PAME I-2019: Agenda 4.3
Project Proposal Title: Factsheet series on Arctic climate change impacts
(1st work package) Revised version 07. December 2018)

Note: This version builds on the document presented at PAME II-2018, and acknowledges the discussions by FI, AMAP Chair, CAFF and PAME Secretariats, respectively.

Project description

Main Tasks 2019-2021:

- Develop an Arctic climate change impacts factsheet series on specific topics. It will act as a test that, if supported by other Arctic Council working groups and the Arctic Council Secretariat, may serve as a basis for a factsheet template more widely used by the Arctic Council, or its working groups.
- Develop the first thematic factsheet(s) on Arctic climate change impacts on MPAs and indigenous people's lives.

Background

The rate of change in the Arctic is unprecedented in the climate record for at least the past few thousand years, with average Arctic temperatures increasing at about twice the global average. The warming has led to massive retreats in the extent and thickness of summer sea ice and the disintegration of ice shelves that have persisted for millennia. Simultaneously, acidification of the Arctic Ocean increases. On land, the warming increases the Active-Layer Thickness (ALT)[1]. The average active-layer thickness (ALT; determined by mechanical probing and typically accurate to 0.5 cm) in 2016 for 20 North Slope sites was 0.52 m, which is 4 cm greater than the 1996-2016 average[2]. Coastal erosion is also increasing, and the temperature is threatening the existence of unique Arctic environments such as Palsa mires[3]. These changes are devastating not only to Arctic biota, but also to today's way of life of Arctic indigenous people.

The Arctic Council has a unique voice to leverage in communicating these facts. However, in order to do so, the Arctic Council needs something to complement the high-quality reports produced by its working groups when addressing decision makers.

Project goals

- To leverage and synthesize factual information from the Arctic Council's work in a layman's format to communicate to decision makers and the public;
- Contribute to cross-working groups cooperation on common topics; and
- Contribute to the outreach aspect of the Arctic Council and ensuring close collaboration with the Arctic Council Secretariat.

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[1] 1 V. E. Romanovsky, S. L. Smith, K. Isaksen, N. I. Shiklomanov, D. A. Streletskiy, A. L. Kholodov, H. H. Christiansen, D. S. Drozdov, G. V. Malkova, S. S. Marchenko 2017: Terrestrial Permafrost. In: The 2017 NOAA Arctic Report Card Essays.

[2] 2 NOAA Climate.gov 2018: https://www.climate.gov/news-features/featured-images/warming-climate-claims-chunks-alaskas-northern-coast (and references therein).

[3] 2 NOAA Climate.gov 2018: https://www.climate.gov/news-features/featured-images/warming-climate-claims-chunks-alaskas-northern-coast (and references therein).
3 Luoto, M., Heikkinen, R.K., Carter, T.R. 2004: Loss of palsa mires in Europe and biological consequences. - Environmental Conservation. 31(1): 30–37

Building on previous work

At PAME's 3rd workshop (co-organized by Finland and Sweden in September 2017) in a series on Arctic Marine Protected Area (MPA) networks, invited speakers presented the UK's Marine Climate Change Impact Partnership (MCCIP) and the MCCIP Report Card (refer to Annex I). The MCCIP has published thematic Report Cards at regular intervals since 2006. The most recent card focussed on climate change and MPAs. Key to the Report Cards' success in the UK is their summary of scientific information – both current conditions and projected trends -- in a concise and digestible format. The Report Cards do not make policy recommendations, leaving the reader free to draw his or her own conclusions based on the science. In the UK, every Member of Parliament received printed versions of the cards. The public could also get the cards, either as printed versions or as online (pdf) versions. This process has also benefitted the scientific community by encouraging more collaboration and communication across disciplines. Our intention is to use the main components of success in our own project and, if possible, invite experts from the MCCIP into the advisory group. Extractions from the UK Report Cards are included in Appendix 1, as examples. Furthermore, this work will also be built on AMAPs work on climate change and the NOAA's Arctic Report Cards.

