



# Ecosystem modelling in support of Marine Spatial Planning and governance

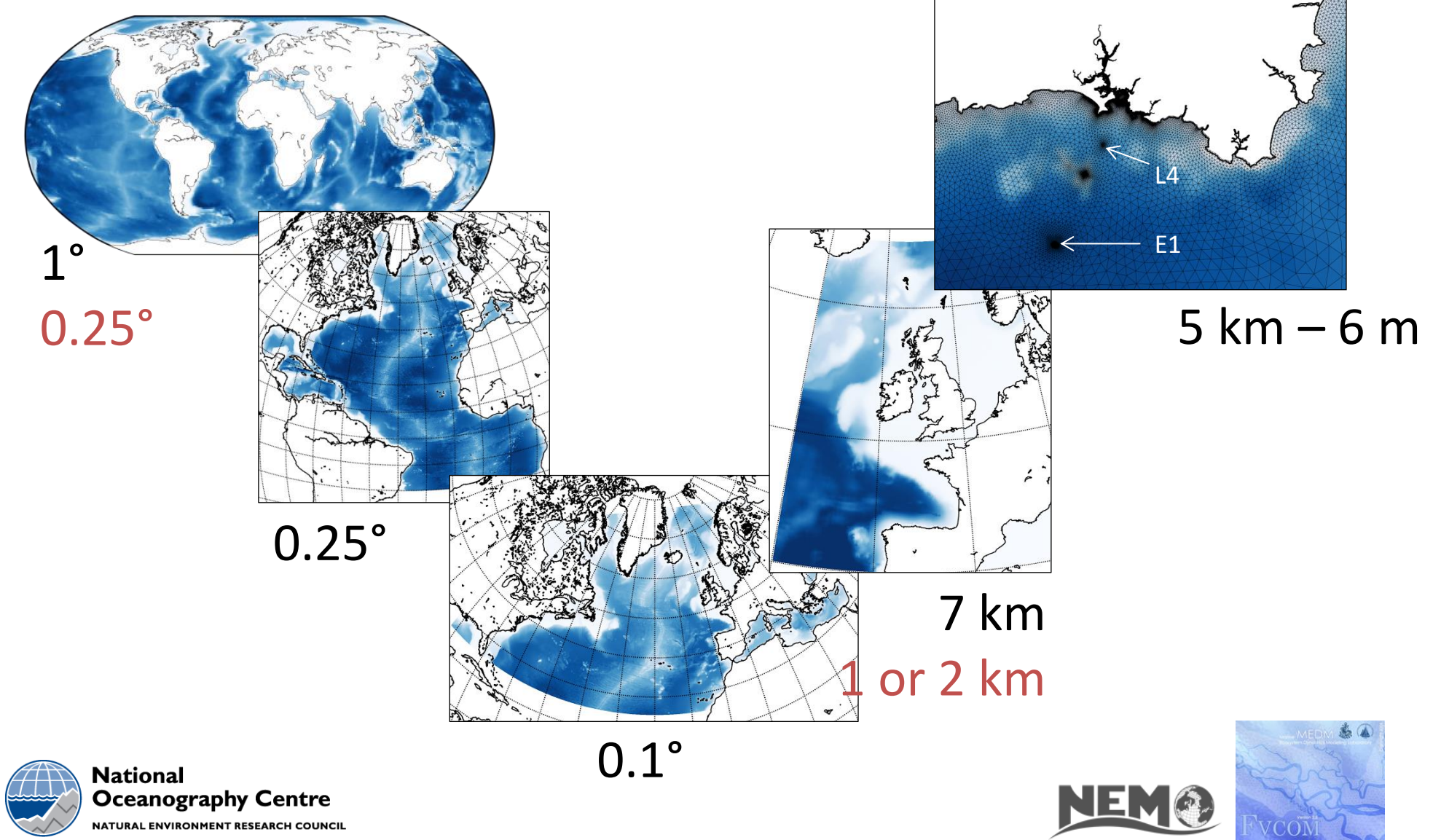
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## Introduction

There is an increasing requirement to take an evidence based approach to Marine Spatial Planning, however the expanding number of maritime activities and our advances in understanding the complex interactions within marine ecosystems require an ever increasing volume of data. A scientifically sound ecosystem based governance is therefore, required to maintain, and possibly increase, the benefits that marine ecosystems provide to society.

