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UNDERSTANDING DEEP ATLANTIC ECOSYSTEMS

Using scenario based simulations to improve marine spatial planning at Rockall Bank

ATLAS GA, Edinburgh, 2020

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marinescotland science

The Scottish Government

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Talk outline

- An introduction to Marine Spatial Planning
  - How Systematic Conservation Planning (SCP) can contribute
- Methodology applied for Rockall Bank case study
  - Basic scenario
  - Impact of MPA and fishing management areas
  - Seasonal oil spill scenarios
  - Trawling
- Deep sea oil and gas exploration technical constraints
- Conclusions

Marine Spatial Planning (MSP)

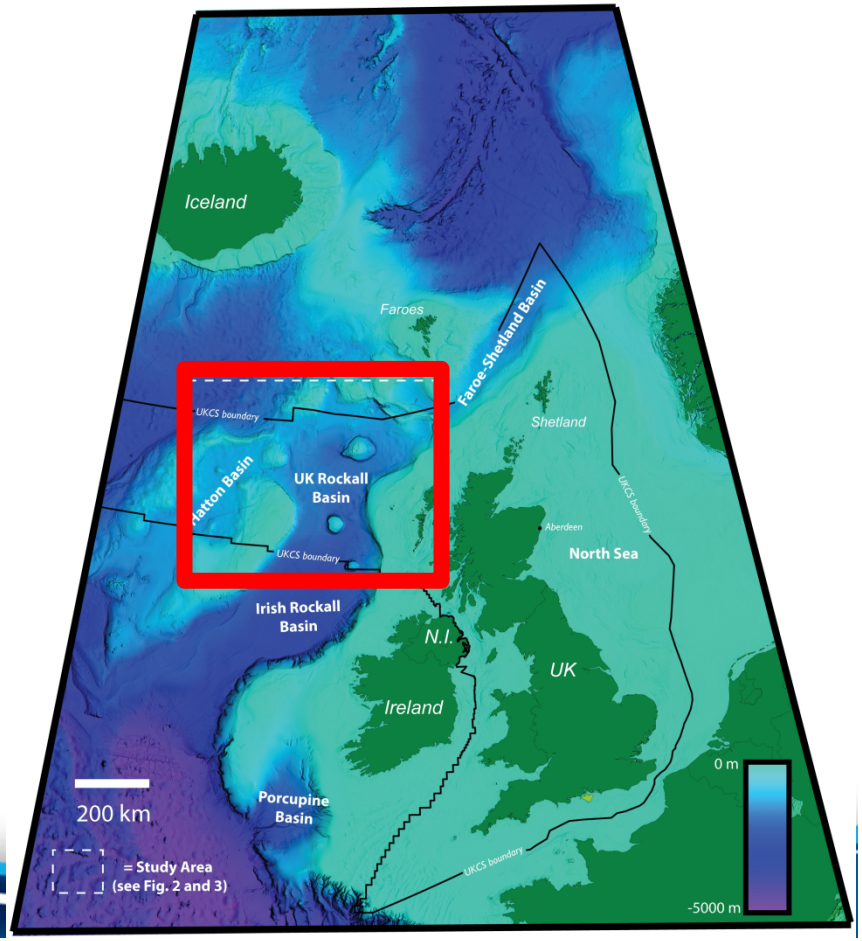
- Aims to improve the use of maritime space in order to achieve various goals.

Systematic Conservation Planning (SCP)

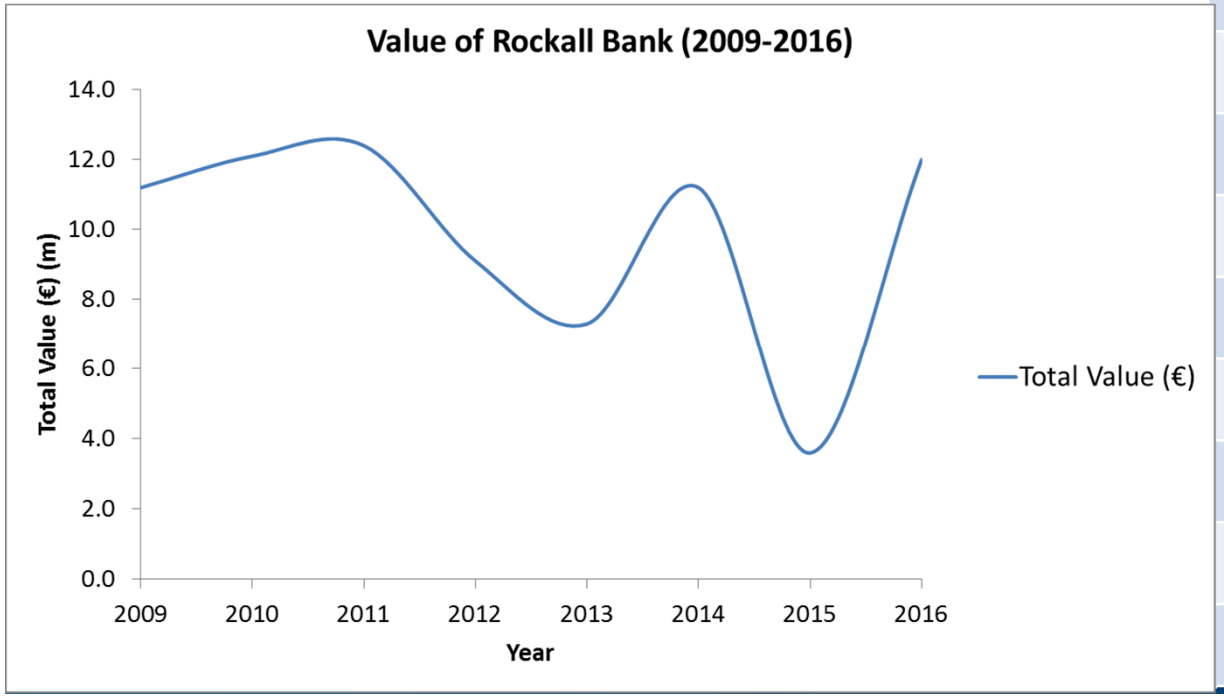
- SCP can contribute to MSP as its main objective is to reduce conflict.
- It can do this by:
  - Developing evidence based scenarios which identify how ocean space is utilised.
  - Including biodiversity information which can be assessed using quantitative targets.
  - Examining distribution and economic value of human activities – assessing likely impacts from different planning regimes.

Case Study: Rockall Bank

- Supports a large diversity of marine species:
  - sponges, Lophelia reefs, coral gardens and a variety of fish (Johnson et al, 2019).
- Fishing activity over the last 200 years.
- Interest in potential oil and gas production (Schofield et al, 2018).



ICES VMS landings records (2009 – 2016)



Year	Total Value (€) (m)
2009	11.2
2010	12.1
2011	12.4
2012	9.1
2013	7.3
2014	11.2
2015	3.6
2016	12.0
Average	9.9

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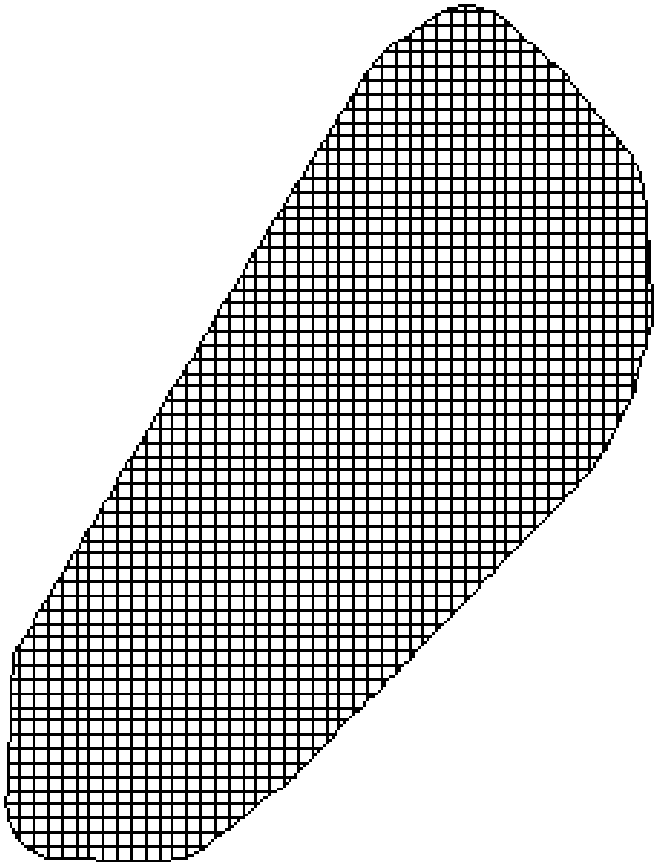
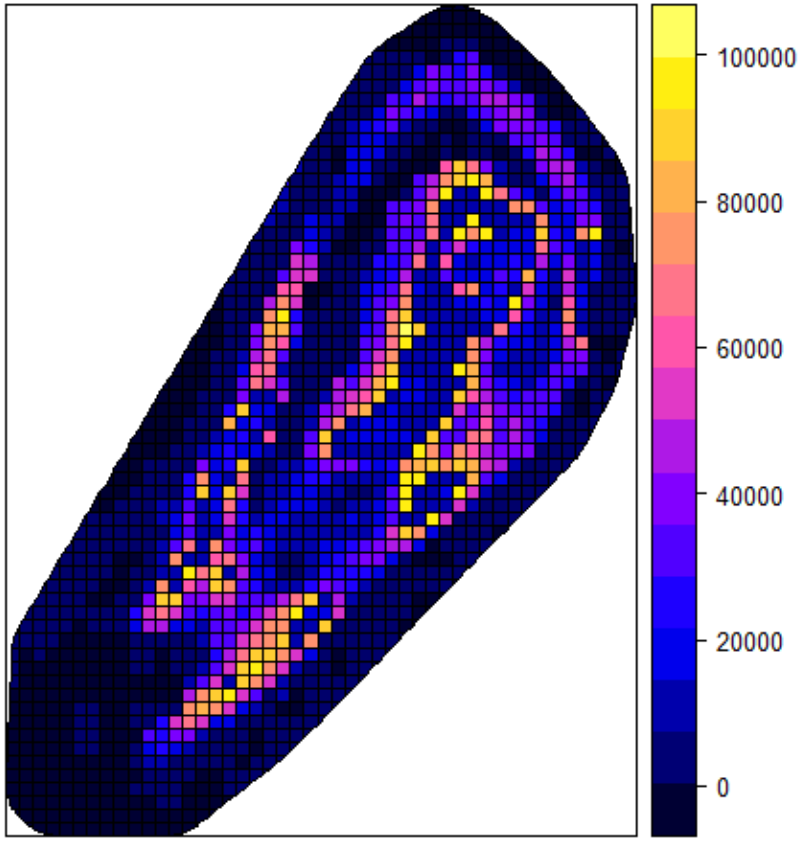
- 5km planning units created as a fishnet.
- A combined total of 102 biodiversity distribution and modelling outputs used
  - Marine Strategy Framework Directive (MSFD) & Joint Nature Conservation Committee (JNCC).
- 2009 – 2016 VMS fish landings data (€)
- ‘prioritizR’ decision support tool (Hanson et al, 2019) based upon Marxan principles.