Finland presented the project idea for an Arctic Marine Climate Change Impact Fact Sheet at PAMEI-2018 in Quebec, Canada. The presentation piqued the interest of the CAFF and AMAP representatives at this meeting, and after discussing it in plenary, the group realized that such a factsheet could be used more widely by other Working Groups, and, possibly by the Arctic Council as a whole. At PAMEII-2018 the project proposal was not supported as written by DK or IS. The meeting agreed to continue the discussions for a possible joint PAME, CAFF and AMAP project at the CAFF Conference and the SAO meeting in Rovaniemi in November 2018. The final side-meeting during the SAO meeting on this subject agreed that the project should be carried out by PAME and CAFF, and AMAP's role will be to ensure the scientific quality of the content of the factsheet (i.e., AMAP experts will act as reviewers). The product of this proposal will be a first take on a factsheet that may, or may not, be used further by the Arctic Council and its working groups.

Project components and products

The project will take into consideration various successful templates such as the MCCIP's template, which is a concise, well informed, and easy to understand factsheet that inspires the reader to reach his or her own conclusions of what actions need to be taken, without giving direct recommendations (Annex I). The project setup should ensure the active participation of all interested Arctic Council working groups toward a joint product.

Structure and Main Products

<u>Structure</u>

The factsheets will be developed according to the following outline:

1. A template/shared design that can be used for all of the fact sheets to include the following:
   i. a summary of the state of affairs today,
   ii. a bulleted list of key facts, and
   iii. "what this means for you" – impacts for the daily lives of humans who are not intimately engaged with these issues in this part of the world.
2. Fact sheets on the impact of climate change on specific topics. Per PAME I-2018, the first factsheet idea is to focus on climate impacts to the marine environment, the impact of these changes on indigenous people, and the role of MPAs in building resilience to climate impacts. Translation of the factsheet into the Arctic States' main and minority languages would be a priority. These three topics could be presented in a single fact sheet with 8 pages, or less.

3. Length: a half-folded A3 (4 pages total).
4. Digital/paper: Primarily seen as digital resources but should be print-ready as well.
5. Brand/layout: The Arctic Council will be the primary brand with other working group's logos following, as relevant to the topic.
6. Audience: The primary audience for all factsheets would be policy makers at all levels and sectors within and outside the Arctic, but important additional audiences would be the public, educators and students. The factsheets would not advocate specific policy positions or provide recommendations, but rather they would lay out major scientific findings to inform policy discussions. The factsheets will help integrate and communicate recent products by Arctic Council working groups on climate change, and they will be based mainly on these reports, scientific publications and traditional and local knowledge, the latter in particular when describing the impact of climate change on indigenous people's lives and cultures.

Main Products

It is proposed that this project be developed in a stepwise approach by starting on the following activities/work packages:

1. Develop a template/outline for the factsheets based on the proposed structure;
2. Develop the 1st thematic factsheet on Arctic climate change impacts on MPAs and indigenous people's lives based on the "master" fact sheet; and
3. The design and the desktop editing and publishing of the final products.

These products will be developed in close coordination and cooperation with other working groups and the Arctic Council Secretariat.

Timetable and Key Milestones

Following table provides the work accomplished during the 2018-2019 period. A more detailed timetable with key milestones will be developed as soon as the project team has been established.

Timetable and milestones 2018 – 2019	
SAO meeting in Rovaniemi, Nov. 2018 - 2019	PAME Secretariat, in cooperation with FI, AMAP Chair, and CAFF Secretariat discussed the best possible setup for the Factsheet project.
Intersessionally: PAME Sec., FI, US, NO	An updated project proposal, in Dec. 2018.
PAME-1-2019	The update project proposal will be presented at PAME 1 2019.
February 2019	If accepted by PAME, and later by CAFF and other Arctic Council working groups, in particular AMAP, a detailed project plan will be drafted by the parties interested to participate in the project.
February - March 2019	The foreseen project leads and the Working Group's Secretariats together identify potential

May-June 2019	funding opportunities and draft joint funding proposals, as appropriate. The project begins (depending on the funding)

Indicative Budget and Funding

Consistent with the overall Arctic Council approach, the development of this project will be financed through voluntary contributions and in-kind support from member governments. The proposed stepwise approach will facilitate financial planning and budgets. Financial contributions will be sought from other sources as well, such as the Nordic Council of Ministers and the Moore Foundation.

