence in the nature and timing of construction activities). The Crown Estate marine data exchange website continues to provide access to data collected by the marine renewables and aggregate industries.	APEM (2016), Borkenhagen *et al.* (2017), Busch & Garthe (2018), Carroll *et al.* (2016), Cook & Robinson (2016), Cook *et al.* (2018), Dierschke *et al.* (2016, 2017), Dorsch *et al.* (2016), Fijn & Gyimesi (2018), Griffin *et al*, (2016), Hüppop *et al.* (2016), Scragg *et al.* (2016), Thaxter *et al.* (2017, 2018a, b), Skov *et al.* (2018), Warwick-Evans *et al.* (2018), Welcker & Nehls (2016), http://www.marinedataexchange.co.uk/
Land and vessel-based observations have improved understanding of the use of tidal stream environments by several species of diving seabirds in Scottish nearshore waters (particularly black guillemot and shag in Orkney). Results can inform collision risk modelling for tidal energy developments.	Waggitt *et al.* (2016a,b, 2017)
Numerical modelling of a tidal array in the Solway Firth to look at potential change in distribution of intertidal and subtidal areas within an estuary and the potential impacts of this for wetland birds.	Garcia-Olivia *et al.* (2017).

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Provides an understanding on how the SNCBs want information on seabird displacement from OWF to be presented in assessments submitted by developers (Marine Industry Group for ornithology advice note - MIG-Birds 2017) and guidance on approaches to collision risk with tidal devices assessments (SNH 2016b). SNH (2016) describes three models which may be used to estimate the numbers of animals likely to collide, with the caveats that there is currently little understanding of how animals react to tidal devices.	SNH (2016), MIG-Birds (2017).
Results of a study using radar to record nocturnal flight movements at four wind farms on the island of Fehmarn, to determine if nocturnal migrants were at a greater risk of colliding with wind turbines compared to diurnally active birds.	Welcker *et al*. (2016).
Gannet tracking data was analysed, resulting in precautionary values being proposed for nocturnal flight activity factors for use in estimating wind farm collision risk, for breeding and non-breeding seasons.	Furness *et al.* (2018)
Results of a review of 12 different published frameworks which purport to identify species that are at risk from climate change, initially seeing if the different frameworks “agreed” on the species, then validating their performance by using historical data to compare this with observed changes in bird distribution and population.	Wheatley *et al*. (2016).
Marine mammals	
A study of harbour seal movement around the SeaGen tidal turbine in Strangford Narrows has now been published in the peer-reviewed literature. Results were previously available and included in OESEA3.	Sparling *et al*. (2017).
In light of the direct observations of an adult grey seal attacking grey seal pups on the Isle of May in 2015 resulting in characteristic spiral injuries, a reassessment of historical post-mortem evidence was conducted. Of the 48 trauma cases necropsied since 2010, 37 (77%) were either observed seal predation or showed pathology suggesting seal predation was highly likely. These findings further substantiate earlier conclusions that vessels with ducted propulsion systems do not pose any increased risk to seals over and above normal shipping activities.	Brownlow *et al*. (2016).
Examination[101] of over 4,000 hours of video monitoring footage of three tidal stream turbines in Bluemull Sound, Shetland, has not yet observed marine wildlife colliding with the blades. Fish, birds and seals were observed to exit the region of the turbine blades while they were turning.	Marine Scotland consultee response, January 2018: http://www.gov.scot/Resource/0053/00530133.pdf
Shore-based observations off Anglesey, Wales, have provided fine-scale information on the habitat use of harbour porpoise in a high tidal energy environment; results can inform the siting of tidal energy devices to minimise interactions with harbour porpoise.	Waggitt *et al*. (2018).
Fish and biological communities around offshore structures	
Recent studies of biological communities associated with offshore infrastructure provide further information on the characteristics and succession of marine growth, mobile benthos and fish on and around oil & gas platforms, wind farms and a single study on a wave device. One study examines the effects of fishery exclusion in a southern North Sea offshore wind farm on macrofaunal communities.	Coates *et al*. (2016), Fujii & Jamieson (2016), Gates *et al*. (2017), Krone *et al*. (2017), Nall *et al*. (2017), van der Stap *et al*. (2016), van Hal *et al*. (2017).

[101] A comment from SNH on the 30th oil and gas Round draft HRA consultation (April 2018) indicated that they understood that not all of the video footage recorded had been reviewed.

