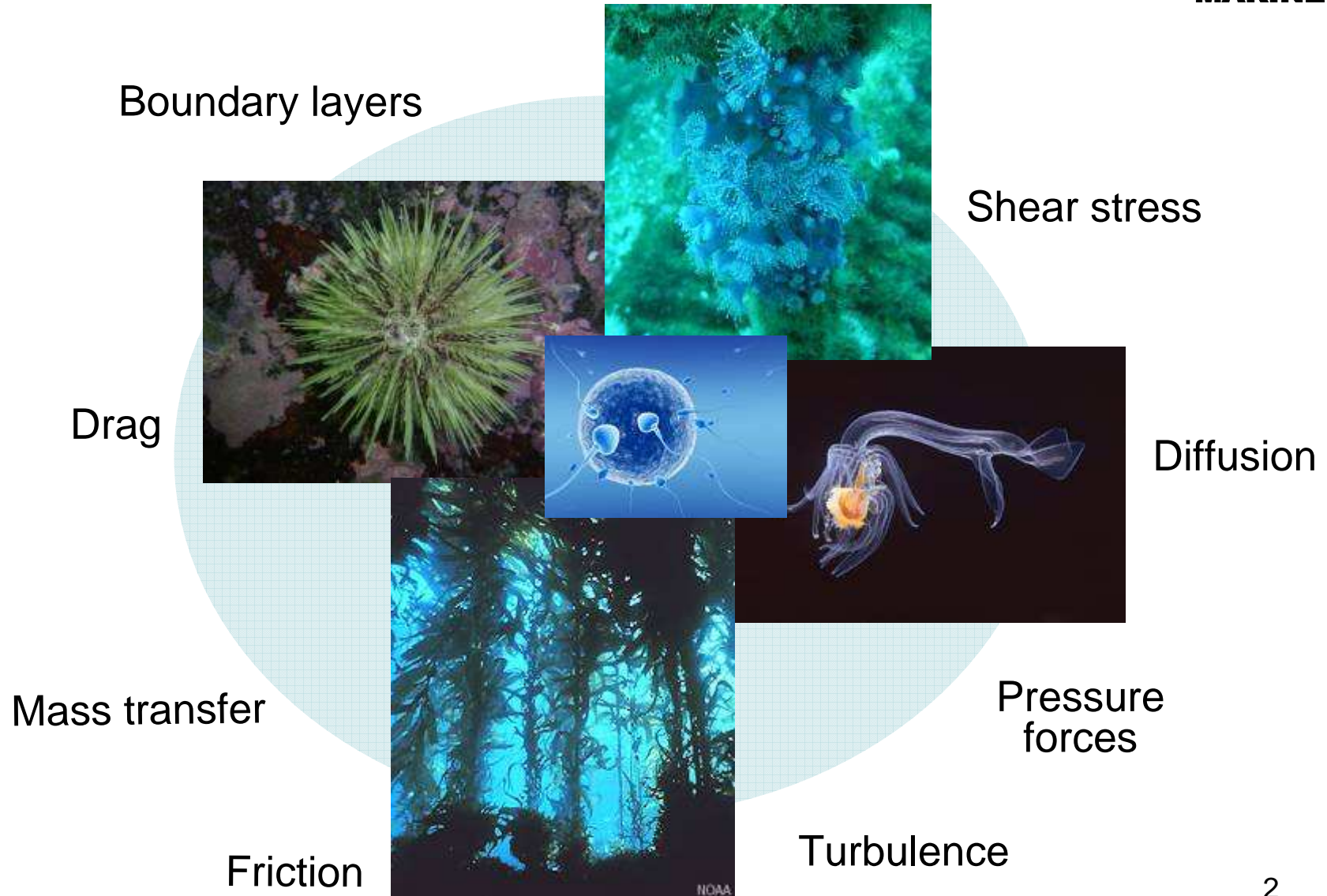


## Environmental Studies

What can they tell us about the impacts  
of marine energy converters on inshore  
ecosystems?

Louise Kregting, Björn Elsäßer and Graham Savidge  
Queens University Belfast

# The complexity of physical processes and biological life forms



## **Despite the complexities of the environment we are working in:**

We can already make some statements about the likely impact of Marine Energy Converters on individual components of the inshore ecosystems.

