The Influence of Man-made Structures on the North Sea Ecosystem

Synthesis and outcomes of Phase 1: (the Foundation Phase)

ISAB Independent Scientific Advisory Board

November 2017
INSITE Background & Scope

- **Oil & Gas UK** Decommissioning Baseline Study JIP (2011-2012):
  - Serious lack of data to describe the influence of man-made structures (MMS) on the North Sea ecosystem

- **2013: Oil & Gas UK** facilitated **INSITE**, a JIP to improve knowledge of the influence of MMS on the North Sea ecosystem
  - Provide scientific evidence to understand the effects of MMS
  - Better information for the decommissioning decision process in future

- **Man-made structures** (MMS) includes…
  - Fixed steel and concrete **oil and gas installations & pipelines**
  - Renewable energy structures (e.g. windfarms).
  - Shipwrecks
  - (Shipping and fishing activity is only included if it has a direct impact on the influence of MMS).
SPECIFIC OBJECTIVE 1: ‘EFFECTS’

Investigate the magnitude of the effects of man-made structures compared to the spatial and temporal variability of the North Sea ecosystem, considered on different time and space scales.

SPECIFIC OBJECTIVE 2: ‘CONNECTIVITY’

To what extent, if any, do the man-made structures in the North Sea represent a large inter-connected hard substrate system?
INSITE Phase 1 (2014-2017): the Foundation Phase

Studies designed to focus on

- identification, collection, synthesis, and analysis of available data
- to a lesser extent generation of new data,
- model development, implementation, and testing,
- preliminary model runs with available data to address INSITE objectives
Time-line for Phase 1: just two years of research

- August 2011: ‘Long-term Environmental Study’ conceived from Decommissioning Baseline JIP
- April 2014: JIP Agreement signed by eight energy company sponsors
- July-October 2014: Pre Proposal and Full Proposal award process
- December 2015: First research contracts awarded
- December 2017: Research Phase 1 concludes
### INSITE Phase 1 projects

<table>
<thead>
<tr>
<th>Primary Institution</th>
<th>Countries</th>
<th>Title of Research</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alfred Wegener Institute (AWI), Helmholtz Centre for Polar and Marine Research</td>
<td>Germany, Belgium, UK, Netherlands</td>
<td>UNDERstanding the INfluence of man-made structures on the Ecosystem functions of the North Sea (UNDINE)</td>
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<tr>
<td>CEFAS Laboratory</td>
<td>UK</td>
<td>Assessing the Ecological Connectivity between man-made structures in the North Sea (EcoConnect)</td>
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<td>CEFAS Laboratory</td>
<td>UK</td>
<td>Coupled Spatial Modelling (COSM) – trophic effects due to structures and habitat change in the North Sea</td>
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<tr>
<td>IMARES</td>
<td>Netherlands</td>
<td>Reef effects of structures in the North Sea: Islands or connections? (RECON)</td>
</tr>
<tr>
<td>Royal Netherlands Institute for Marine Research (NIOZ)</td>
<td>Netherlands, Norway</td>
<td>Measuring the shadow effect of artificial structures in the North Sea on the surrounding soft bottom community (Shadow)</td>
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<td>University of Edinburgh</td>
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<td>Appraisal of network connectivity between North Sea subsea oil and gas platforms (<strong>ANCHor</strong>)</td>
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<tr>
<td>Sea Mammal Research Unit (SMRU), University of St Andrews</td>
<td>UK</td>
<td>Man-made structures and Apex Predators: Spatial interactions and overlap (<strong>MAPS</strong>).</td>
</tr>
<tr>
<td>Sir Alistair Hardy Foundation for Ocean Science (SAHFOS)</td>
<td>UK</td>
<td>Influence of Man-Made Structures in the ecosystem: Is there a planktonic signal? (<strong>Signal</strong>)</td>
</tr>
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<td>University of Edinburgh</td>
<td>UK</td>
<td><strong>INSITE Data Initiative</strong></td>
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Mapping the Programme to the INSITE Objectives

Objective 1: EFFECTS
- COSM
- Cefas
- Signal
- Shadow

Objective 2: CONNECTIVITY
- RECON
- MAPS
- UNDINE
- EcoConnect
- ANChor

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Overall assessment of Phase 1

- A major step has been made to compile available data on the physical features of MMS, their associated fauna and flora, and biological characteristics of the surrounding benthos. These are crucial for Phase 2, and should be extended. Need to add Norwegian data.

- Still a major challenge to make existing environmental data available to the projects

- Another major step has been to identify, adopt, implement, test, and run a range of dispersion and ecosystem numerical models, separately or in concert to achieve the INSITE objectives

- Studies of the available data have improved our knowledge of the geographical and depth distribution of offshore hard bottom biodiversity in the North Sea. Also new knowledge on how MMS features regulate the epigrowth community structure and function

- INSITE has provided model and field evidence that the physical presence of MMS and their epigrowth may influence the surrounding benthos, but only locally.
Overall assessment of Phase 1

• INSITE has provided the first estimates of the scale of ecological influence of MMS on plankton communities and top predators. The influence is marginal relative to natural factors.

• In spite of different modelling approaches INSITE results indicate that several common species do form interconnected networks through larval dispersion.

• The networks are dependent on species specific reproductive traits as well as oceanographic conditions.

• INSITE has demonstrated the value of DNA barcoding and population genetic fingerprinting to support species specific connectivity modelling.

• The connectivity and network analysis modelling tools developed within INSITE are potentially useful to support decommissioning decisions (but need to be quantified).
• The **connectivity patterns** identified are **reasonably consistent** between projects, but there are inconsistencies e.g.
  – Opposite dispersal directions for *Lophelia* in the northern NS

• **Ground-truthing (validation) of model results** has been done in some instances, but needs to be encouraged. Validation is **hampered by insufficient field data.**

• **Phase 1 research is geographically unbalanced.**
  – Several projects have only dealt with the southern part of the North Sea.
  – Validity of extrapolation to the greater North Sea has not been assessed
  – Only two projects cover the whole North Sea (including the Norwegian sector)

• The **quantification of the project results** needs to be investigated more thoroughly, e.g.
  – Short-term vs long-term & local vs regional effects, and NS-wide influences of MMS.
Decommissioning: Is the MMS impact on the NS ecosystem sensitive to decommissioning options? (preliminary results from model predictions)

- An important driver for industry engagement in INSITE is to **improve the knowledge base that can inform decommissioning strategy**

- Scenarios that remove more oil and gas structures have a larger negative impact on the connectivity network. *(as expected!)*

- **Generic derogation (leave in place) has little impact**, probably due to the small changes in the size of the hard substrate areas

- **Some clusters and sites of MMS are identified as more important** than others in keeping the networks connected

- **Bespoke derogation could be effective** to maximise ecological benefit (*but need to define this…*) based on the network role of an installation
Overall Conclusions for Phase 1

• Phase 1 was intentionally designed as the Foundation Phase
• A good foundation has been laid...
• Much relevant data has been collected and collated
• Appropriate models have been developed and implemented
• Some preliminary analysis has been undertaken
  – No major surprises: impacts exist but appear to be small (+ve and –ve)
  – Connectivity can be detected, but significance is undetermined
• No firm evidence relevant to decommissioning yet
• Need to proceed with Phase 2: Data analysis & quantitative modelling
• Need continuing industry support to match NERC (science-led) funding
• and to maintain the international nature of the programme