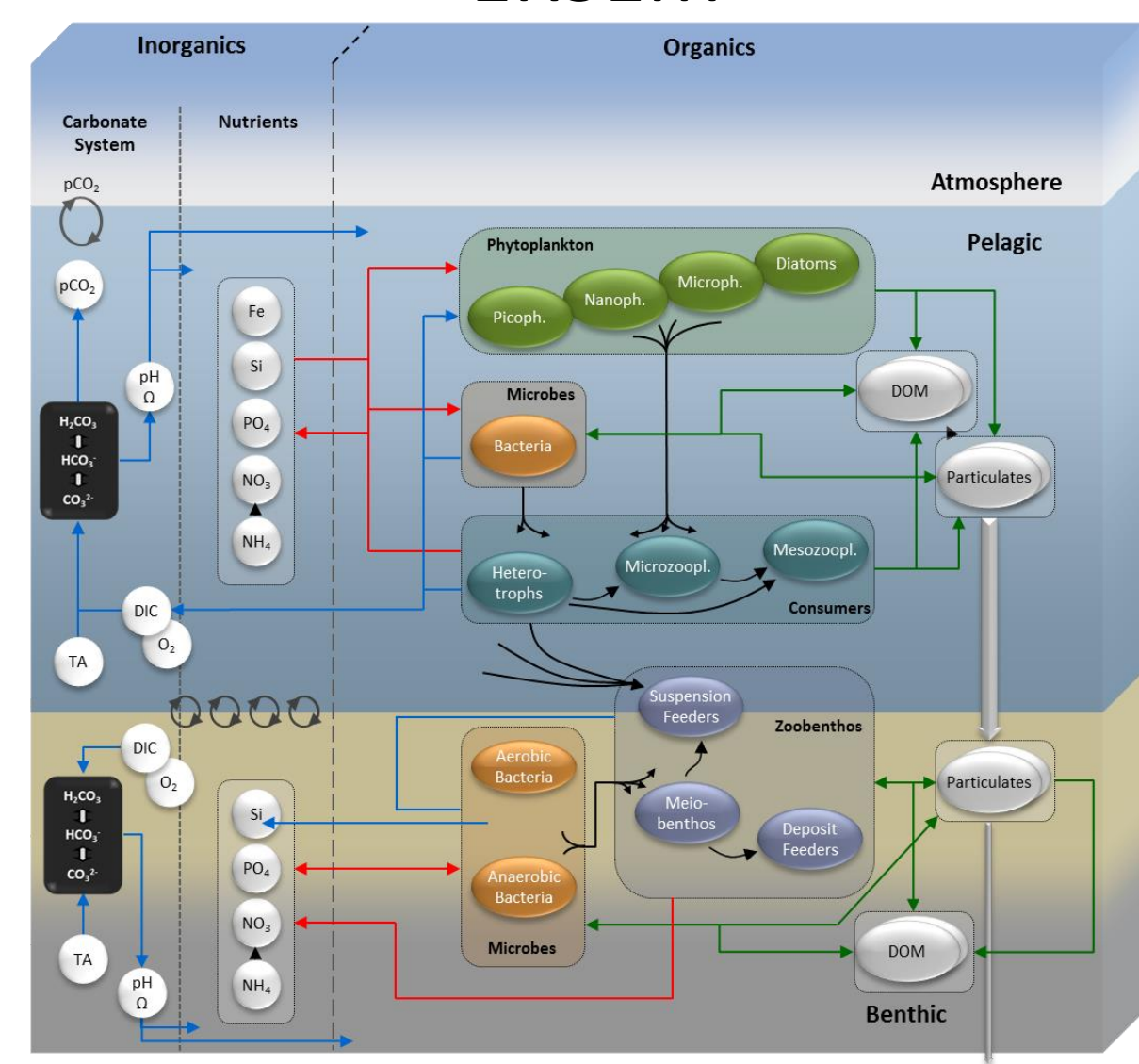
Marine ecosystem models are numerical tools that are able to simulate the dynamics of marine ecosystems under present stressors and different policy scenarios. They can integrate spatial and temporal gaps of monitoring programs giving the best synoptic picture of the state of the ecosystem.