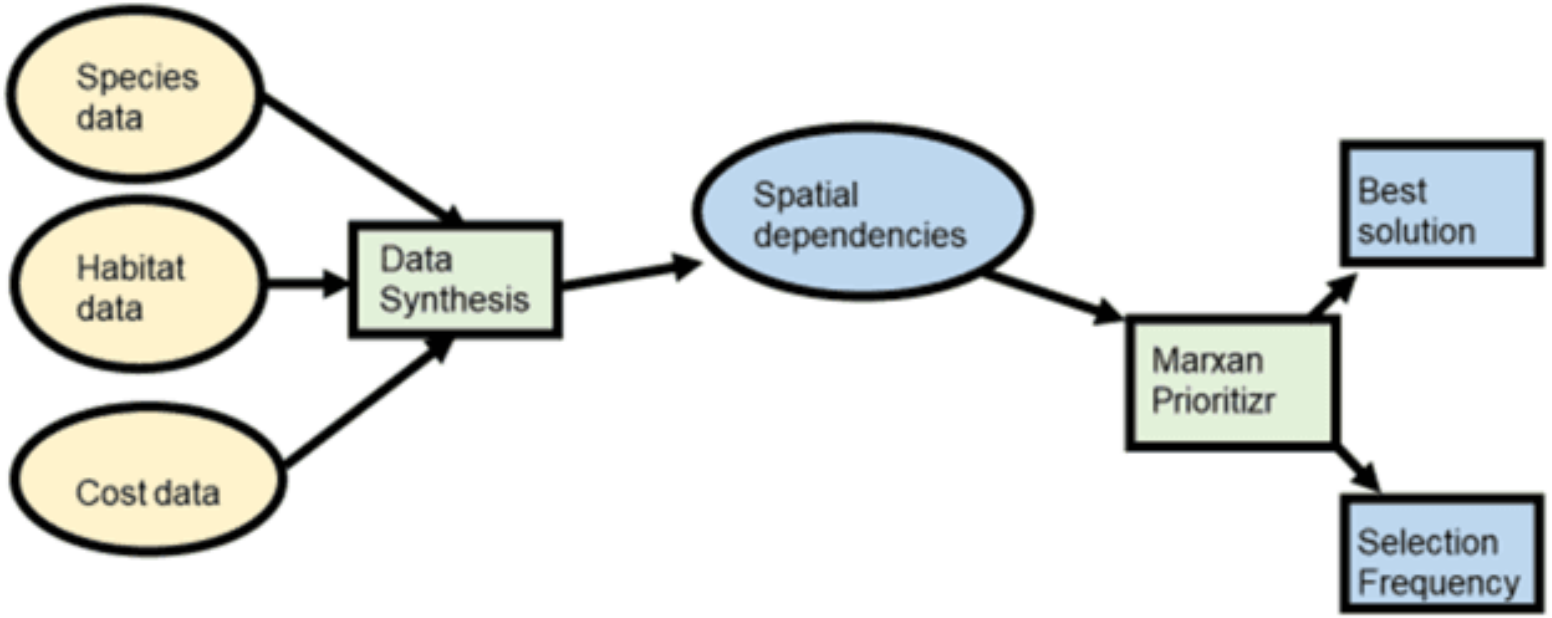
atlas Planning Units



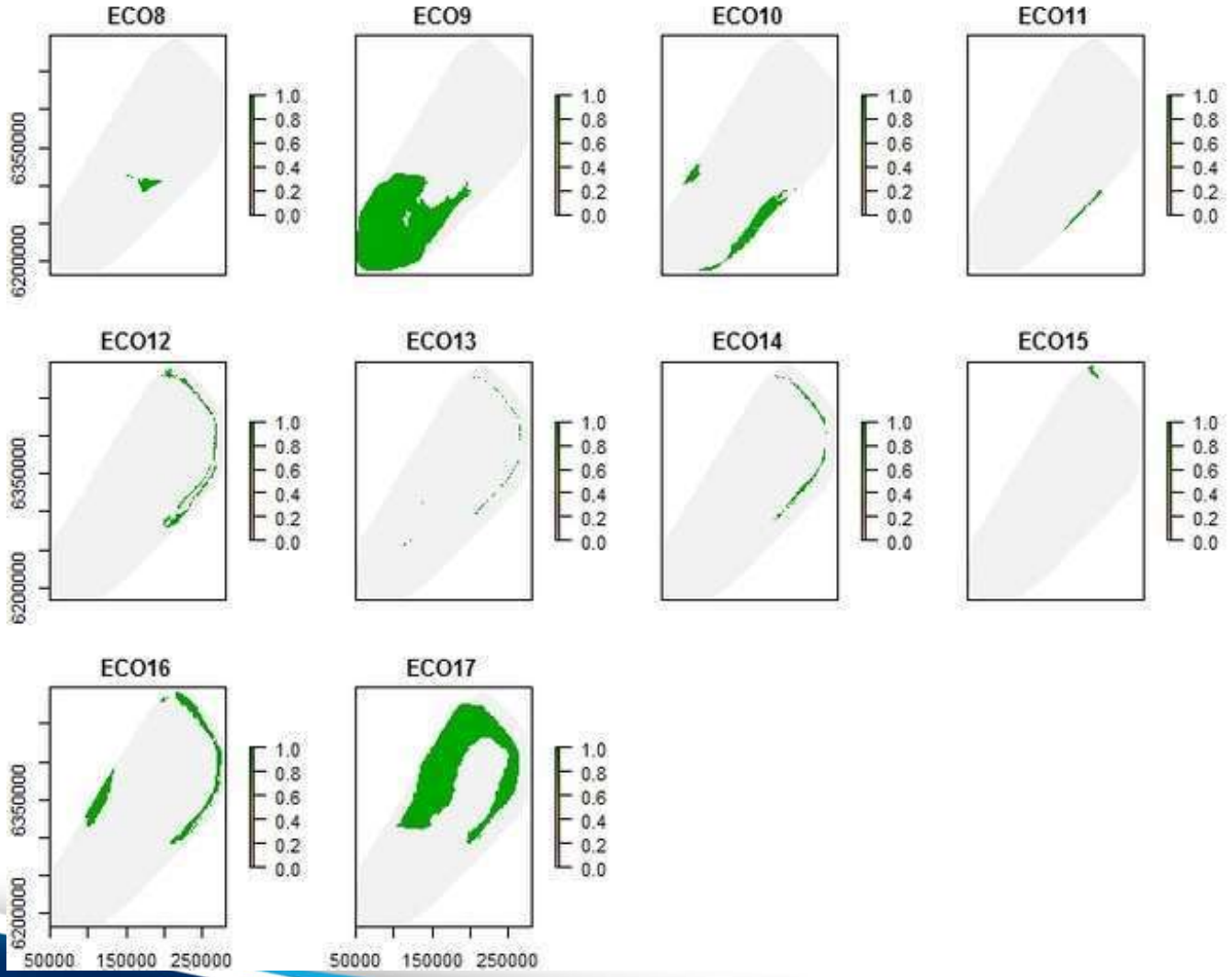


Example data (Accumulated Average Value from 2009- 2016)

