UK Climate Change Risk Assessment 2012

Reflections on the key messages and lessons for the coastal and marine environment

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Llywodraeth Cymru Welsh Government

DOE Department of the Environment www.doeni.gov.uk

The Scottish Government

defra Department for Environment Food and Rural Affairs

HR Wallingford

Some key messages (1)

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CCRA is the first national overview of climate change risks and opportunities

The CCRA was based on UKCP09 climate projections and existing information on impacts: there was little new research

Natural systems are complex with many interactions: our understanding is limited

Some key messages (2)

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CCRA identified potential impacts and provides estimates of magnitude in some cases

CCRA has also identified gaps in evidence and knowledge

There is a need for monitoring and research to improve our understanding and fill gaps

Legislative Framework

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The CCRA is one stage in a process that started in 2008

Climate Change Act 2008

Climate Change Risk Assessment January 2012

National Adaptation Programme 2013

UKCP09 (projections) 2009

Policy & Economics Analyses

Sectors and Themes

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Sectors (for initial analysis)

1. Agriculture
2. Biodiversity & Ecosystem Services
3. Built Environment
4. Business, Industry & Services
5. Energy
6. Floods & Coastal Erosion
7. Forestry
8. Health
9. Marine & Fisheries
10. Transport
11. Water

Themes (for synthesis)

- **Agriculture & Forestry**
- **Business**
- **Health & Wellbeing**
- **Buildings & Infrastructure**
- **Natural Environment**

CCRA Method Overview

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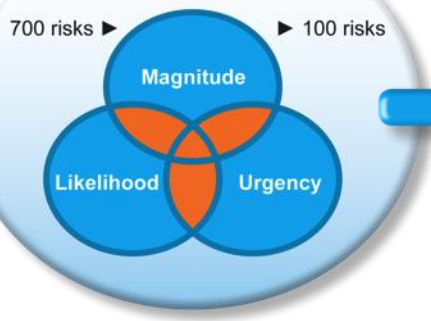
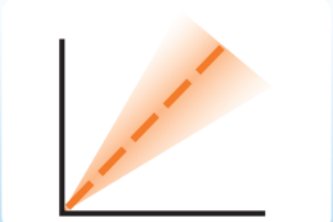
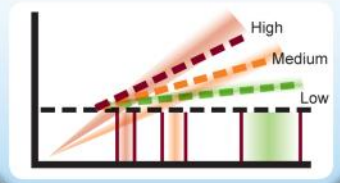
1. Choose priority risks



2. Assess sensitivity of each risk to climate



3. Apply projections of future climate & population to each risk



4. To assess each risk for the UK and regionally (where possible)

5. Assign magnitude (logarithmic scale) and confidence scores to each risk

Magnitude	Low	Medium	High
Social	100s	1000s	Millions
Economic	£1M	£10M	£100M
Environment	100km	100km	10,000km