Complex ecosystem models can provide a wide range of information on Ecosystem services and indicators (e.g. Habitats, nutrients and oxygen concentration, carbon sequestration, food web structure...) and straddle multiple scales, from global to regional to local capturing the requirements of Marine Spatial planning.

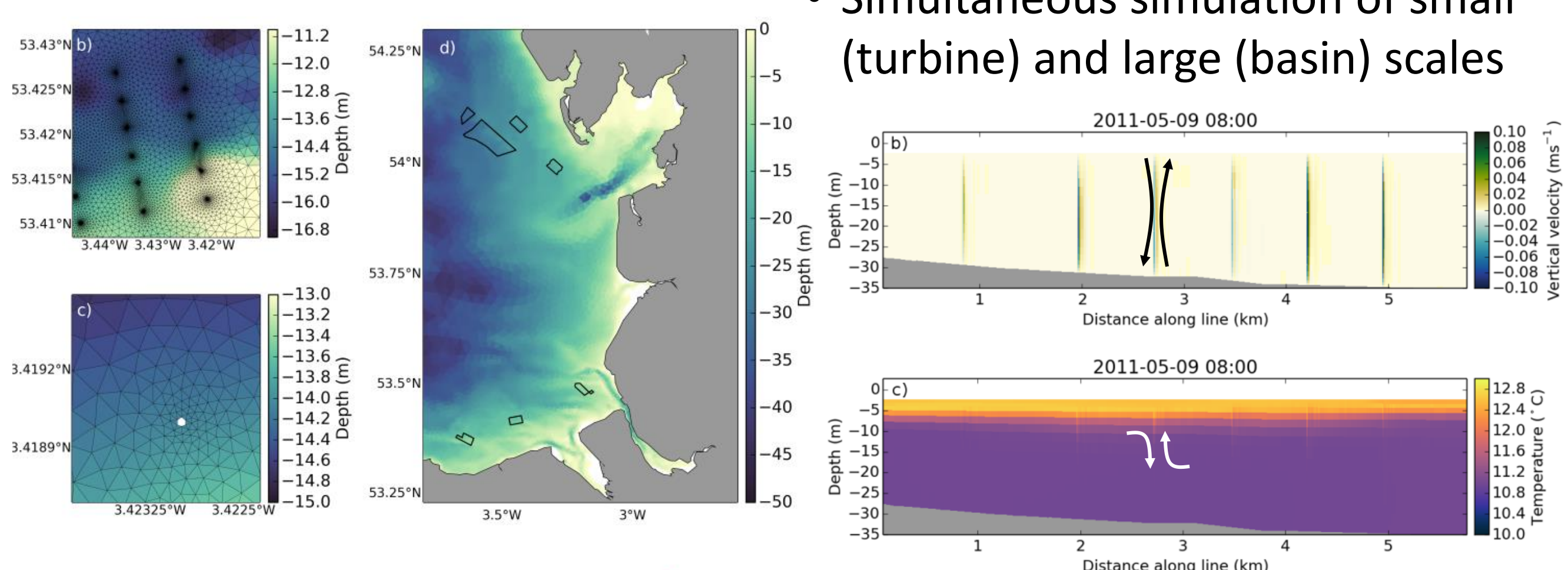


National Oceanography Centre

## ERSEM

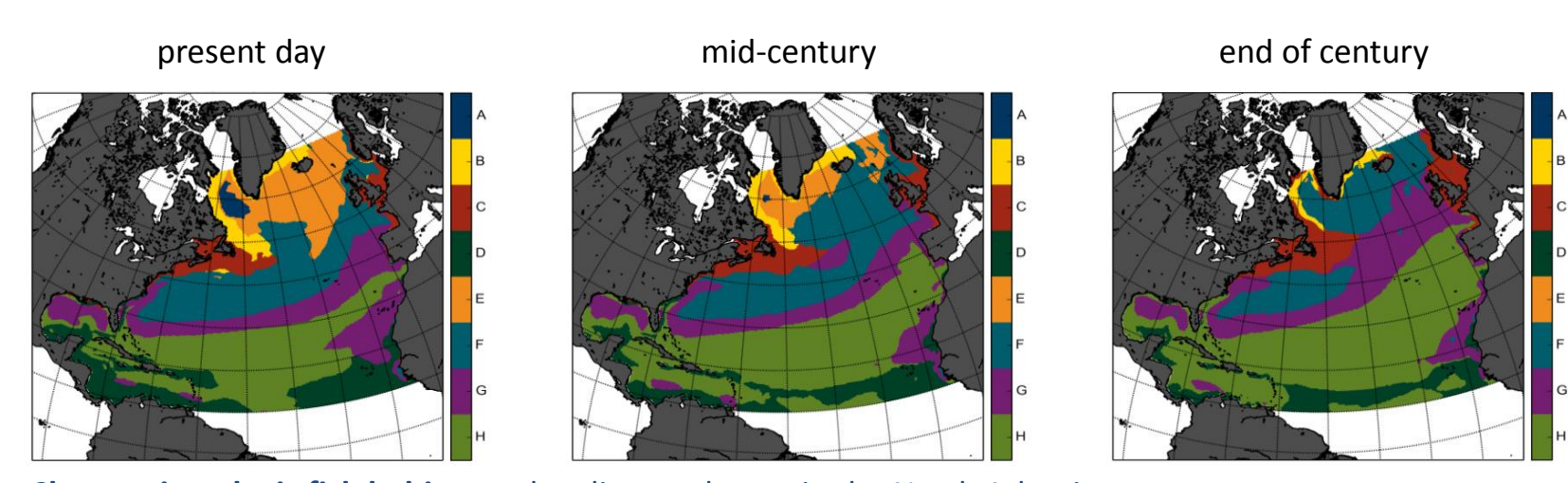
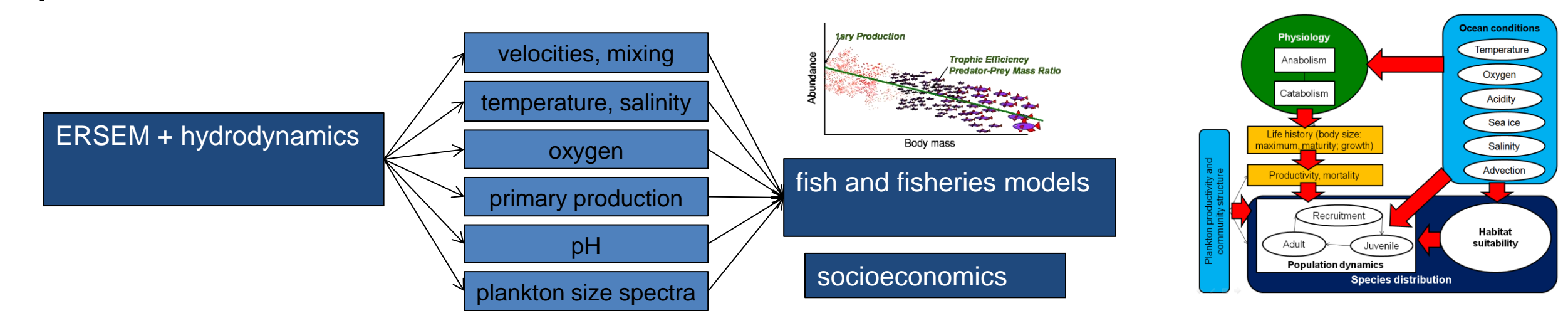