Prioritizr flowchart



atlas Example Habitat Descriptors



Protection Targets

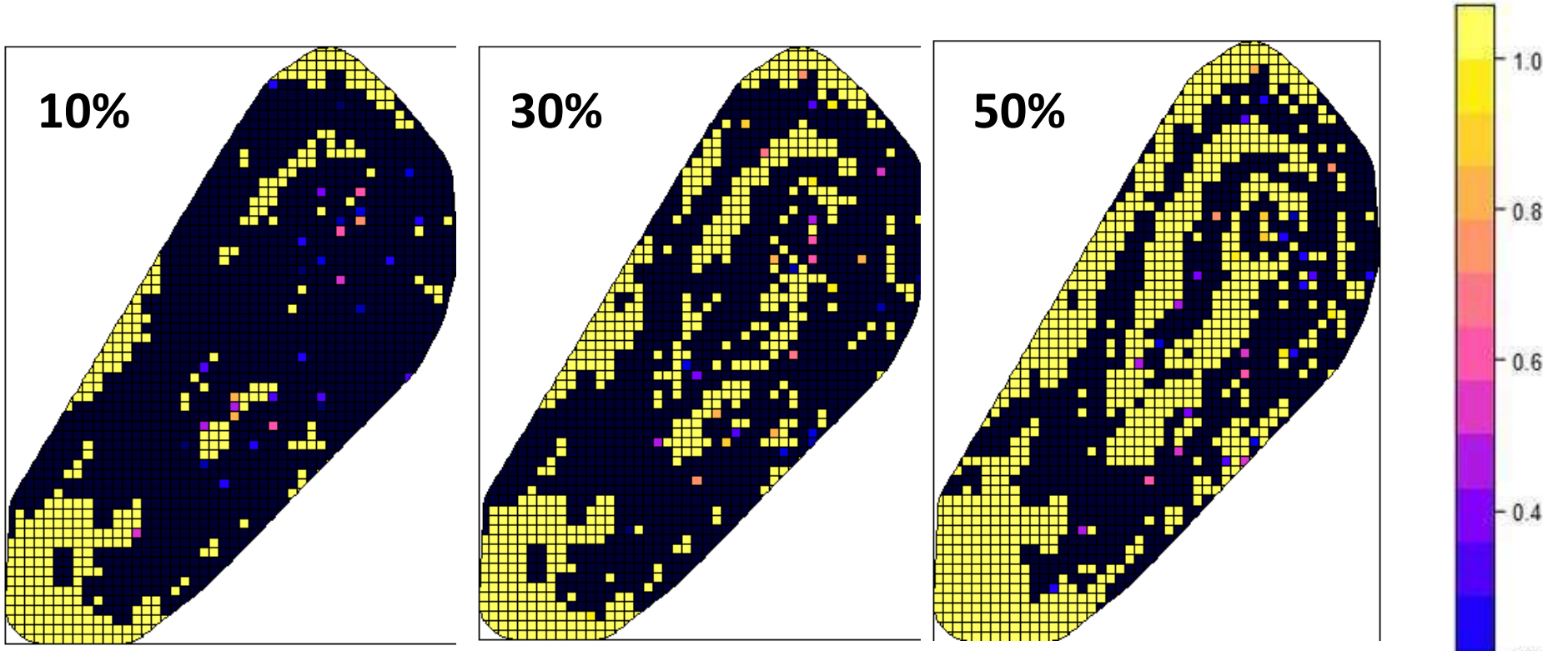
The following targets were set for this work:

10%: "*The Convention on Biological Diversity(CBD) target currently commits…to conserving 10% of marine environments by 2020 through "ecologically representative" protected area networks (Convention on Biological Diversity 2010)"* (O'Leary et al, 2016; Aichi Target 11).

30%: "*Previous reviews in 2003…suggested that 20–40% coverage is warranted…large disconnect between the UN 10% (MPA) target and the results of these studies, a broader synthesis of current research is required*." (O'Leary et al, 2016)

50%: Ambitious targets!