6. Compare scores of all risks

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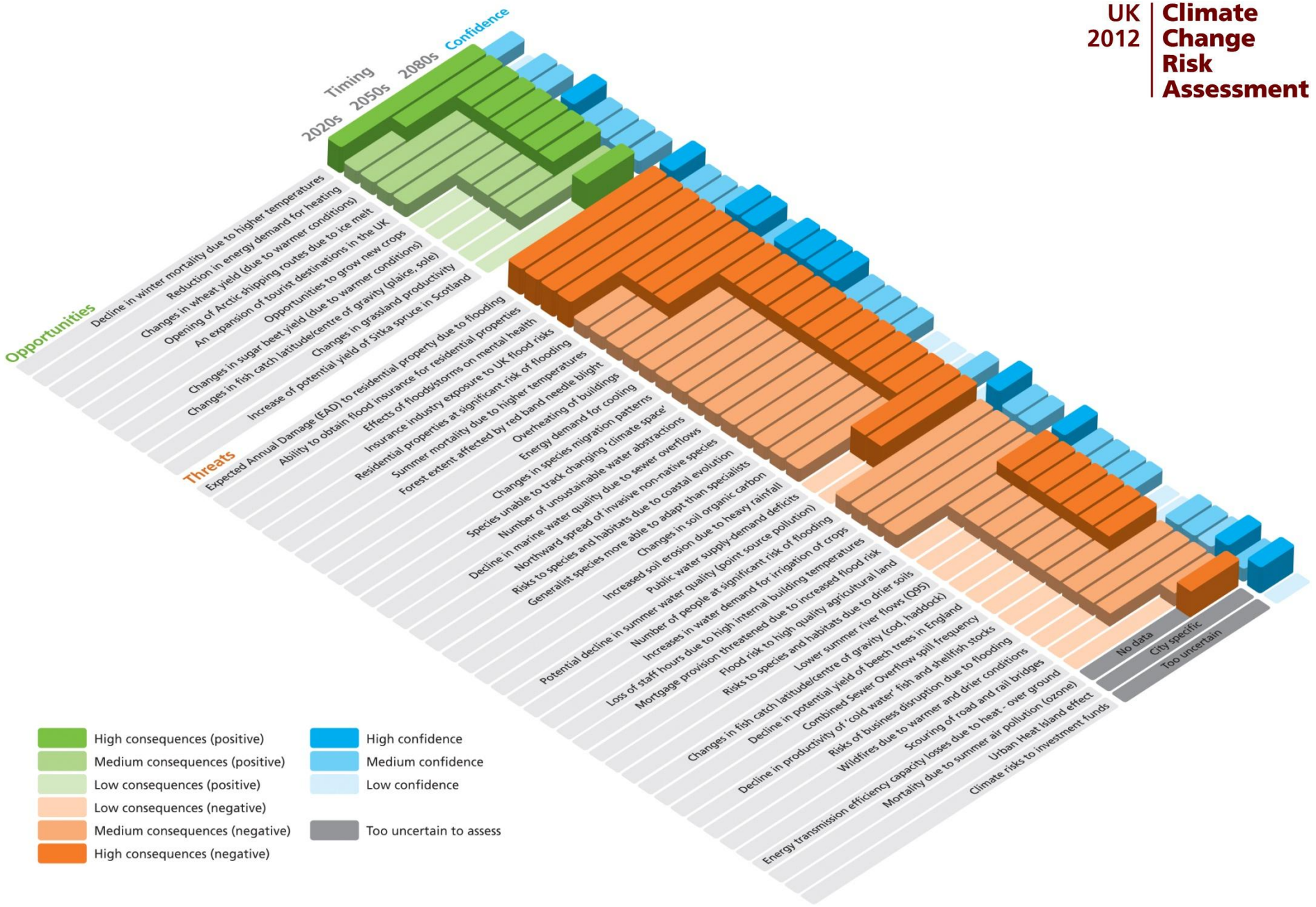

