Assessing cumulative pressures on priority marine features

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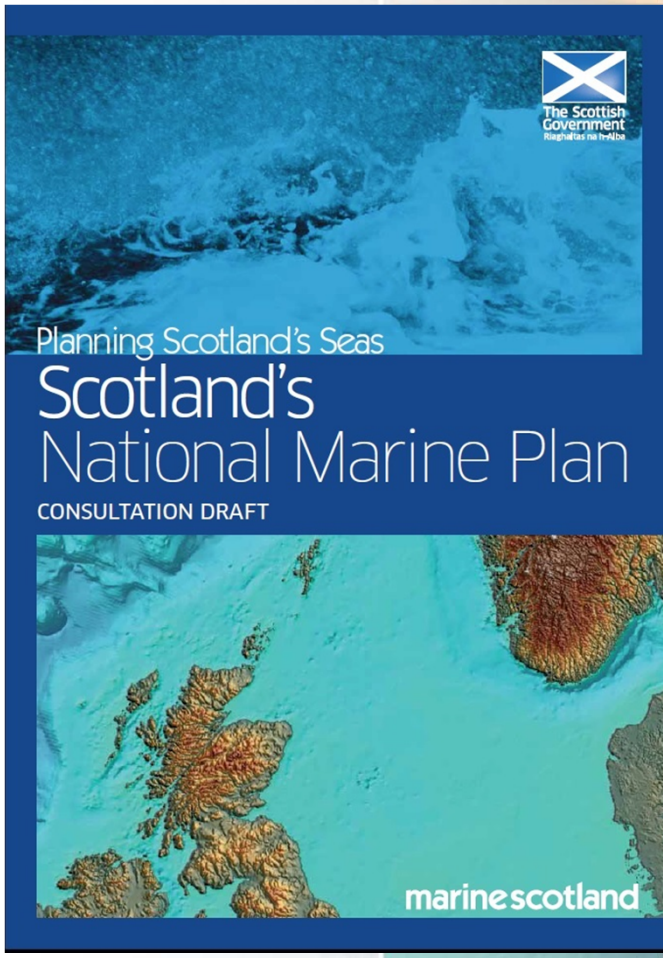
Marine management

- Sectorial approach to marine planning
- In the last decade marine spatial planning (MSP) become one of the most widely endorsed tools for integrated management of coastal and marine environments

MSP in Scotland

- Marine Act 2010 set out a framework for the development of a national marine plan and regional plans
- Launched National Marine Plan in 2013
- Sets out an overarching strategy



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MSP in Scotland

- Regional marine planning will allow more local ownership and decision making
- 11 across Scotland
- Shetland and Clyde first statutory regional marine plans developed under Marine Act
- PFOW pilot plan

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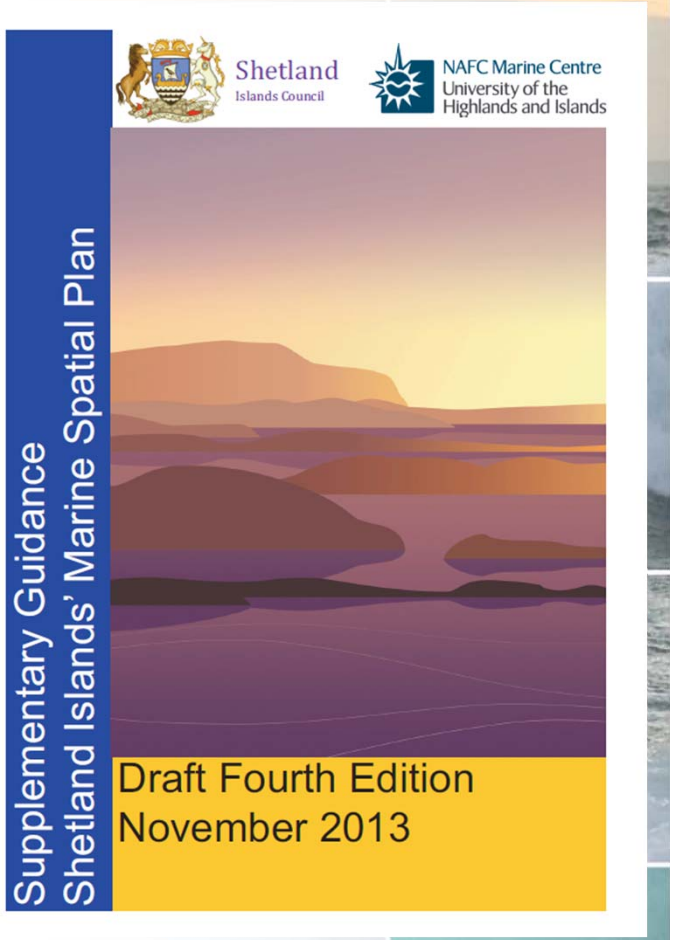
Spatial Planning Framework