Basic scenario outputs

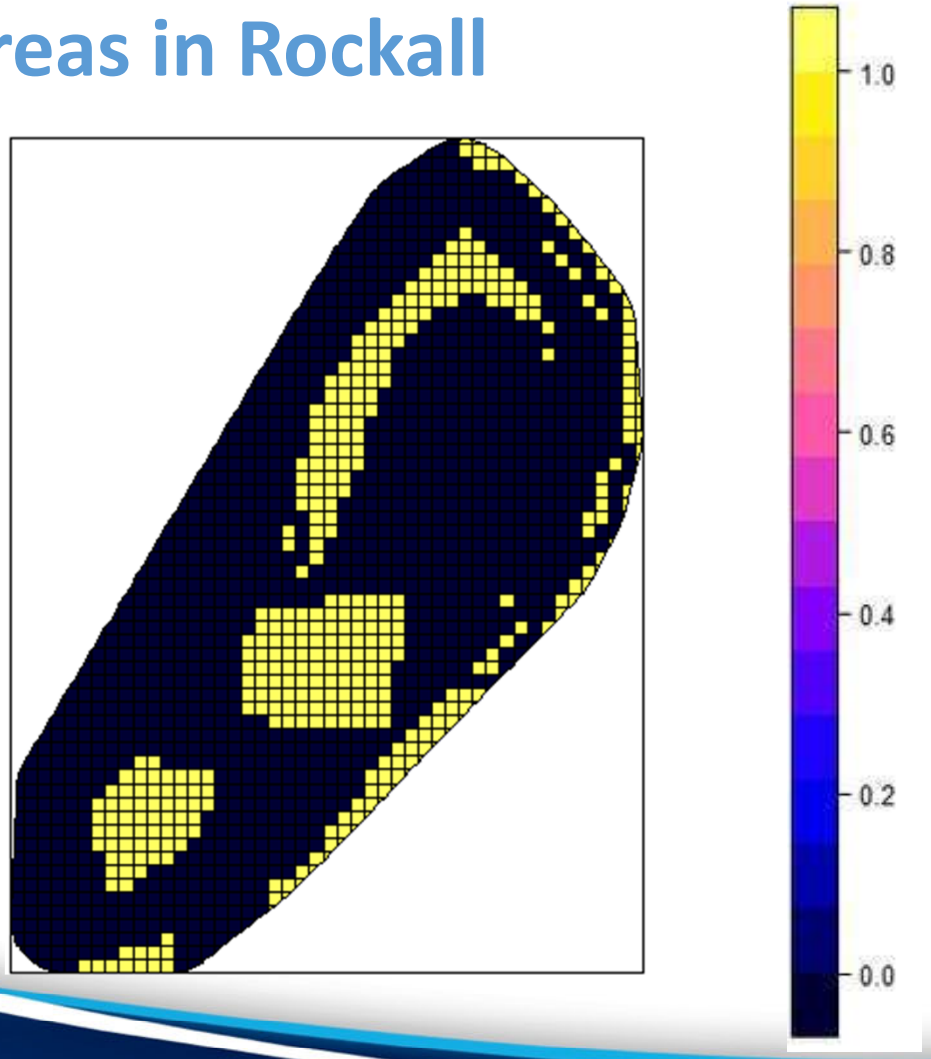


Cost: €390k

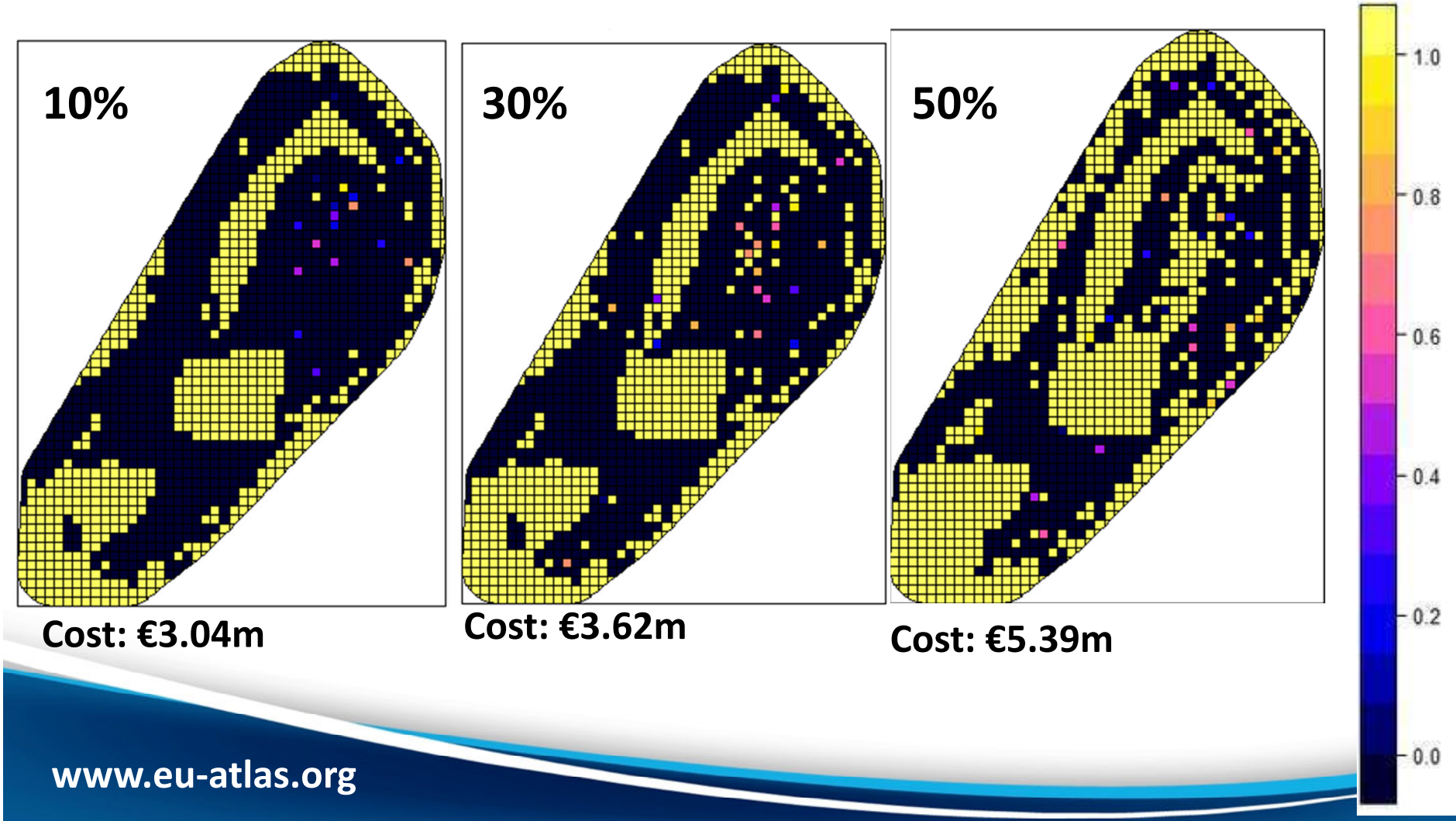
Cost: €1.70m

Cost: €4.00m

Location of MPAs/ fishery managed areas in Rockall



Management areas results



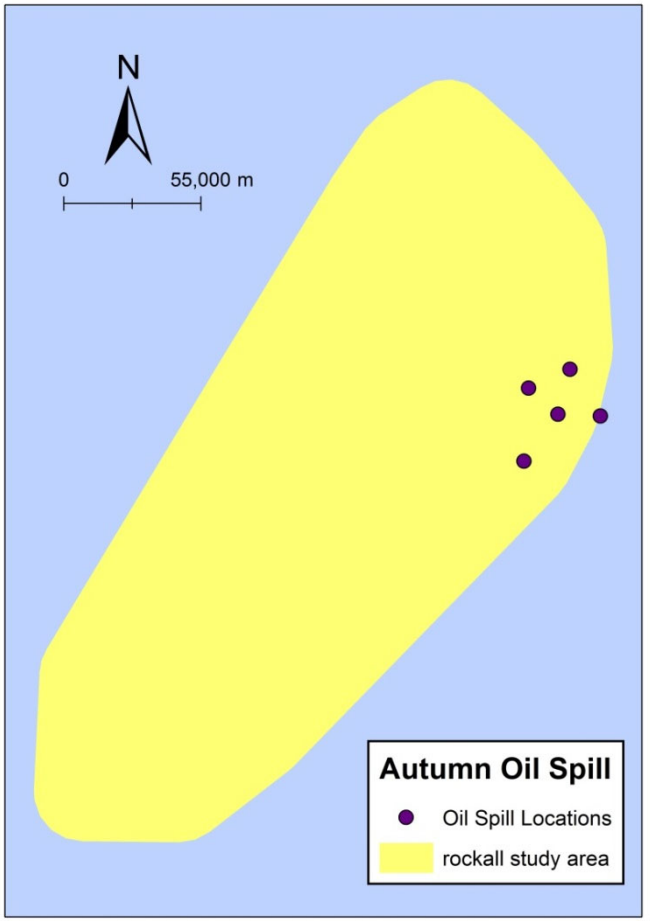
Cost: €3.04m

Cost: €3.62m

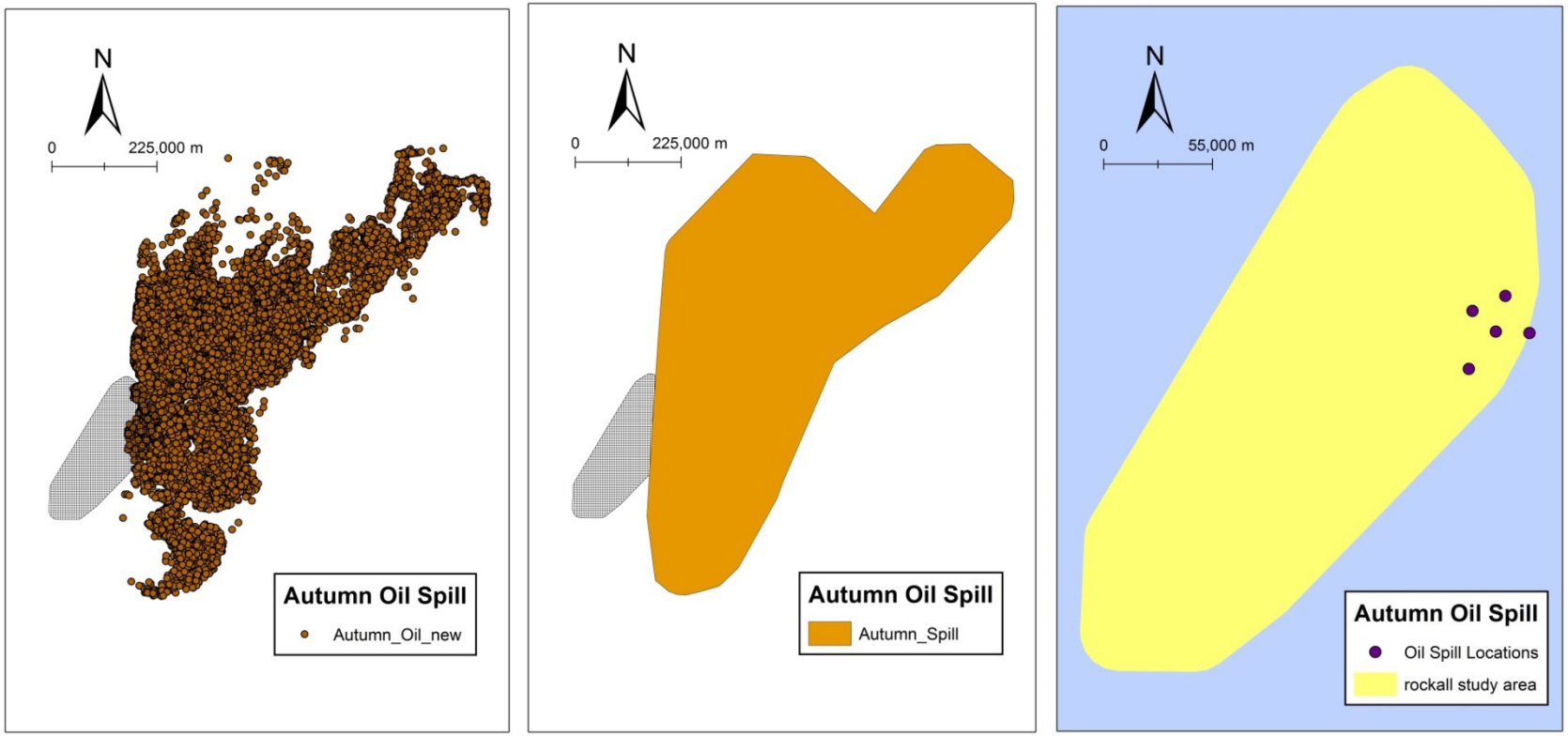
Cost: €5.39m

Oil and Gas scenario parameters

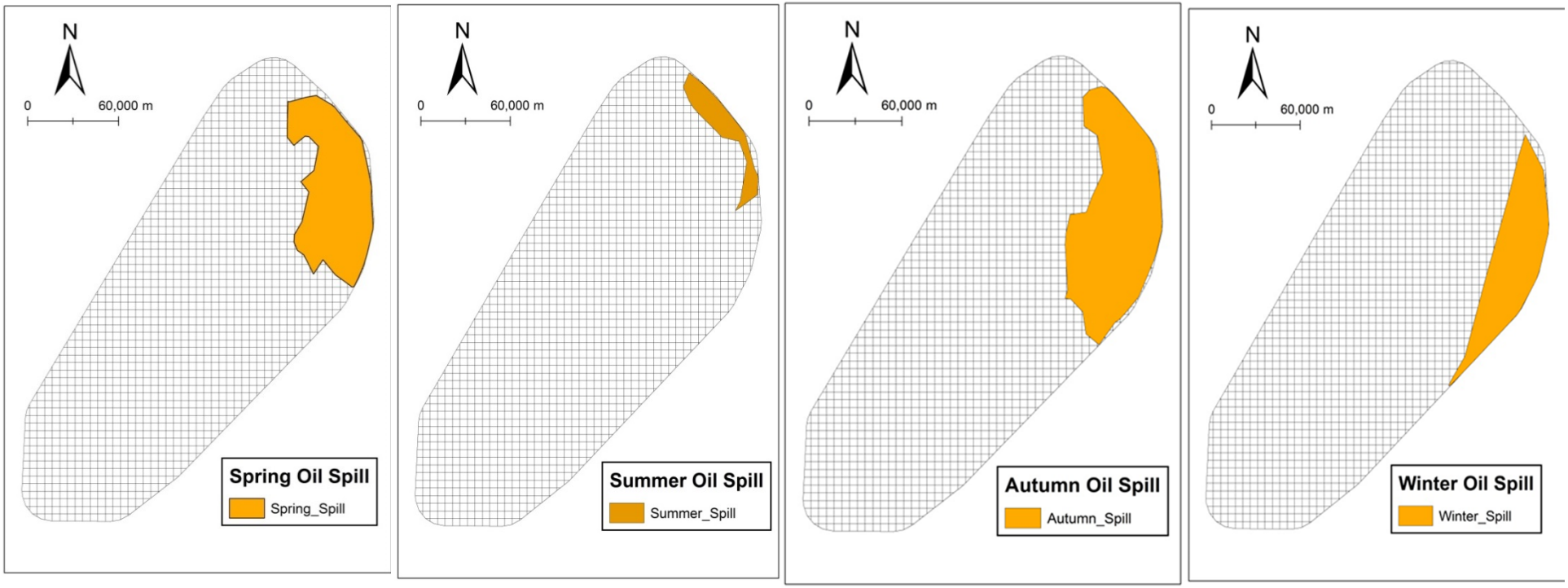
- Minimum set objective
- Proportion decisions
- Management areas included
- Oil Spill (simulated seasonally)
- Targets (LOW = 10%, MEDIUM = 30%, HIGH = 50%)
- Gurobi solver
- Accumulated Average costs 2009- 2016 costs (€)
- Approach adopted by McNicoll et al (2019)