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With an increasing number of oil and gas platforms approaching decommissioning, there has been interest in understanding the ecological role of these platforms (and other anthropogenic structures), along with the potential consequences of their removal after several decades in the marine environment. A series of projects within the INSITE programme have investigated the effects of man-made structures (MMS) on the North Sea ecosystem and whether they represent a connected system of hard substrate, with the application being consideration of MMS removal during decommissioning. Phase 1 projects (2015-2017) are now complete, having focussed on data compilation and initial analysis and with inferences based on modelling and field evidence (primarily from Southern North Sea). The second phase will include model validation, further data analysis and quantitative modelling.	Review: Bishop *et al*. (2017). INSITE outputs: Coolen & Jak (2018), Grecian *et al*. (2018), Henry *et al*. (2017a), Hyder *et al*. (2017), Reichart *et al*. (2017), Wilson *et al*. (2017).
Physical presence – other users	
The Celtic Sea Partnership Project[102] was established to help marine authorities, users and interests from across the EU Celtic Seas sub-region work together across borders and sectoral boundaries, in ways which avoid conflict and support the EU MSFD's target of achieving GES in its seas by 2020. To support this aim, the project has developed best practice guidelines for the Co-Existence of Marine Renewables and other Marine Interests. The main output of the project was a study exploring future growth scenarios in the Celtic Seas and the resulting economic, social and environmental impacts. A baseline of the environmental conditions and marine sector activities was established and reviewed by stakeholders, and three future scenarios were developed, based on the National Ecosystem Assessment Follow-On project and stakeholder input on future priorities. Future scenarios (over 20 years) were developed for ten selected marine sectors, and for nature conservation (implementation of marine protected areas and management measures within them).	CSP (2016). See: http://www.celticseaspartnership.eu/wp-content/uploads/2016/11/CSP_Doc2_co-location-of-marine-renewables_Final.pdf See: http://futuretrends.celticseaspartnership.eu/
Multi Use Platform (MUP) concepts integrate different maritime economic activities within the same space. In line with the EU's Blue Growth Strategy, this new type of business model provides a series of potential advantages: efficient use of marine space, sharing of risks and costs, sharing resources, reduced environmental impacts, and enhanced socio-economic benefits. Delivering this vision will require tools that identify viable multiuse combinations allowing for the optimal use of sea space. The analysis reported shows how the combined use of statistical analyses and Geographical Information Systems (GIS) might achieve this task in the context of oil & gas and offshore wind in the North Sea.	Legorburu *et al.* (2018) Part of MARIBE (Marine Investment for the Blue Economy) project (2014-2016, http://maribe.eu/) which aimed to unlock the potential of multi-use of space in the offshore economy Another MARIBE project of potential relevance: van den Burg *et al.* (2017) describes a business case for mussel aquaculture in offshore wind farms in the North Sea
The gas-to-wire (GTW) concept involves generating electricity offshore from natural gas produced from gas fields. The electricity is then transmitted to shore via spare capacity in windfarm export cables. Wind is intermittent and annual use of windfarm power infrastructure is typically 40%. This spare capacity presents an alternative to exporting gas to shore by pipeline allowing export of energy produced offshore from gas fields. This may extend the	OGA (2018b)

[102] EU LIFE+ funded project which aims to bring together key marine stakeholders, governments and the scientific community within the Celtic Seas to support the implementation of EU environmental and maritime policy

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economic life of depleted gas fields and allow undeveloped discoveries and stranded gas resources to be exploited. As a relatively flexible and fast responding form of power generation, it could play a useful role in balancing the electricity grid as supply and demand fluctuates. OGA (2018b) outlines the technical considerations and potential benefits from GTW in areas such as the southern North Sea and the eastern Irish Sea which have established offshore gas-producing facilities and large existing and planned offshore windfarms. Spatial planning and consultation between industry sectors will be required to prevent inadvertent sterilisation of potential gas resources which could be used/developed for GTW.	
Horizon 2020 funded project that is exploring the opportunities for Multi-Use in European Seas across five EU sea basins (Baltic Sea, North Sea, Mediterranean Sea, Black Sea and Eastern Atlantic). Two year project, co-ordinated by Marine Scotland, commenced November 2016 and will conclude October 2018. Project Objectives: • Explore the opportunities for Multi-Use in European Seas, including the scope for innovation and Blue Growth potential • Present practical solutions on how to overcome existing barriers and minimise risks associated with Multi-Use development whilst maximising local benefits • Provide an understanding of environmental, spatial, economic & societal benefits of co-location • Highlight inappropriate regulatory, operational, environmental, H&S, societal and legal aspects. Case study 1 (North Sea) will consider: • Existing and potential co-use of marine space between offshore wind facilities and the production of food (fisheries and aquaculture) in the Southern North Sea. Further, the effect of MPAs within OWFs on fisheries (active and passive) and vice versa will be investigated. • Alternative solutions for MU of ocean space between commercial fisheries (trawlers & scallop dredgers) and offshore wind development/cables routes of the East Coast of Scotland, to overcome barriers and conflicts, minimise limitations and maximise synergies between the two industries. • Tidal energy generation off the north coast of Scotland, interactions with the environment including wild salmon and marine mammals and the identification of technical solutions to minimise environmental impact.	Multi-Use in European Seas (MUSES) project See: https://muses-project.eu/
Landscape/seascape	
There have been no significant changes to the approaches to considering the effects of aspects of the plan/programme on landscape/seascape since OESEA3, though a number of academic publications demonstrate continued study into the effects of offshore renewables on human wellbeing, the perception and therefore public acceptability of offshore wind (not just in terms of landscape but also perceptions of impacts on wider environmental topics but also positive benefits from the transition to low carbon energy sources), and also potential economic consequences related to tourism. The studies generally indicate negative local landscape externalities/perceptions from large-scale renewables projects at least initially, with distance from projects remaining a controlling factor.	Hattam *et al.* (2017), Voltaire *et al.* (2017), Krekel & Zerrahn (2017), Hooper *et al.* (2017), Kermagoret *et al.* (2017), de Groot & Bailey (2016).

