



Understanding the Impact of Oil & Gas Infrastructure on the Marine Ecosystem

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RESEARCH FELLOW

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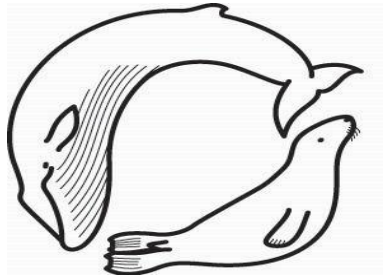
UNIVERSITY OF ST ANDREWS



600
YEARS

Understanding the impact of oil & gas infrastructure on the marine ecosystem

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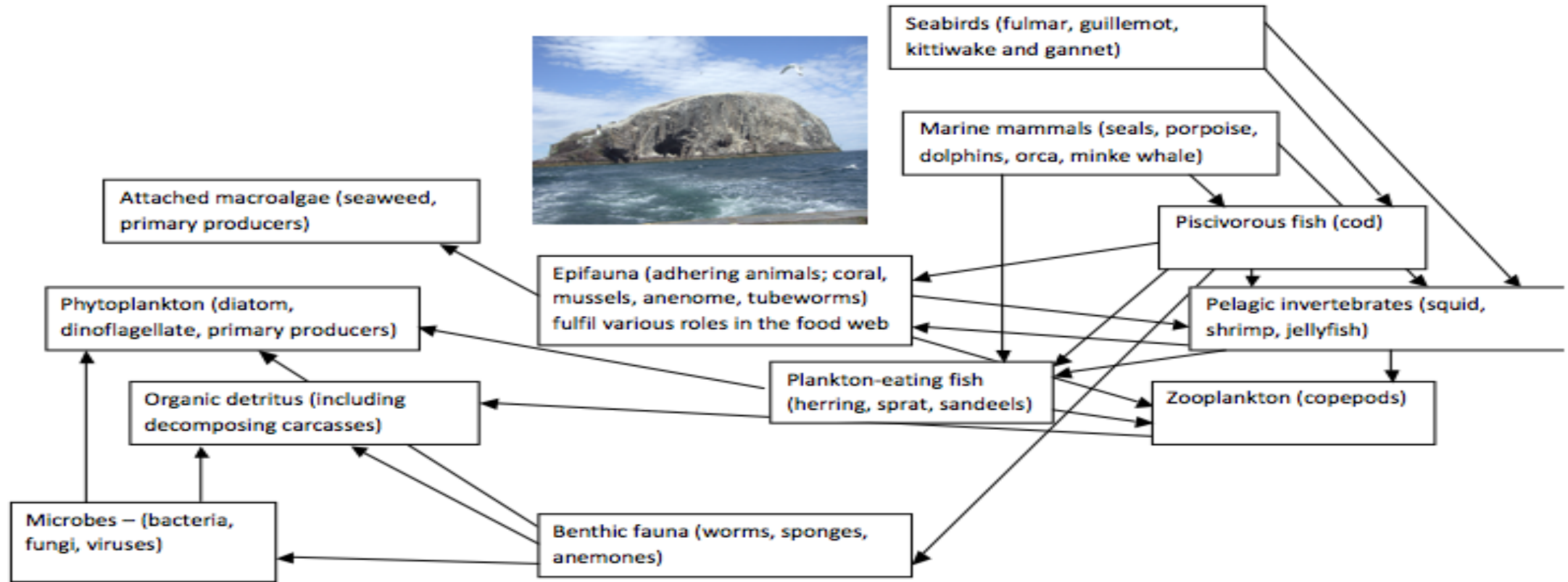
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Potential effect of the presence of structures