The Queen's University Belfast SuperGen 2 work programme has focused on two topics:

- 1. Growth response of kelp plants to varying hydrodynamic conditions**
- 2. Environmental impact of the SeaGen tidal turbine**
  - Investigations carried out in conjunction with Marine Current Turbines**

## Why are kelp important?

- Kelp species can be viewed as ecosystem drivers as they input the bulk of primary production (energy) to coastal ecosystems.
- They help to maintain biodiversity
- Provide essential nursery grounds for inshore fisheries

## How does water motion influence kelp growth (primary productivity)?

- Influences nutrient and carbon acquisition through boundary layer effects hence controlling photosynthesis and growth
- Reduces self-shading of the fronds
- Affects plants and populations directly through physical damage – storm effects





# Comparison of the growth rates of two different kelp species

*Laminaria hyperborea* (Subtidal)



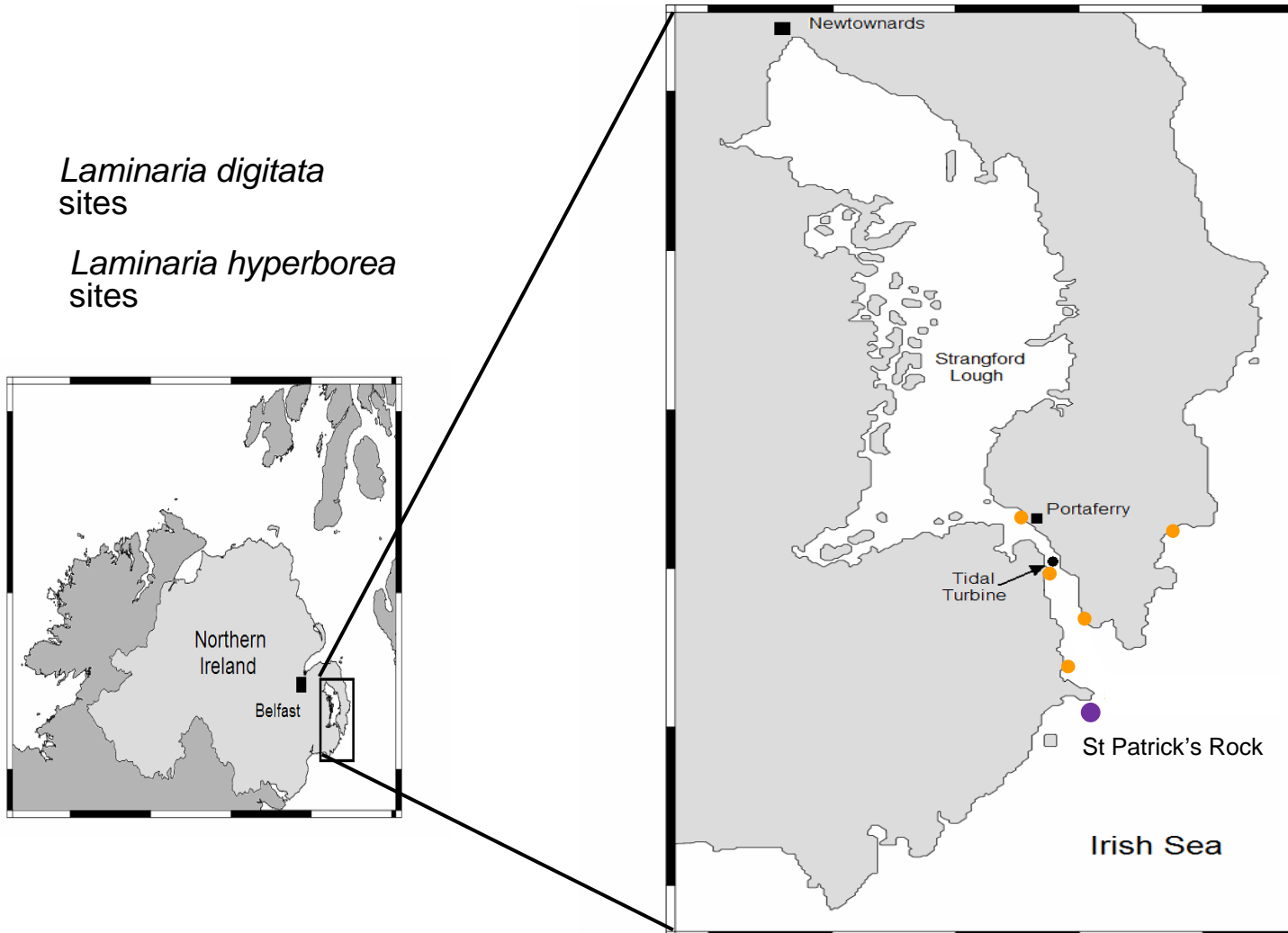
*Laminaria digitata* (Intertidal)



# Location of kelp studies

Sampling sites encompass a broad range of hydrodynamic environments.

