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Influence of man-made structures in the ecosystem

The INSITE Programme: Describing the role of man-made structures in the ecosystem of the North Sea

London Protocol and London Convention Science Day , April 2021

Richard Heard
INSITE Programme Director

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North Sea Man-made Structures

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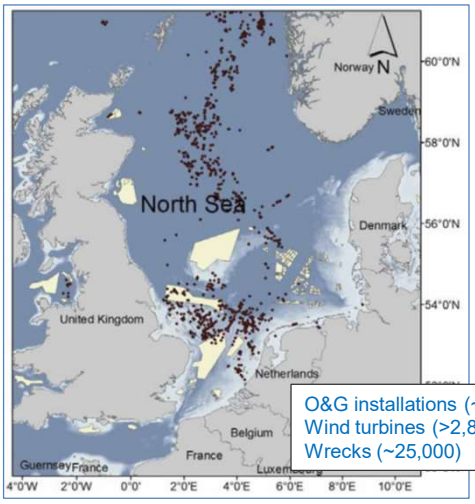

- Large number of artificial hard substrates on natural sandy and muddy bottoms
- Extend from the seafloor to the surface
- Fundamental fauna difference on hard and soft bottom substrates

Source: INSITE RECON

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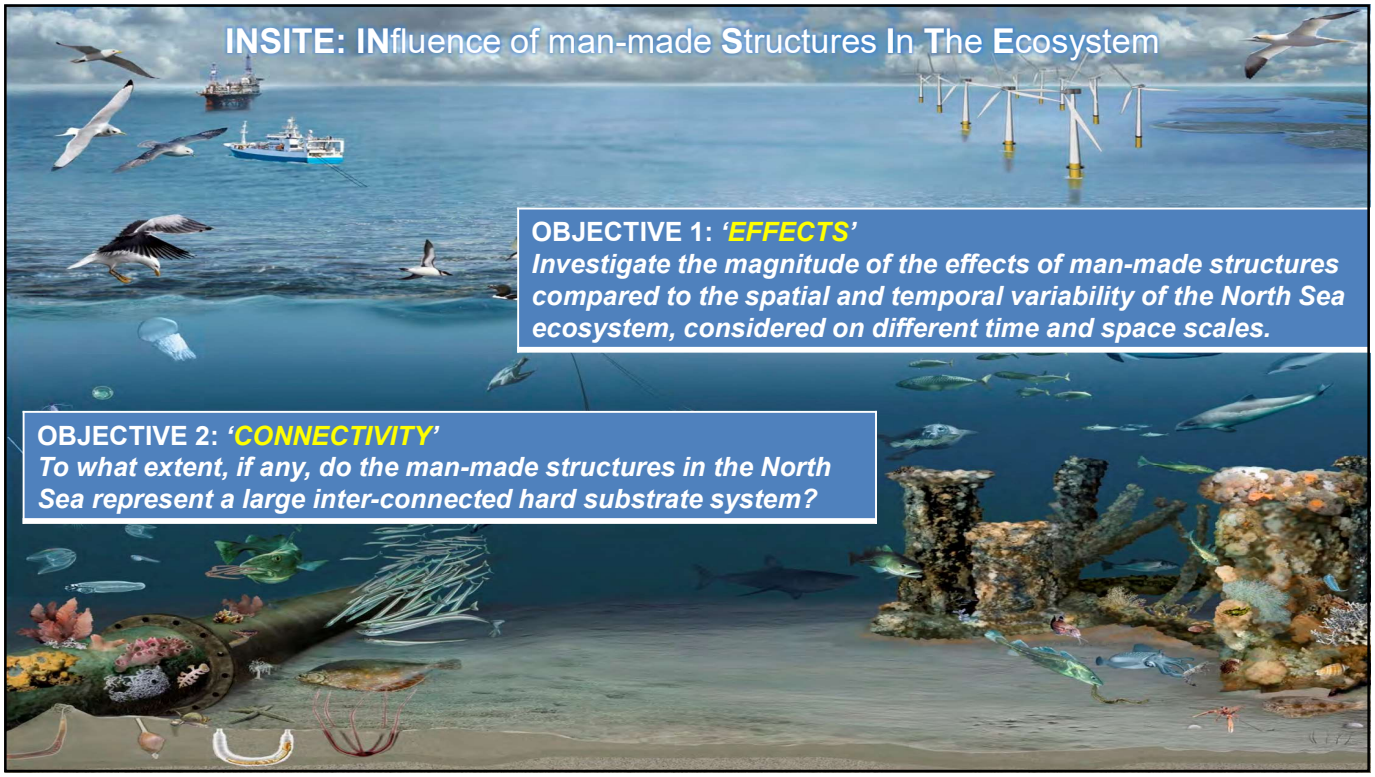