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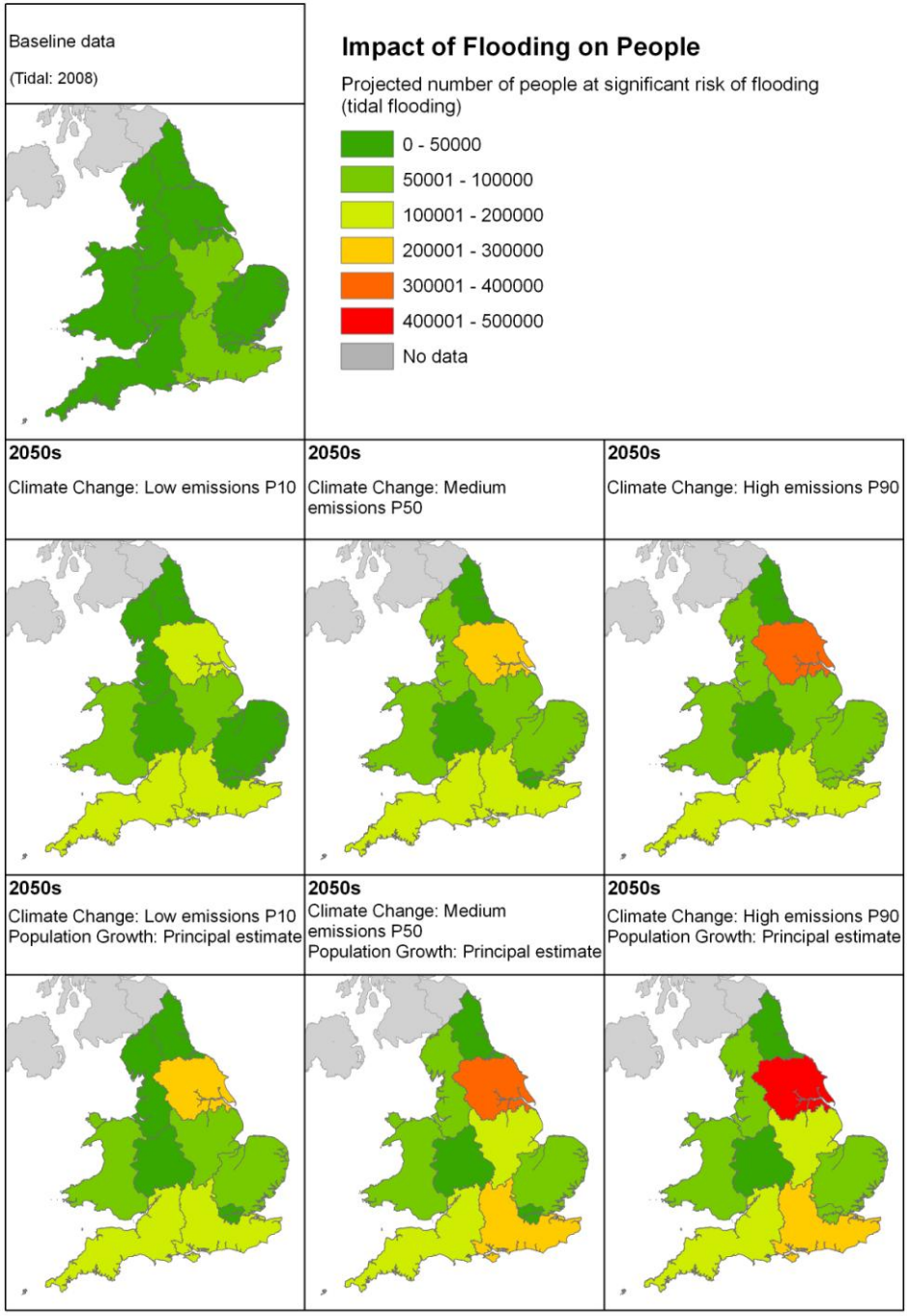
Tidal flooding



- 0.8 to 2.2 million people exposed to significant likelihood of tidal flooding by the 2080s (current figure 0.3 million)

- £1 billion - £4.2 billion annual damage to properties due to tidal flooding by the 2080s (current figure £400 million)

Coastal habitats

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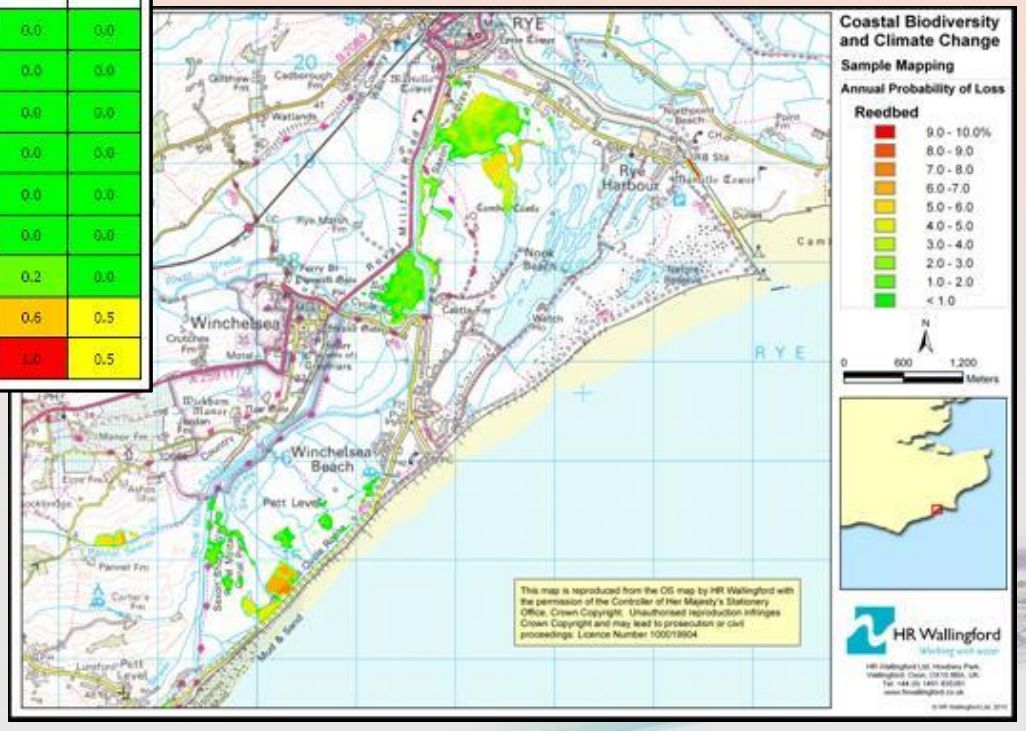
Projected loss of intertidal habitat due to sea level rise