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The BEIS Energy and Climate Change Attitudes Tracker continues to record high rates of public support (79%) for renewable energy, with a similar proportion agreeing that they should provide direct community benefits (77%) and a high proportion (58%) happy to have a large scale renewables project developed locally.	BEIS (2017b)
Connected to the above, research on wider socio-economic effects of offshore wind, and the efficacy of community benefits schemes, is being undertaken to try and better understand and qualify impacts so they can be better accounted for in project level assessment.	Rudolph *et al.* (2017), Glasson (2017).
Marine Discharges	
Updated annual reports describing discharges, spills and emissions from oil and gas installations have been published, along with an OSPAR Intermediate Assessment report which has assessed data over the period 2009-2014. OSPAR (2017b) indicated a general downward trend for several indicators: • The amount of dispersed oil discharged in produced water decreased by 18% between 2009 and 2014 • The use of chemicals on OSPAR's List of Chemicals for Priority Action (LCPA) has reduced by over 90% since 2009, and in 2014 no LCPA chemicals were discharged 30% decrease in the use of chemicals carrying substitution warnings, and a 40% decrease in their discharge between 2009 and 2014.	OGUK (2017), OSPAR (2017b)
Ongoing work considering the potential impacts of weathered crude, drill cuttings and associated drilling fluids and their constituents, i.e. barite, on marine species and the temporal and spatial extent of effects.	Edge *et al.* (2016), Farkas *et al.* (2017), Finch *et al.* (2016), Henry *et al*. (2017), IOGP (2016), Järnegren *et al*. (2017), Trannum (2017).
A focus remains on produced water from oil and gas production, its potential effects, its treatment and management and the emergence of new technologies and legislation to address this by-product of the industry, including trying to identify potential alternative reuse options for treated produced water.	NEL (2017), Nasiri *et al*. (2017).
The Ballast Water Management Convention entered into force in September 2017 and applies to all vessels that operate in the waters of more than one Party to the Convention (internationally operating vessels). The aim is to prevent the spread of harmful aquatic organisms from one region to another, by establishing standards and procedures for managing the discharge of ships ballast water and gaining an understanding of the potential effects of ballast water releases remains important.	IMO http://www.imo.org/en/About/Conventions/ListOfConventions/Pages/International-Convention-for-the-Control-and-Management-of-Ships'-Ballast-Water-and-Sediments-(BWM).aspx, Hyun *et al.* (2017).
Spatial heterogeneity of zooplankton within ballast water measured using three sampling methodologies; results used to provide a guide on methods and timing of sample collection.	Bailey & Rajakaruna (2017).
Climatic Factors	
Confidence in the nature and likelihood of potential impacts of climate change continue to improve at a global and national level. Research indicates the potential for sea-level rise and changes in large-scale hydrographic processes (e.g. the AMOC) may be greater and/or more rapid than previously predicted.	MCCIP report card 2017 and related technical reviews (e.g. Haigh & Nicholls 2017, McCarthy *et al.* 2017, Bresnan *et al.* 2017, Hughes *et al.* 2017, Williamson *et al.* 2017, Pinnegar *et al* 2017, Cottier-Cook *et al.* 2017, Daunt *et al.* 2017), Birchenough *et al.* (2017), Genner *et al.* (2017), Sgubin *et al.* (2017), Thornalley *et*

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	al. (2018).
The Special Report on global warming of 1.5°C is presently being prepared by the IPCC to inform the "Talanoa Dialogue" which is to take stock of the collective efforts of the Parties towards achieving the Paris Agreement.	Due October 2018.
In addition to the above, the IPCC is also preparing a Special Report on the Ocean and Cryosphere in a Changing Climate (SROCC) in preparation for the Sixth Assessment Report due in 2021.	Due September 2019.
UKCP18 will provide updates to marine projections for sea-level rise up to 2100 for the Representative Concentration Pathways (RCP) 2.6, 4.5 and 8.5 scenarios, and a "plausible but unlikely" scenario, and corresponding projections for storm surge, incorporating sea-level and "storminess" changes.	Due 2018.
Accidental events	
The Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement (Final PDARP/PEIS) considers programmatic alternatives, composed of Restoration Types, to restore natural resources, ecological services, and recreational use services injured or lost as a result of the Deepwater Horizon oil spill incident. The Final PDARP/PEIS also evaluates the environmental consequences of the restoration alternatives. The document shows that the injuries caused by the Deepwater Horizon oil spill incident affected such a wide array of linked resources over such an enormous area that the effects must be described as constituting an ecosystem-level injury. Consequently, the Trustees' preferred alternative for a restoration plan employs a comprehensive, integrated ecosystem approach to best address these ecosystem-level injuries.	Deepwater Horizon Oil Spill Natural Resource Trustees (2016). Final PDARP/PEIS A host of primary literature on DWH impacts on different elements of the GoM ecosystem published since OESEA3 including: Ainsworth *et al*. (2018), Balthis *et al.* (2017), Beyer *et al.* (2016). Dias *et al.* (2017), Joye *et al*. (2016), Maggini *et al.* (2017a, b), Powers *et al*. (2017), Prouty *et al.* (2016a, b), Short *et al*. (2017), Smith *et al.* (2017), Takeshita *et al*. (2017), Wallace *et al*. (2017), Washburn *et al*. (2017). Special issue: Effects of the Deepwater Horizon oil spill on protected marine species. *Endangered Species Research* **33** http://www.int-res.com/abstracts/esr/v33/ See Wallace *et al*. (2017) for introduction to special issue
Special Issue organised by the North Pacific Marine Science Organization to provide an introduction to the current state of scientific understanding regarding the environmental effects of oil spills. Aims to provide an introduction to the most important ways that oil spills can harm biota, habitats, and ecosystems through invited, targeted mini-reviews augmented by original research articles.	Special Issue: Ocean spills and accidents. *Archives of environmental contamination and toxicology* (2017) **73** https://link.springer.com/journal/244/73/1/page/1 See: Yim & Short (2017) for introduction to special issue
Rapidly deployed monitoring of a natural gas blowout in 2013 after the Hercules 265 drilling rig in the GoM experienced a catastrophic loss of control.	Romero *et al.* (2016), Weber *et al.* (2016)

