Cumulative Effects Assessment

Understanding the influence of man-made structures in the marine environment

INSITE

Influence of man-made structures in the ecosystem

INSITE SUMMARY

The INSITE Programme was launched in 2014 as the first joint industry partnership between academia and oil and gas operators in the North Sea. The programme delivers focused research that provides the independent scientific evidence base to better understand the influence of man-made structures (MMS) on the North Sea ecosystem.

The programme is contributing to the current global scientific consensus on the ecological and environmental implications of deploying MMS in the sea at scale, leaving non-operational MMS in situ, or removing non-operational MMS. INSITE evidence supports the development of policy for this and nature-positive approaches to decommissioning that can underpin the attainment of good environmental status and other policy actions relating to the sustainable management of UK seas.

CONTRIBUTORS

This policy brief was prepared by Howell Marine Consulting (HMC) using evidence gathered by contributing scientists and policy leads, as presented in the 'INSITEs Into: Cumulative Effects Assessment' webinar:

Dr Antony Knights
(DREAMS & Synthesis Projects)
University of Plymouth
E: antony.knights@plymouth.ac.uk
And affiliated partners: Anaëlle Lemasson, Paul Somerfield and many others.

Dr Eoin O'Gorman and Zelin Chen
(FuECoMMS Project)
University of Essex
E: e.ogorman@essex.ac.uk
And affiliated partners: Bill Austin, Tom Cameron, Elena Couce, Clive Fox, Clement Garcia, Natalie Hicks, John Howe, Kerry l'Anson, Tiziana Luisetti, Chris Lynam, Roi Martinez, Boyd McKew, Ruth Parker, David Paterson, Torben Lund Skovus, Murray Thompson, Corinne Whitby, and Tom Wilding.

Dr Edward Willsteed
Howell Marine Consulting
E: ed@howellmarine.co.uk

Dr Aisling Lannin
Marine Management Organisation (MMO), Evidence Team
E: aisling.lannin@marinemanagement.org.uk

The content was prepared by Georgina Roberts and edited by Professor Dickon Howell, Dr Henk van Rein, Hayley Hinchen, and Kimberley Lloyd (HMC) (info@insitenorthsea.org), with support and guidance from Daniel Wood and Adrian Judd, Centre for Environment, Fisheries and Aquaculture Science (Cefas).

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Front cover Illustration credit: Katie Chappell

SYNOPSIS

This document summarises the key findings from the "INSITEs Into Cumulative Effects Assessments" webinar held on July 6th, 2023. The evidence presented demonstrates that MMS create multiple pressures and effects.

The FuECoMMS project determines that decommissioning may mitigate negative effects on benthic food webs and reduce the loss of species richness near structures. The Synthesis project reveals that repurposing or abandoning individual or multiple structures in place could contribute most strongly to most of the 35 environmental targets and aspirations identified by the United Nations and OSPAR. However, to adopt this practice would require a fundamental shift in approach to current policy; one which could lead to the disposal of 1000s of structures at sea.

The scientific consensus on the effects of MMS and the different decommissioning options, reveals a diversity of effects and ecological outcomes that are considered positive (desirable) and negative (undesirable) from an environmental, ethical, and societal standpoint. Choice of decommissioning option(s) requires policymakers and managers to prioritise some targets over others, or when considering a holistic approach, to accept that some targets will likely not be met.

INTRODUCTION

Cumulative Effects Assessments (CEA) should systematically identify and evaluate the significance of effects from multiple human activities and pressures, to inform the design of planning and management measures. However, decision-makers and scientists remain uncertain about how best to do so.

From a plan-led decision-making perspective, there should be some discussion of project-level CEA, as well as the role CEA could play in integrating economic, social, and environmental considerations. Efforts are underway with, for example, the Marine Management Organisation (MMO) with dedicated resources to better manage cumulative effects, and Cefas to develop a CEA methodology, which applies the ecosystem approach to support decision-making. But higher-level challenges remain. There is a need to discuss where CEAs sit within the context of achieving distinct but related, and sometimes competing policy objectives and the scale of application, e.g., project, plan, and strategic level. This includes energy security, climate change, nature protection and recovery, and how to enable interdisciplinary approaches to address broad-reaching cumulative effects questions. This policy brief explores some implications of the increasing complexity and the scale of CEA in the North Sea. It examines how INSITE science can build an understanding of multiple ecological effects of MMS, desirable and undesirable, for consideration in cumulative assessment approaches.