Item	Budget (USD)
Project management, coordination, consultation and outreach	50.000
Project consultant(s) for 2 years (e.g. ToR) [1)]	75.000
Meetings and travel costs	15.000
Editing, final layout and printing	30.000
Estimated Total:	**170.000** *(150.000 euros)*

1) Terms of Reference could e.g. be explored with GRID Arendal.

Project Team Structure/Lead Countries

The leads for the initial work package are: Finland, USA, Canada (and Norway/TBC)

Other co-leads:

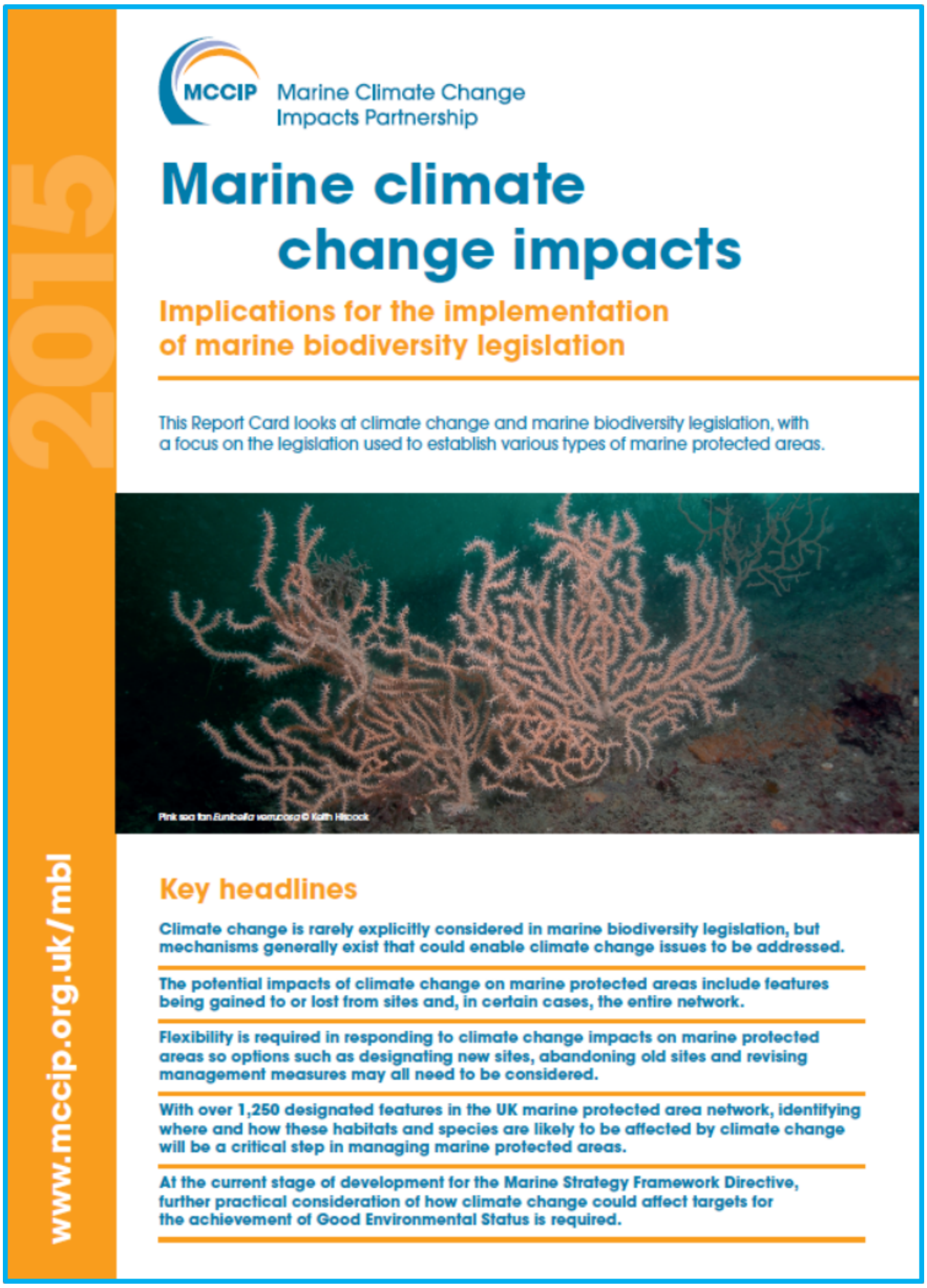
- ✓ PAME Secretariat and the CAFF secretariats (TBC).
- ✓ Each working group and Permanent Participants' organization will be invited to appoint a project team member.

