CORSICA ISLAND ADAPATION REPORT CARD PROJECT

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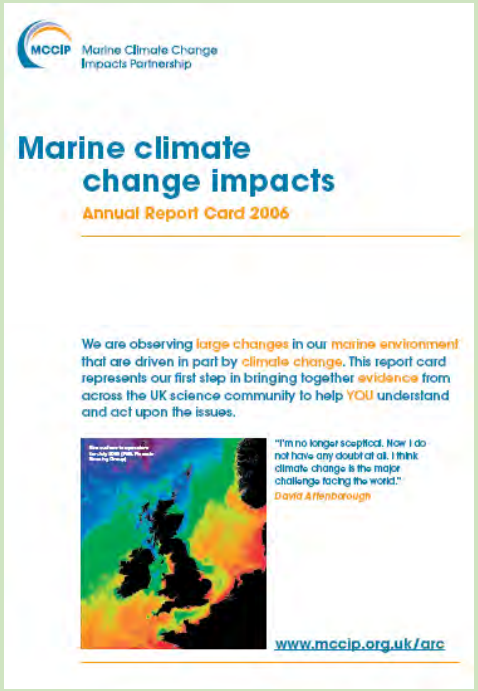
Many things are happening as a result of climate change, so:

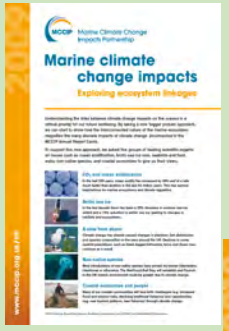
* What is the real story?
* What is the true overview?

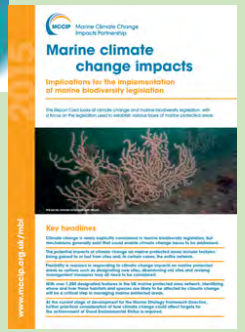
Challenges:

- Cutting the delay between scientific discovery and advice to decision makers
- Communicating what is known in an accessible way.
- Converting knowledge into policy and action.

Marine Climate Change Impacts Partnership Model







Marine Climate Change Impacts Partnership Model

MCCIP Key topics

- Temperature (Air and Sea)
- Storms and Waves
- Sea level
- Ocean acidification
- Atlantic heat conveyor
- Salinity
- Shelf sea stratification
- Coastal erosion
- Air-sea exchanges of CO_2
- Air-sea exchanges of heat and water

- Plankton
- Fish
- Seabirds
- Marine mammals
- Waterbirds
- Non-natives
- Coastal habitats
- Intertidal habitats
- Shallow and shelf subtidal habitats
- Deep sea habitats

- Coastal flooding
- Nutrient enrichment
- Harmful algal blooms
- Pollution
- Human health

- Shipping
- Tourism
- Built structures
- Fisheries
- Aquaculture

Corsica Key topics

- Evolution of water column/ oceanographic data (temperature, currents, sea level, etc.)
- Coastal erosion
- Modification of hydrological regime (temperature, rainfall, extreme events)

- Plankton
- Fish and fisheries
- Marine mammals and turtles
- Non-natives
- Coastal habitats
- Sea bed ecology / coastal habitats (seagrass, maerl, lagoons)

- Harmful algal blooms
- Carbon sequestration
- Management of MPAs in the context of climate change

Marine Climate Change Impacts Partnership Model

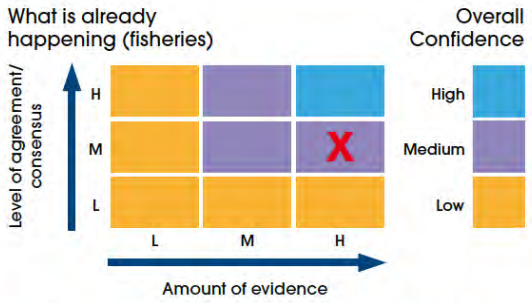
Process:

- Commission experts to review the most up to date information on selected topics highlighting what evidence there is of climate change effects already apparent and what could happen in the future, and ascribe a level of confidence to the statements being made
- Undertake a peer review and revision of topic reviews
- Extract key messages for inclusion in Report Card in simple non-technical language
- Check with experts that summary has not misinterpreted the science
- Publish the Report Card and the backing papers

Confidence assessments

Contributing authors were asked to consider the level of confidence in the science for 'what is already happening' and 'what could happen in the future' for their specialist topics.