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INSITE Programme: 2014 to 2023

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INSITE Phase 1					INSITE Phase 2				
2014	2015	2016	2017	2018	2019	2020	2021	2022	2023

INSITE Phase 1

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INSITE Sponsors: £2.4Million
8 Research Projects
1 Data Project

Cefas, SAHFOS, NIOZ, Sea Mammal Research Unit, ANI, Heriot Watt University, Wageningen University & Research

INSITE Phase 2

INSITE, NERC Science of the Environment, Cefas20

NERC: £5.0Million
CEFAS: £600K
7 Research Projects
Synthesis Project

Sea Mammal Research Unit, University of Southampton, University of Aberdeen, University of Essex, Heriot Watt University, PML Plymouth Marine Laboratory, Cefas20, National Oceanography Centre, University of Strathclyde Glasgow, SAMS Scottish Association for Marine Science

INSITE Sponsors: £1.9Million
INSITE Interactive – Data Sharing Initiative
PhD Scholarship Programme (6-8 PhD's)

bp, centrica, Chevron, CNR International, ExxonMobil, MarathonOil, REPSOL SINOPEC, Shell, TAQA, TOTAL

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INSITE Phase 1: Research Projects vs Objectives

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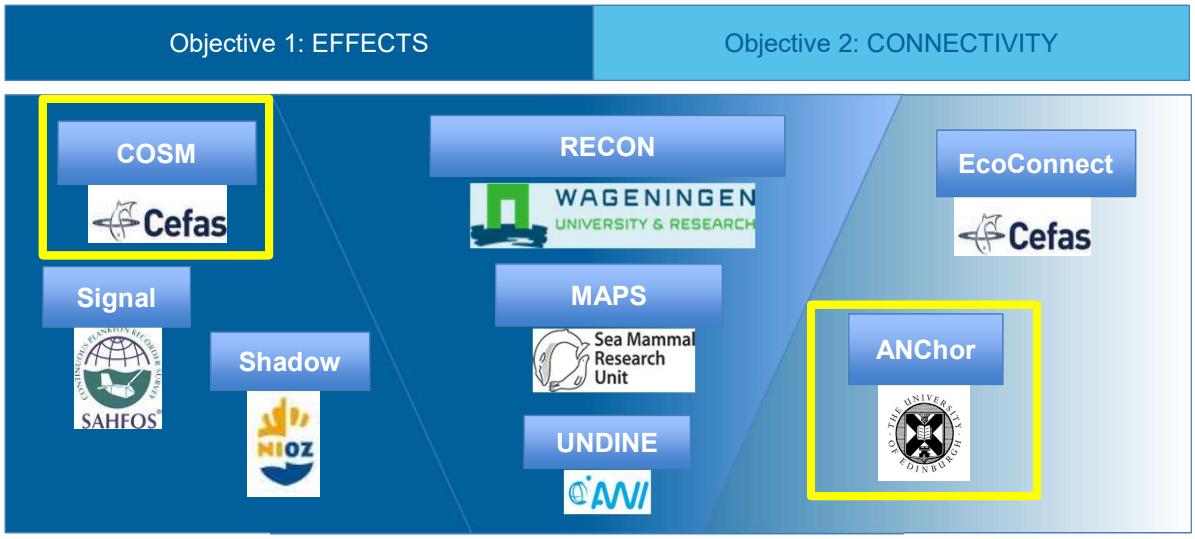

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INSITE Phase 1 Research Institutions

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University of the Highlands and Islands
rspb
BMT Cordah
HERIOT WATT UNIVERSITY
CEH Centre for Ecology & Hydrology
SAHFOS
National Oceanography Centre
NATURAL ENVIRONMENT RESEARCH COUNCIL

IRIS
Sea Mammal Research Unit
Cefas
NIOZ
Bureau Waardenburg bv
WAGENINGEN UNIVERSITY & RESEARCH
AWI
museum