## Offshore Marine Renewables



## Physics to food

Marine ecosystem models coupled to fish and fisheries models can evaluate natural world interactions with socio-economics management aspects.



Changes in pelagic fish habitat under climate change in the North Atlantic. Note the disappearance of high-latitude habitats by 2100 (Butenschön et al. 2015 ICES ASC)

• Simultaneous simulation of small (turbine) and large (basin) scales

- Local/regional impacts include residual circulation changes and increased vertical exchange of deep waters with surface layer and vice versa.
- Potential large scale impacts include shifts in tidal structure with increased coastal risks

## Climate change

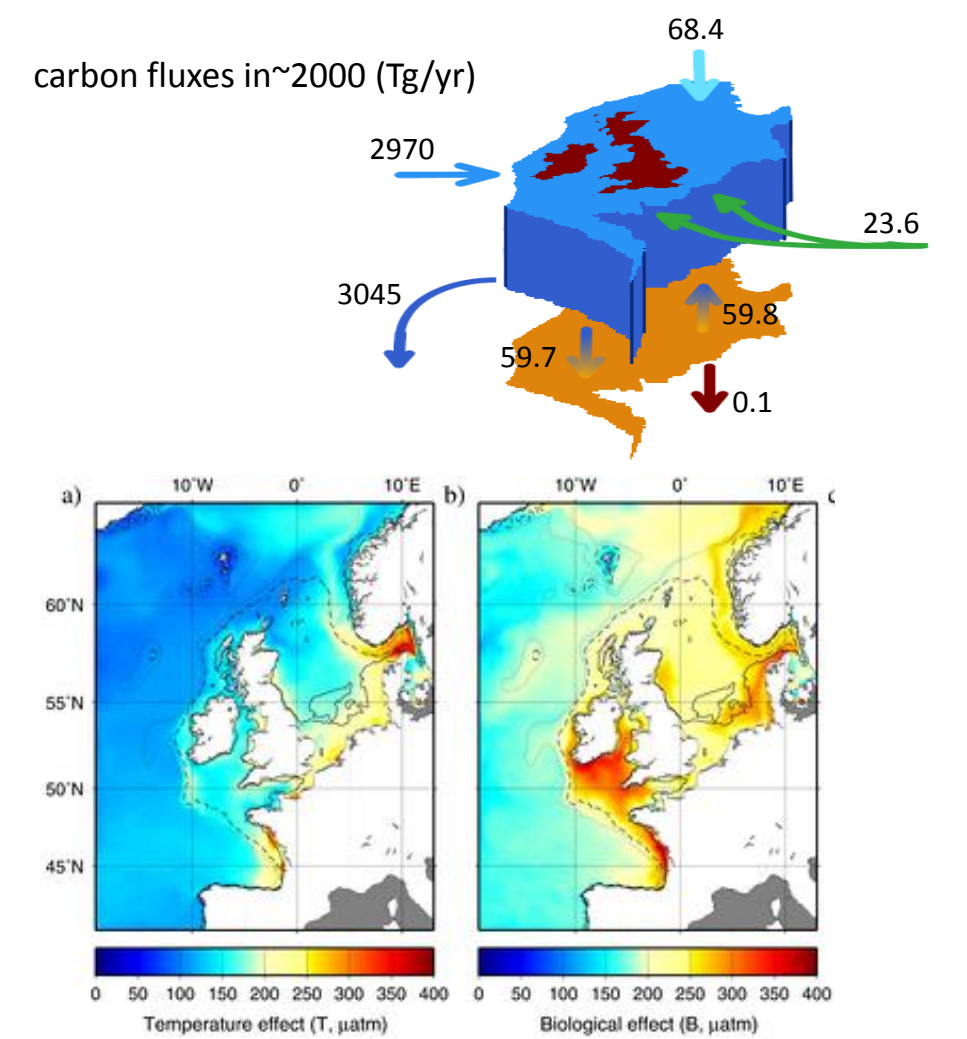
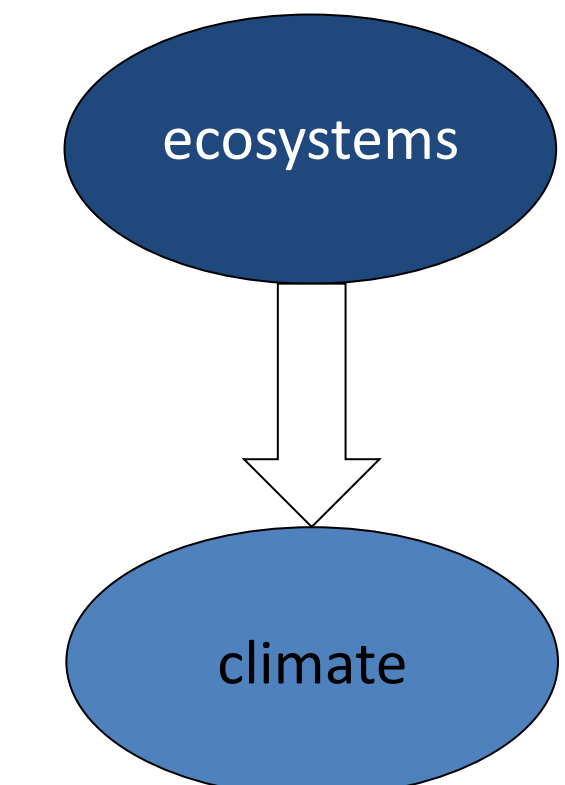
Models can be used to project responses of the marine ecosystem to global change.