Projected damage and loss of coastal grazing marsh and other coastal habitats because of an increase in flooding

BAP Habitat Sensitivity Matrix: Reedbeds

Flood Duration		Flood Frequency: Events Per Year 365	52	26	12	4	2	Years between Events 1	10	100	1000
hours	1	1.0	1.0	1.0	0.8	0.5	0.3	0.0	0.0	0.0	0.0
	12	1.0	1.0	1.0	1.0	0.6	0.4	0.0	0.0	0.0	0.0
days	1		1.0	1.0	1.0	0.8	0.5	0.1	0.0	0.0	0.0
	2		1.0	1.0	1.0	0.9	0.7	0.2	0.1	0.0	0.0
	7			1.0	1.0	1.0	0.8	0.6	0.2	0.0	0.0
	14				1.0	1.0	1.0	0.7	0.4	0.0	0.0
months	1					1.0	1.0	0.9	0.7	0.2	0.0
	6							1.0	0.9	0.6	0.5
	12								1.0	1.0	0.5



Ocean chemistry (acidification)

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- Ocean uptake of CO_2 affects the ocean carbonate system resulting in decreases in pH and carbonate-ion concentration
- Modelling and observational studies suggest that the absorption of CO_2 by the ocean has decreased the pH of the ocean surface by 0.1 since 1750
- Potential impacts on vulnerable species and ecosystems, including commercial shellfish species

- Projected oceanic pH
  - Present day: 8.05
  - 2050s: 7.96 to 7.90 (low emissions to high emissions scenarios)
  - 2100s: 7.91 to 7.69 (low emissions to high emissions scenarios)

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Marine biodiversity and ecosystems

- Potential increase in rate of carbon cycling near sea surface may cause disruption to food webs
- Potential increase in eutrophication dues to warmer temperatures and change in rainfall
- Species shifting:
  - Non-native species establishing in the UK e.g. yellow-legged gull
  - Loss of breeding ground in the UK for existing species e.g. puffin and gannet
- Potential expansion of the range of many invasive non-native species

Spider crab is now found in Welsh waters

Harmful algal blooms

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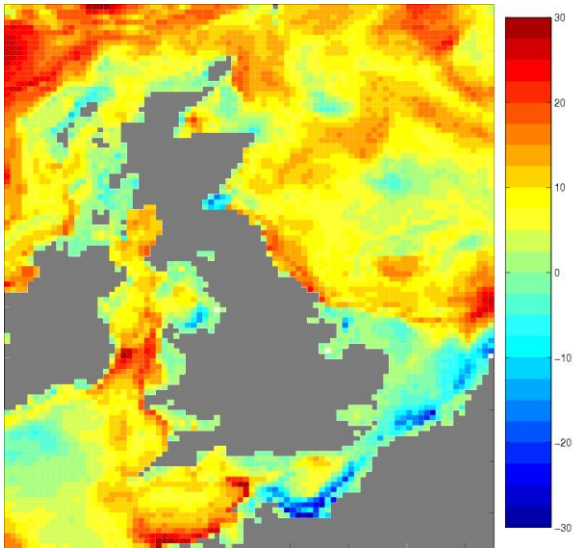
Different HAB species

- massive blooms generally caused by high nutrient loads or changes in nutrient use (bathing water impacts)
- high toxic low biomass blooms generally occur in stratified systems (death of shellfish)

Potential impacts

- Increase in precipitation may increase nutrient loads in coastal waters causing massive blooms
- The magnitude of stratification and the timing of onset and break down may change



Projected changes in the number of days of stratification for the 2080s, compared to the present-day (Medium Emission scenario).

