Cumulative Effects of Offshore Renewables: from pragmatic policies to holistic marine spatial planning tools

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To alleviate climate change consequences, UK governments are pioneering offshore energy developments (ORE) at an ever-increasing pace. The North Sea is a dynamic ecosystem with strong bottom-up/top-down natural and anthropogenic drivers facing rapid climate change impacts. Therefore, to ensure the compatibility of such large-scale developments with nature conservation obligations, cumulative effects need to be evaluated through cumulative impact assessments (CIA). However, by excluding climate change impacts, the CIA lacks spatio-temporal appropriate baselines linking oceanic ecosystem indicators to population dynamics, leading to uncertain predictions at populations levels. At a European level, the CIA is currently required under both the Strategic Environmental Assessment (SEA, Directive 2001/42/EC) and the amended Environmental Impact Assessment (EIA, Directive 2014/52/EU). The Marine Strategy Framework Directive (MSFD, Directive 2008/56/EC) also requires the assessment of the main cumulative and synergetic effects based on its ecosystem approach. At the UK level, CIA requirements and MSFD are mirrored within the Marine and Coastal Access Act, the UK Marine Policy Statement, and the UK National Policy Statement.

This study presents an overview of the CIA policy framework, enabling an ecosystem-based approach linking lower ecosystem components to top-predator populations using the UK as a case study. Firstly, we show how CIA and MSFD requirements are integrated into the UK licensing and maritime planning frameworks. Secondly, we provide policy pathways embedding the MSFD as a baseline for CIA at the European and UK levels. Thirdly we propose tools such as a shared monitoring effort and a modelling approach with connections to current online databases. Finally, we highlight how Contracts for Difference policy could be used as an integrative tool to enhance a holistic and pragmatic ecosystem-based framework for an inter-disciplinary CIA approach fit for a rapid expansion of ORE.

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Investigating best practices for fishermen wellbeing in Scotland

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Globally, there is increasing interest in fishermen wellbeing on board fishing vessels in wild capture fisheries. Reports of human rights abuses within global seafood supply chains, (e.g., Thailand, 2015) has resulted in the seafood industry strengthening their use of market-based assurance tools (e.g., third-party certifications, risk assessment tools, etc) to ensure that their supply chains are free from such abuses. In the UK, recent research has found instances of human and labour rights violations onboard UK fishing vessels (Sparks, 2022; ITF, 2022). Our research aims to understand best practices in market-based tools for supporting fishermen wellbeing on board vessels. Fieldwork is planned in three fisheries, one of which is Scottish trawled nephrops, with fieldwork taking place during autumn 2022. We aim to understand the perspectives of a range of actors along the supply chain including, but not limited to, supply chain managers, civil society organizations, policymakers, NGOs, fishermen, fish worker associations.

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Nuances of Nature Based Development

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As part of supporting the Blue Economy Vision there is a need to ensure sustainable development and solutions that bring biodiversity net gain.

In this talk we present some of Mott MacDonalds experience in sustainable development to date and the challenges encountered with using nature-based solutions. Projects covered include coastal defence programs, touching on handling managed realignment and wastewater treatment solution with accompanying habitat creation. The question of compensatory habitats and current understanding of what, where, when and how these can be undertaken is raised.

We also seek to provide insight on some of the policy and evidence-based challenges that occur, and the current gaps in knowledge experienced. This includes recent programs to map stakeholders and link associated environmental processes to enable a holistic view on impacts and cumulative aspects to be taken. This holistic view on processes is often missed and is a particular concern to properly assess outcomes of projects.

Communication of these challenges and their resolution is key to enhancing the uptake of blue economy within Scottish waters. As such, this talk seeks to encourage the development of partnerships, summarise lessons learned and identify potential opportunities for future research to deliver measurable impacts.
Blue carbon stores with a higher proportion of terrigenous material are less vulnerable to organic carbon remineralisation

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The ability of coastal systems to sequester atmospheric carbon dioxide as organic carbon (termed blue carbon) has received global interest, with such systems playing a role in mitigating climate change (Macreadie et al. 2019). Coastal systems are several magnitudes more efficient at storing carbon than terrestrial ones, with carbon locked away for millennia (Howard et al. 2017). Organic carbon (OC) stored in coastal sediments can come from a variety of sources, both terrestrial and marine (Mao et al. 2020). Understanding the origin of carbon stored in blue carbon systems is important, with the potential for anthropogenic activities to have unintended consequences on the supply of carbon (Mao et al. 2020). Furthermore, not all carbon stored in coastal sediments is of equal quality, with some sediments - such as those being more vulnerable to resuspension from activities such as trawling - containing more labile carbon than others (Black et al. 2022; Smeaton and Austin 2022).