Authors were asked to mark an 'X' in the following grid to indicate the current level of confidence in the science, based on 'level of agreement / consensus' and the 'amount of evidence available' (see below for an example from the fisheries topic for 'what is already happening'):



In each of the full, peer-reviewed topic submissions, a rationale is provided explaining why the authors have assigned a low, medium or high level of confidence.

Marine Climate Change Impacts Partnership Model

	WHAT IS ALREADY HAPPENING	WHAT COULD HAPPEN
Temperature (Air and Sea) *Marine Scotland; NOC; Cefas; IMGL; MOHC; PML; SAMS*	**High Confidence** ↔ • 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.	**Medium Confidence** ↓ • 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.
Fish *Cefas; Strathclyde University*	**Medium Confidence** ↔ • Some fish distributions have moved northwards over the past 30 years by between 50 to 400km, with coldwater species such as monkfish and snake blenny moving the furthest. At the same time, some have moved into deeper waters at an average rate of about 3.5 metres per decade. • Warmer temperatures around the UK are correlated with poor conditions for survival of cod larvae and cod growth, but enhanced growth rates in sole (a warm-water species). • Diadromous species (which spend some of their life in both fresh and marine waters) such as salmon and eel have been shown to be particularly vulnerable to climate change (water temperature and river flow) with impacts on both the freshwater and marine phases.	**Medium Confidence** ↑ • By 2050, climate change may lead to pelagic species (such as herring and anchovy) moving northward by an average of 600km and demersal species (such as cod and haddock) by 220km. • Changes to currents may have an impact on the dispersal of fish eggs and larvae. It is anticipated that winter and early spring spawners (such as cod and plaice) will experience poor larval survival, whereas warmer-water species (such as sprat) may benefit.

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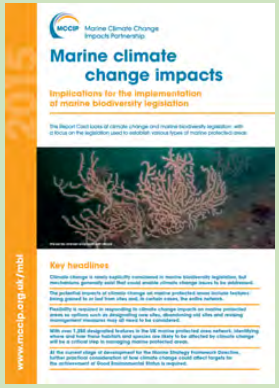


The quality of the feature changes

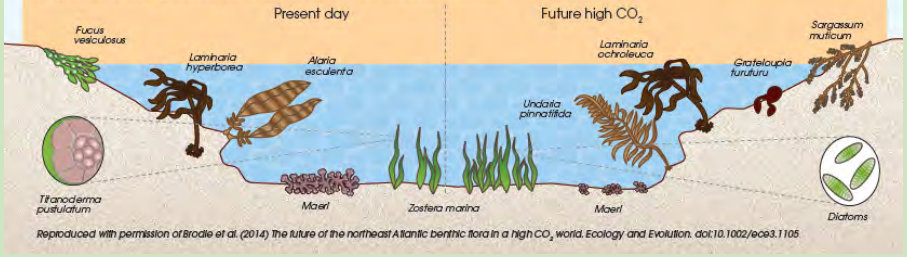
For example, in the northernmost Atlantic marine ecosystem, increased carbon dioxide (CO_2) is likely to stimulate the growth of seagrasses such as *Zostera marina*, but the increase in acidity of the seawater will be corrosive to maerl.

A feature is gained to a particular marine protected area

A marine protected area may become more suitable for the establishment of a designated feature. For example, *Laminaria ochroleuca*, a southern species of kelp is increasing its distribution and abundance in the UK with increasing temperatures and competing with the current dominant species *Laminaria hyperborea*. This may influence the make-up of kelp beds as a designated feature and could require new approaches to management as *L. ochroleuca* is more vulnerable to storm damage and exhibits different biodiversity patterns and ecological processes to *L. hyperborea*.

The composition of the feature changes

This could include a change in biodiversity and increased opportunities for non-native species establishment (e.g. *Sargassum muticum*) that may continue to spread, altering community composition. Changes in biodiversity may be facilitated by increasing levels of carbon dioxide and warming seas which are expected to impact on feature composition. An example is provided below for predicted changes in boreal northeast Atlantic benthic marine flora.



