Understanding Climate Change Impacts and Adaption for Ecosystems Using Qualitative Models

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Uncertainty and Climate Impacts

Physical Processes

Ecosystem Impacts

Stainforth et al. (2007)

Harley et al. (2006)

The Problem in a Nutshell

Climate change and adaptation

Interaction strength

Ecosystem responses

Number of interactions

?
So what can we do?

- Fully parameterise models for all ecosystems

  - Very difficult!!

  (see Berlow et al. 2004)

- Identify when we can make generalisations

  - AND

- Identify which interactions determine ecosystem responses

OR

(see Berlow et al. 2004)
Qualitative Loop Analysis

Ecosystem 1

Ecosystem 2

Prediction Matrices

Bondavalli et al. (2009)

(See papers by Levins, Puccia and Dambacher)
South West Marine Region

Important fishery and tourism industries

Small pelagic fish important for fisheries and tourism

Potential climate change impacts not well understood
Adaptation - Reduce Fishing Effort

- CO₂
- EFF
- SPL
- CARB
- TEMP
- MIX
- PYT
- NUT

+ CO₂
+ SPL
+ CARB
+ TEMP
+ MIX
+ PYT
+ NUT

- EFF
- SPL
- CARB
- TEMP
- MIX
- PYT
- NUT

+ WIND
+ SPL
+ CARB
+ MIX
+ NUT

- CO₂
- EFF
- SPL
- CARB
- TEMP
- MIX
- PYT
- NUT

- WIND
- SPL
- CARB
- MIX
- NUT
Conclusions

May need to quantify interactions to predict climate change impacts and adaptation in many cases

In some cases generalities may be possible

Qualitative loop analysis provides a means of rapidly assessing this and to drive research priorities
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