Marine Biodiversity

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 to deliver focused research to provide the independent scientific evidence base to better understand the influence of man-made structures (MMS) on the North Sea ecosystem.

Building on the existing evidence base under INSITE I and II, and other relevant global studies, the programme has been developing an understanding of 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. Evidence gathered through INSITE supports the development of high-level policy 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.

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SYNOPSIS

This policy briefing summarises the key findings from the 'INSITEs Into: Marine Biodiversity' webinar held as part of the INSITE programme on the 15th of February 2023.

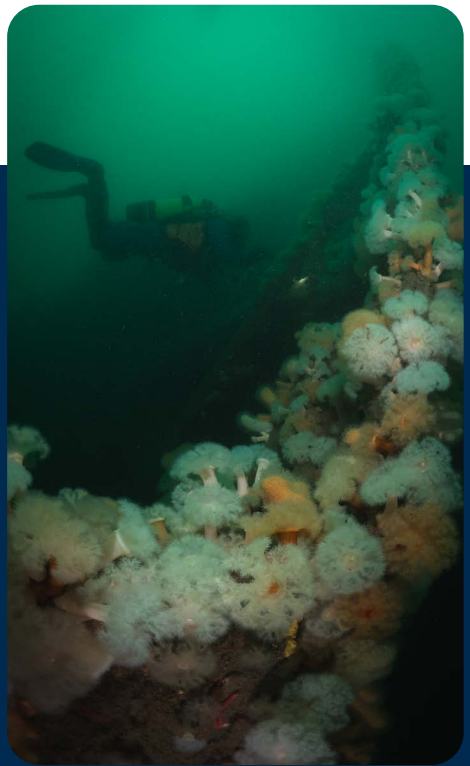
The webinar featured several INSITE projects, including DREAMS, Synthesis, CHASANS and NS3D, which contribute to the scientific evidence base that underpins decommissioning decisions and current biodiversity policy objectives. One notable consensus emerging from the INSITE projects is the recognition that the complete decommissioning and removal of MMS has a negative impact on ecosystem services and biodiversity. From an environmental targets perspective the scientific consensus is that it is beneficial to consider options such as partial removal or leaving structures in place, as these structures can support biodiversity and restoration.

INTRODUCTION

The North Sea, once characterised by extensive shellfish reefs and diverse marine life, has undergone significant transformations over time. Presently, the region is dominated by vast sedimentary areas interspersed with numerous artificial structures.

These changes have led to the removal and fragmentation of crucial habitats, leading to both biodiversity declines and gains. MMS can often be considered as artificial reef communities which deliver ecosystem services, including water filtration, carbon sequestration and fisheries. Although the colonisation by marine life of structures has been extensively studied at local scales, the understanding of the role played by artificial reefs in regional processes and ecosystems remains limited. The increase of MMS in marine ecosystems has the potential to cause profound effects on ecosystem processes, including plankton consumption and production, as well as the spatial distribution of fish, mammals, and birds. Consequently, the interpretation of results may be considered beneficial or detrimental based on the framing of policy objectives. Thus, it is crucial to conduct rigorous scientific studies to understand the potential ecological impacts to inform decision-making processes. This policy briefing aims to explore the intersection of INSITE science, marine biodiversity and policy objectives. By examining where INSITE science can support policy work, particularly concerning marine biodiversity and related goals such as Marine Net Gain (MNG), we can enhance our understanding of the potential ecological implications and provide valuable insights for more effective decision-making.

Image credit Dr Joseph Marlow



Marine Biodiversity: Encompasses the structural taxonomic elements such as species/habitats richness and diversity, the functionality of ecosystems including processes and production, as well as interconnections of the food web, capturing the diversity of energy flow pathways. *This policy briefing can inform key biodiversity policies including marine conservation strategies for Marine Protected Area (MPA), achieving Good Environmental Status (GES) under the UK Marine Strategy and balancing energy security goals, and marine conservation under the British Energy Security Strategy (BESS).*