Marine Spatial Planning (MSP): defining priorities and directions for future marine use development, guiding sustainable use of marine resources, and supporting marine users and decision-makers to form a plan-led system for marine activities. MSPs will provide for greater coherence in policy and a forward-looking and proactive approach to the activities and interactions that take place within the marine area and its resources. *For decisions to be made on what activities should go ahead in certain areas but not in others, and where 'knock-on' effects may occur for other resource users, there is a need to understand the impact MMS will have e.g., effects on biodiversity and fish stocks when considering offshore wind commissioning and fisheries. This includes shifts in community types, potential increases in biomass and changes in predator-prey interactions.* MSP will help to maximise adherence to plan-led proposals, identify opportunities for compatible uses and minimise potential conflicts. Policies underpinning marine planning include the Marine and Coastal Access Act 2009, the UK Marine Policy Statement (MPS) and the National Planning Policy Framework (NPPF).'

Cumulative Effects Assessment (CEA): is defined by the OSPAR Commission as a systematic procedure for identifying and evaluating the significance of effects from multiple human activities. It should estimate the expected impact to inform management decisions. *Analysis of the causes, pathways of exposure and consequences of effects on the ecosystem is an essential and integral part of the process. The INSITE program can support CEAs by providing evidence to inform CEAs. Identifying and mitigating cumulative effects also helps to fulfil wider policy and plans including Marine Spatial Prioritisation (MSPri), the British Energy Security Strategy (BESS) and Marine Protected Area (MPA) management targets under the UK Marine Strategy.*

INSITE PROJECTS

PROJECT 1 & 2

Synthesis
Synthesis (2022-2024)

(HIGH CERTAINTY)

Engaged expert scientific opinion and judgement from ~40 scientists, four continents and 28 different academic and government institutions to assess what the different pressures and effects of MMS might be. It is also developing an evidence base that informs on the ecological and environmental implications of deploying, leaving, or removing MMS at scale.

Decommissioning Relative Effects of Alternative Management Strategies (DREAMS) (2019-2024)

(HIGH CERTAINTY)

Conducted a comprehensive meta-analysis of global evidence on the impact of MMS decommissioning on the structure, functioning and dynamics of marine ecosystems and incorporated this into a model to help forecast ecosystem services and understand impacts to assist in policy decision making and ensure ecosystem-based management approaches are taken.

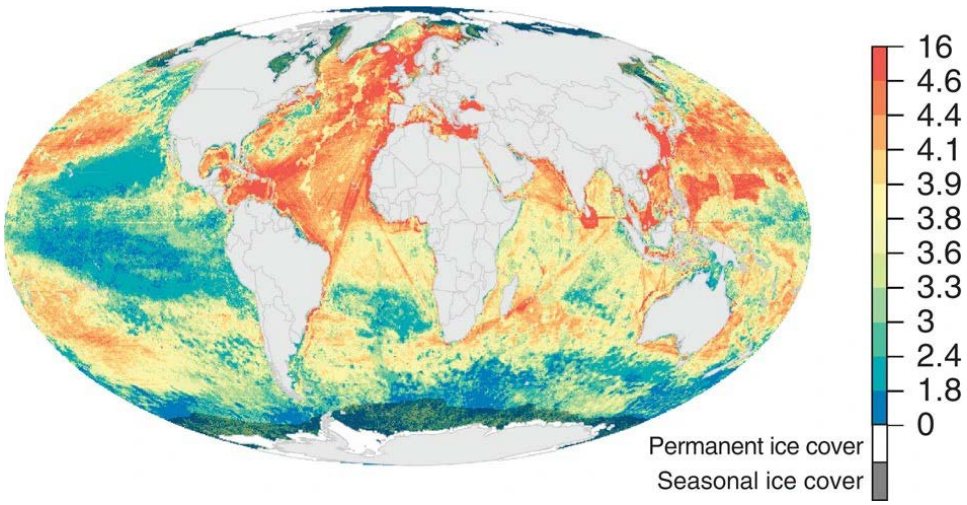
Additional evidence: *the ORIES (Offshore Renewable Impacts on Ecosystem Services) Decision Support Tool is being developed, which is Excel-web based and builds on the DREAMS/Synthesis work to identify the impacts of offshore wind on ecosystem services. It is set to be completed in* ***October 2023*** *and hopes to fill some of the necessary criteria for developers to make the best decisions in the marine space.*