- SMSP – 2006 SSMEI*
- 4th edition launched in 2014
- First statutory MSP in Scotland
- Policy Framework
- Now developing 5th edition under the Marine Act



*Kelly C., Gray L., Shucksmith R., Tweddle JF. (2014) Review and evaluation of marine spatial planning in the Shetland Islands. *Marine Policy*, 46: 152-160.

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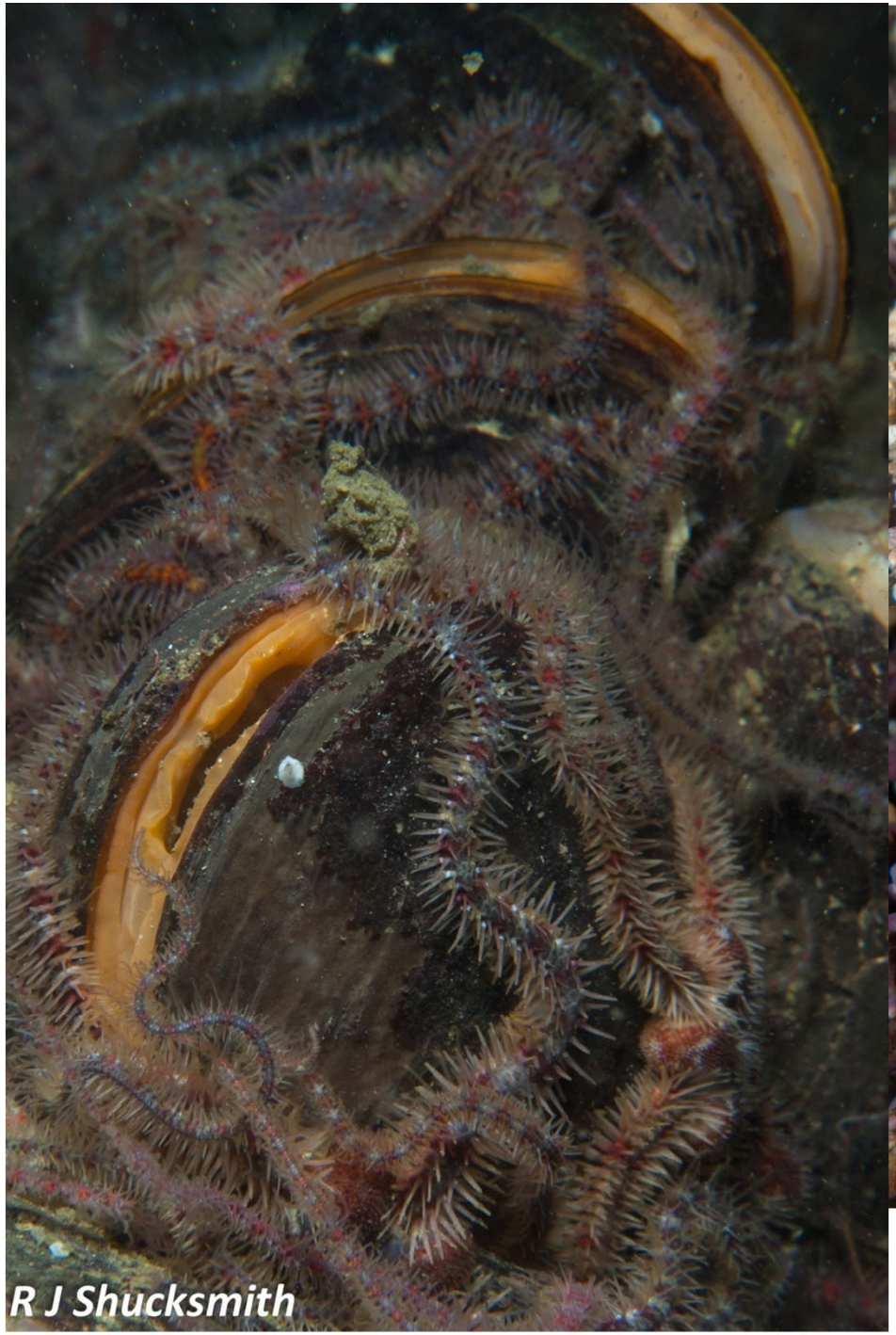
Spatial Planning Framework