Maerl beds are global blue carbon systems and have a similar carbon storage capacity to Australian temperate seagrasses (Mao et al. 2020). Beds form when individual pieces of coralline algae come together, facilitating sedimentation and the storage of allochthonous (external origin) carbon. Maerl beds can form in both exposed and sheltered environments, and currently little is known of how carbon storage varies spatially and temporally.

Here we assess the source and vulnerability of carbon stored in maerl beds. Sediment cores were collected from both exposed and sheltered sites around Scotland. Stable isotope analysis was used to assess the source of carbon in sediments, whilst the Carbon Reactivity Index (CRI) was used to assess the vulnerability of the carbon to bacterial remineralisation (CRI of 0 = fully biodegradable, whilst a CRI of 1 = non-biodegradable; Smeaton and Austin 2022).

Exposure and location were found to affect both the source of carbon and the CRI, with sites closer to the terrestrial environment and in sheltered locations storing a high quantity of OC which was of more terrestrial origin and less reactive. On the other hand, sites closer to the marine environment stored less OC, which was more vulnerable to remineralisation due to greater contributions from macroalgae and marine plankton.

The results suggest that OC stored in all sites was to a degree labile, and therefore, if disturbed, could potentially be partially remineralised, reintroducing stored carbon to the atmosphere. Furthermore, the results show that whilst all maerl beds store OC, some sites are larger and more stable blue carbon repositories than others and should be prioritised for protection in future policy and management strategies.

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Improving understanding of vessel activity in Scotland’s coastal waterways: implications for wildlife and policy

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Understanding, and then subsequently monitoring and managing human activities in the marine environment is inherently challenging. Challenges include inadequate data, a limited understanding of environmental interactions within marine ecosystems, and the inherent complexities of managing species and activities that traverse multiple jurisdictions. To assess and understand the degree of impact or potential risk an activity poses, we first must know where and when that activity is taking place. For many ‘static’ actions, this information is relatively simple to obtain and characterise, but this is not true for all uses, especially ‘mobile’ activities. For example, vessel activity is highly mobile, and so understanding the potential risk posed in space and time can be challenging. This is, in part, because the vessel tracking system known as ‘Automatic Identification System’ (AIS) is only legally required to be broadcast by vessels over a certain tonnage or length, working commercially, or carrying a certain number of passengers. This means that without targeted data collection there is only a limited understanding of the presence and distribution of non-AIS vessels, such as small fishing boats, recreational vessels, and jet skis, despite non-AIS vessels constituting a significant portion of maritime traffic. This has important conservation management and policy implications, as these types of (more commonly non-AIS) vessel are associated with several potential impacts to marine wildlife, including underwater noise exposure, strike, and behavioural disturbance.

To address this, the Scottish Vessel Project is a collaborative initiative exploring several data collection approaches to build a more holistic overview of vessel traffic in coastal Scottish waters. The project utilises land-based watch data (through Whale and Dolphin Conservation’s (WDC) Shorewatch and the Orkney Marine Mammal Research Initiative), collects and analyses AIS and time-lapse camera data (in collaboration with FleetMon.com and ECCC), and explores the utility of ship noise models to predict minimum underwater noise contributions from AIS vessels in an urbanised waterway (in collaboration with FleetMon.com and Styles Group Acoustics). This project provides a fundamental step towards improving our understanding of the total volume/presence of vessels, and their potential associated impacts, in Scotland’s coastal seas. This understanding is imperative to provide managers and decision-makers the information to support the sustainable management of our coastal spaces.

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Assessing faunal diversity and status of European flat oyster beds through analysis of soundscapes, eDNA and visual surveys

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European flat oyster beds (EFOBs) improve water quality, increase overall biodiversity and store carbon [1,2]. Overfishing in the early 1900’s vastly reduced their numbers and extent, and today only trace populations remain[3]. Many native oyster restoration projects have recently been implemented across Europe, but time/cost effective methods for evaluating their ecological status are lacking. This PhD project will apply, develop, and compare different methods and metrics, i.e. soundscapes, environmental(e)DNA and visual surveys, for assessing diversity of fauna associated with EFOBs at varying states of development/recovery, as an indicator for ecosystem complexity and status. The first ever systematic EFOB soundscape recordings were generated in Scottish and Swedish remnant habitats (summer 2022), by deploying passive acoustic monitoring units over ~2 weeks (Sweden) and 6 weeks (Scotland). Soundscape recordings, to be analysed using e.g. machine learning, will be compared with eDNA results derived from water and sediment samples, and with visual biodiversity survey data. Forthcoming results will demonstrate whether the applied methods, individually or combined, can be used as time and cost-effective tools to adequately assess/monitor ecosystem complexity and status, and inform EFOB conservation and restoration efforts. This research is timely, given recent national and international emphasis on restoring degraded habitats.

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