Source: UKCP09

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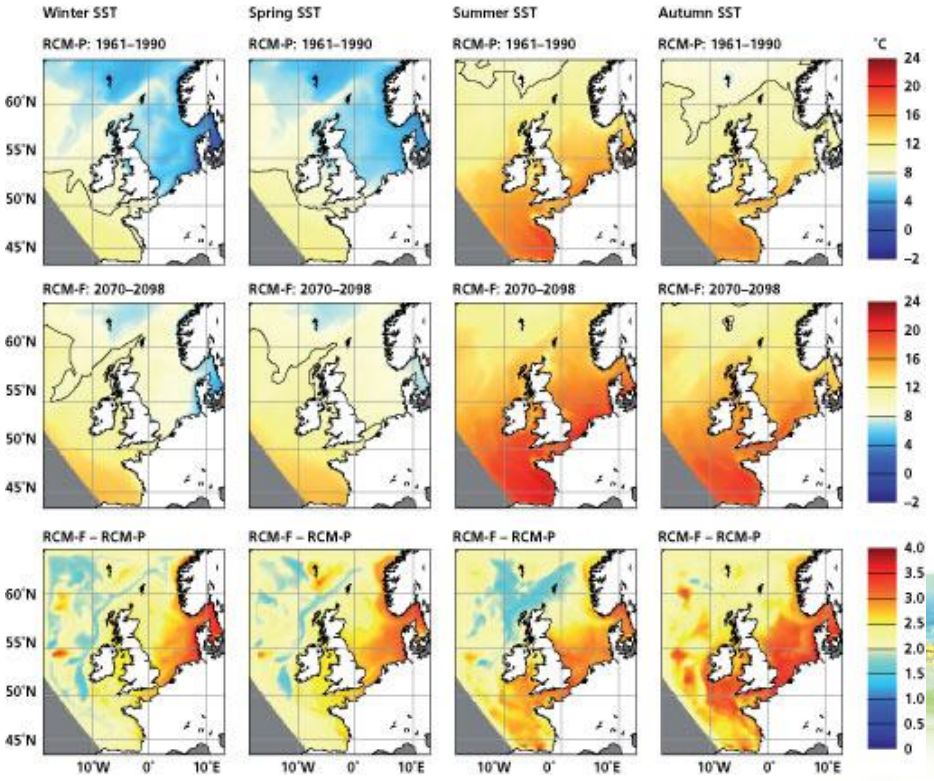
Risk of human illness due to marine pathogens

- Marine *Vibrio* species prevalence increases in sea temperatures >16˚C
- Human ingestion of *vibrios* can cause serious illness and potentially death
- **Potential annual cost of sea-borne infections:** £1-10 million by the 2020s rising to £10–100 million by the 2050s.



Seasonal mean sea surface temperature (SST) for:

the period 1961–1990 (upper panels),

2070–2098 (middle panels) and

the differences between them (lower panels).

Source: UKCP09

Fisheries

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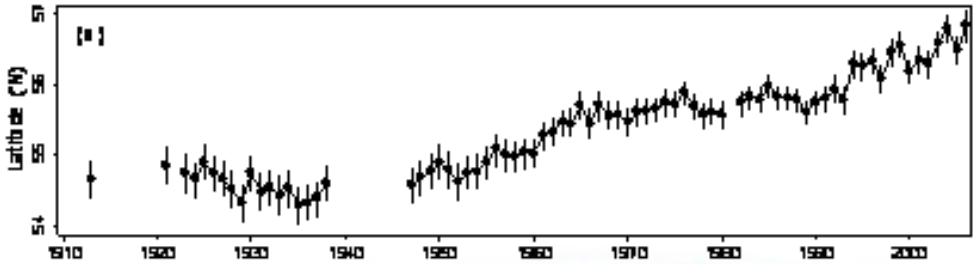
- Rising sea temperature may lead to a shift northwards of some fish and shellfish
- Year-class strength may change: potential decline in cod and haddock and increase in plaice and sole
- Distribution shifts (example): plaice may move 140 km to the north-west over the next 70-80 years
- Future fish catch is likely to change as new species move into UK waters