The project team will serve as the advisory group and have an oversight over this work. The project team may change for subsequent work package/thematic factsheet.

Observers and External Partners

Observers and external partners are also invited to participate in the project advisory group and the sub-projects/sub-groups or be invited as experts in the meetings of these.

ANNEX I. Extracts form the UK Marine Climate Change Impact Partnerships Report Cards (extracts are from several cards (not only from one annual card).



MCCIP Marine Climate Change Impacts Partnership

2015

Marine climate change impacts

Implications for the implementation of marine biodiversity legislation

This Report Card looks at climate change and marine biodiversity legislation, with a focus on the legislation used to establish various types of marine protected areas.

Pink sea fan *Eunicella verrucosa* © Keith Hiscock

Key headlines

Climate change is rarely explicitly considered in marine biodiversity legislation, but mechanisms generally exist that could enable climate change issues to be addressed.

The potential impacts of climate change on marine protected areas include features being gained to or lost from sites and, in certain cases, the entire network.

Flexibility is required in responding to climate change impacts on marine protected areas so options such as designating new sites, abandoning old sites and revising management measures may all need to be considered.

With over 1,250 designated features in the UK marine protected area network, identifying where and how these habitats and species are likely to be affected by climate change will be a critical step in managing marine protected areas.

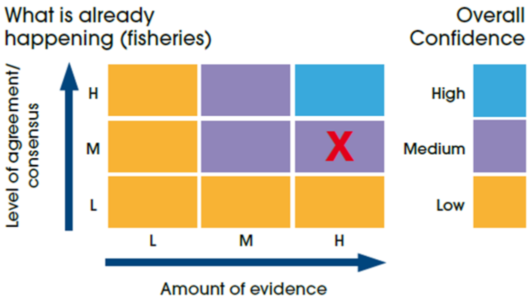
At the current stage of development for the Marine Strategy Framework Directive, further practical consideration of how climate change could affect targets for the achievement of Good Environmental Status is required.

www.mccip.org.uk/mbl

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'):

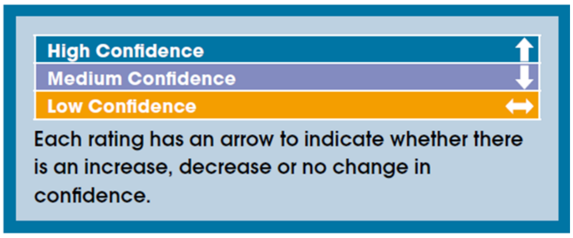


In each of the full, peer-reviewed topic submissions, a rationale is provided explaining why the authors have assigned a low, medium or high level of confidence.

It is important to note that the confidence assessments are for each topic taken as a whole rather than for the specific headlines included in this summary report card.

Changes in confidence since the 2007–2008 Annual Report Card

Changes in the overall level of confidence since the 2007–2008 Annual Report Card are shown as arrows within the confidence bars for each topic.