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The cross-government Premiam (Pollution Response in Emergencies: Marine Impact Assessment and Monitoring) initiative works to promote effective post-spill monitoring and these guidelines form a key deliverable and an update to an earlier 2011 version. Of relevance is the information on specific habitat and wildlife resources which could be impacted derived from experience gained from studies carried out during oil spills including DWH.	Kirby *et al.* (2018).
Updated Seabird Oil Sensitivity Index (SOSI) based on seabird survey data collected from 1995 to 2015, from a wide survey area extending beyond the UKCS using boat-based, visual aerial, and digital video aerial survey techniques. Seabird data was combined with individual seabird species sensitivity index values based on a number of factors considered to contribute towards the sensitivity of seabirds to oil pollution (e.g. habitat flexibility, adult survival rate, potential annual productivity, and the proportion of the biogeographical population in the UK). The combined seabird data and species sensitivity index values were subsequently summed at each location to create a single measure of seabird sensitivity to oil pollution. This is presented as a series of fine scale density maps for each month that show the median, minimum and maximum seabird sensitivity to oil pollution, and an indication of data confidence. The index is independent of where oil pollution is most likely to occur; rather, it indicates where the highest seabird sensitivities might lie if there were to be a pollution incident.	See: http://jncc.defra.gov.uk/page-7373
Further modelling and mesocosm experiments on the potential impacts of CO_2 leakage from potential CCUS facilities on marine bacterial and benthic communities.	Amaro *et al.* (2018), Borrero-Santiago *et al.* (2017), Lessin *et al.* (2016), Sokołowski *et al.* (2018).
Potential for cumulative effects	
Further development of the iPCoD and DEPONS models (as detailed above under 'Noise') is resulting in greater ability to assess the cumulative impacts of noise from multiple sources on marine mammal populations. However, there remains very limited empirical data to support quantification of the transfer functions/pathways between physiological and behavioural changes (e.g. hearing loss, displacement) and changes in vital rates (e.g. survival, fertility).	Booth *et al*. (2017), Nabe-Nielsen *et al*. (2018)
The iPCoD framework has been extended to include multiple stressors on marine mammals (i.e. more than just noise). However, this framework remains conceptual with insufficient data for practical applications at present.	National Academy of Sciences (2017)
Data is collated in the UK Marine Noise Registry[103] (MNR), including information on the distribution in time and space of low to mid-frequency impulsive sounds. Maps are produced annually showing the spread of activities in 'pulse block days', with data for 2015 and 2016 now available. From a cumulative effects perspective, these aggregated data will facilitate a better understanding of the spatio-temporal overlap between different impulsive noise-producing activities and could potentially be used in a planning capacity with regard to scheduling of activities.	See overview of MNR in JNCC (2016) and 2015 and 2016 data available from data.gov.uk[104].
The proliferation of studies using techniques such as telemetry, radar, high definition aerial photography and video, is facilitating assessments of the potential impact on seabirds and migratory wildfowl from the cumulative exposure to the multiple offshore and onshore wind farms both within the UK, and in other nations. One such study will soon report findings for UK lesser black-backed gull SPA populations, while assessments for other species are likely to be forthcoming within the next few years.	Thaxter *et al.* (submitted).

[103] http://jncc.defra.gov.uk/page-7070
[104] https://data.gov.uk/dataset/70f838a6-8d53-4e36-9496-d7e94a398675/uk-marine-noise-registry-outputs-for-2016

Table 5.1: Overview of updates to the sources of effect relevant to the OESEA3 plan/programme

High level summary of update	Relevant publications
Recent reviews (including of completed Environmental Statements for wind farms in Scottish waters and Round 3 zones) highlight the uncertainties around the cumulative effects of marine renewable energy, the complexities involved in assessing them, and the shortcomings of the current practise of EIA-led assessment of effects. Various recommendations have been made as part of these reviews to improve practise, which often advocate a more coordinated, ecosystem-level approach, and that such effects could be better considered at the strategic level. In general, while the assessment of cumulative impacts on species, species groups, and habitats is a high priority there remains an absence of a consistent approach to effective assessment of cumulative impacts.	Stelzenmüller *et al.* (2018), Willsteed *et al.* (2017, 2018).
The Strategic Environmental Assessment North Sea Energy (SEANSE) project, has a subgroup of Support Group 1 to develop a Common Environmental Assessment Framework (CEAF) for cumulative effects, particularly for offshore wind. The framework will be tested using case studies, one focussed on eastern Scotland. Species to be covered include harbour porpoise, kittiwake, lesser black-backed gull and red-throated diver. This work is in development, and will continue through 2019.	http://northseaportal.eu/

5.1 Implications of updates to understanding of effects

It is not regarded that the above literature updates significantly alter the conclusions of OESEA3 for any assessment topic, but they do present a number of important updates to the approach for assessment at the strategic and project level, and highlight a number of ongoing information gaps that will be considered in future SEA. The following synthesises the key updates listed in Table 5.1.

Noise

The evidence base for effects of underwater noise on marine mammals, fish, invertebrates, plankton and birds continues to improve, but fundamental information gaps remain on the noise characteristics of anthropogenic noise sources, related behavioural responses, and the efficacy of mitigation measures. In particular for marine mammals, the NMFS (2016) acoustic thresholds for auditory injury and frequency weighting functions reflect the current state of scientific knowledge, superseding the previously universally adopted approach by Southall *et al.* (2007), noting that an update to the latter publication is expected later in 2018. Similarly, an ongoing BEIS-funded project to improve the expert elicitation elements of iPCoD (see above) is expected to report by the end of 2018 and will likely update and strengthen the model.