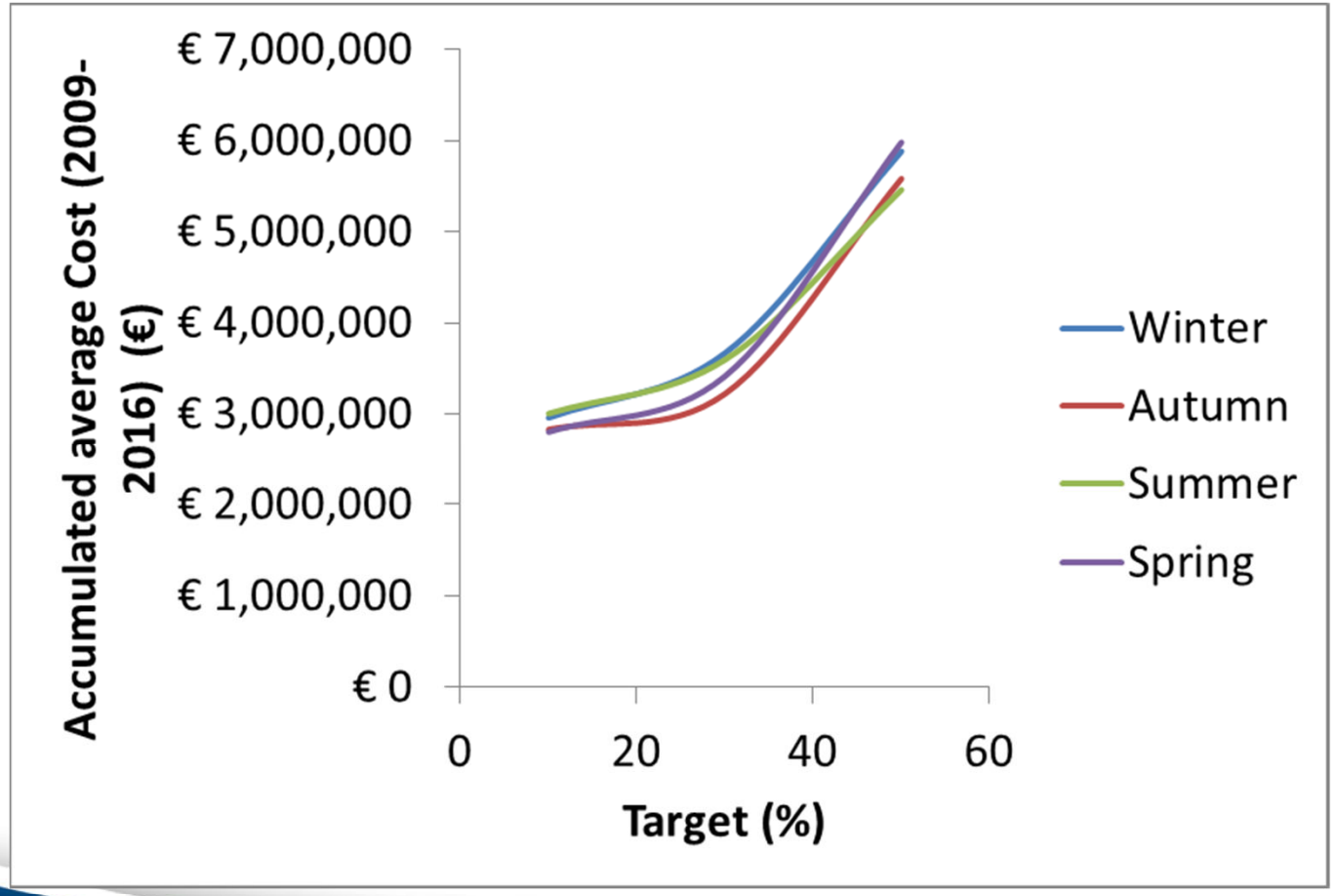
Example (oil spill Autumn Sept 2019 – Nov 2019)