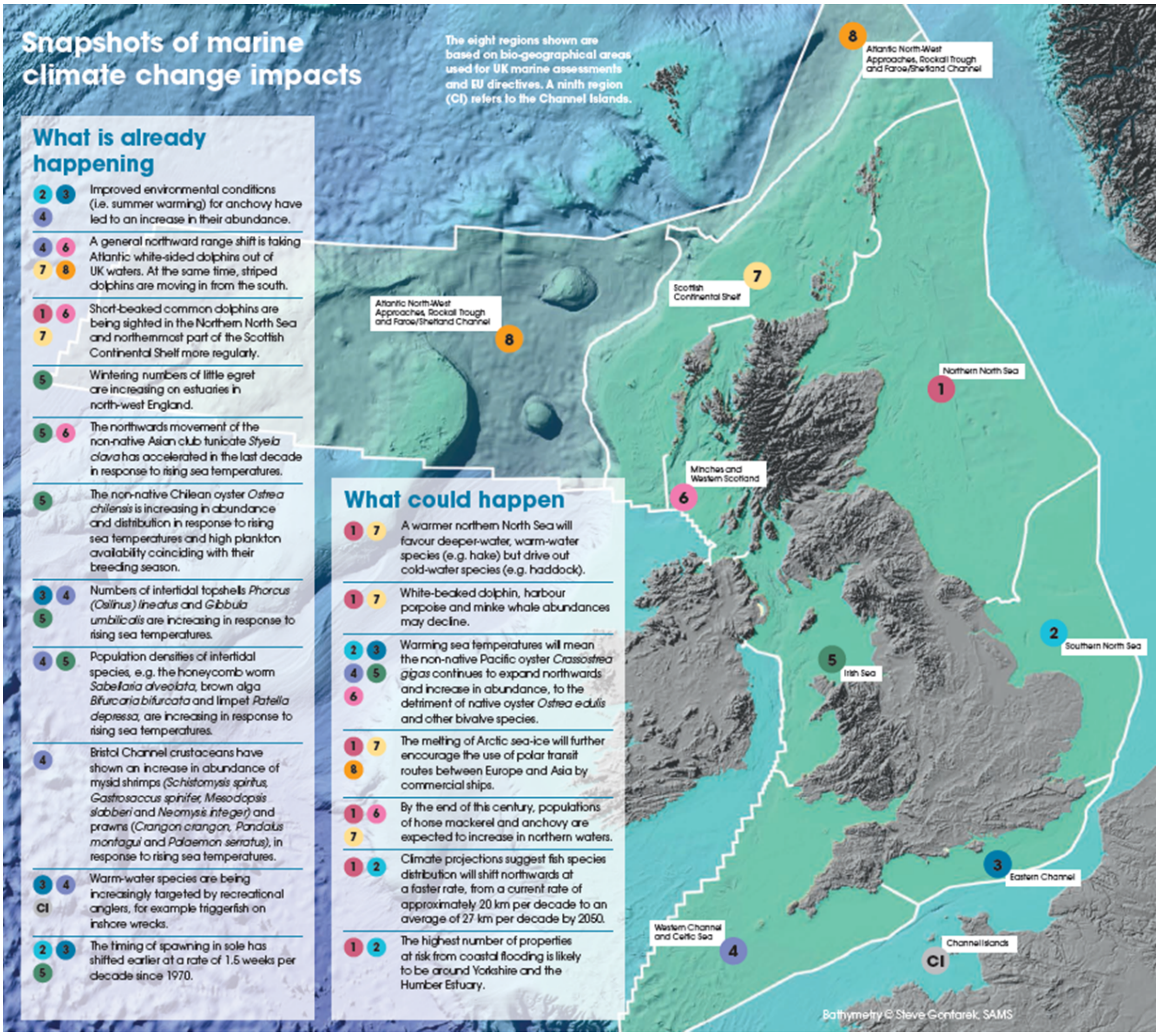
Confidence may go up or down due to new data and model outputs becoming available or through changes in understanding of the science.

The majority of confidence ratings have stayed the same since 2007–2008. However, nine have gone up, whilst six have gone down.