Physical presence – ecological effects

Understanding of the interactions between seabirds and OWFs is increasing with additional post-construction monitoring data and new GPS telemetry studies providing greater insight into potential displacement and barrier effects and the risk of collisions. A significant number of SEA-funded studies addressing these issues have been completed and published. Given the gaps in our understanding and the large-scale of offshore wind farm development in the pipeline, more research will be required to inform future SEAs. Similarly, understanding of potential interactions between marine mammals and diving birds and tidal stream developments is limited to tracking animal movements within prospective areas or field observations of single devices. The recent deployment of small arrays (e.g. Meygen) should allow more field-based data to be collected.

Climatic factors

Whilst confidence in the nature and likelihood of potential impacts of climate change continue to improve at a global and national level, the next couple of years will see the publication of a number of reports which will likely further augment confidence, particularly with respect to the marine impacts of climate change (e.g. IPCC Special Report on the Ocean and Cryosphere in a Changing Climate) and with particular relevance to the UK (e.g. marine projections as part of UKCP18).

Cumulative effects

Whilst a strategic level consideration is often advocated as the preferred approach to assess cumulative effects, a suitable mechanism(s) to take account of the inherent complexity involved in an assessment of plan-related activities has yet to be developed. Further development of the iPCoD and DEPONS models is resulting in greater ability to assess the cumulative impacts of noise from multiple sources on marine mammal populations. However, there remains very limited empirical data to support quantification of the transfer functions/pathways between physiological and behavioural changes (e.g. hearing loss, displacement) and changes in vital rates (e.g. survival, fertility). Promisingly, the iPCoD framework has been extended to include multiple stressors on marine mammals (i.e. more than just noise) although this remains conceptual at present. For the moment, the paucity of data on interactions between pressures and cause-effect relationships dictate that considerable uncertainty in cumulative effects and a lack of credible quantitative assessment approaches persist.

6 OESEA3 Monitoring

In fulfilment of the requirements of the *Environmental Assessment of Plans and Programmes Regulations 2004*, BEIS monitor the effects of the activities arising following the adoption of the draft plan/programme for the purpose of identifying unforeseen adverse effects at an early stage, and to allow appropriate remedial action to be undertaken where necessary. BEIS has not noted any unforeseen adverse effects through the various monitoring and other programmes used to fulfil the Department's obligations as responsible authority for monitoring under Regulation 17(1) in relation to OESEA3.

Three types of relevant monitoring indicated in OESEA3 were:

- Emissions monitoring
- Effects monitoring
- SEA objectives monitoring

The following table provides a high level consideration of SEA monitoring against OESEA3 objectives/indicators which uses a number of existing monitoring and other arrangements to fulfil the requirements of the Regulations[105].

Table 6.1: Consideration of SEA monitoring and OESEA3 objectives/indicators

Indicator	High Level Monitoring Outcomes and Relevant links
Biodiversity, habitats, flora and fauna	
For selected 'valued ecosystem components' no loss of diversity or decline in population (measured as % of relevant biogeographic population) attributable to plan related marine activities and promotion of recovery wherever possible.	Research and monitoring relating to conservation sites and species are kept under review as part of the SEA programme. These include: Monitoring and Advice by The Special Committee on Seals (SCOS) The Seabird Monitoring Programme (SMP) The Wetland Bird Survey (WeBS) Site condition monitoring for Natura 2000 sites Common Standards Monitoring for Designated Sites (CSM) The Clean Seas Environment Monitoring Programme (CSEMP) Available outputs from these programmes have already been described in Section 4.2 and 4.3. Studies have been undertaken, or are underway/in planning, to further understand potential effects of plan activities on birds and marine mammals which have resulted in a number of publications, documented on the SEA pages of the gov.uk website. Links: UKMMAS, SCOS Reports, SMP Results, WeBS Report, CSM, CSEMP, Supporting documents for OESEA and OESEA2 and OESEA3, the Offshore Energy SEA BGS data archive, OSPAR Intermediate Assessment 2017 Marine Strategy Part Two: UK Marine Monitoring Programmes (to be considered

105 In keeping with Regulation 17(2), "The responsible authority's monitoring arrangements may comprise or include arrangements established otherwise than for the express purpose of complying with paragraph 17(1)".

Table 6.1: Consideration of SEA monitoring and OESEA3 objectives/indicators

Indicator	High Level Monitoring Outcomes and Relevant links
	in relation to all MSFD Annex I descriptors)
Activities subsequent to licensing/leasing which are on, or potentially affecting, a Natura site are compliant with the requirements of the *Conservation (Natural Habitats, &c.) Regulations 1994 (as amended), the Conservation (Natural Habitats, etc.) (Northern Ireland) Regulations 1995 (as amended), the Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007 (as amended),* and *the Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001 (as amended).*	HRA screening and Appropriate Assessment was undertaken for Block licences where a likely significant effect was identified for the 29th Round and a Supplementary Seaward licensing Round in 2016, and most recently the 30th Round for mature areas of the UKCS. In each case, the granting of licences applied for was not found to give rise to significant effects on the integrity of relevant sites. Further HRA is expected to take place for the 31st Round which opened on 10 July 2018. Since the publication of OESEA3, 2,096 Blocks have been offered as part of Seaward Licensing Rounds spanning all of the major hydrocarbon basins of the UKCS. The licensing rounds attracting applications for 363 Blocks, 86 of which have been subject to HRA as they met relevant screening criteria (e.g. BEIS 2017c). For those Rounds which have been completed, 122 Blocks were subsequently licensed, 25 of which were also subject to HRA. Of these 25, no work programmes involving the drilling of a well have been completed to date. Links: 29th Seaward Licensing Round HRA, Supplementary Seaward Licensing Round HRA, 30th Seaward Licensing Round HRA
Every activity with the potential to impact upon or disturb a protected species is compliant with the requirements of the *Conservation (Natural Habitats, &c.) Regulations 1994 (as amended), the Conservation (Natural Habitats, etc.) (Northern Ireland) Regulations 1995 (as amended), the Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007 (as amended),* and *the Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001 (as amended).*	There have been no convictions relating to European protected species disturbance in relation to plan activities.
Geology and soils	
No adverse change in quality of seabed sediments, and seabed sediment transport, at a series of regional monitoring stations.	Results from regional surveys and syntheses of offshore wind farm licensing conditions monitoring do not reveal adverse changes to sediment quality or character associated with plan activities. Further offshore wind monitoring reviews have yet to be published. An update to the MSFD Initial Assessment is expected in 2018. Links: Review of Offshore Wind Farm Monitoring Data 2010 and 2014, OSPAR Coordinated Environmental Monitoring Programme (CEMP) Reporting, OSPAR Intermediate Assessment 2017, Regional surveys undertaken under the SEA programme, Marine Strategy Part Two: UK Marine Monitoring Programmes (to be considered in relation to MSFD Annex I descriptors 6 and 7).