atlas Seasonal Spill

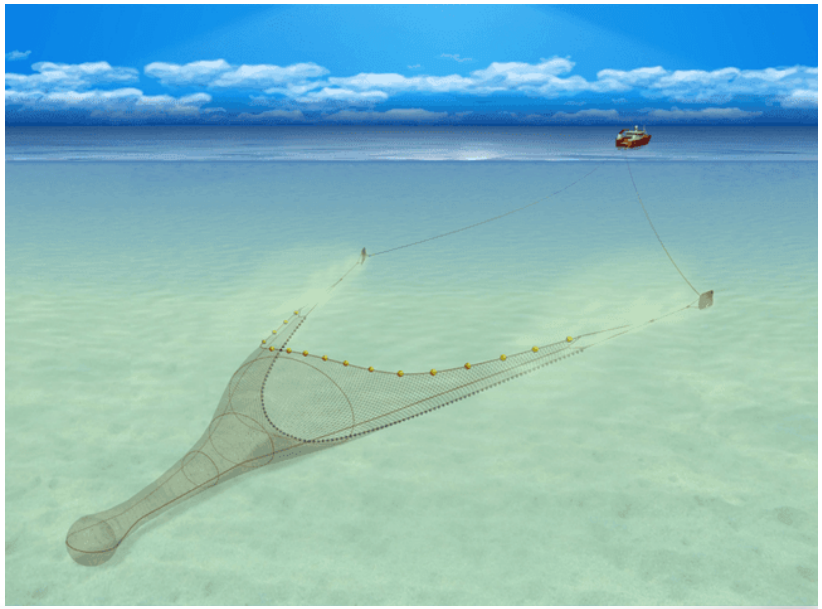


Oil and Gas seasonal outcomes

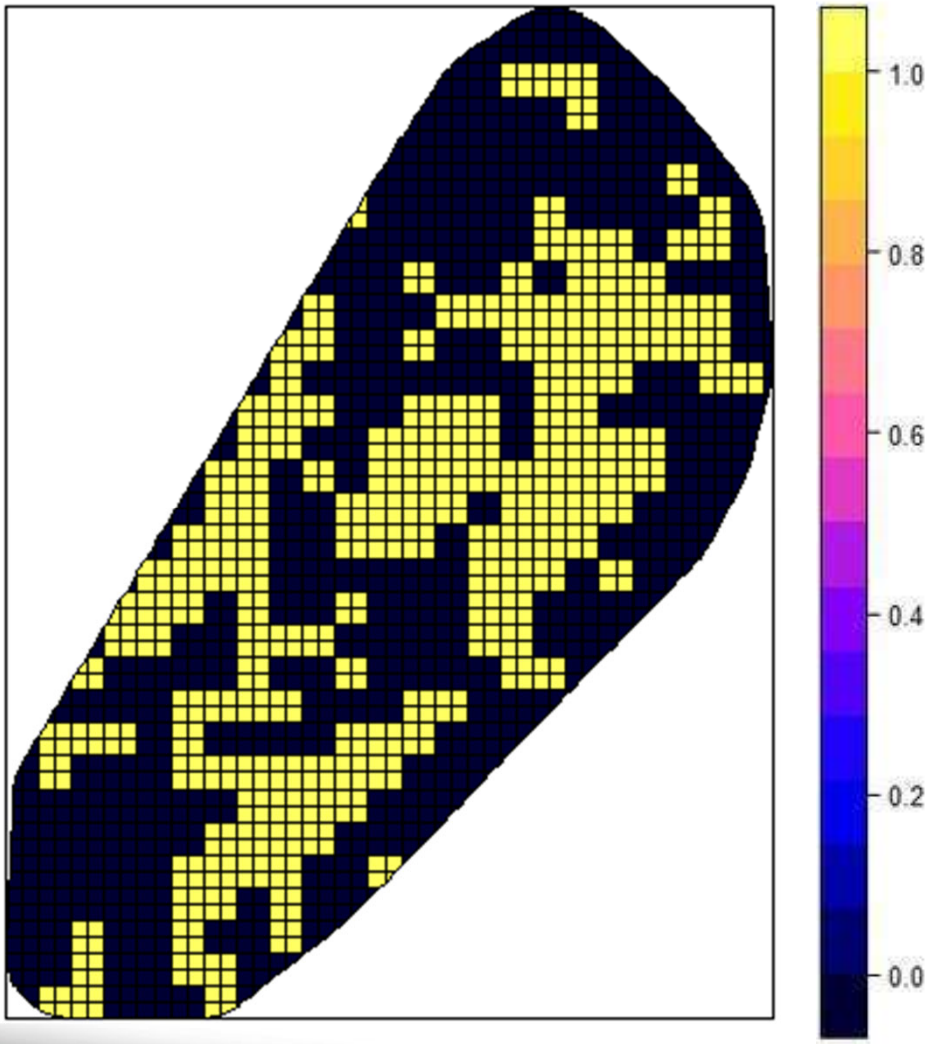


Trawling scenario parameters

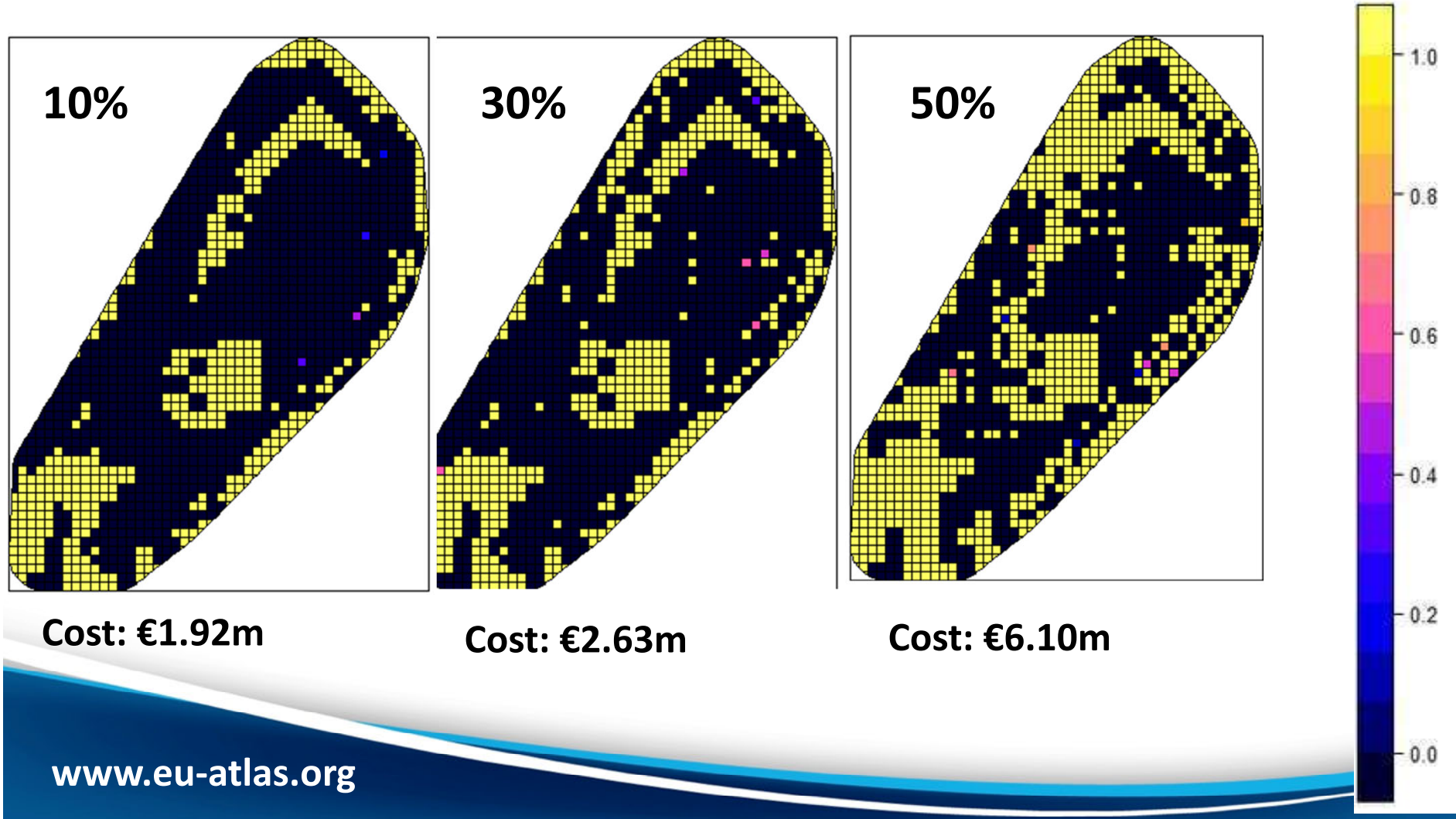
- Minimum set objective
- Proportion decisions
- Management areas included
- Trawling (AIS)
- Targets (LOW = 10%, MEDIUM = 30%, HIGH = 50%)
- Gurobi solver
- Accumulated average costs 2009-2016 VMS data