KEY SCIENTIFIC FINDINGS

A wide range of impacts, both negative and positive, severe and benign, are identified through the integrated synthesis of expert opinion. **In terms of costs and benefits related to the effects of MMS, enhanced primary productivity (through increased connectivity and food) is considered potentially beneficial and desirable, whereas noise and light are undesirable and considered costs.** Other costs include pollution, disturbance, habitat loss and assisted dispersal of non-native species due to the increased connectivity between MMS (links with the CHASANs[1] project findings).

The effects of structures being left in place could be beneficial to the environment, but this viewpoint very much depends on how the system is managed; i.e., if management is focused on biodiversity maintenance, net gain and provision of habitat, MMS produce these desirable effects.

Image credit: Halpern B.S. et al., 2015. Cumulative impacts to marine ecosystems as of 2013. Impact scores based on 19 stressors.



[1] Connectivity of Hard Substrate Assemblages in the North Sea

INSITE PROJECTS

PROJECT 3

Functionality and Ecological Connectivity of Man-made Structures (FuECoMMS) (2019-2024)

(HIGH CERTAINTY)

Helps to fill knowledge gaps and identify the effects of MMS on key marine ecosystem processes and the implications or benefits they have if left in place.

The project includes fieldwork to sample around MMS to measure the changes in carbon storage and biodiversity within the sediments helping to inform on achieving wider policy objectives through food web based assessments.

KEY SCIENTIFIC FINDINGS

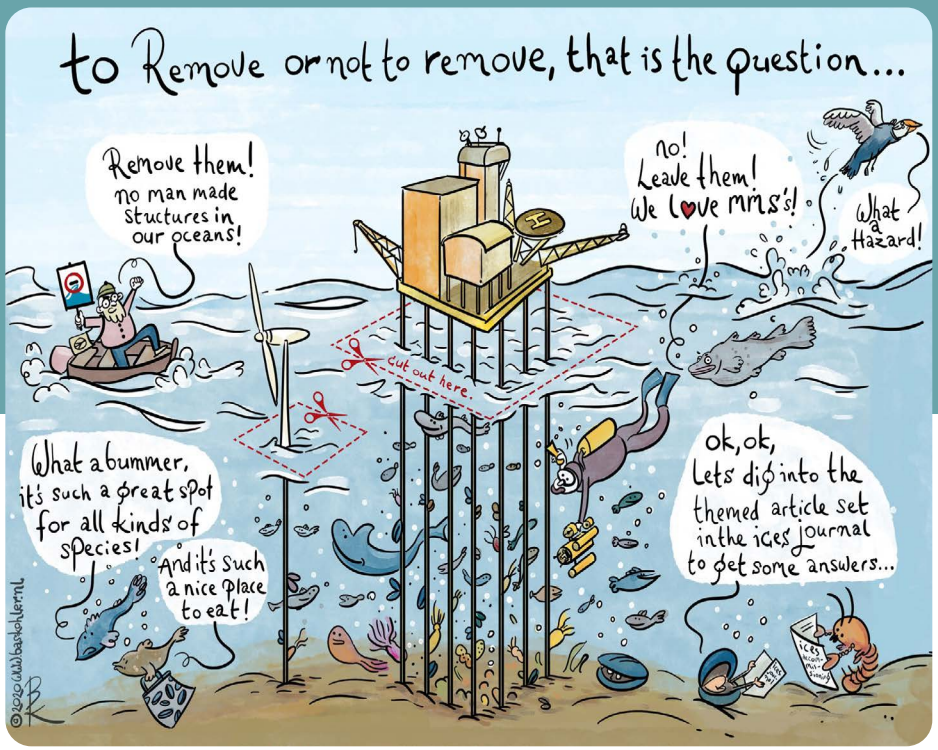
FuECoMMS conducted benthic food web assessments around oil and gas structures within impact (<500 metres), buffer (500-1500 metres) and control (1500-5000 metres) zones. These zones were determined by comparing the total concentrations of hydrocarbons found within the sediment before and after the MMS start to produce oil. For example, after oil production starts hydrocarbon levels increase overall but follow a decreasing trend out to a 500 metre radius from the structures. Where the buffer zone starts at 500 metres, small increases in hydrocarbon concentrations occur again before levelling out in the control zone at 1500 metres albeit however at slightly elevated levels compared to the same area pre-commissioning.