- *Laminaria digitata* sites
- *Laminaria hyperborea* sites





# Parameters measured

## *Physical*

Hydrodynamics (ADCP)  
Temperature  
Light  
Seawater Nutrient Concentration

## *Biological*

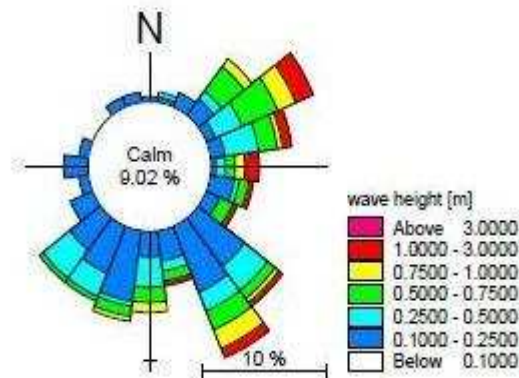
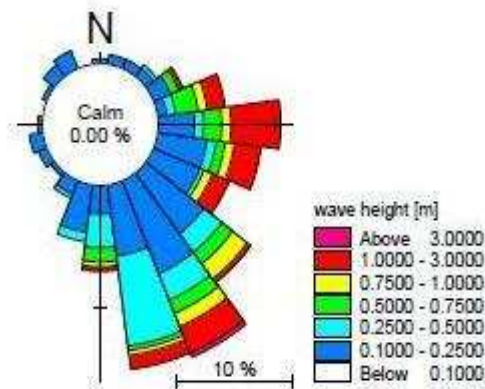
Blade and Stipe Length  
Internal Soluble Nutrient Pools  
Total Carbon  
Total Nitrogen  
Isotopes ( $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$ )  
Population Density  
Plant Morphology



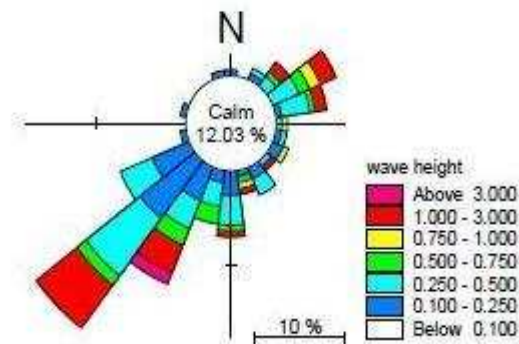
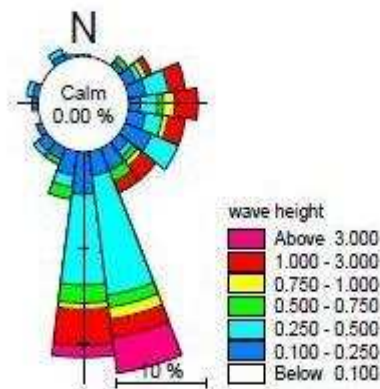
# Wave climate on exposed and sheltered sides of St Patrick's Rock