This allows managers and policy makers to tailor their strategies to a changing ecosystem, and to test the efficacy of the planned measures before implementation.

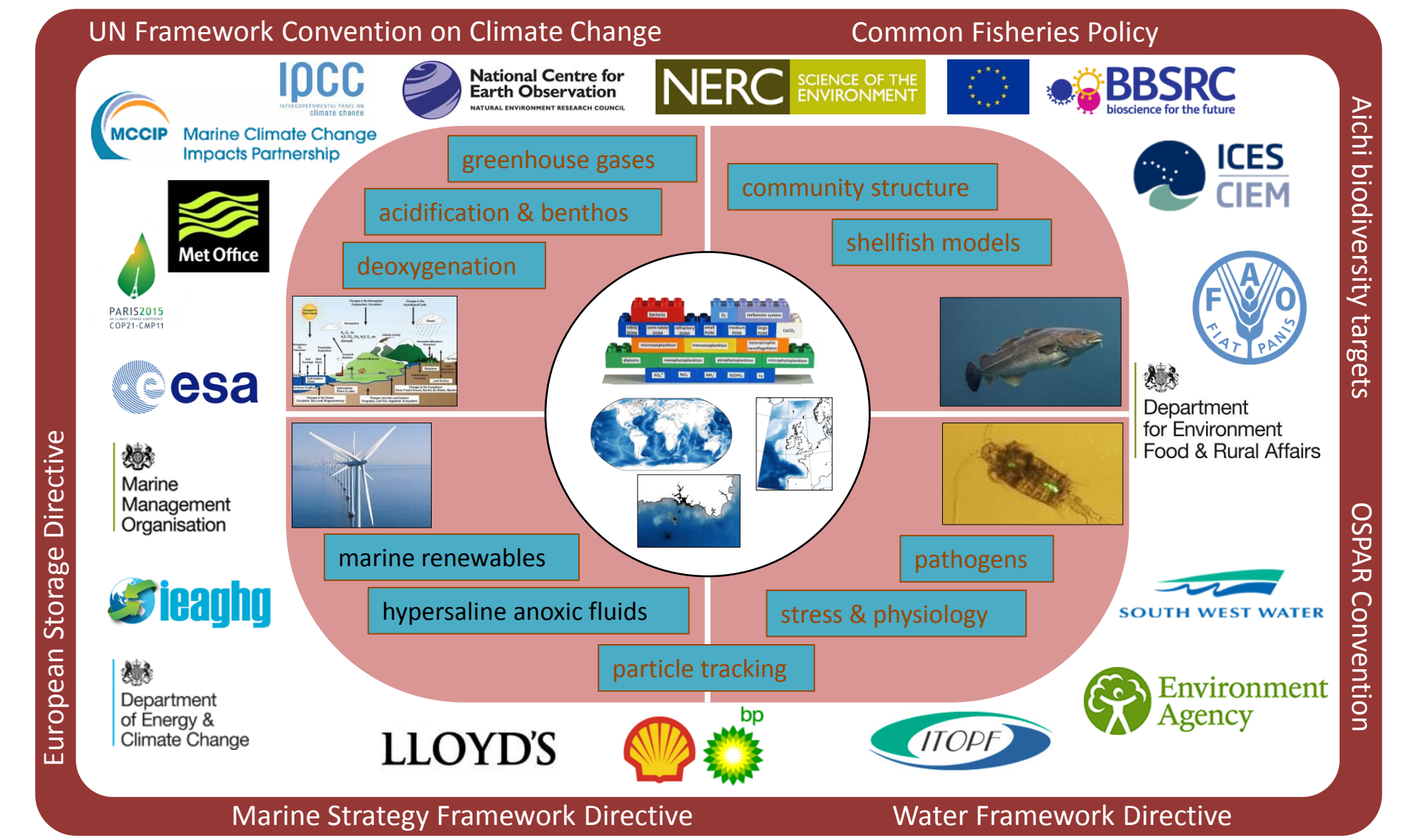
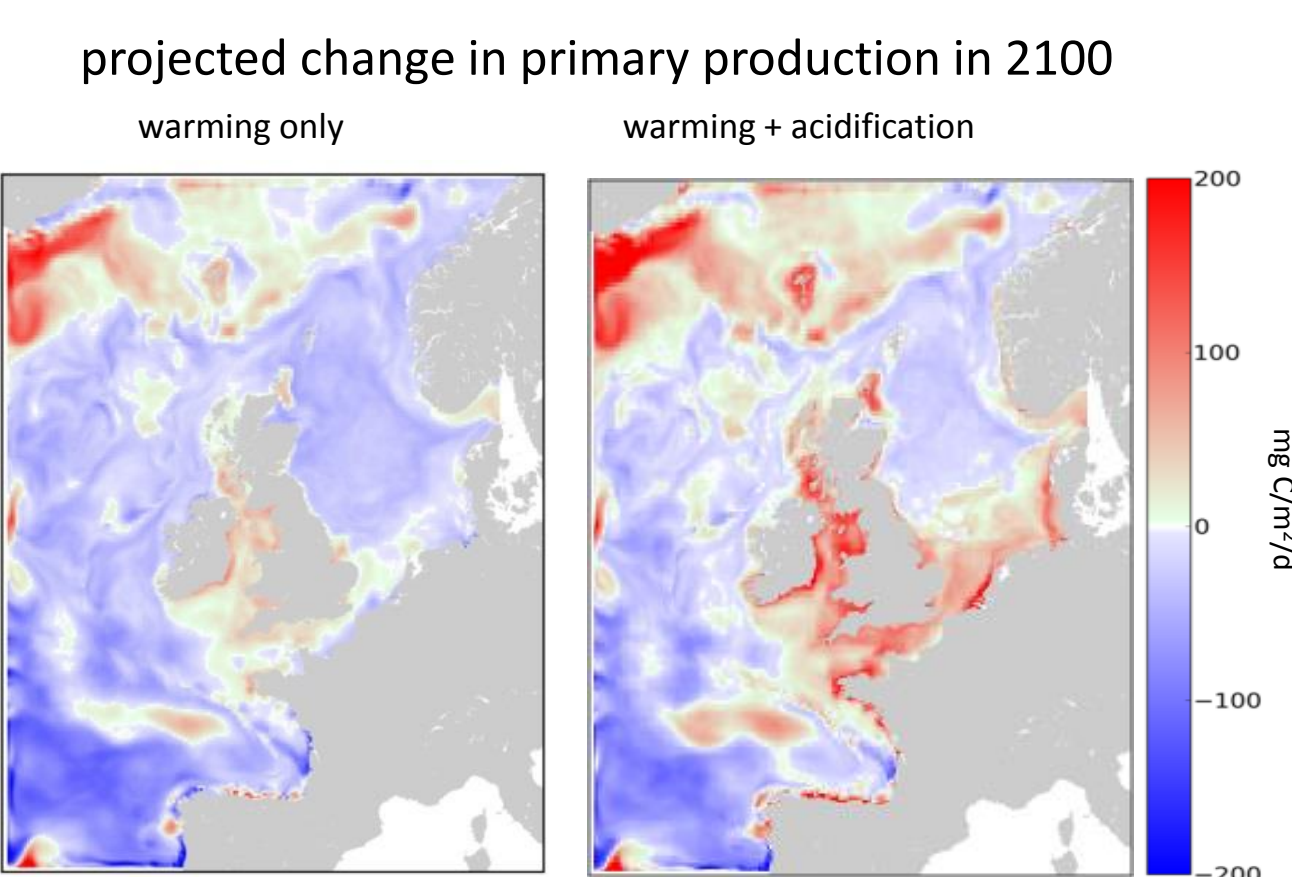