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Influence of man-made structures in the ecosystem

*Co*upled Spatial *M*odelling (*COSM*) - food web effects due to structures and habitat change in the North Sea

Dr Christopher Lynam, CEFAS

Ecopath International Initiative (EII)

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COSM Objectives

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- Evaluate the habitat preferences of key functional groups of infauna (in the sediments), epifauna (on the sediments or structure) and fish
- Develop a state-of-the-art modelling tool "*Ecospace*" that links spatial data layers with temporal food-web dynamics
- Explore the role of man-made structures on the food web relative to natural variation and other pressures through scenarios

Ecopath International Initiative (EII)

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Artificial habitat

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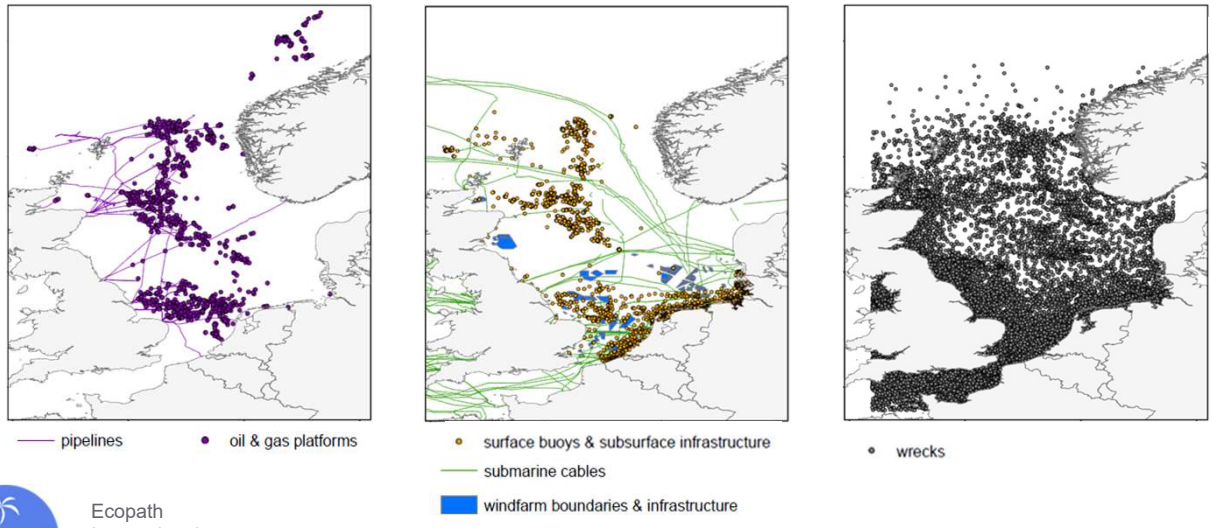

Ecopath International Initiative (EII)

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COSM Methodology

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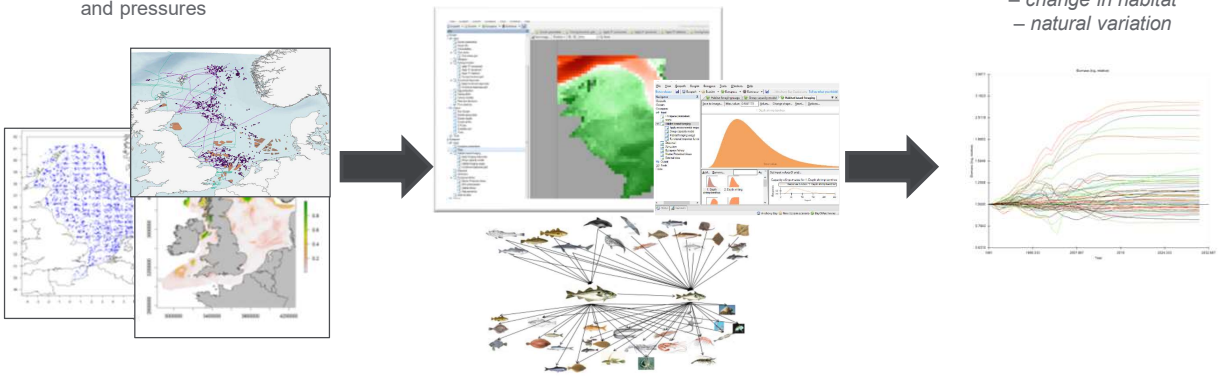
Habitat mapping
plus covariates
and pressures

