CLIMATE CHANGE REPORT CARDS

THE MARINE CLIMATE CHANGE IMPACTS PARTNERSHIP EXPERIENCE AND ARCTIC POSSIBILITIES

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The Need

To ensure politicians and their advisers take decisions in a timely fashion based on accurate, simple, timely information provided without bias.

It was not to provide advice on what to do.
The Solution

MCCIP KEY TOPICS

MARINE CLIMATE CHANGE
Temperature (air and sea)
Storms and waves
Sea level
Ocean acidification
Atlantic Heat Conveyor
Salinity
Shelf sea stratification
Coastal erosion
Air – sea exchange of CO₂
Air – sea exchange of heat and water

CLEAN AND SAFE
Coastal flooding
Nutrient enrichment
Harmful algal blooms
Pollution
Human health

PRODUCTIVE
Shipping
Tourism
Built structures
Fisheries
Aquaculture

HEALTHY AND BIOLOGICALLY DIVERSE
Plankton
Fish
Seabirds
Waterbirds
Marine mammals
Non-native species
Coastal habitats
Intertidal habitats
Shallow and shelf sublittoral habitats
Deep sea habitats

We are observing large changes in our marine environment that are driven in part by climate change. This report card represents our first step in bringing together evidence from across the UK science community to help YOU understand and act upon the issues.
**WHAT IS ALREADY HAPPENING**

**Temperature (Air and Sea)**

- Marine air and sea surface temperatures have risen over the north-east Atlantic and UK waters in the last 25 years.
- The largest increase in air temperature has been over the southern North Sea at a rate of around 0.6°C per decade.
- The largest increases in sea surface temperature have occurred in the eastern English Channel and the southern North Sea at a rate of between 0.6 and 0.8°C per decade.
- Although temperatures are generally increasing, inter-annual variability is high. 2008 UK coastal sea surface temperatures were lower than the 2003–2007 mean.

**What Could Happen**

- Models project that temperatures will continue to rise in UK and north-eastern Atlantic waters up until at least the 2080s. However, in the next 10 years, natural oceanic and atmospheric variability make it difficult to predict whether temperatures will go up or down.

**Seabirds**

- Between 2000 and 2008, the total number of seabirds breeding in the UK decreased by approximately 9%. Breeding success also declined. Climate change is partly responsible.
- Major changes in plankton abundance in the North Sea have contributed to the reduction in quality and abundance of prey species such as sandeels.
- The greatest reductions in breeding success of species most sensitive to food shortages, such as Arctic skua, black-legged kittiwake and shag are seen in the Northern North Sea and Scottish Continental Shelf.

**Medium Confidence**

- Models predict that by 2100, UK climate will no longer be suitable for great skua and Arctic skua. The same models predict that the geographic range of black guillemot, common gull and Arctic tern will shrink so that only Shetland and the most northerly tips of mainland Scotland will hold breeding colonies.
- Any increased storminess would reduce the amount of safe breeding habitat for shoreline-nesting species (e.g. terns) and create unfavourable foraging conditions at sea, which may lead to starvation of adults and chicks of some species.
Regional Snapshots of Marine Climate Change Impacts

What Is Already Happening
This map shows some of the changes in each regional sea. It is noticeable that it is in the south that many of the changes can be observed.

Region 1 - Northern North Sea
- Occasional severe storms have led to increased wave action and coastal erosion.
- Fish populations have declined due to changes in oceanic conditions.

Region 2 - Southern North Sea
- Ocean warming has led to a change in the distribution of certain species.
- Increased temperatures have led to a rise in sea levels.

Region 3 - Eastern English Channel
- Increased salinity has led to changes in the distribution of certain species.
- Water levels have been rising due to increased rainfall.

Region 4 - Western English Channel, Celtic Sea and South West Approaches
- Increased water temperatures have led to changes in the distribution of certain species.
- Increased salinity has led to changes in the distribution of certain species.

Region 5 - Irish Sea and North Channel
- Increased water temperatures have led to changes in the distribution of certain species.
- Increased salinity has led to changes in the distribution of certain species.

Region 6 - Minch and Western Scotland
- Increased water temperatures have led to changes in the distribution of certain species.
- Increased salinity has led to changes in the distribution of certain species.

Region 7 - Scottish Continental Shelf
- Increased water temperatures have led to changes in the distribution of certain species.
- Increased salinity has led to changes in the distribution of certain species.

Region 8 - Atlantic North-West Approaches, Rockall Trough and Faroe-Shetland Channel
- Increased water temperatures have led to changes in the distribution of certain species.
- Increased salinity has led to changes in the distribution of certain species.

Future Sea Surface Temperature
Seasonal mean sea surface temperature increases for the 2070–2099 period (compared with a 1960–1990 baseline). Changes are based on the UKCP09 model projections under a medium greenhouse gas emissions scenario.

What Could Happen
Based on UKCIP projections these are some possible consequences of climate change in each regional sea.

Region 1 - Northern North Sea
- 35% of the area is projected to experience changes in temperature and ocean currents.

Region 2 - Southern North Sea
- 45% of the area is projected to experience changes in temperature and ocean currents.

