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Responses of the Intertidal Key Species *Fucus serratus* to North Atlantic Warming

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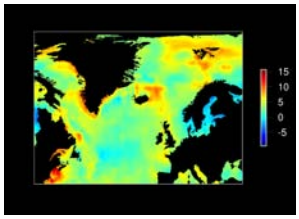
Introduction

Marine intertidal ecosystems are likely to be profoundly affected by climate change because human impacts have already undermined their resilience and capacity to buffer additional environmental stresses. Global environmental change invokes two basic responses of organisms: ecological (dispersal, phenotypic plasticity) and evolutionary (genetic change), both of which are integrated into a "move, be plastic, or evolve" strategy. We investigate ocean warming responses in the seaweed *Fucus serratus*, a key ecosystem engineer of North Atlantic rocky shores with focus on: (1) predicting distributional changes under warming air and water temperatures and (2) identifying genetic changes over the past decade throughout the species' distributional range.



Maximum SST Change (2000 - 2200)

Ocean warming impact →

Fucus serratus

Ecosystem effect →

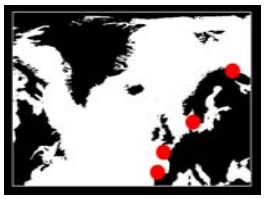
Habitat Provisioning Key Species

Fucus serratus Responses

Methods

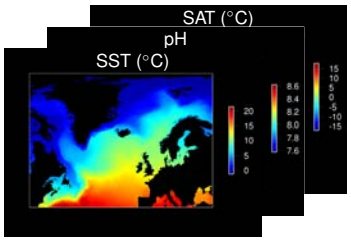
Adaptation

2000 — 2010



Temporally paired samples

Distributional Shift



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Environmental Variables

Georeferenced Occurrences

MAXENT
Phillips et al. (2006)
Ecological Modelling

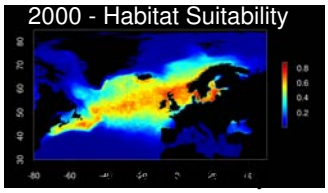
Genotyping

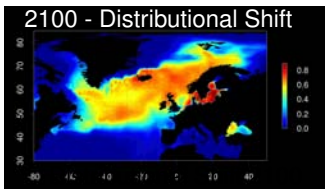
31 Microsatellite loci
20 linked to ESTs

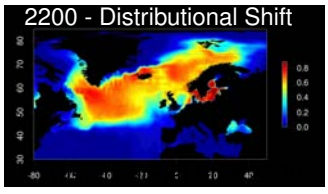
ABI 3500xl Genetic Analyzer

Data Analysis

- Genetic Variability
  GENETIX - Belkhir et al. (2001)
- Genetic Differentiation
  GENETIX - Belkhir et al. (2001);
  DEMEtics - Gerlach et al. (2010) Mol. Ecol.







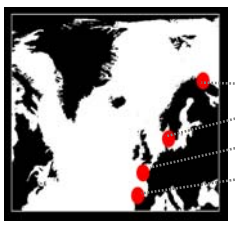
Habitat suitability of *F. serratus*

Future projections based on predicted changes of:

- SAT Surface Air Temperature
- SST Sea Surface Temperature
- Salinity

according to the A1B (720 ppm stabilization) IPCC scenario.

Results



	Heterozygosity 2000/2010	Differentiation (2000 - 2010) F_{ST}/D_{est}
	0.28/0.31	0.087*/0.057*
	0.52/0.50	0.012*/0.016*
	0.69/0.68	0.006*/0.019*
	0.46/0.42	0.009*/0.018*

$* : p < 0.05$

Conclusion

The predicted absence of *F. serratus* from North Atlantic rocky shores below 45° latidude may result in substantial ecosystem restructuring with potential societal and economic impacts. Whole genome scans for loci under selection will clarify whether the drastic genetic changes over the past decade with a loss of genetic diversity at the southern distributional range indicate adaptation to strong selective pressure. Adaptive responses could mitigate the predicted northward retreatment