Marine Net Gain: an approach to development that aims to leave the natural environment in a measurably better state than beforehand. This means protecting, creating or restoring environmental features that are of greater ecological value to wildlife, habitat and people than any losses associated with the original project. *This policy briefing informs important aspects of MNG policies, such as natural recovery, ecosystem restoration, Marine Spatial Prioritisation (MSPri), MPA networking, and evidence-based recommendations for implementing MNG measures that contribute to resilience, sustainability and ecosystem objectives.*

INSITE

INSITE PROJECTS

PROJECT 1

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

An evidence map and ecosystem service effects study with comprehensive meta-analysis of global evidence on the impact of MMS decommissioning. State-of-the-art ecosystem models to forecast ecosystem states and estimate goods and services have been produced, along with associated trade-offs across spatial and temporal scales, derived from different decommissioning strategies.

PROJECT 2

Synthesis (2022-2024)

40 global scientific experts shared their knowledge and built a scientific consensus on the ecological implications of the presence of MMS, and the ability of various decommissioning options.

PROJECT 3

Connectivity of Hard Substrate Assemblages in the North Sea (CHASANS) (2019-2024)

Image credit Prof Joanne Porter, Heriot-Watt University

Biologically realistic models of larval connectivity to predict how networks of hard substrate in the North Sea function as part of the dispersal and metapopulation structure of marine epifauna.

PROJECT 4

North Sea 3D - Automated marine growth identification and biomass estimation (NS3D) (2019-2024)

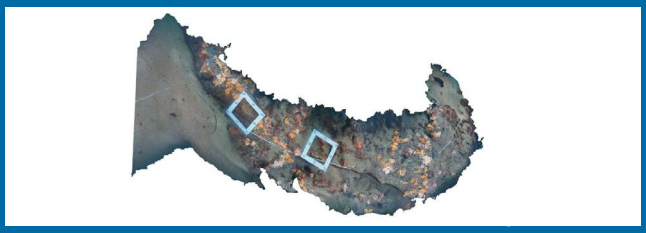


Image credit North Sea 3D and the Scottish Association of Marine Science (SAMS)

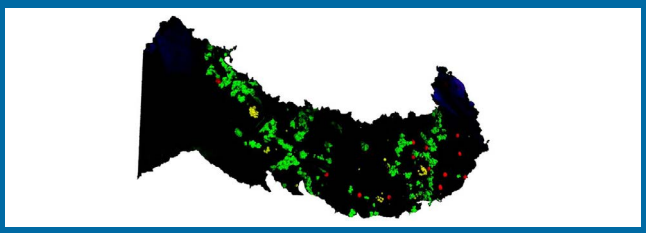


Image credit North Sea 3D and the Scottish Association of Marine Science (SAMS)

3D imaging enables more precise predictions of biological mass and drag on MMS, supporting ecosystem-scale assessments of the consequences of installing and removing structures at local, regional, and global levels. Accurate mass estimates can also inform removal strategies, vessel procedures, and cleaning regimes, minimising disruption to energy generation and the marine environment.

KEY MESSAGES AND POLICY CONTRIBUTIONS

Understanding the influence of MMS on marine biodiversity is highly relevant to Government's marine evidence and policy objectives, the Environmental Improvement Plan, the 25-Year Environment Plan, as well as the UK Biodiversity Action Plan.

The evidence gathered through this research supports the development of high-level policy approaches and nature-positive approaches to decommissioning, including the Marine Management Organisation (MMO) strategic plan, attainment of GES, MSPri, and effective marine licensing procedures. Thus, this research holds the potential to add value across several policy areas, including:

POLICY 1

UK Marine Strategy

The research provides evidence to assist in assessing GES, decommissioning decisions and support the design of nature-focused approaches that prioritise intentional biodiversity gains.

KEY MESSAGE 1

DREAMS

The DREAMS results provide a robust understanding of potential trade-offs associated with different decommissioning and management strategies. This can inform the prioritisation of research efforts and provide a more **comprehensive understanding of the quantification of the impacts of decommissioning on ecosystem structure, function, and services.**

KEY MESSAGE 2

SYNTHESIS

The INSITE Synthesis project has formed a scientific consensus that provides a solid foundation and shared understanding of the **potential benefits of partial removal and incorporating protective structures to improve biodiversity and ecosystem service provision,** supporting the development of effective decommissioning strategies.