- Adopt the ecosystem based approach to marine management
- State of the environment assessment in 2014/2015
- Determine current pressures on Priority Marine Features- maerl and horse mussels
- Relevant to achieving MSFD requirements


R J Shucksmith

Clean and Safe → Healthy and diverse → Productive

Ecosystems

Core ecosystem processes
Biophysical structures and processes

Production
Decomposition
Nutrient cycling
Water cycling
Ecological interactions

Beneficial Ecosystem Process
Ecosystem functions

1° Production
2° Production
Food wed dynamics
Formation of species habitat
Climate regulation
Water cycling
Waste assimilation
Erosion control
Species diversification

Human well-being- benefits

Beneficial ecosystem services

Fisheries
Aquaculture
Fertiliser
Salt
Biofuels
Medicines
Natural hazard protection
Environmental resilience
Regulation of pollution
Tourism
Aesthetic benefits

Values

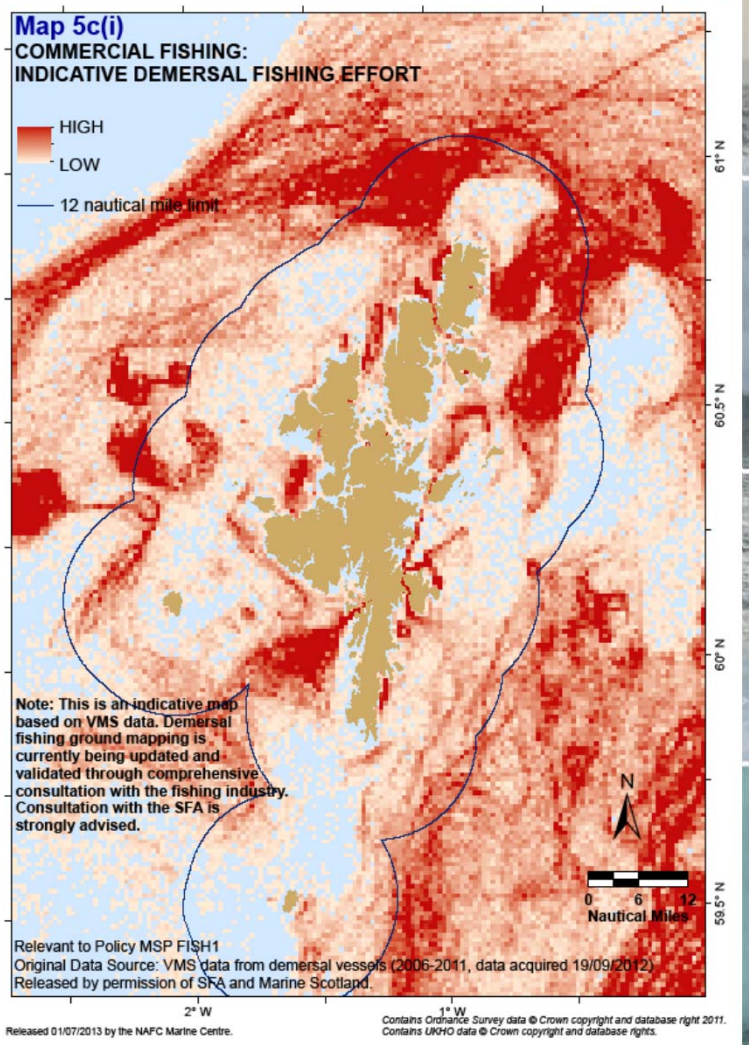
e.g. willingness to pay

Marine management

- Adequately manage both direct and indirect pressures on ecosystems
- Activities take occur in the right place, at the right scale and at the right time
- Assess both individual developments or activities
- Also cumulative pressures