Development of modelling tool
production at structures and
dispersal of mobile species

Simulation and Scenario testing
– change in habitat
– natural variation



Ecopath International Initiative (EII)

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COSM: Main findings

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- Model simulations indicate that man-made structures have an effect on the **local community composition** and these effects can **disperse** throughout the North Sea ecosystem mediated by interactions between species.
- The removal of oil and gas platforms and pipelines may ultimately contribute to **declines** in some groups (large crabs, sessile epifauna, skates, rays), but **increases** in others (small mobile epifauna, infaunal macrobenthos, sharks, flatfish and roundfish).

Ecopath International Initiative (EII)

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Influence of man-made structures in the ecosystem

ANChor:

Appraisal of network connectivity between North Sea oil and gas platforms

David Corne, Joe Ferris, Alan Fox, Lea-Anne Henry, Claudia Mayorga-Adame, Chris McCabe,
Faron McClellan, Jeff Polton, J. Murray Roberts

School of GeoSciences, University of Edinburgh, Edinburgh, UK
National Oceanography Centre, Liverpool, UK
BMT Cordah, Broadfold House, Bridge of Don, Aberdeen, UK
Heriot-Watt University, Edinburgh, UK

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ANCHor Project: Ocean sprawl facilitates dispersal and connectivity of protected species* (*Lophelia pertusa*)

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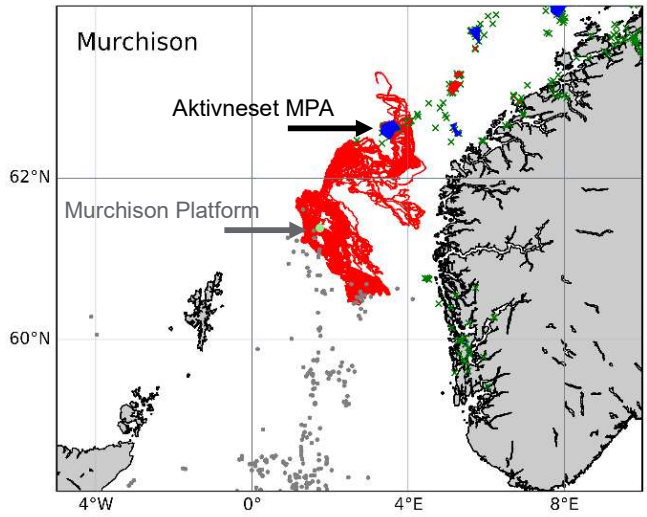

- *"… strong potential for oil and gas installations to have significant conservation significance to protected species."*
- *"Installations had the potential to form a highly inter-connected network of coral ecosystems that can enhance ecosystem resilience of natural populations."*

*Henry *et al*, 'Ocean sprawl facilitates dispersal and connectivity of protected species', published in Nature Scientific Reports, August 2018

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INSITE Phase 1 – Scientific Progress

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On the **effect** of structures:

- Detailed understanding of the composition and function of species on and around man-made structures
- Increased our understanding of the effect of structures on:
  - The abundance and diversity of key species
  - The distribution and behaviour of sea mammals and birds
  - Planktonic communities from pre-North Sea oil and gas until now

On the **connectivity** or *reef-effect* of man-made substrate:

- Modelling ecosystems to predict the effect of man-made structures (oil and gas, renewables and wrecks) on a range of species across the North Sea
- Enabling the prediction of ecological consequences of altering the network of structures

Project summaries and peer reviewed publication listing available on http://www.insitenorthsea.org

Cefas · SAHFOS · Bureau Waardenburg bv · Sea Mammal Research Unit · WAGENINGEN UNIVERSITY & RESEARCH · HERIOT WATT UNIVERSITY · AWI · NIOZ · IRIS · rspb · museum · BMT Cordah · National Oceanography Centre · CEH Centre for Ecology & Hydrology

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INSITE Programme: 2014 to 2023