KEY MESSAGE 3

CHASANS

The CHASANS models on larval connectivity between hard substrata populations will assist decision-makers by **determining whether retaining specific MMS will be beneficial for biodiversity while considering the best options for ecosystem restoration.** Access to connectivity patterns based on future climate-driven scenarios can provide evidence on **population viability for species of commercial/ conservation interest that can support the assessment of GES, MPA network guidance and sustainable management** of bio-resources and fisheries management.

KEY MESSAGE 4

NS3D

The Regional estimates made by NS3D modelling of **epibiota secondary production and biomass associated with platforms can better inform biodiversity monitoring programmes and assessments of GES.**

Working example of ecosystem service (from the DREAMS project)
Watson et al., (2023) 'The global impact of offshore wind farms on biodiversity and ecosystem services'. *(in review)*

POLICY 2

British Energy Security Strategy

The research can contribute to strategic compensation efforts, standardisation of monitoring methods, optimal use of data, and alignment to deliver energy security while maximising marine biodiversity.

KEY MESSAGE 1

DREAMS
The DREAMS results bolsters the evidence base essential for policymakers to **assess the potential trade-offs between energy security and ecological considerations.** The research findings can also **inform strategic compensation efforts** by identifying the potential impacts of decommissioning MMS on marine ecosystems.

KEY MESSAGE 2

SYNTHESIS
The INSITE Synthesis project has formed **scientific consensus that no removal or partial removal of MMS produces outcomes that better align with OSPAR's strategic objectives.** Such information can be used to also align with BESS delivery with OSPAR's goals and broader international commitments.

KEY MESSAGE 3

CHASANS
The CHASANS **larval connectivity models provide crucial biodiversity data** that can be incorporated into decommissioning processes to assist the transition to a net-zero future. The results can be **used to examine the potential benefits for ecosystem service restoration, fisheries and carbon-sequestrating habitats.** This information is valuable for strategic compensation measures, as it offers insights into how compensation efforts can be directed to maximise biodiversity gains.

KEY MESSAGE 4

NS3D
NS3D modelling can serve as an **evidence base to support Environmental Impact Assessments (EIA), which could support the standardisation of EIA methods, and facilitate a fast, effective and transparent EIA process.** The results can inform best practices in decommissioning and contribute to reducing decommissioning costs, which aligns with the BESS goal of **achieving cost-effective energy infrastructure management.**

POLICY 3

Marine Net Gain

The research can complement MNG metrics that assign a value to ecosystem service and impacts, as well as assisted vs natural recovery by providing insights for intentional biodiversity gains, and the implementation of effective MNG aspirations.

KEY MESSAGE 1

DREAMS
DREAMS evaluates the impacts of MMS on biodiversity, abundance and biomass which can contribute to assessing MNG initiatives. However, DREAMS identifies that using MMS as artificial reefs may not deliver the scale or type of biodiversity required to achieve net gain, compared to purpose built reefs and natural ecosystems. The information from DREAMS explores different options and **can inform effective management strategies and guide efforts aimed at optimising ecosystem services and preserving biodiversity.**

KEY MESSAGE 2

SYNTHESIS
The INSITE Synthesis project findings emphasise a collective viewpoint from expert and personal knowledge of evidence to determine the overall effects of MMS on marine biodiversity. Such information will inform an **evidence-based, multi-criteria approach to explore trade-offs in MMS decommissioning decision-making** in order to identify suitable decommissioning options.

KEY MESSAGE 3

CHASANS
The CHASANS larval connectivity models provide valuable data on the diversity, distribution and connectivity of epifauna, which is beneficial for policymakers in **identifying opportunities for targeted restoration efforts in strategic locations to enhance biodiversity and provision of ecosystem services,** that reduce fragmentation and promote ecological coherence.

KEY MESSAGE 4

NS3D
The NS3D techniques provide valuable data and assessments to inform restoration efforts and enable the design of new infrastructure to be more 'nature-inclusive', while also monitoring progress towards achieving MNG aspirations. The results can support the **integration of environmental considerations into infrastructure design to achieve a net increase in biodiversity.**