Cumulative Impacts – Ecosystem based approach

- How to address CIs?
- Diverse human activities- mapped in MSP*
- Combined activity pressure with habitat sensitivity



*Shucksmith, R., Gray, L., Kelly, C., Tweddle, J.F. (2014) Regional Marine Spatial Planning- the data collection and mapping process. *Marine Policy* 50:1-9

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Methodology

- MSFD pressures and impacts
- Scores based on criteria – developed by Spatial Analysis Working Group
- Activity data and mapping
- ArcGIS model

Pressures, Impacts & criteria

Activities
Whitefish fishing
Shellfish fishing
Aquaculture
Oil & Gas
Renewables
Coastal Infrastructure
Tourism & Recreation
Wastewater Discharge
Shipping
Dredging
Telecommunications

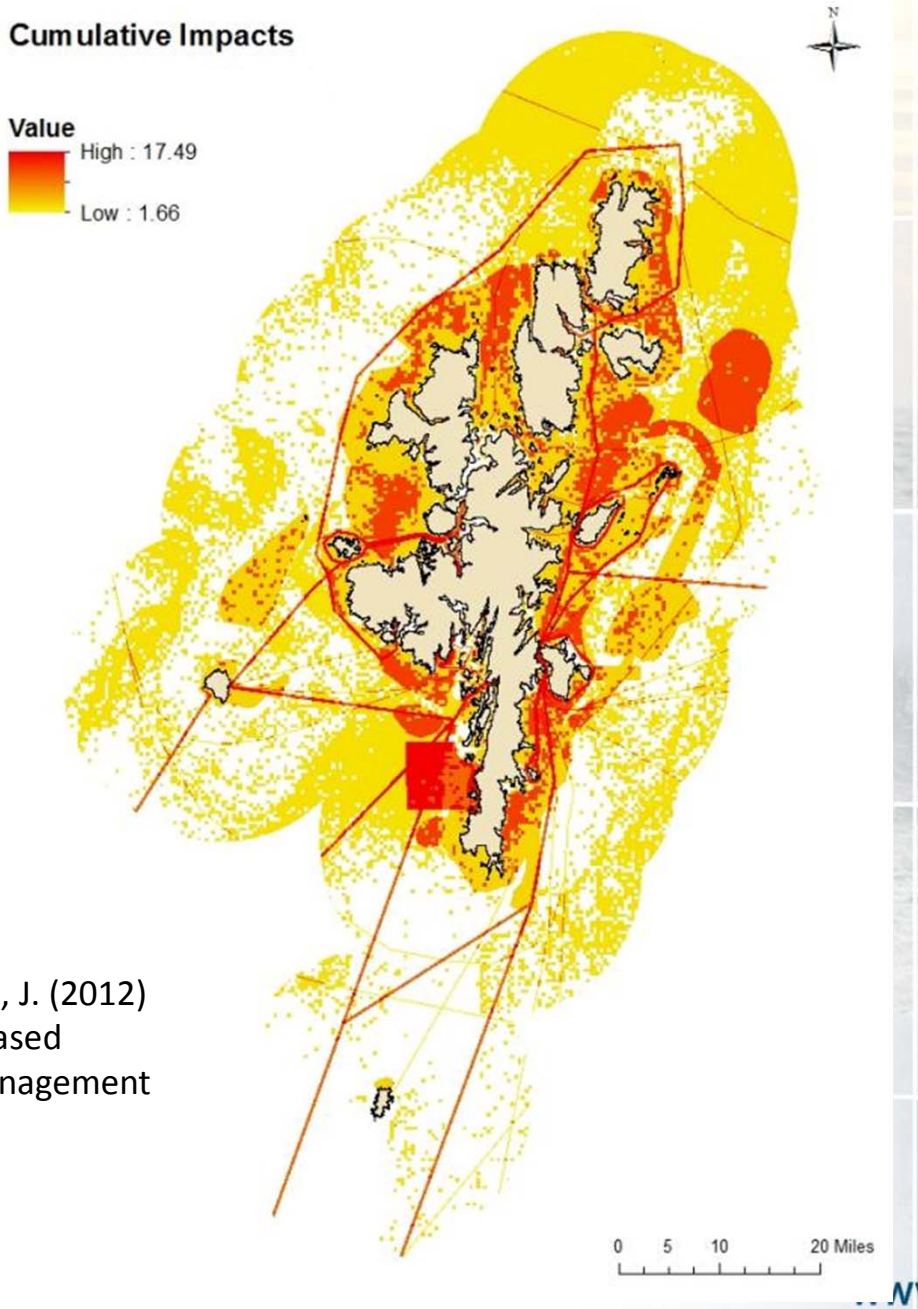
MSFD Impacts
Physical loss
Physical damage
Other physical disturbance
Interference with hydrological processes
Contamination by hazardous substances
Systematic and/or intentional release of substances
Nutrient and organic matter enrichment
Biological disturbance
Death or injury by collision
Barrier to species movement
Electromagnetic changes