Exposed site

Sheltered site

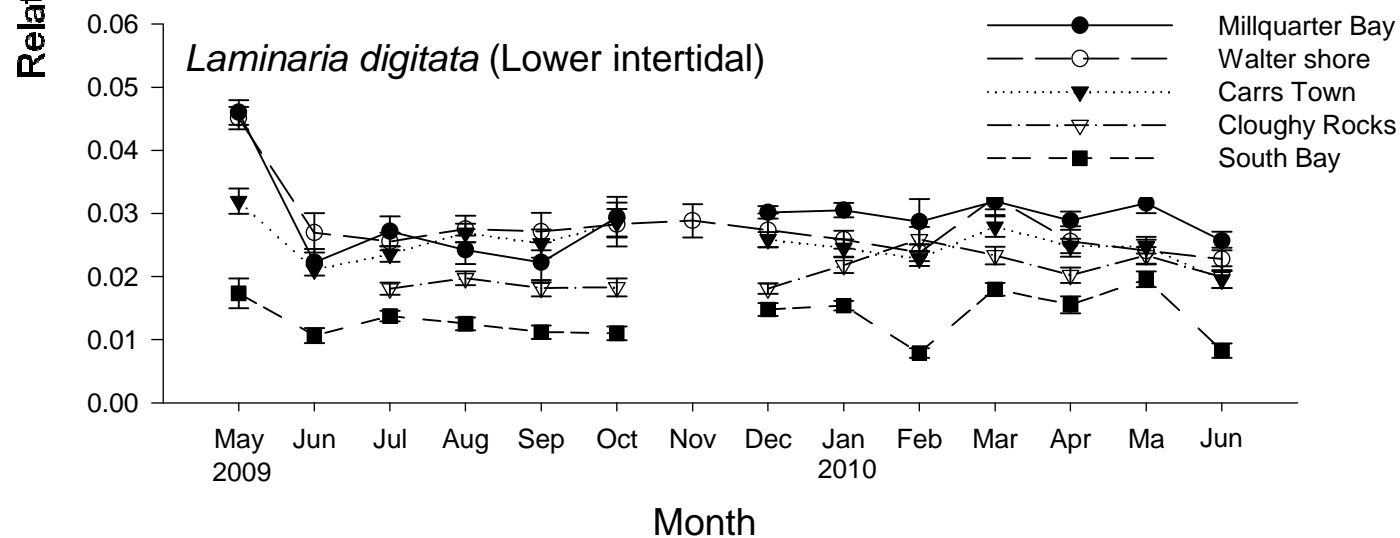
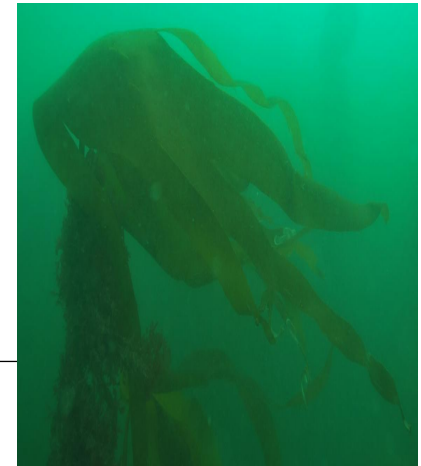
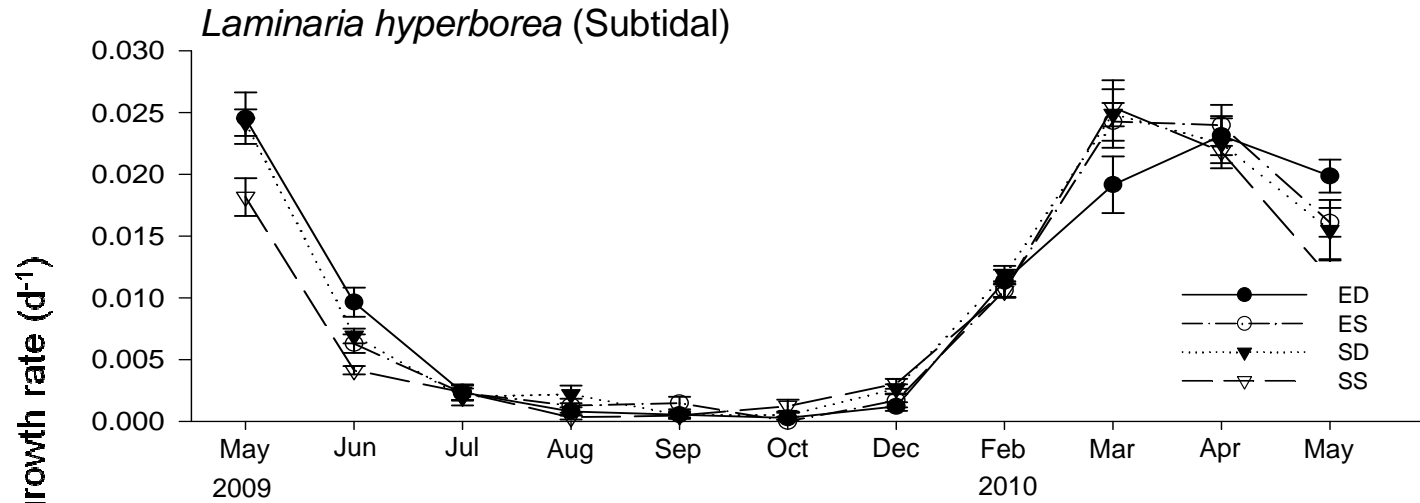


Feb/March 2010



March/April 2010

# Effect of contrasting hydrodynamic environments on kelp growth



## Kelp research - Conclusions

1. Changes in wave climate are unlikely to have an impact on the growth rate of adult *Laminaria hyperborea*
2. For *Laminaria digitata*, the two most exposed wave and current sites had the lowest growth rates

*The data highlight the complexity of responses of individual species to changes in the environment*

# The environmental impact of the SeaGen tidal turbine





# SeaGen Tidal Turbine Environmental Monitoring Studies

- Shore-based observations of seal, porpoise and seabird activities have shown no significant biological influence of deployment of SeaGen.
- Observations are on-going and will be completed in spring 2011
- Observations of benthic communities have demonstrated no significant influence of SeaGen
- Mitigation measures designed to minimise collisions of seals with SeaGen (Sea Mammal Research Unit Ltd) are ongoing





## SuperGen 2 WS 10 Outcomes

- Two applications have been submitted to Technology Strategy Board through Marine Current Turbines:
  - 1) To establish a generic relationship between current velocity and benthic communities (QUB, Envision Limited and NUI Galway)
  - 2) Analysis of SeaGen seabird data in relation to historical records (University of Exeter and QUB)
- Strong interactive working relationship developed between engineers and biologists