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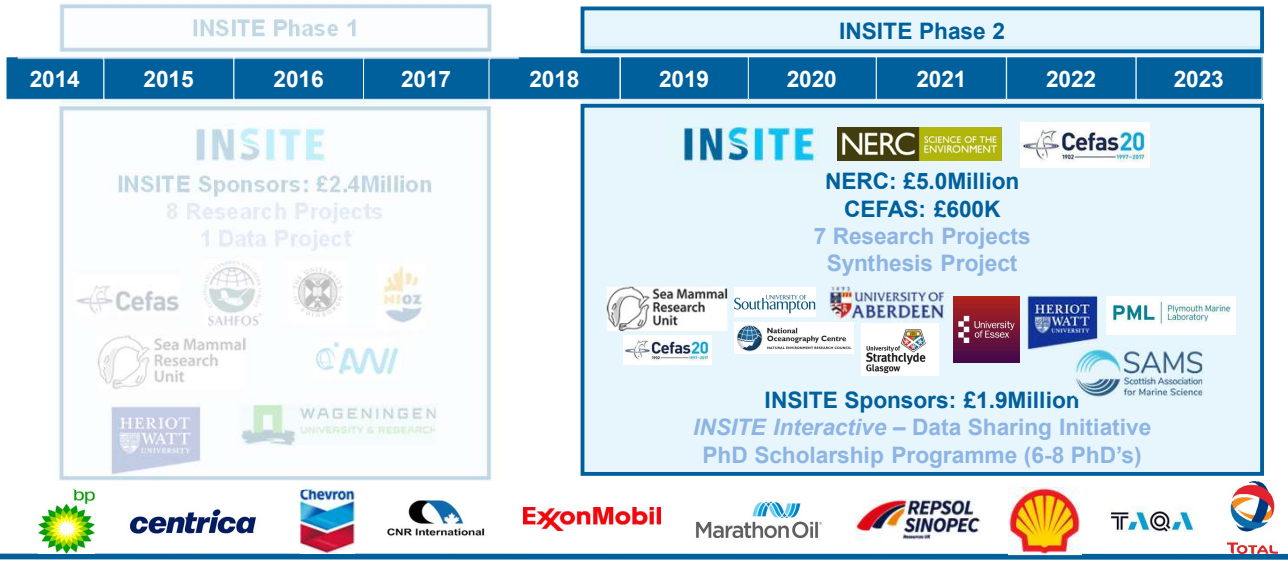

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INSITE NERC-Funded Programme: 2020-2023

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Principal Investigator	Project
Dr Debbie Russell St Andrews University	**EcoSTAR: Ecosystem level importance of Structures as Artificial Reefs** Improve our understanding of the importance of MMS as habitat for benthic communities such as mussels, anemones and starfish; measure how MMS influence the distribution and movement patterns of marine mammals in the North Sea
Dr Daniel Jones NOC	**Autonomous Techniques for anthropogenic Structure Ecological Assessment (ATSEA)** Carry out the first fully autonomous environmental monitoring of multiple man-made structures without the aid of a support vessel.
Prof. Paul Fernandes University of Aberdeen	**Aggregation, production and spillover: the cumulative effect of man-made offshore structures on fish** Analyse new and legacy acoustic data to estimate the density of fish as a function of distance to MMS and other covariates, and estimate abundance of fish at all MMS
Dr Natalie Hicks University of Essex	**Functionality and Ecological Connectivity of Man-Made Structures (FuECoMMS)** Determine how the removal or placement of MMS will affect marine biodiversity and ecosystem function (including services and economic value) of associated benthic habitats
Dr Paul Somerfield Plymouth Marine Lab	**Decommissioning - Relative Effects of Alternative Management Strategies (DREAMS)** To conduct comprehensive and systematic analyses of all available relevant information to understand the roles of installations in the sea, how these vary under decommissioning scenarios
Dr Joanne Porter, Heriot-Watt University	**Connectivity of Hard Substrate Assemblages in the North Sea (CHASANS)** What role does substrate type (i.e. natural vs artificial; historic vs recent) have on connectivity of epifaunal populations? How will network connectivity be altered by future changes including the removal or addition of artificial structures following decommissioning and/or installations?
Dr Thomas Wilding SAMS	**Application of novel 3D imaging techniques to quantify biomass and secondary production associated with North Sea artificial structures.** Model the relationship between ecosystem function and artificial structures within the North Sea according to structure type, location, depth, age and food supply.