The impact zone showed several effects not observed in the buffer and control zones:

- **higher concentrations of hydrocarbon compounds and different heavy metals within the impact zone;**
- **chemical changes in the sediment led to decreases in benthic invertebrates irrespective of the species (reduced species richness and evenness) and decreases in average body mass;**
- **mean trophic level decreased within the food web, indicating shorter food chains, due to the loss of larger predatory organisms.**

Such effects on local benthic food webs will affect local ecosystem health and productivity, important when considering cumulative effects across the entire ecosystem.

Image credit: Bas Kohler



FuECoMMS will be conducting further research to tackle important questions such as whether full removal causes the same effects and how long it takes to alleviate these effects. For example: What is the response of fish communities and their diets to these chemical pressures?

POLICY CONTRIBUTIONS

POLICY 1

British Energy Security Strategy (BESS)

INSITE research findings can support the sector-wide overhaul of strategic monitoring, facilitating the standardisation of techniques and data collection for offshore energy installations. INSITE can also contribute to impactful strategic compensation initiatives, and highlight areas for consideration of cumulative effects, supporting smarter strategic planning at a sectoral and marine planning level.

POLICY CONTRIBUTION

FuECoMMS (HIGH CERTAINTY)

Project results contribute to understanding the impacts of construction activities on food webs. **The research outcomes provide evidence that stresses the need to preserve essential ecosystem functions that underpin food-web stability when devising strategic compensation measures to mitigate and resolve cumulative food-web impacts.**

By understanding changes in predator-prey dynamics, a more comprehensive Environmental Impact Assessment (EIA) can be achieved. These findings provide insights into potential shifts in trophic interactions, species composition, and overall ecosystem functioning, which are essential for assessing long-term ecological implications. *Policymakers can leverage this information to ensure effective alignment with BESS objectives through informed decision-making on offshore structure location, design, and mitigation measures. This approach can be used to anticipate possible benthic effects with offshore wind development.*

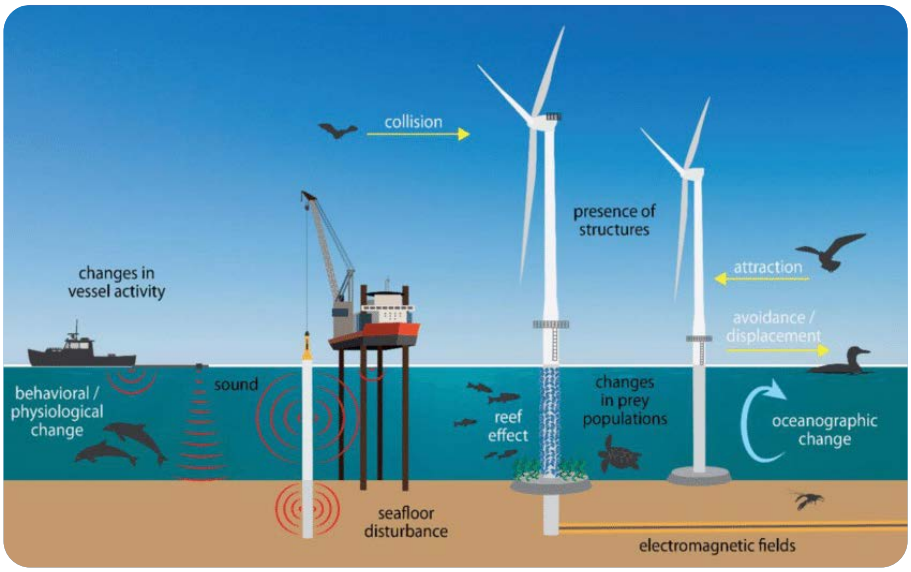
Image credit: Gulka J. et al., 2022. Potential stressors (black labels) and effects (white labels) of offshore wind energy development on wildlife.