Table 6.1: Consideration of SEA monitoring and OESEA3 objectives/indicators

Indicator	High Level Monitoring Outcomes and Relevant links
No physical damage to designated marine and coastal geological conservation sites (e.g. GCRs and MCZs).	50 Marine Conservation Zones and 30 nature conservation Marine Protected Areas have been designated in English and Scottish waters respectively, and a further 4 MCZs have been designated in Northern Ireland, however, none have been specifically designated for geological features. OGA/BEIS required consideration of designated and potential MCZs for all new Block licence applications through the 29th, Supplementary and 30th Rounds, and requires their consideration during permitting of all subsequent activities. Links: Information provided for seaward licensing rounds, latest BEIS (2018) EIA guidance, Environmental Statements reviewed/approved in relation to oil and gas activity (including pipelines),
Landscape/seascape	
No significant impact on nationally-designated areas.	The former proposed Navitus Bay offshore wind farm was refused development consent primarily on the basis of its impact on landscape/seascape, including how AONBs and the Jurassic Coast World Heritage Site would be experienced, and related economic effects on tourism.
Extent of the visual resource potentially affected by the particular developments.	Taken as a measure of the number of proposed or approved developments associated with the plan which are within 12nm, or viewable distance, of the coast, a number of proposals have been made in relation to tidal stream (e.g. the Morlais Tidal project off Anglesey) and tidal range (Tidal Lagoon Cardiff, Newport, and the West Somerset tidal lagoon) developments, however, only the Swansea Bay tidal lagoon project has received development consent (note this was prior to the publication of OESEA3) though it is uncertain that it will proceed as a suitable CfD was not agreed (see Section 4.2.8). Further offshore wind projects not already accounted for in OESEA3 will come forward in future leasing rounds, and this topic will be kept under review following identification of new leasing areas, and any further proposed development under OESEA3.
Number of areas of landscape sensitivity affected by proposed developments (e.g. offshore wind).	Taken as a measure of the number of proposed or approved developments associated with the plan which are within 12nm, or viewable distance, of sensitive or designated landscapes. As noted above, tidal lagoons and other nearshore renewables are likely to be in viewable distance of AONBs (e.g. Anglesey, Gower). This topic will be kept under review following identification of new leasing areas, and any further proposed development under OESEA3.
Trajectory of change in coastal National Character Areas shows no adverse effects arising from plan activities.	The majority of plan activities to date have taken place some distance offshore or are transient, however, the scale of future offshore wind may present changes to the character of some coasts associated with National Character Areas (NCAs). Such a trajectory of change will be reviewed following offshore wind farm construction and review of NCAs, and it is acknowledged that these are identified as a driver of change within certain NCA descriptions, and may continue to be so in some areas. The completion of the seascape character assessment for English and Welsh waters as part of their respective marine planning processes provides a further baseline on which to assess the trajectory of change and any influence of the plan on this. Link: National Character Areas, Wales Marine Character Areas, marine planning in England (ongoing), seascape character areas Northern Ireland
Change in 'tranquillity' based on CPRE and CCW national mapping projects.	Updates to these measures will be kept under review so that a monitoring outcome can be provided. No updates have been made to mapped outputs since 2007 by CPRE or 2009 for Wales.
Water Environment	
No adverse change in quality of surface water and aquifers.	WFD indicators of chemical and biological status for coastal and transitional waters are reported to the EEA. WFD surface water status (including coastal waters) for the UK showed no significance change up to 2016. As noted in Section 4.3, while trends in hazardous substances and eutrophication indicate long term declines, they are still problems in some areas. Trends in beach litter and at sea are not certain, but litter is widespread and remains a significant problem. Data for non-nuclear sources of radioactive

Table 6.1: Consideration of SEA monitoring and OESEA3 objectives/indicators

<table>
<tr><th>Indicator</th><th>High Level Monitoring Outcomes and Relevant links</th></tr>
<tr><td></td><td>substances (e.g. oil and gas) has been collated since 2005 and it has not been possible to derive trends, however, overall impacts on people and the environment are expected to be low (OSPAR 2017b).