Trawling presence/absence



Trawling results



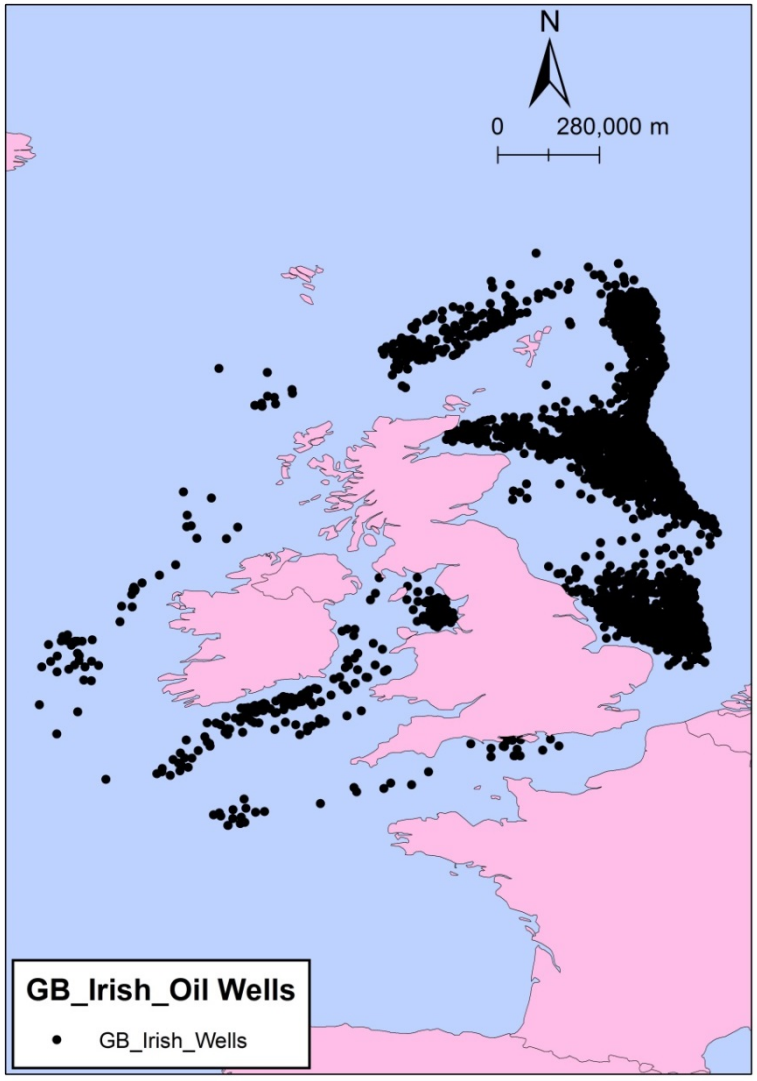
Cost: €1.92m

Cost: €2.63m

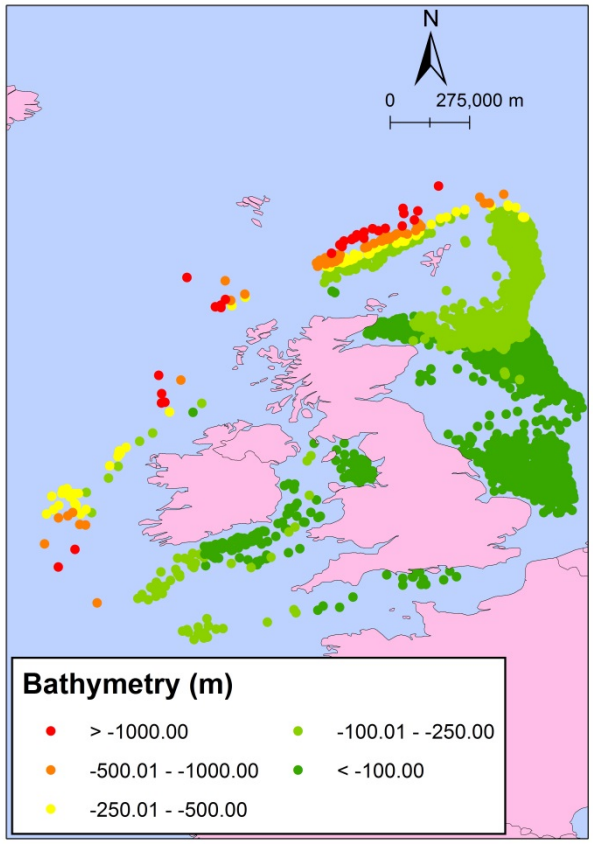
Cost: €6.10m

Deep sea oil and gas exploration technical constraints

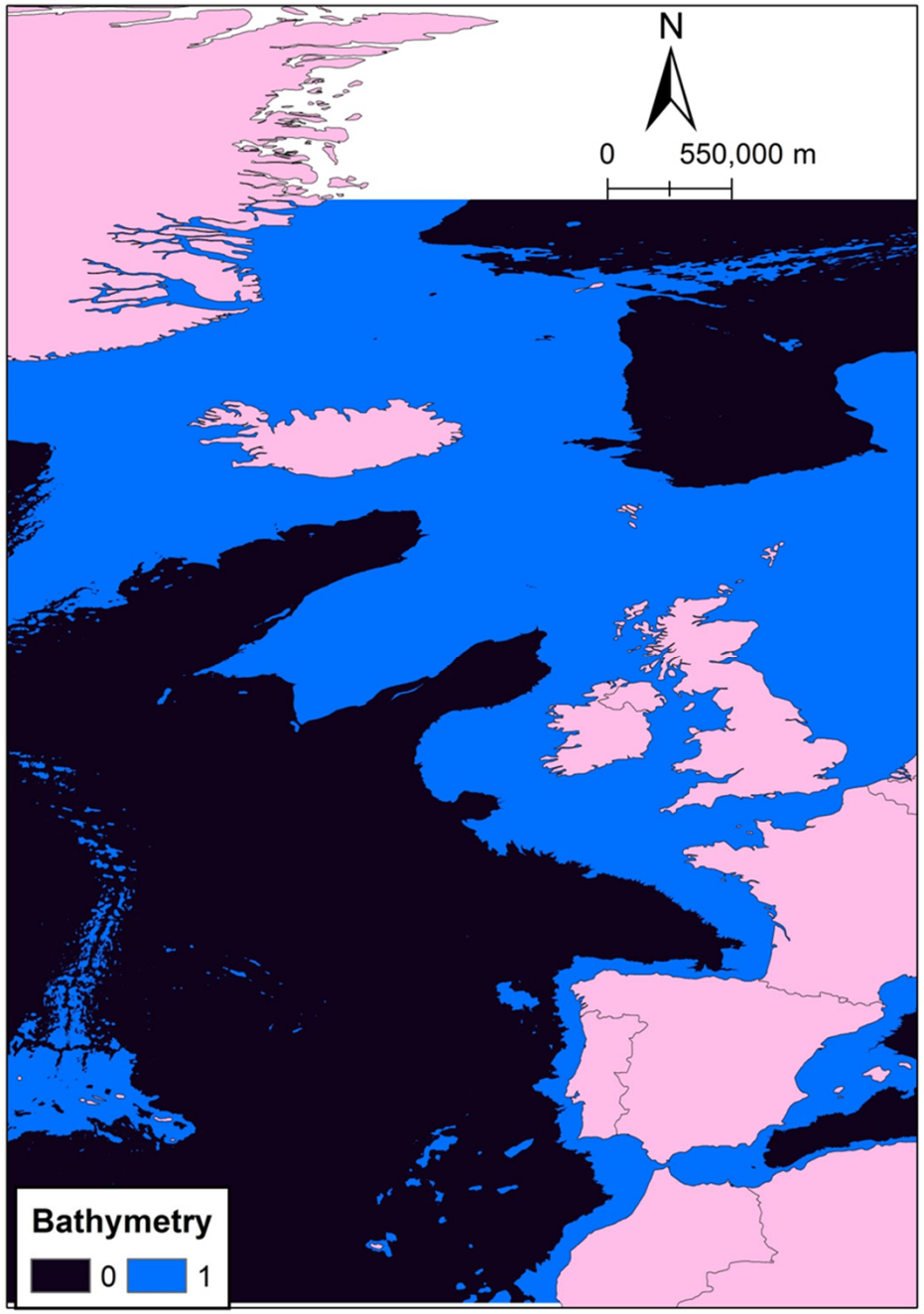
- Using available environmental layers for future oil and gas exploration based on known information.
- **Known oil wells data** = UK Oil and Gas Authority and Ireland's Department of Communications, Climate Action and Environment (DCCAE).
- How this relates to the N Atlantic:
  - Slope
  - Bathymetry
  - Kinetic energy at seabed (currents)



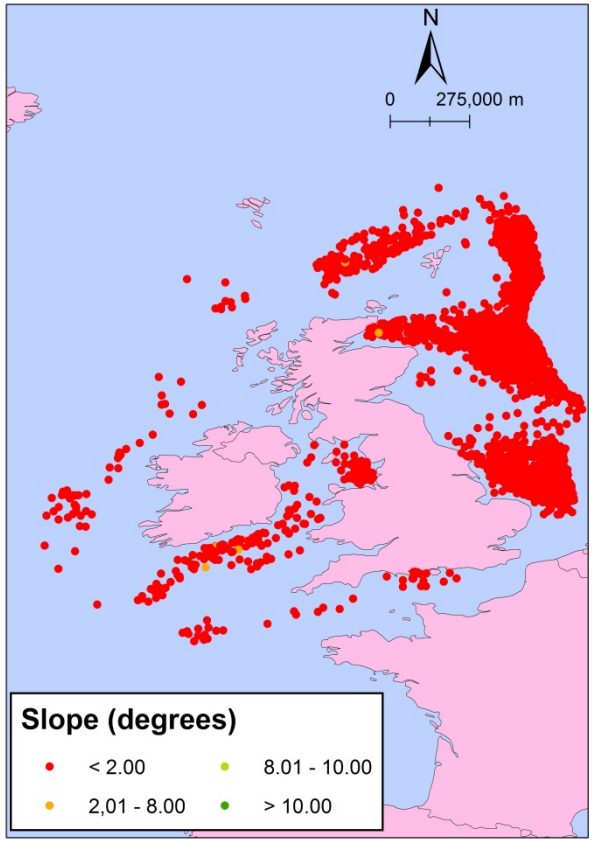
atlas Bathymetry



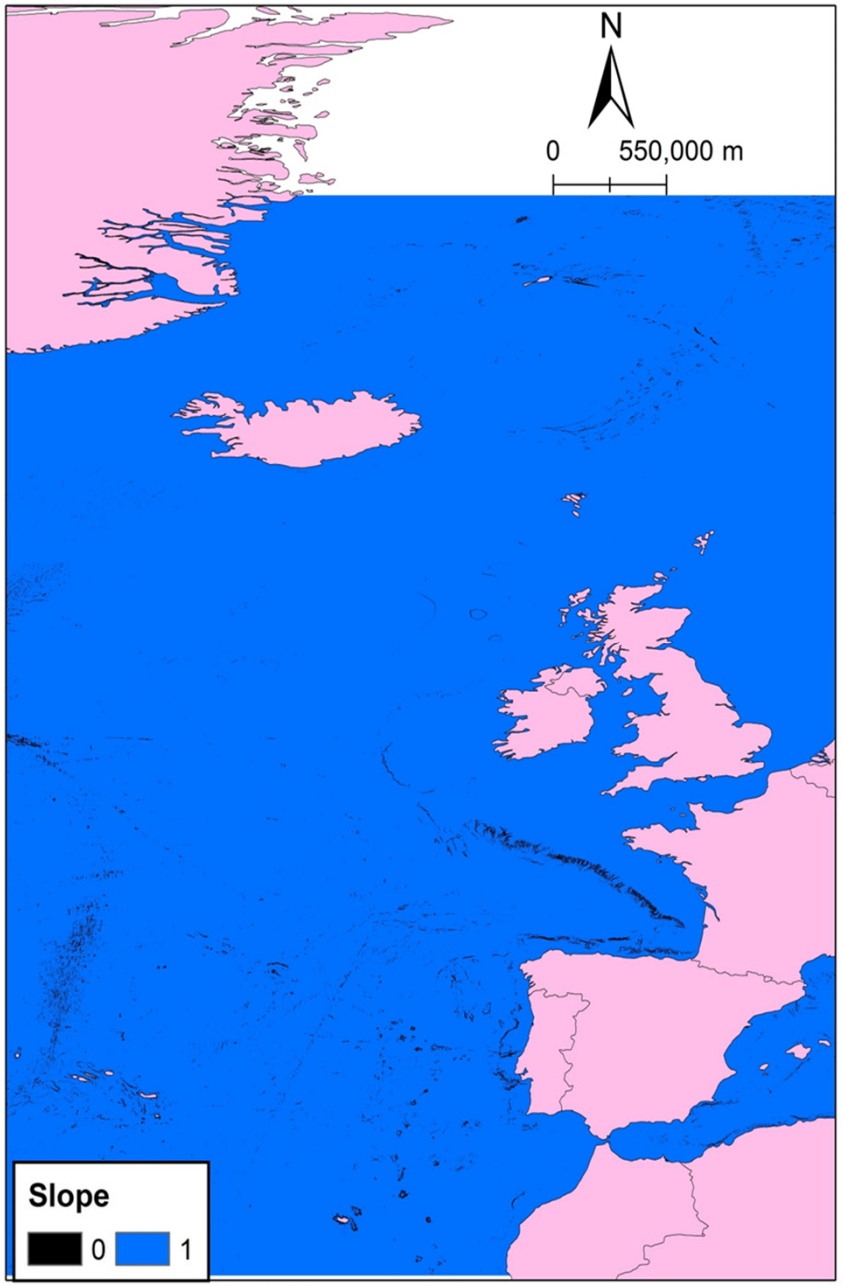
Blue <2224.39 m depth (deepest bathymetric point in relation to oil wells)