Criteria and Scores	
Likelihood of impact/ certainty	**Rating 1-5**
Frequency of Activity / Effort	
Timescale to ecosystem recovery / stability (following cessation of activity)	
Extent of permitted impact / footprint	
Confidence in maps	

Outputs

Overall*

Cumulative Pressures



*Kelly, C., Gray, L., Shucksmith, R. and Tweddle, J. (2012) Shetland Marine Spatial Plan: An ecosystem-based approach in formulating marine policy and management options. *ICES CRR*

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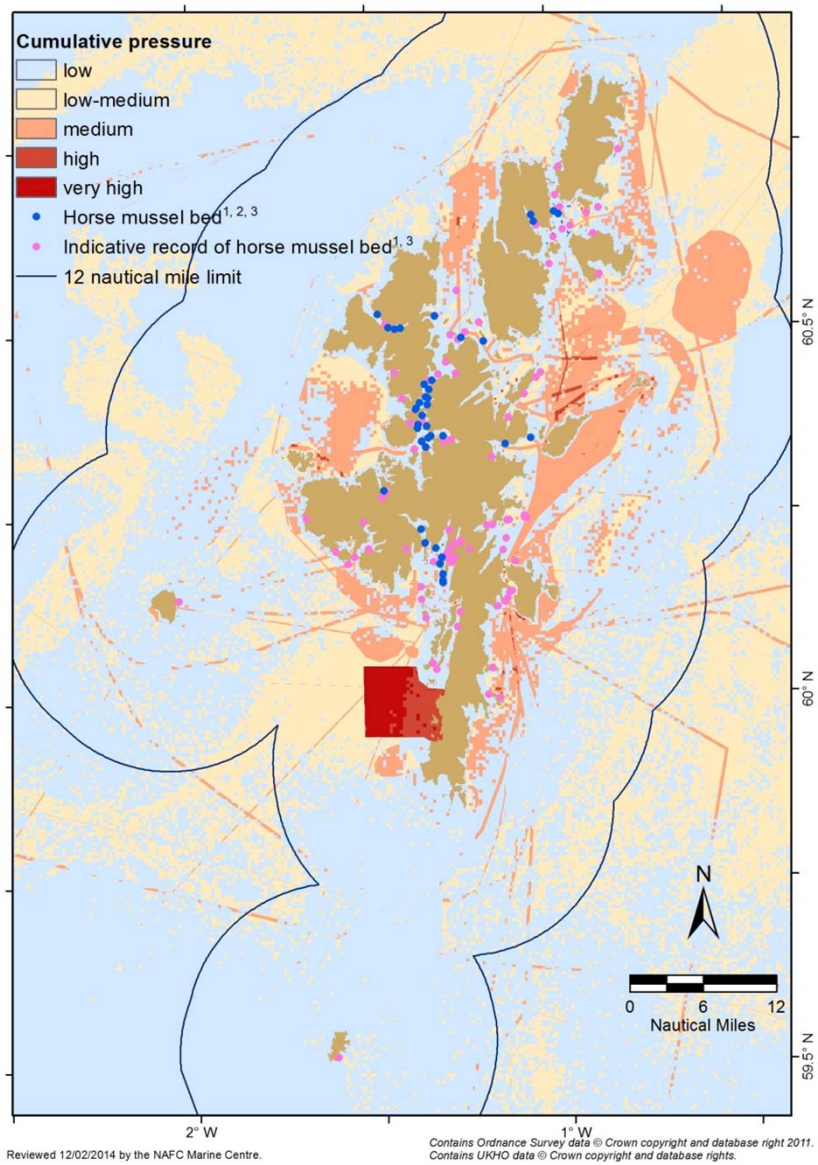
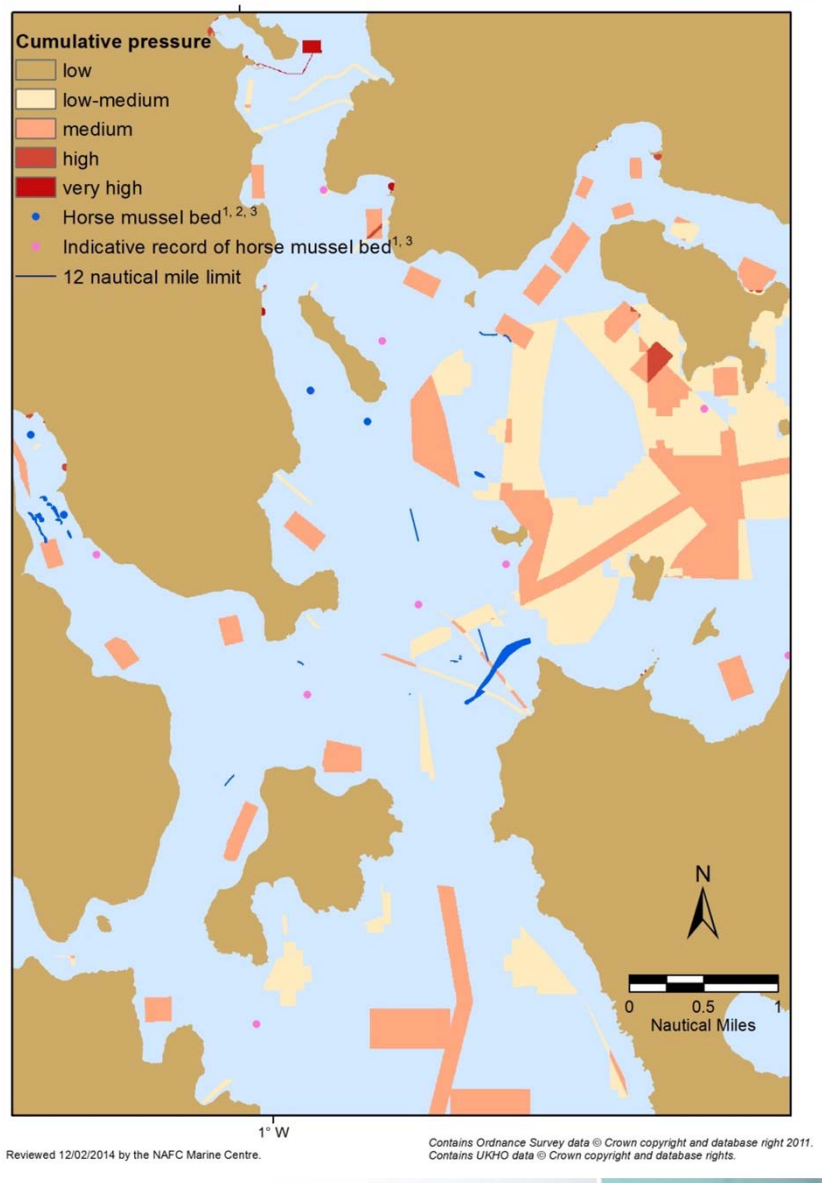
Species sensitivity