Links: Charting Progress 2, Charting Progress Clean and Safe Seas feeder report, Marine Strategy Part Two: UK Marine Monitoring Programmes (to be considered in relation to MSFD Annex I descriptors 5, 8 and 10), WFD trends, OSPAR Intermediate Assessment 2017, UK Biodiversity Indicators 2017</td></tr>
<tr><td>UKCS Exploration and Production (E&P) meets OSPAR discharge reduction targets.</td><td>Since 2008 up to the latest reported figures (2014), both the quantity of produced water discharged and average oil in water concentrations have reduced: 198 to 156 million m^3 and 16 to 12.8mg/l respectively.

Links: Oil and gas: field data, OSPAR Intermediate Assessment, OSPAR Offshore Industry Committee (OIC) Discharges</td></tr>
<tr><td>Number of oil and chemical spills and quantity of material spilled.</td><td>
<table>
<tr><th></th><th colspan="2">Oil released</th><th colspan="2">Chemicals released</th></tr>
<tr><th></th><th>No.</th><th>Quantity (tonnes)</th><th>No.</th><th>Quantity (kg)</th></tr>
<tr><td>2016*</td><td>282</td><td>20.6</td><td>341</td><td>303,220</td></tr>
<tr><td>2017</td><td>209</td><td>19.1</td><td>212</td><td>246,851</td></tr>
<tr><td>2018**</td><td>12</td><td>0.1</td><td>23</td><td>1,210</td></tr>
</table>
Notes: * Does not include oil released at the Clair Phase 1 Platform on 2^{nd} October as the incident remains under review; **up to 20^{th} February 2018. Source: PON1 data.

Links: ACOPS, PON1 reporting</td></tr>
<tr><th colspan="2">Air Quality</th></tr>
<tr><td>Monitoring of local air quality shows no adverse impact.</td><td>The direct contribution of plan activities to emissions associated with designation of Local Air Quality Management Areas is limited to vessel traffic at ports used for construction/support vessels.

Links: Air Pollution in the UK 2016</td></tr>
<tr><td>Targets relating to airborne emissions at a regional and UK level are not exceeded.</td><td>Levels of pollutants on the National Atmospheric Emissions Inventory (NAEI) during the currency of the OESEA3 plan/programmes for England and the devolved administrations. National Emissions Ceilings Directive targets for NO_x, NMVOCs, SO_2 and NH_3 and those set under the Gothenburg Protocol continue to be met (however noting continued local exceedances of NO_2 not directly connected with the plan, see Section 4.3). Revised NECD and Gothenburg emissions targets come into force in 2020.

Regional deposition of air pollutants around the North Sea and the North-East Atlantic reported under the Comprehensive Atmospheric Monitoring Programme (CAMP) indicate substantial reductions in nitrogen oxides, heavy metals and persistent organic pollutants within the timeseries of 1990-2015.

Links: OSPAR CAMP Report 2015, UK National Atmospheric Emissions of Air Quality Pollutants 1970-2011, NAEI data and reports, National Statistics: Emissions of air pollutants</td></tr>
<tr><th colspan="2">Climatic Factors</th></tr>
<tr><td>UKCS E&P greenhouse gas emissions.</td><td>UK E&P greenhouse gas emissions through the duration of the plan/programme. Note that the latest available OSPAR data is up to 2014 and NAEI data up to 2015, and neither therefore cover emissions for plan activities since the publication of OESEA3.

Link: OSPAR oil and gas emissions and discharges, UK greenhouse gas emissions statistics (Exploration and production of oils and gas)</td></tr>
<tr><td>UK progress towards meeting greenhouse reduction targets</td><td>The contribution of renewables to electricity supply was 29.4% in 2017 (provisional), supplying 8.9% of total energy in 2016 (offshore wind supplied 20%</td></tr>
</table>

Table 6.1: Consideration of SEA monitoring and OESEA3 objectives/indicators

Indicator	High Level Monitoring Outcomes and Relevant links
under *The Climate Change Act 2008*.	of this), contributing to a reduction of greenhouse gases associated with energy production. Link: UK greenhouse gas emissions statistics, UK Carbon Budget, Digest of UK Energy Statistics: renewable sources of energy
UKCP09 projections for the expected currency of the plan/programme.	Projections for publications cited in OESEA3 remain broadly current, though will need to be updated with new information from UKCP18 and the IPCC Assessment Report 6, which is due for publication in 2021. Links: IPCC Assessment Report 5, UKCP09
Population and human health	
Progress in achieving OSPAR targets for continued reduction in harmfulness of offshore discharges.	See response to indicators for **Water Environment** and **Air Quality**
Monitoring in relation to Noise Action Plans shows no adverse effects.	Most relevant aspect of noise mapping for the plan/programme relates to the consideration of industrial activity, which includes ports, under Annex IV of the Environmental Noise Directive. The next set of noise actions plans are due in 2019. Link: Noise Action Plans
Relevant Office for National Statistics wellbeing metrics.	Trends in well-being are reported through the Office for National Statistics (ONS). The ONS records positive changes in the short and long term for environmental areas such as greenhouse gas emissions reductions, the number of protected areas, level of renewable energy as a proportion of total energy consumption and access to the environment. Link: Measuring National Well-being: Life in the UK 2018
Other users of the sea, material assets (infrastructure, and natural resources)	
Spatial planning capable of addressing changes in technology, policy and prioritisation of site selection	The Northern Irish and Welsh marine plans have been published, and are broadly consistent with those already published for other UK seas. It is expected that the remaining English marine plans will be broadly consistent with these in terms of their policy wording and approach. In this first phase of marine planning, there has been much consolidation of existing policy, and mapping of resources (including for renewable energy) along with supportive/safeguarding policy, though no spatially prescriptive planning has taken place to date. OESEA3 and the SEA programme will maintain awareness of plan adoption and review. Link: Marine planning in England, National Marine Plan for Scotland, Wales, Northern Ireland
Economic and social impact (both positive and negative).	While the plan assessed as part of OESEA3 is yet to result in any new offshore renewable energy or oil and gas production, it has enabled further seaward oil and gas licensing rounds which have the potential to result in new developments which will contribute to UK security of supply. The announcement by The Crown Estate that a new leasing round will take place for offshore wind is similarly enabled through the adoption of the plan/programme assessed by OESEA3, which will lead to the next tranche of offshore wind sites in UK waters. Production tax receipts from the UKCS were positive in 2015-16 (£151 million) and are expected to increase to ~£1 billion per year over the rest of the decade. Links: Oil & Gas UK Economic Report 2016, 2017, the ONS UK Environmental Accounts 2016, 2017, BEIS Energy Trends 2016, 2017, 2018 (provisional)