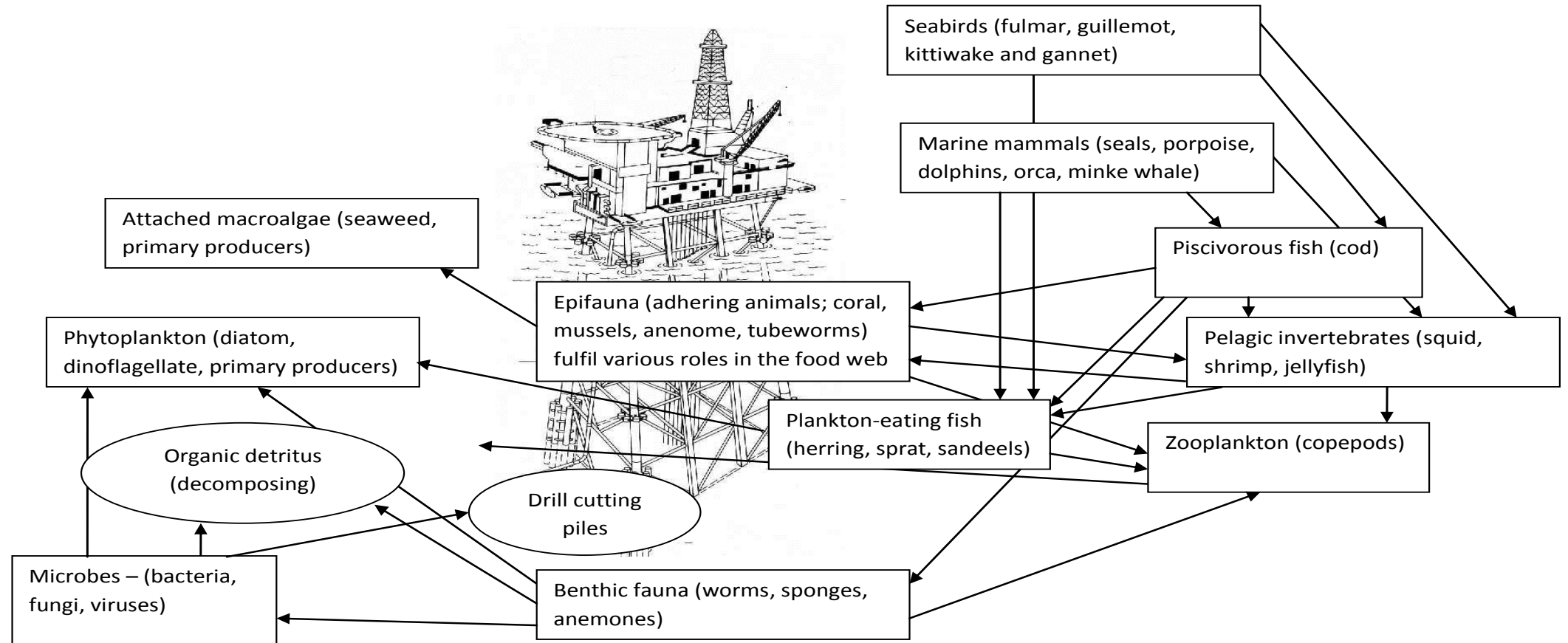
- Disturbance
- Collision
- Rest stops
- *De facto* MPAs
- Structure degradation
- Leaching of pollutants
- **Artificial Reefs**



Reefs in the North Sea food web



Artificial Reefs in the North Sea food web



How important is the role of artificial reefs?

- Spatial scale
- Temporal scale
 - Temporal variability of the environment of the North Sea
- Species ... functional groups of species
- Surrounding environment
 - Each oil & gas structure cannot be considered an independent entity
 - Cumulative impact
 - Increasing levels of infrastructure



Current state of knowledge

INSITE

- Focus on the results of INSITE
- INSITE
 - An industry-sponsored programme examining the **IN**fluence of **Str**uctures **In** **T**he **E**cosystem
 - <https://www.insitenorthsea.org/>
- Phase 1
 - Completed in 2017
 - To collate and use existing data to ask
 - Has the physical presence of MMS had any discernible ecological effect over the past 40 – 50 years?
 - Identify data and knowledge gaps
 - 8 research projects



Local Impacts

- Structures
 - High biodiversity
 - Over 200 hard-substrate species found (17 structures)
- Surrounding soft sediment
 - Results inconclusive
 - Some effects on nutrients, species abundance...
 - Questions remain as to how wide-ranging these effects are...