Project summaries can be found on: https://www.insitenorthsea.org/projects/

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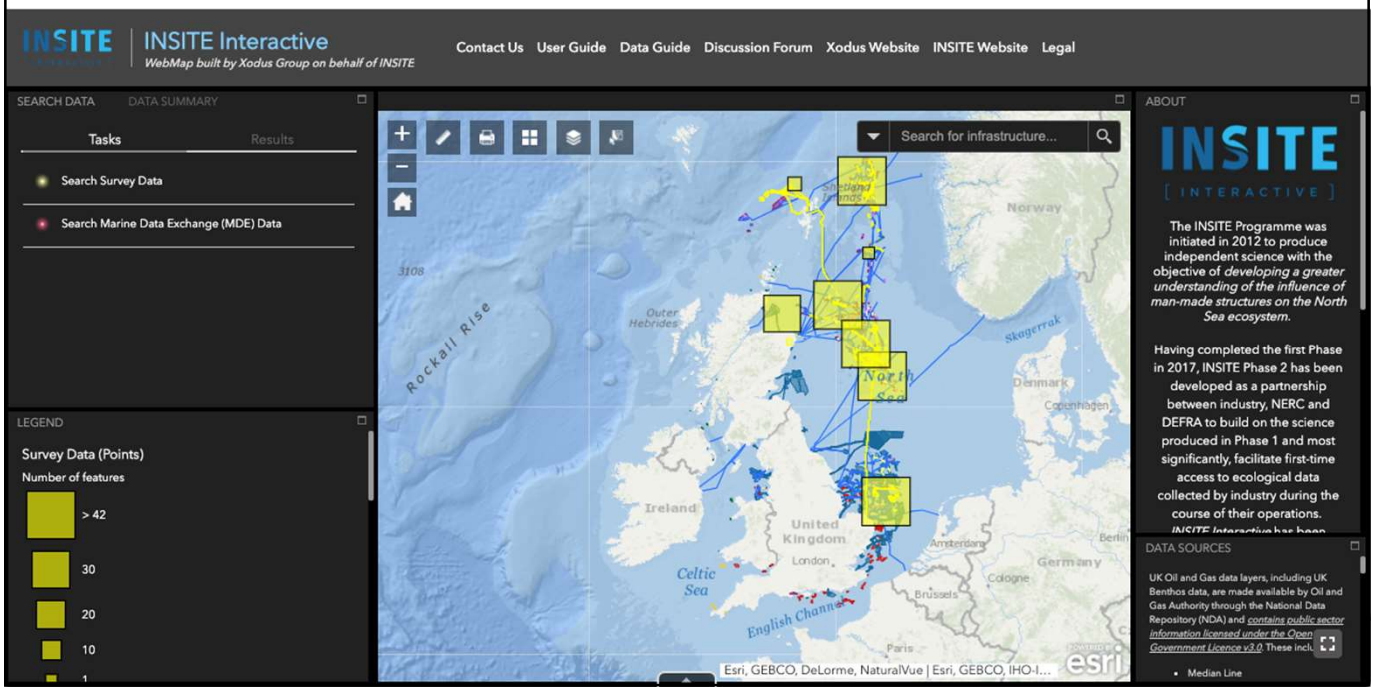
INSITE Interactive – The Data Sharing portal



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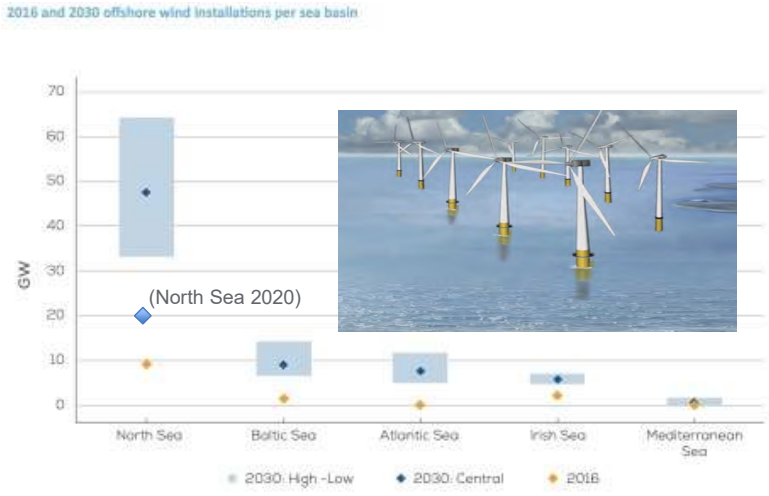
Offshore Wind Structures – Growth Scenarios to 2030