Centre of gravity of North Sea plaice catch: 1910 - 2005



Tourism

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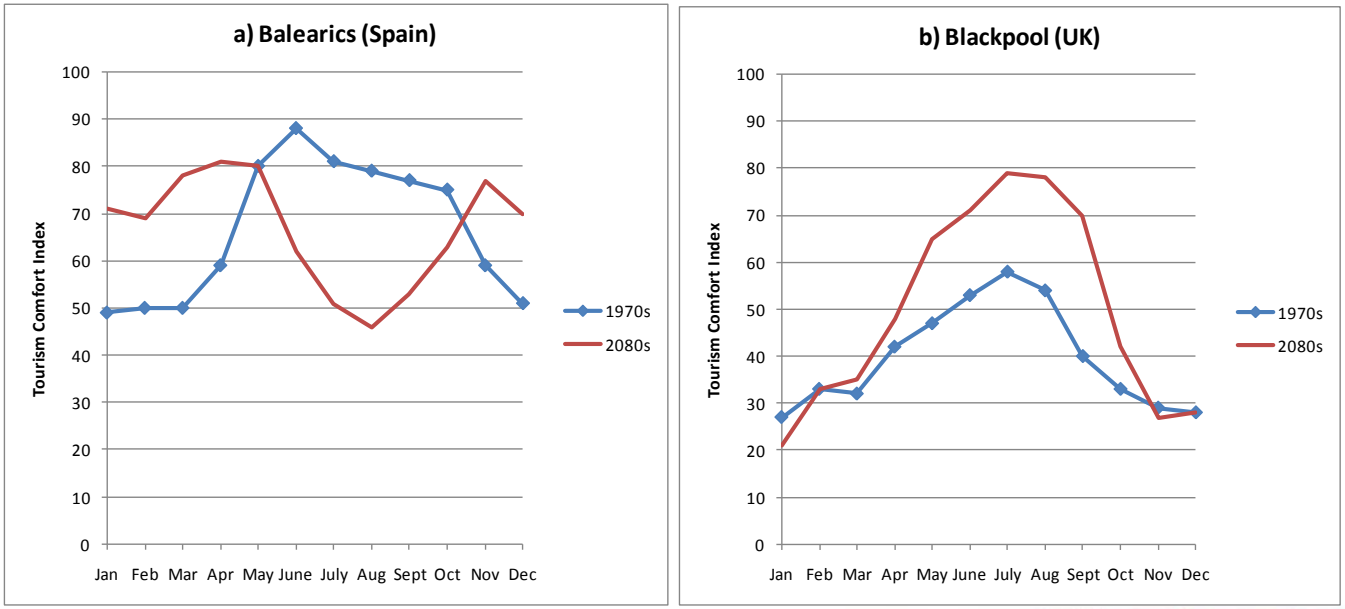
Potential increase in coastal tourism with longer drier summers, including longer tourist seasons