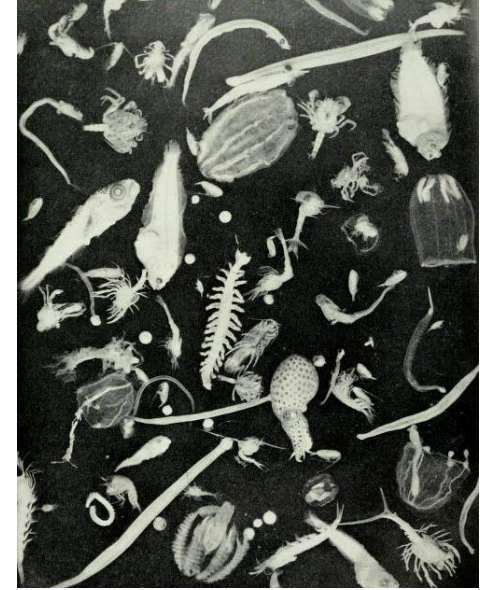


Baeye and Fettweis 2015

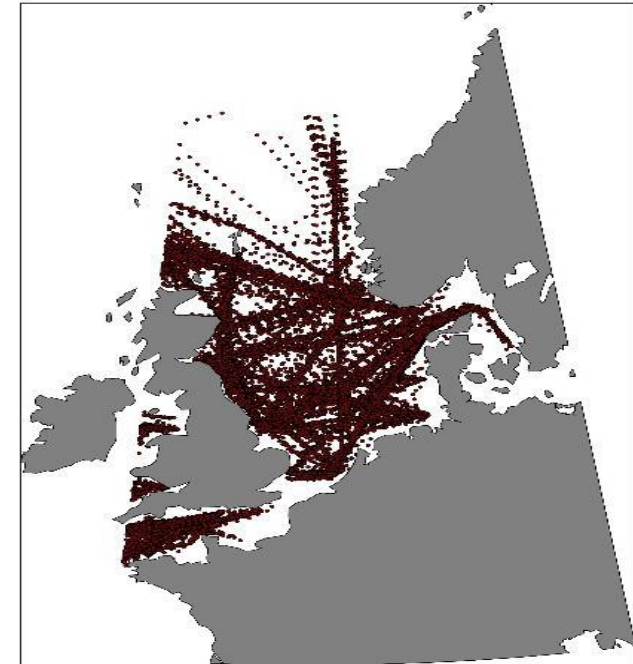


Plankton

- Plants and Animals
 - Mostly microscopic
 - Drift with currents
 - Base of marine food web
- Many marine species spend at least part of their life as plankton
 - E.g. starfish, crabs, fish
- Surveyed using Continuous Plankton Recorder (CPR)
- No effect detected
 - On spatial scales investigated
 - At monthly to decadal temporal scales
- Thus any impacts on THESE SCALES likely to be marginal compared to the impact of environmental variation