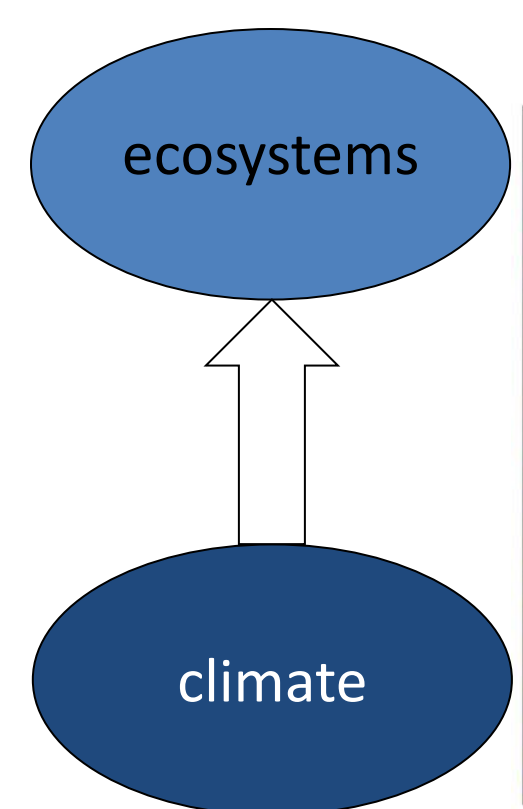
Marine ecosystem models are powerful tools capable of implementing an ecosystem-based approach for marine governance.

## Aspiration

PML aspiration is to develop ecosystem models capable of addressing issues relevant to national, international and global policy by establishing partnerships across academia, industry and management bodies.



Wakelin et al. 2012 J Geophys Res Oceans



Climate impacts projections can be incorporated into policy providing relevant long-term management options