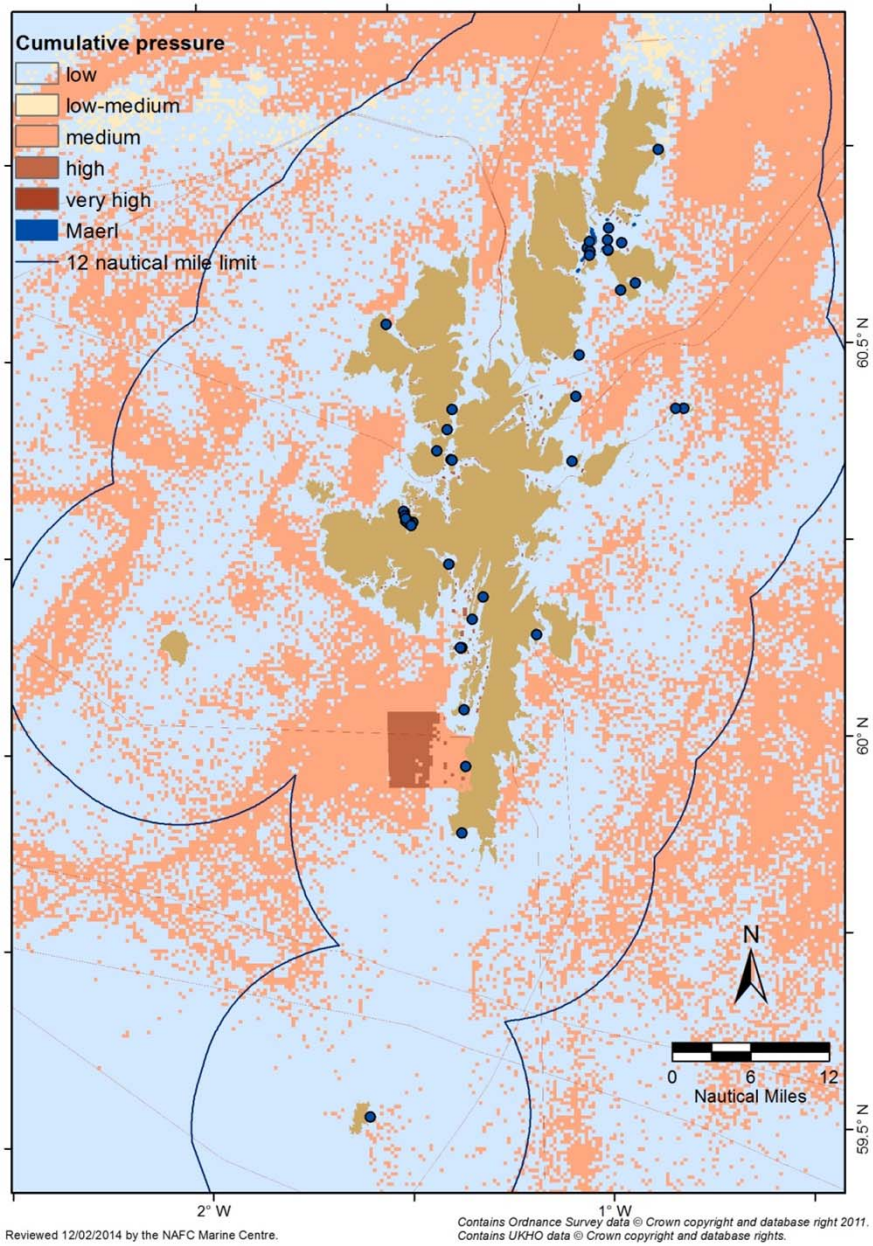
- Used sensitivity information from MARLIN
- Combined with activity data
- ArcGIS model
- Habitat/ species specific outputs