POLICY CONTRIBUTION

SYNTHESIS AND DREAMS (HIGH CERTAINTY)

The projects show that there are both desirable and undesirable environmental effects associated with MMS. For example, Synthesis findings highlight the potential of MMS to enhance biodiversity and restore populations as desirable effects while local pollution and disturbance are undesirable environmental effects. **Weighing up this evidence appropriately can support various initiatives, e.g., Marine Net Gain (MNG), impactful strategic compensation, local recovery to Good Environmental Status (GES) Whilst also also ensuring the UKs energy security.**

Furthermore, **Synthesis and DREAMS evidence on various MMS effects can better align BESS with OSPAR's goals and international commitments while addressing data gaps and policy ambitions around decommissioning.** For example, MMS that are left in place have the potential to contribute to environmental benefits such as Ecosystems as the areas in question cannot be utilised for other resource extraction or activity. *Note that it is crucial to also understand what political factors need to be considered alongside the conservation of essential ecological functions when decommissioning. fisheries management.*



POLICY CONTRIBUTIONS

POLICY 2

Marine Spatial Prioritisation (MSPri)

Defra's MSPri Programme, aims to optimise marine space use, maximise coexistence between different sea users and prioritise sea usage where coexistence is not possible. INSITE research contributes to a better understanding of desirable and undesirable effects of MMS. This understanding can be used to support CEA and trade-off scenarios. This can be used to maximise returns from the altered environment, via ecosystem services, as well as design strategic compensation or mitigation measures, and target activities that better meet policy ambitions.

POLICY CONTRIBUTION

FuECoMMS (HIGH CERTAINTY)

Data from the surveys around and adjacent to MMS will be used to inform of potential ecosystem changes and wider impacts during operation and post-decommissioning in the North Sea. **Knowing this information and being able to predict future food web impacts make it possible to pinpoint areas where the presence of offshore structures may alter ecosystems and on what temporal scale. This knowledge will aid Marine Planning and MSPri goals.** This information can also guide the implementation of strategic compensation measures, MPA and fisheries management strategies. *The ongoing work within this project aims to look at impacts on the wider fish populations that inhabit these MMS systems and therefore can also be used to inform on the health of fish stocks and fisheries management strategies.*

POLICY CONTRIBUTION

SYNTHESIS AND DREAMS (HIGH CERTAINTY)

The evidence shows desirable effects of MMS, such as biodiversity enhancement and the formation of OECMs around MMS, and undesirable effects such as the loss of sedimentary habitats and increase in various forms of pollution around MMS. This underlying evidence leads to a better understanding of the cumulative effect of MMS at different scales, from local to regional to national. **When used to inform decision making, such as in Marine Planning and MSPri, the multifactor, cumulative assessment approach taken in the Synthesis project leads to broader understanding of potential benefits and losses associated with MMS to different sectors and policies when considering trade-offs.** If considering decommissioning decisions for example, the numerous biodiversity-related benefits provided by MMS support policy areas such as MNG, nature restoration and sustainable energy security, which suggests there is value in considering case-by-case assessments that take in a wider variety of factors.

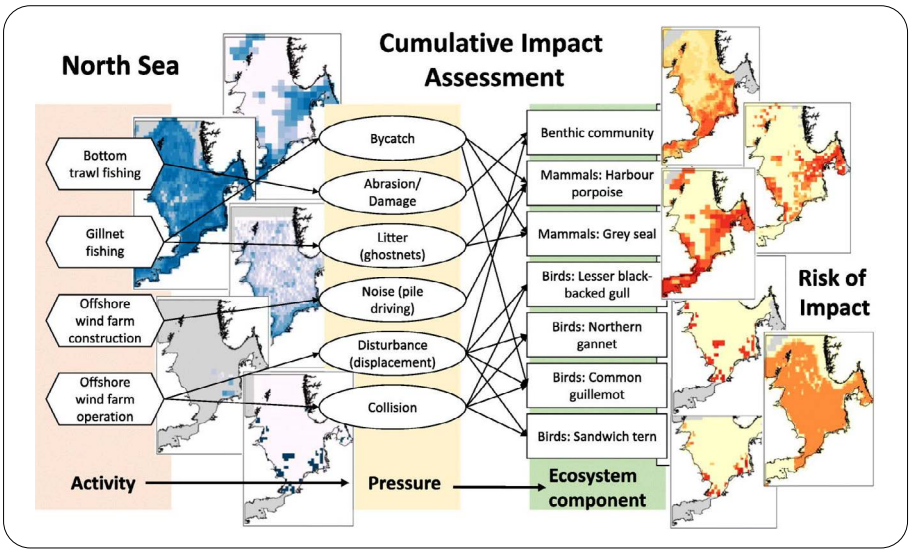


Image credit: Piet G.J et al., 2021. A roadmap towards quantitative cumulative impact assessments in the North Sea.