JH Fraser

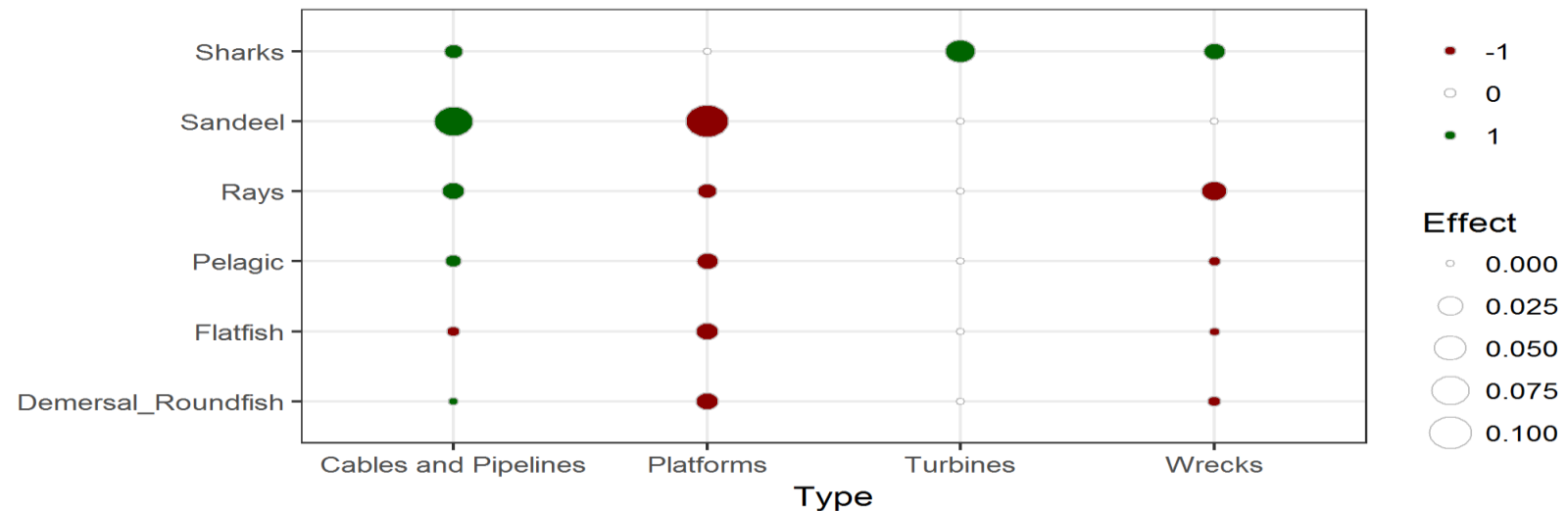


INSITE project: SIGNAL