Changes in the tourism comfort index by the 2080s: Spain and Blackpool

Death / Injury / Mental Illness

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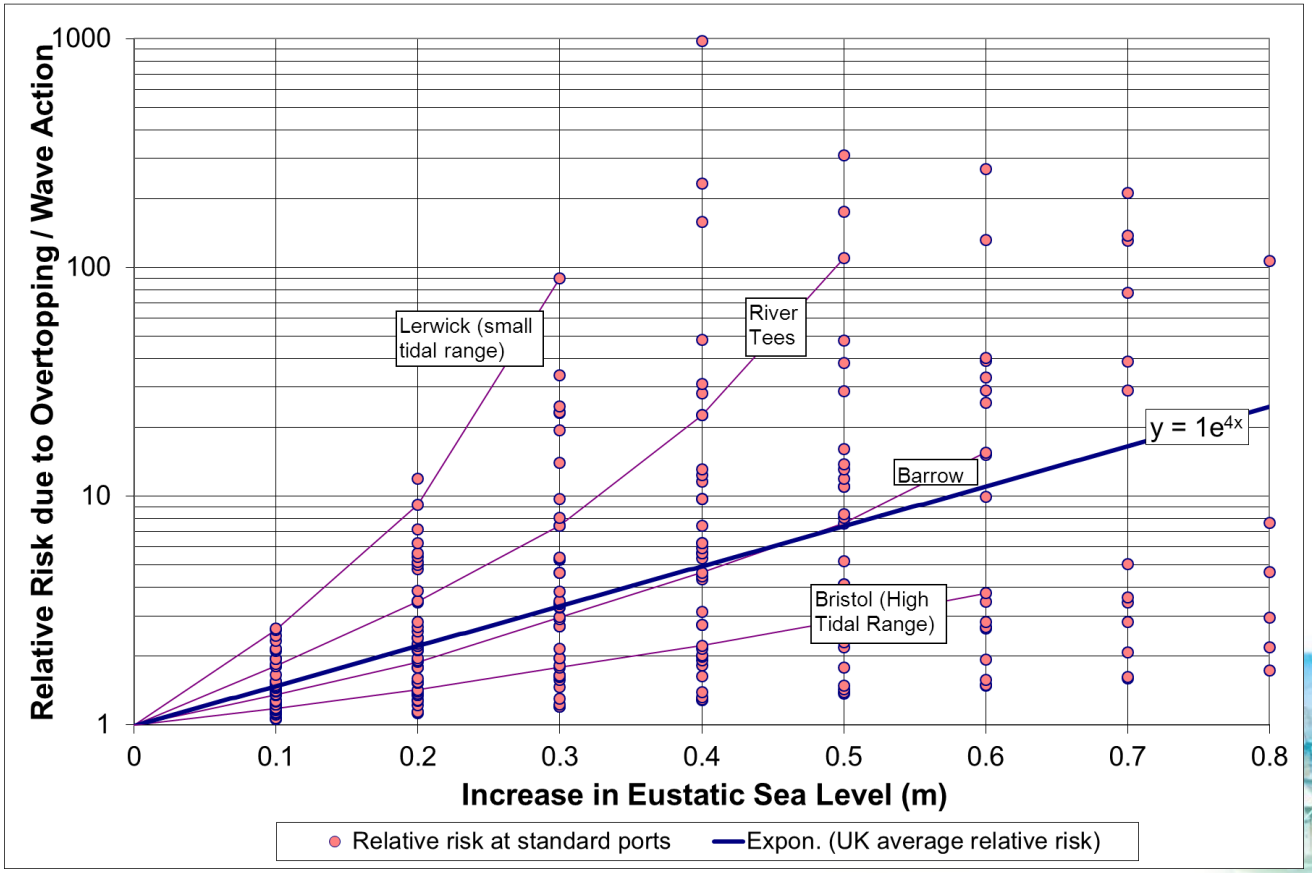
Potential increase in numbers of deaths and injuries and mental health effects at the coastline due to overtopping and coastal flooding



Risk proportional to number of people at risk:

Coastal wave activity:
Baseline : 7
2020s : 8-10
2050s : 9-23
2080s : 11-55

Tourism

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Potential loss of tourist assets with sea level rise, flooding and erosion (for example, beach area)

Potential increase in damage to natural tourist assets if tourism increases

Marine Transport

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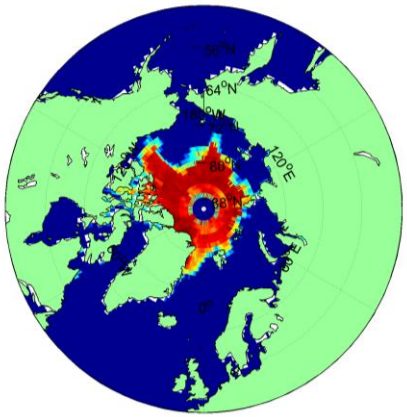
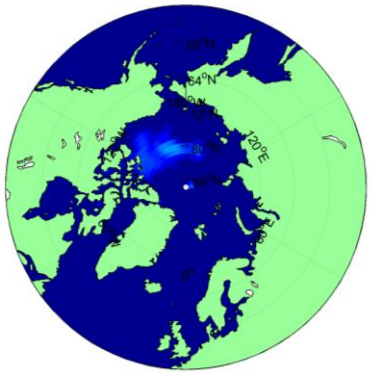