Horse mussels





Maerl


Cumulative pressure
low
low-medium
medium
high
very high
Maerl
12 nautical mile limit
N
0
6
12
Nautical Miles
60.5° N
60° N
59.5° N
2° W
1° W
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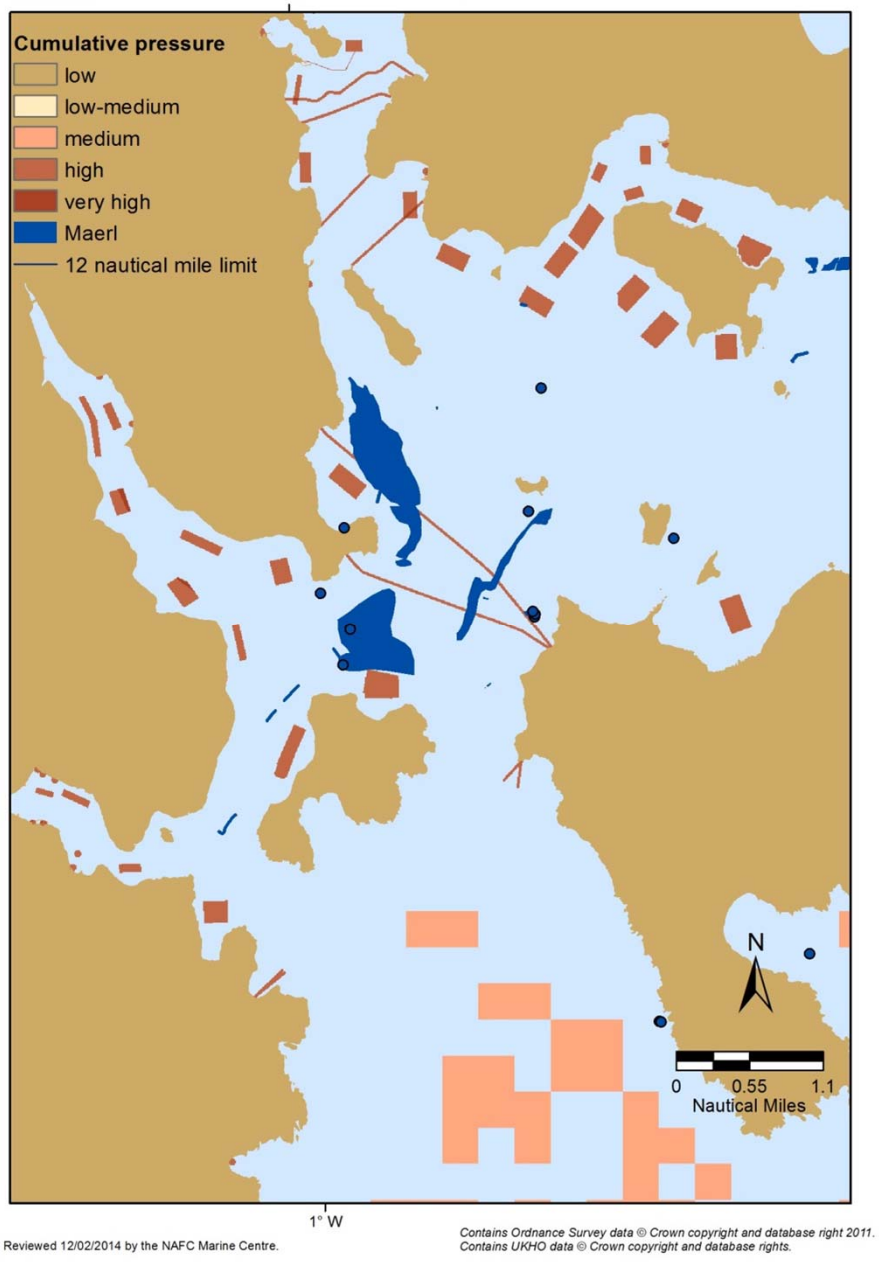
Cumulative pressure
low
low-medium
medium
high
very high
Maerl
12 nautical mile limit
N
0
0.55
1.1
Nautical Miles
1° W
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Modelling

- Current marine area subject to varying pressure (low, medium, high)
- Impacts of new activities or new management measures
- Direct policy development
- For example fisheries closed areas*

*Shelmerdine, R.L., Stone, D., Leslie, B., and Robinson, M. (2014) Implications of defining fisheries closed areas based on predicted habitats in Shetland: a proactive and precautionary approach. *Marine Policy* 43:184-199.

Ecosystem management

- No systematic survey for these features
- Most data only available as point data
- Exception data collected by NAFC Marine Centre*
- Some records collected due to development
- Difficult to determine what spatial extent (%) of PMF is being impacted

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Ecosystem management

- Impacts of historical activities and how effect current distribution
- Spatial accuracy of historical records
- Link modelled pressure to observable impact
- Difficult to create evidence base to guide ecosystem based management

Conclusion

- Benefits:
- inform and develop marine planning policy
- safeguard the marine environment
- ensure sustainable provision of goods and services
- Further research required:
- determine spatial extent of features
- ground truth mapped pressure levels

Conclusions

'It is not possible to plan and manage marine ecosystems or components of ecosystems, only human activities in marine areas' (Ehler and Douvere, 2009)

Thank you,

Any Questions?

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