STEPS TO ENABLE CEA TO BECOME A USEFUL TOOL

Need for a cohesive assessment framework

Quantifying and managing the cumulative effects of human activities on marine environments is among the foremost challenges in enabling sustainable development in the twenty-first century. Adequate consideration of the complexity and scales relevant to receptors are inherent to good CEA. There are ongoing initiatives internationally (Symphony) and within the U.K. (Cefas work on CEA in each of the OSPAR Quality Status Report Thematic Assessments, Defras Natural Capital and Ecosystem Assessment (NCEA) Programme, MSPri, The Crown Estate's Whole of Seabed Programme, OWEC and ECOWind) in which CEA are being taken forward. **Scientific progress is also advancing evidence gathering, such as in INSITE. Currently EIA/CEA is very much focused on projects e.g. an OWF or perhaps a small group/ site of MMS. To make sense of complexity focus needs to be shifted to assessing impacts on ecological functions and natural resources. An approach is needed that considers the impacts of an activity rather than individual sites at a scale that is ecologically relevant which requires a cohesive framework.** The current challenge lies in fragmented policies, necessitating improved utilisation of existing information and using risk-based approaches to permit progress while there are evidence gaps. **To improve alignment across policy and political and ecological scales, the system for assessing cumulative effects and using the outputs of those assessments needs to evolve to specifically focus on delivering complementary, cohesive marine and coastal policies** *(as below).*

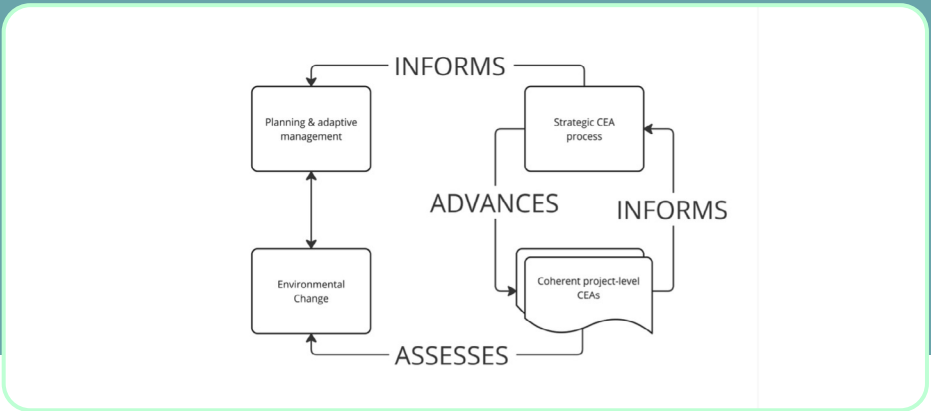


Image credit Dr. E. Willsteed (HMC)

Need to repurpose existing assessment approaches

To enable consideration of multiple receptors and variables, we need an assessment system with sufficient funding that can make use of multiple compatible data sets, covering appropriate spatial scales.

It should also be able to overcome the problem of shifting baselines, along with a strategic perspective that is independent of one activity. *Regional strategic approaches are essential, to determine the significance of project impacts as well as policies and plans. There is great value in high-resolution assessments such as those provided by EIAs, but EIAs should be repurposed to be CEA that feed into a strategic assessment process (e.g., SEAs and EORs[2]).* ***There is a need for a system that is allied to adaptive management where increasing knowledge and capacity supports policymakers and delivery partners to incrementally improve how cumulative effects are assessed and managed. While there are many scientific knowledge gaps, the biggest task is better alignment of political and ecological scales.***

For example, *Scotland's Sectoral Marine Plan for Offshore Wind Energy*: a key part of the implementation of this plan includes the application of an Iterative Plan Review (IPR) process that allows for new evidence through, for example, EIAs, scientific research and/or monitoring programmes to be considered and incorporated into the plan where appropriate. To support this process, the Scottish Government have commissioned the Centre for Ecology and Hydrology (CEH) to develop a tool for the assessment of cumulative effects for key receptors.

[2] Strategic Environmental Assessments and Environmental Outcomes Reports