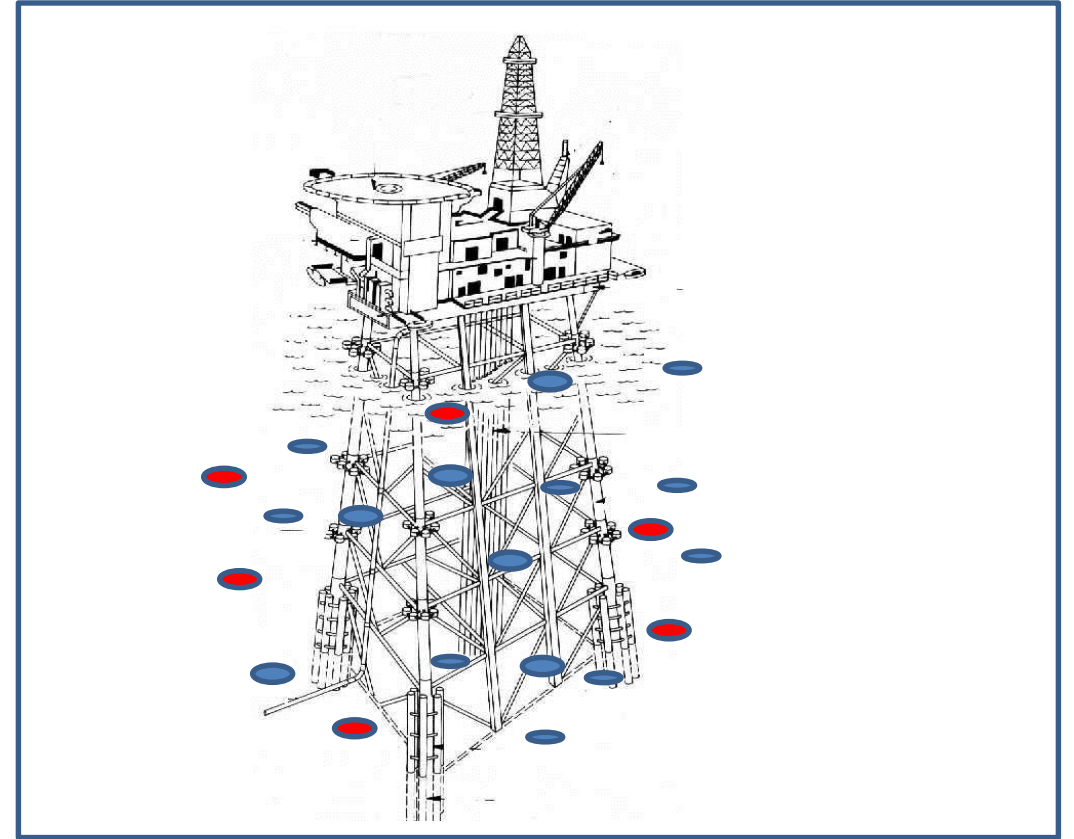
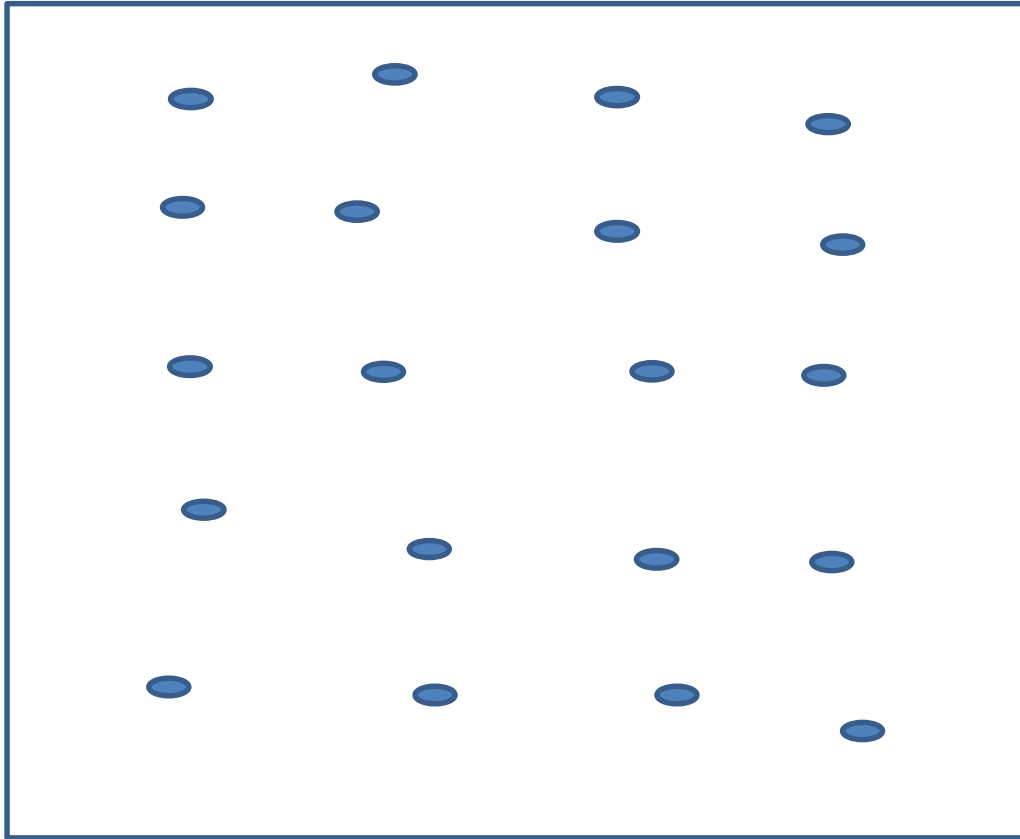