From: Wind Energy in Europe: Scenarios for 2030, Wind Europe 2017

- 2020 in Europe:
  - 116 Wind farms
  - 25GW total capacity (20GW in North Sea)
  - 5,402 turbines
- 2030 in Europe (forecasts)
  - Low: 49.5GW
  - Medium: 70.2GW
  - High: 98.9GW

From: Offshore Wind in Europe – Key trends and statistics 2020, Wind Europe

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Windfarm Planning/Construction – Southern North Sea

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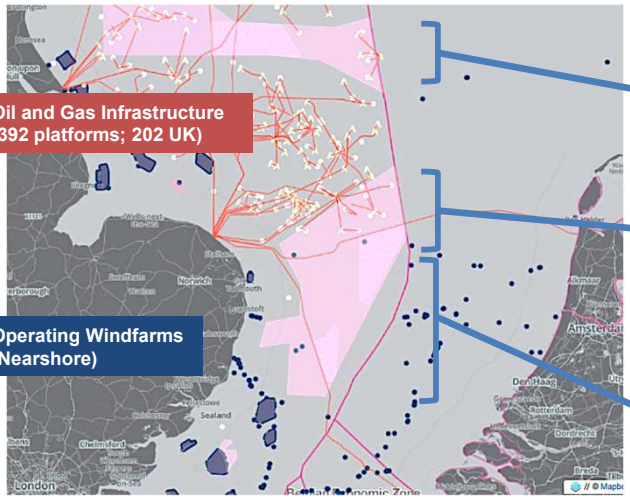

Hornsea	Orsted
One	174 x 7MW Turbines
Two	165 x 8MW Turbines
Three	Up to 231 Turbines
Four	112 x 8.9MW

Up to 682 Turbines

Norfolk	Vattenfall
Boreas	1800MW Capacity
Vanguard	120-257 x 7-15MW

East Anglia	Scottish Power Renewables
One	102 x 7MW Turbines
One North	Up to 67 Turbines
Two	Up to 72 Turbines
Three	100-120 Turbines

Up to 361 Turbines

Planned or 'Under Construction' Windfarms

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Global Environment Outlook, UNEP, 2019

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Executive summary

Biodiversity is a key component of a healthy planet with healthy people *(well established)*. Though evidence regarding the importance of biodiversity for economic output, health and security has grown significantly in the last two decades, it is certain that existing measures to conserve and sustainably manage biodiversity are inadequate {Box 13.1, Section 6.1, 13.1}.

Policy instruments working in silos are insufficient to stem biodiversity loss *(well established)*. Instead, multiple approaches that embrace a diversity of instruments and scales, including platforms for encouraging behaviour change, are vital {13.1, 13.2.3}.

The cost of inaction (societal and economic) for biodiversity conservation and restoration is extremely high, as biodiversity loss is largely irreversible *(established but incomplete)* {13.1, 13.2.1, 13.2.4}.

There is an urgent need to act now and strengthen policy responses for conserving biodiversity and invest in capacity-building and institutional infrastructure to reach the Aichi

Investing in independent monitoring and cost–benefit analysis could help in measuring policy effectiveness *(well established)*. Countries could integrate autonomous monitoring and evaluation in the implementation of programmes to improve effectiveness. As a start, building an evidence base of what works in conservation could be prioritized at a national level {13.2}.

Conservation problems require long-term solutions, while conservation and research funding is usually short term *(well established)*. Addressing this **timescale mismatch** is urgently needed in the design phase of policy interventions {13.2.3}.

Policies and mechanisms need to be in place to support innovative measures to strengthen biodiversity protection. For example, while traditional approaches such as protected areas have been the norm to secure tenure, other forms of arrangements such as community-based protected areas (e.g. Locally Managed Marine Areas) are needed to supplem protected areas for conserving biodiversity in the long term {13.1}

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In Summary …
• Pressures on biodiversity and ecosystems is real and well-documented
• The scientific community, including INSITE is building a substantial evidence-base describing the role of MMS in the marine ecosystem
The Opportunity …
• This increased understanding of artificial substrate in the marine environment provides an opportunity to use MMS as part of a strategy to mitigate pressures on ecosystems and increase biodiversity
Richard Heard
INSITE Programme Director
email: richard.heard@insitenorthsea.org
phone: +44 7817 200801

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Thank you!
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