Reproduced with permission of Brodie et al. (2014) The future of the northeast Atlantic benthic flora in a high CO_2 world. Ecology and Evolution. doi:10.1002/ece3.1105

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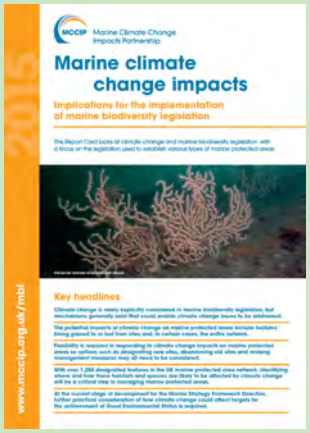

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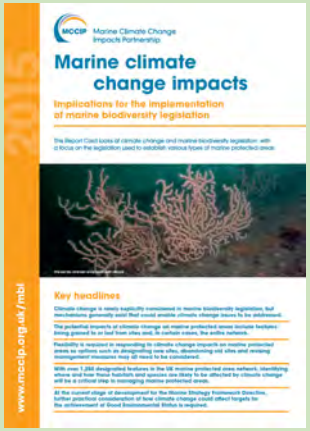

Possible ways MPAs help address climate change

- Provide areas where non-climate stressors can be reduced
- Reducing risk and promoting resilience by encouraging as high levels of diversity as possible
- Protecting habitats that can help mitigate climate change impacts by their carbon capture and storage capacity
- Providing ecologically connected corridors for shifting species
- Acting as control or sentinel sites for the monitoring of climate change impacts
- Promoting public awareness of the implications of climate change

Possible management implications for MPAs with climate change

- Where an MPA is designated for multiple features and one or more are lost then the designation may need to be revised
- If the quality of the feature changes then adaptive management measures may need to be considered
- Where a feature is lost from MPAs then alternative MPAs may need to be found
- If the species composition of a feature changes then different adaptive management measures may need to be considered
- Where a designated feature expands in range additional MPAs may be required.

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Scientific integrity and independence

A robust and transparent process can mitigate against accusations of a lack of integrity or of bias in reporting. MCCIP is an independent provider of evidence for policy-makers and has developed a four-step process to ensure scientific integrity and independence in its products.

Step 1: Information identification

Risk	Mitigation	MCCIP approach
Selection bias: 'cherry-picking' topics or research areas that support pre-held opinions	• Joint setting of 'information agenda' • Transparent decisions	• The MCCIP Steering Group, including 26 partners, indentify information need • Scope of information need is then refined through audited discussions with policy customers and science community

Step 2: Expert identification

Risk	Mitigation	MCCIP approach
Expert bias: selecting a narrow group of experts known for promoting certain views or hypotheses	• Comprehensive expert involvement • Clear instruction to authors to include representative range of opinion • Independent peer review process	• Provisional lead authors identified and approached • Lead authors are required to represent and work with community of experts in their field regardless of individuals' opinions • Materials produced by authors are anonymously and independently peer reviewed and revised accordingly

Step 3: Information translation

Risk	Mitigation	MCCIP approach
Interpretation bias: those responsible for translating the information can introduce their own bias and opinion	• Clear terms of reference and accountability • Scientists cross-check • Information and data audit	• Report Card Working Group established - individuals mandated as experts, not representatives of their organisations • All summary information to be published shared with lead authors for cross-checking • All information and data made publically available (online) and any publications provided as open access in journals

Step 4: Information communication

Risk	Mitigation	MCCIP approach
Evidence 'weighting' bias: evidence or advice may be given too much credence or credibility	• Confidence assessment	• Lead authors provide confidence ratingas indication of uncertainty around topic • Simple language used to avoid ambiguity

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Steering Committee

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Content

Summarize current knowledge

Highlight adaptation issues and opportunities

Timetable:

February 2017 Steering Group kick-off meeting

April 2017 Presentation at Monaco Blue

July 2017 Workshop with experts

- Confirm topic leads
- Initial brief presentations
- Agree work schedule

September 2017 Presentation at IMPAC4

February 2018 Steering Group meeting

April 2018 Presentation at Monaco Blue

June 2018 Presentation of Report Card - Bastia

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