Impacts on food web

- Most fish species only use structures for part of life span
- Modelled distribution of many species as function of
 - Environment including other species
 - Structure presence
- Effects of structures demonstrated
 - But minor compared to other potential pressures
 - Climate change
 - fishing
- Validation required



Attraction vs production debate



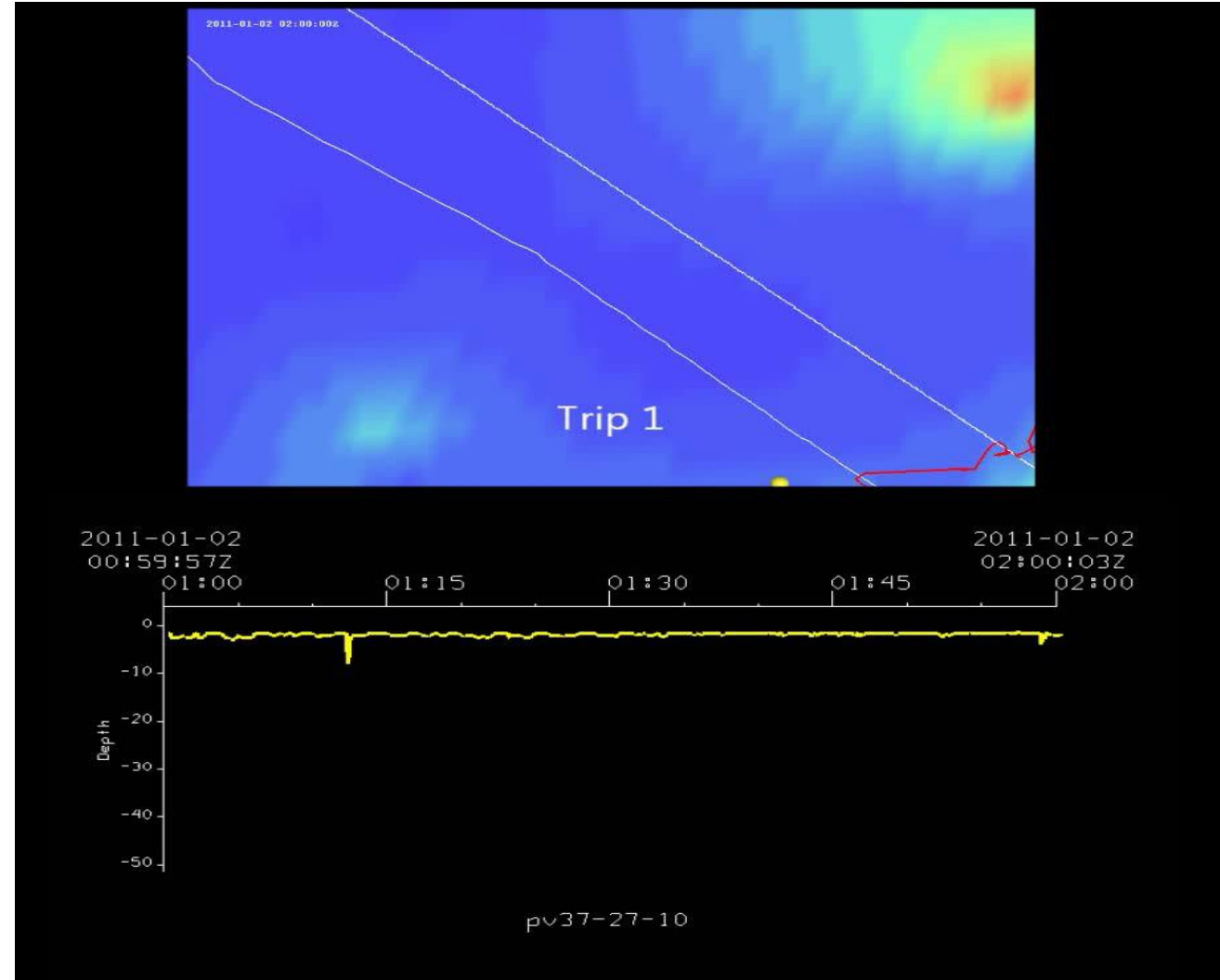
There is debate as to the degree to which MMS

(1) simply attract and thus concentrate **fish** already in the environment

(2) Facilitate an increase in **fish** abundance overall

Predators

- Some top predator species observed using structures for foraging
 - Harbour porpoise
 - Seals
- Translating an effect on individuals to populations...



Predator Distributions

- Modelled distribution of species as function of
 - Environmental covariates
 - Structure presence
- No positive association between MMS and seal distribution
 - Animal-borne tag data
- Positive association between MMS and harbour porpoise distribution
 - Survey Data
 - Warrants further investigation
- No noteworthy association between MMS and other study species
 - Seabirds (razorbill, guillemot, kittiwake, fulmar, shag)
 - Cetaceans (minke whale, white-beaked dolphin)
 - Doubts about data suitability...



Do MMS represent stepping stones for species?

- Yes
- Some structures are particularly influential
- Results vary with
 - Species
 - Trait dependent
 - Data/methods
 - Network analyses
 - Genetics
- Whether such affects are positive depend on whether species are
 - Invasive
 - Of conservation concern



Conclusions & Future

- Local impact of structures
 - Increased biodiversity
- Impacts on the behaviour of individual top predators but population level impacts unclear
 - Need to increase understanding of mechanisms of impacts
- Structures provide stepping stones
 - This role need to be considered with increasing marine renewable developments as well as potential removal of oil & gas infrastructure
- Build on relationship between regulators/industry and scientists
 - The important questions
 - Appropriate funding
 - Expertise from industry
 - Standardised collection and provision of appropriate data