Summer sea ice extent: September 2009

Total navigable days per year through the North East Passage:

- between 30 and 90 by the 2020s
- between 90 and 120 by the 2050s
- between 120 and 180 by the 2080s



Projected summer sea ice extent: 2080s

Reflections

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The CCRA has identified and brought together existing work on the future impacts of climate change

The main potential impacts have been identified but there is great uncertainty regarding the overall impacts of climate change on natural systems

The CCRA provides a starting point for planning of monitoring and research to improve understanding of the potential impacts

Where to get more information

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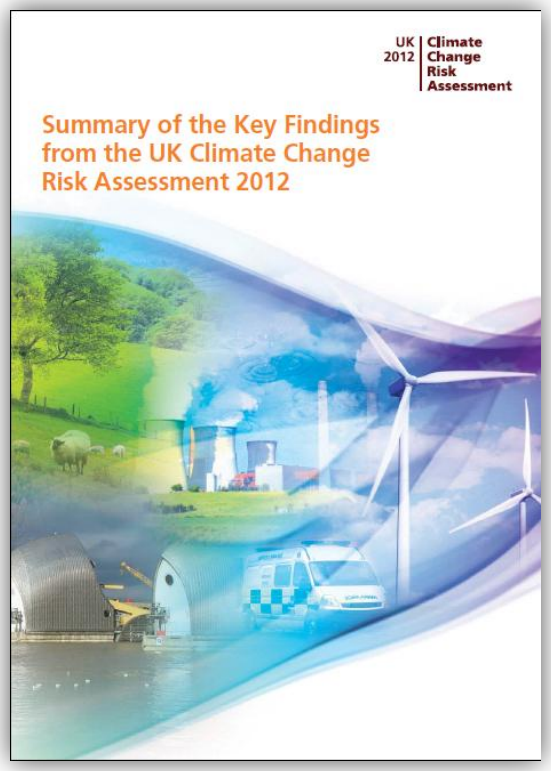
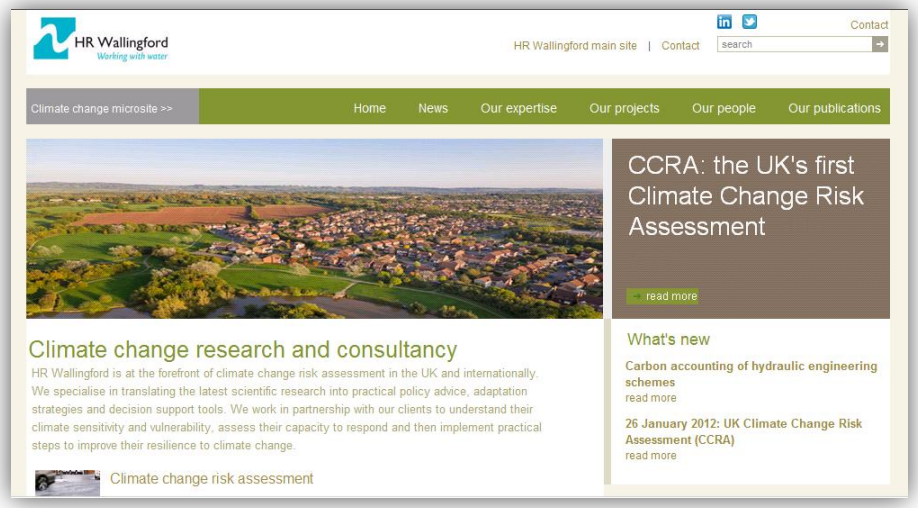


HRW climate change microsite:

http://www.hrwallingford.com/climate-change/



CCRA reports and summaries:

http://www.defra.gov.uk/environment/climate/government/

http://ccra.hrwallingford.com/