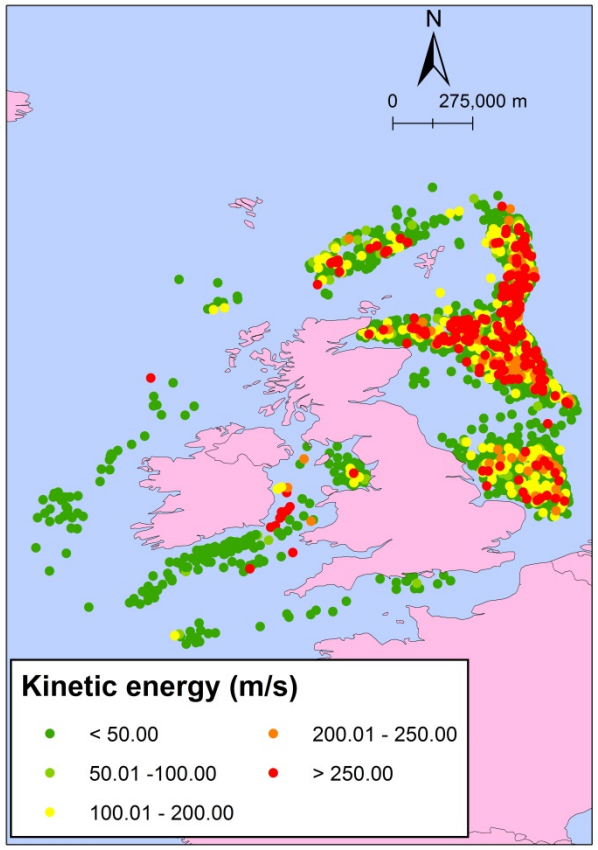
atlas Slope



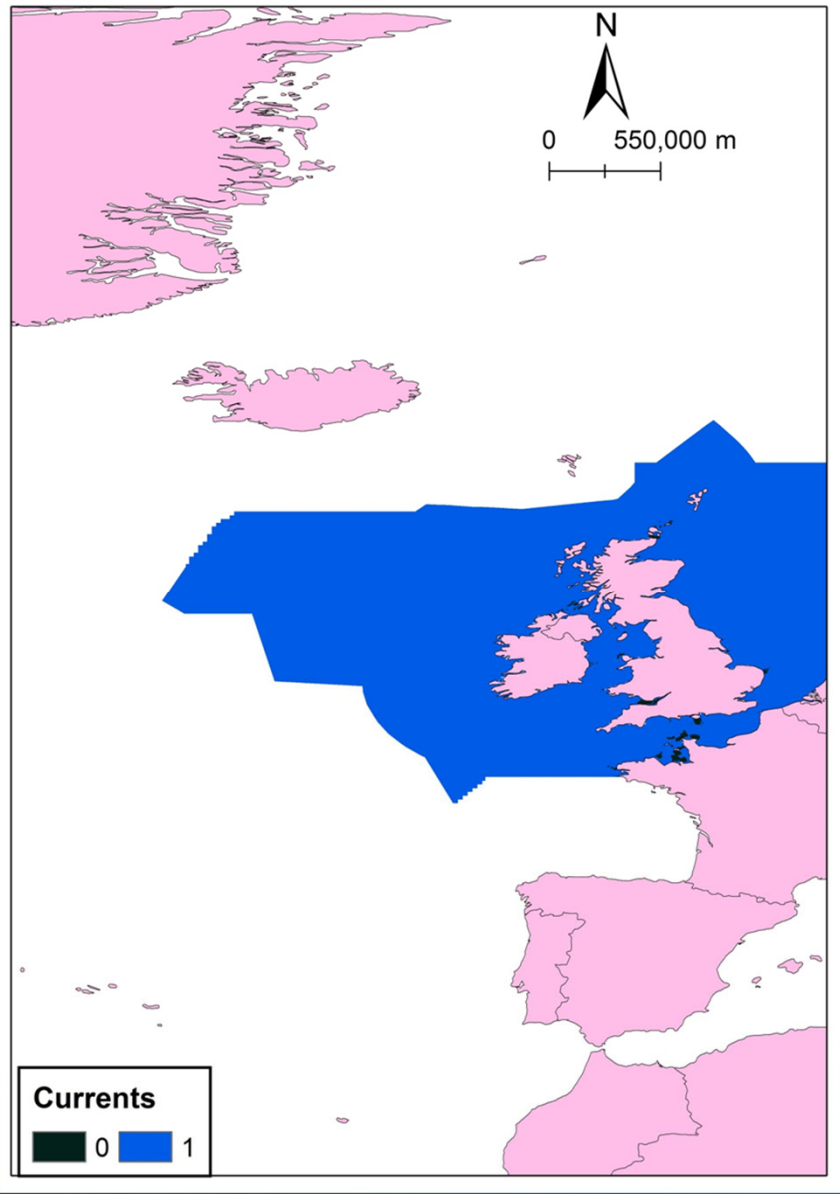
Blue represents values <14.344 degrees (largest angle in relation to oil wells data)



atlas Kinetic energy (Atlantic)



Blue represents values < 877 (largest value in relation to oil wells data)



atlas Aggregate

BATHYMETRY

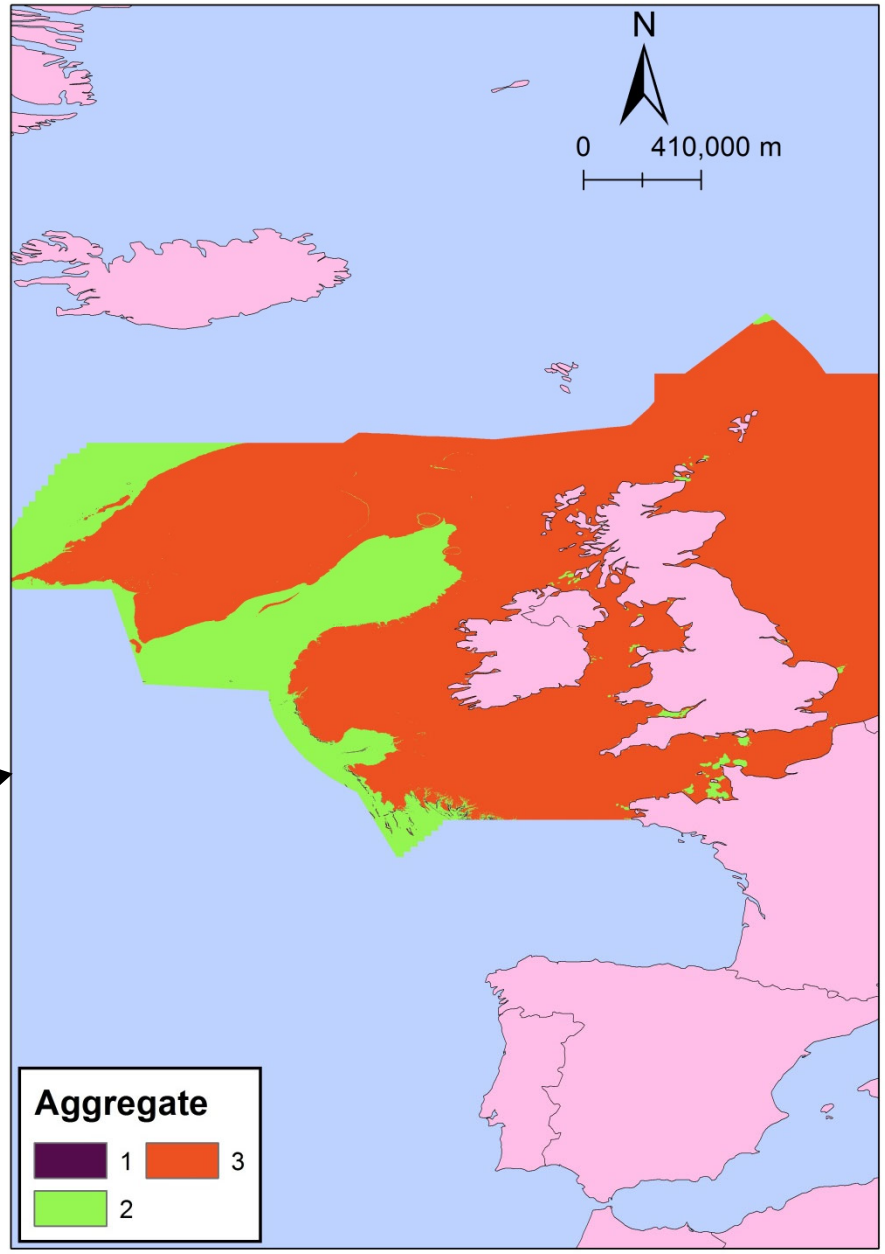
+

SLOPE

+

KE_CURRENTS

=



Summary

- A number of factors which will increase Marine Spatial Planning costs. Things which need to be considered by stakeholders/policy makers:
  - How much (%) of species can feasibly be protected for the lowest cost possible.
  - The effects of including MPA and fishing managed areas will have
  - The effects of fishing/trawling and (potential) oil exploitation will have.
- A basic technical constraints analysis involving deep sea oil and gas exploration in the North Atlantic was considered (and can be further developed).
- Factors such as bathymetry, topography (e.g. slope) and current speed should be taken into account.

Thank You!

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