Table 6.1: Consideration of SEA monitoring and OESEA3 objectives/indicators

Indicator	High Level Monitoring Outcomes and Relevant links
Increased collision risks and restrictions on pollution prevention methods or Search & Rescue options in the event of an emergency.	Compliance of all developments to undertake suitable navigational risk assessments. Adherence of offshore wind farm applications to MCA Marine Guidance Note 371: Offshore Renewable Energy Installations (OREIs) - Guidance on UK Navigational Practice, Safety and Emergency Response Issues (now MGN 543). Adherence to CAA 2016 guidelines on windfarms (CAP 764), particularly with respect to appropriate consultation with offshore helicopter operators, the operators of existing installations and exploration and development locations to maintain safe offshore helicopter operations alongside proposed wind farm developments. Links: Oil and gas environmental data: consent to locate, Triton Knoll, East Anglia One, East Anglia Three, Galloper Wind Farm, Burbo Bank Extension, Walney Extension, Rampion, Dogger Bank Creyke Beck, Dogger Bank Teesside A&B, Hornsea Offshore Wind Farm (Zone 4) Project One, Hornsea Offshore Wind Farm (Zone 4) Project Two.
Progress in reducing volumes of waste to landfill.	Waste quantity, type and disposal route (e.g. landfill, recycling) data is reported to BEIS through EEMS. General trends in operator waste production and disposal routes publicised through annual OSPAR Environmental Management System (EMS) reporting requirements – summarised in Oil and Gas UK Environment Report 2017. The total amount of waste generated on the UKCS fell by 22% from 2015 to just under 170,000 tonnes in 2016, reversing the general upward trend of the last decade. Reduced operational waste was the main cause. There was a 54% rise in decommissioning waste from 2015-16 reaching just over 7,200 tonnes; the highest on record for this activity. Almost 15,000 tonnes less waste was sent to landfill in 2016 than 2015 and *ca*. 50,000 tonnes of total waste were reused or recycled. Of the 7,289 tonnes of decommissioning waste generated in 2016, 91% was either reused, recycled or used for power generation. Links: EMS Public statements
Cultural Heritage	
No adverse impact upon the condition of designated sites and features (including impact on their setting) and minimal impact on all other recorded sites and features.	The Historic England Heritage at Risk (HAR) Register provides an indicator of condition of designated heritage assets within the coast and marine area. The register is updated every year so it is possible to monitor sites and the degree to which they are at risk (i.e. being conserved) over time. The 2017 register indicates that there are 4 protected shipwrecks at risk in the south east area although none from plan-related activities. Link: HAR 2016, HAR 2017
Number of archaeological finds reported through best practice as a result of plan activities.	Information collected by the Receiver of Wreck, relevant local Historic Environment Records and National Monuments Records. Link: Wreck and salvage law

7 Overall conclusions

Continued leasing and licensing in relevant UK waters, enabled by the adoption of the plan/programme assessed in the OESEA3 Environmental Report, relies on the continued currency of the information base of OESEA3 and its conclusions. This review has examined whether new information and updates published since OESEA3 have significantly changed the policy and technology context of the plan, the environmental baseline underpinning the assessment of the plan or the assessment itself.

There have been some minor updates to certain leasing and licensing arrangements, and to the policy context within which OESEA3 was drafted and these are reflected in Section 2. However, these do not change the basis of the SEA as they remain within the wider UK Government targets for renewables deployment, carbon dioxide emissions reductions and the MER UK strategy, all which remain unchanged since the publication of OESEA3. Technologies have advanced with respect to most aspects of OESEA3 related activities although these are within the scope of the plan assessed.

New data and information updates on the physical and biological aspects of the environmental baseline (Section 4) are generally in line with the broad descriptions of the environment provided in OESEA3 although more specific information may further augment or change understanding at a local level. The relatively short time period since publication of OESEA3, means that much of the updated information on other users of the environment and existing environmental issues is not significantly different to that presented previously.

New information published since OESEA3 has added to our understanding of the environmental effects of plan-related activities, and is summarised in Section 5. It is concluded that the updates to our understanding of effects of the activities covered by the plan do not significantly alter the conclusions of OESEA3.

With the exception of windfarms, research on the effects of other marine renewables is still primarily derived from deployments of single or few devices with improved models providing understanding of potential effects of large scale arrays (the recent deployment of the Meygen array is noted). For the more established technologies covered by the plan, there are some information gaps, particularly in relation to issues such as: the potential displacement of birds by offshore wind farms; faunal behavioural responses to noise (e.g. seismic survey and piling) and the efficacy of associated mitigation measures; and, the nature and scale of potential cumulative effects. The recommendations of OESEA3 are considered to remain relevant, with work ongoing directly as part of SEA-related research activities, or indirectly via other initiatives, to address these.

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