Region 3 - Eastern English Channel
- 30% of the area is projected to experience changes in temperature and ocean currents.

Region 4 - Western English Channel, Celtic Sea and South West Approaches
- 40% of the area is projected to experience changes in temperature and ocean currents.

Region 5 - Irish Sea and North Channel
- 25% of the area is projected to experience changes in temperature and ocean currents.

Region 6 - Minch and Western Scotland
- 30% of the area is projected to experience changes in temperature and ocean currents.

Region 7 - Scottish Continental Shelf
- 20% of the area is projected to experience changes in temperature and ocean currents.

Region 8 - Atlantic North-West Approaches, Rockall Trough and Faroe-Shetland Channel
- 25% of the area is projected to experience changes in temperature and ocean currents.
Variations on a theme – Special Topics
The Process

• Commission topic experts to provide up-to-date briefing addressing specific questions and provide confidence assessments

• Peer review the briefing

• Revise the briefing in light of peer review comments

• Report card working group summarize and simplify key messages from briefing documents

• Check with experts that simplified key messages are accurate

• Publish report card and full briefing documents
The Feedback

• The report cards are used by a wide range of people including advisers and politicians to inform thinking and policy decisions

• The full briefing papers and cards are well cited in peer review literature

• The process is well respected and experts are fully engaged and willing to continue to contribute

• Special topic reports are requested by advisers and politicians
**Extreme events**

**What is already happening?**

Since the 1990s, there has been an increase in both the number and strength of storms and hurricanes in the North Atlantic. These changes have important consequences for society, given the damage and destruction that hurricanes inflict on lives and infrastructure, as well as the damage done to natural sea defences such as corals and mangroves.

Changing patterns of rainfall are having serious impacts. Prolonged droughts are leading to serious water availability issues for local populations and tourists. Some of the most extreme flooding events in recent years have not been associated with hurricane events; rather, they have been caused by extreme rainfall events.

Sea level in the region has risen by around 20 cm over the past 100 years, increasing the risk of flooding.

**What could happen?**

While the overall frequency of Atlantic storms may decrease in the future, the strongest category 4 and 5 storms may increase by 50% in frequency over this century, with higher winds and rainfall rates associated with these storms.

Global mean sea level is projected to rise by a further 26-82 cm (10-32 inches) over the coming century, but higher increases exceeding a metre are possible. In the northern Caribbean, sea level rise could be 25% higher than the global average due to other physical factors affecting land elevation.

This projected rise in sea level and severe storms is likely to increase the risk of storm surge events for Caribbean states, which will further exacerbate risks to biodiversity, settlements and infrastructure across Caribbean states.
What could an Arctic marine climate change impacts fact sheet look like?

Two aspects I will cover

1) What it could look like - the concept
2) What process is needed to produce it
The Concept – basic v thematic

• Cover - key points

• Introduction - purpose, standard confidence, why all this matters and why rapid translation of science into knowledge is needed, proven approach, body of evidence on which to draw in the Arctic

• The facts - what is happening and what may happen in the future on climate change impacts - on the system, on biodiversity, on ecosystem services, on humans

• Regional impact hot spots perspective based around a polar view double page spread map to show the challenges of impacts in context of wider Arctic environment change

• Pace of change - seen and anticipated for the Arctic - scale and magnitude - set against history with inset graphs and short case studies and also against pace elsewhere in the world

• Impact research priorities to plan for the future in the face of climate change - What we need to now consolidate or fill gaps on and how to enhance connectivity and resilience for adaptation

• Further information
The facts: impacts on the Arctic ocean system

- Temperature (air, sea-surface, deeper water layers)
- Ice extent (summer/September ice, ice quality)
- pH changes (surface waters, deeper water layers)
- Salinity (changes in salinity, with information on main areas of changes such as glacier fronts/estuaries)
- Currents (changes in the overall current patterns)
- Shore-thaw and erosion (changes in shoreline)
- Changes in inland permafrost (input of nutrients, heavy metals, etc from land increases?)
The facts: impacts on marine biodiversity

• Impact on ecosystems (changes in ecosystem structures) and habitats (areal loss, changes in habitat distribution)

• Impact on “key species groups/species”:
  • mammals,
  • birds,
  • fish,
  • invertebrates,
  • marine macrophytes
  • and on the distribution and abundance of these

Which ecosystems, habitats and species are sensitive to climate change impact (vulnerability and resilience for these)

How projected changes shift ecologically important features (e.g. ice edges changing in space and time)?
The facts: impacts on ecosystem services

• What are the most important ecosystem services that will likely be impacted?

• Changing foodwebs, changing food quantities and qualities

The facts: impacts on humans

• Socio-economic impact on coastal indigenous communities

• Opening of new maritime traffic routes multiplying the amount of shipping through Arctic.

• Increased development of offshore petroleum and gas industry /offshore constructions and energy infrastructure (oil rigs, cables, pipeline)

• Development of fisheries in new areas previously covered by ice or otherwise not utilised.

• Arctic tourism...

The facts: impacts on marine biodiversity
The process

• Agree the topics to be covered
• Identify the experts to provide the backing papers
• Produce the backing papers and carry out peer review
• Produce fact sheet content and review with authors
• Translate into different languages
• Design and publication