2009 MCCIP Ecosystem Linkages Report Card

The 2009 MCCIP Ecosystem Linkages Report Card looked at five key issues (CO_2 and ocean acidification, Arctic sea-ice loss, seabirds and food webs, non-native species, and coastal economies) to show how the interconnected nature of the marine ecosystem magnifies the many discrete impacts of climate change, documented in the MCCIP Annual Report Cards.

	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.**
Storms and Waves *ERI; NOC*	**Medium Confidence** ↓ • **Natural variability in wave climate is large and the role of anthropogenic influence is unclear.** • Increases in monthly mean and maximum wave height in the north-eastern Atlantic occurred between 1960 and 1990; however, this rise in wave height may be part of long-term natural variability. There has been no clear pattern since 1990.	**Low Confidence** ↔ • **There is no consensus on the future storm and wave climate for north-western Europe, since projected future storm track behaviour varies among atmospheric models.** • **Predictions of storm behaviour used by the UKCP09 wave model show storm tracks moving south, resulting in lower wave heights to the north of the UK and slightly larger wave heights in some southern regions, especially the south-west.**
Sea Level *NOC; MOHC*	**High Confidence** ↔ • Global sea level has risen at a mean rate of 1.8mm per year since 1955. From 1992 onwards a higher mean rate of 3mm per year has been observed. • **Sea-level rise measured over the UK is consistent with the observed global mean.**	**Medium Confidence** ↑ • Projections of change in the UK suggest a rise of between 12 and 76cm by 2095, compared to a 1980–1999 baseline. This approximately equates to rates of between 1.2 and 7.6 mm per year respectively. • Considering projected land movements, a greater rise in southern regions of the UK is likely relative to the north.
Ocean Acidification *PML; Bristol University; MBA*	**High Confidence** ↔ • The ocean is becoming more acidic as increasing amounts of atmospheric carbon dioxide (CO_2) are absorbed at the sea surface. Models and measurements suggest about a 30% decrease in surface pH (an increase in acidity) and a 16% decrease in carbonate ion concentrations since 1750. • **The rate of change in pH is faster than anything experienced in the last 55 million years and is causing concern for marine ecosystems and species.**	**Medium Confidence** ↔ • Oceans will continue to acidify with increasing CO_2 emissions. • Whilst we have high confidence that ocean acidification will continue, subsequent impacts on ecosystems are less well understood. • Future increases in ocean acidity may have major negative impacts on some shell and skeleton-forming organisms by 2100.
Atlantic Heat Conveyor *NOC; Cefas; MOHC; Reading University*	**Medium Confidence** ↑ • Daily observations of the Atlantic heat conveyor began in 2004, revealing substantial daily to seasonal variability. At present the record length is too short to determine inter-annual variability or longer-term trends. • **Observations and ocean models provide some evidence for recent slowing at some latitudes, during the 1990s and early 2000s. However, we do not yet have compelling evidence for a direct influence of changes in the Atlantic heat conveyor on climate in and around the North Atlantic over recent decades.**	**Medium Confidence** ↑ • It is very likely that the Atlantic heat conveyor will slow this century, with models predicting an average 25% reduction of pre-industrial strength.
Salinity *Marine Scotland; Cefas; IMGL; NOC; PML; SAMS*	**Medium Confidence** ↔ • The shelf sea and oceanic surface waters to the north and west of the UK have become relatively more saline since the 1970s. There are no clear trends in the shelf sea waters of the Irish Sea, southern North Sea and western Scotland. • **Salinity of the deep waters of the North Atlantic decreased between 1960–2000 but has been stable for the last decade.**	**Low Confidence** ↔ • **The salinity of shelf seas and oceanic surface waters may decrease slightly, though there are considerable uncertainties due to the influence of climate-driven changes in precipitation, evaporation, ocean circulation and ice-melt.**


Snapshots of marine climate change impacts
The eight regions shown are based on bio-geographical areas used for UK marine assessments and EU directives. A ninth region (CI) refers to the Channel Islands.
What is already happening
2 3 4 Improved environmental conditions (i.e. summer warming) for anchovy have led to an increase in their abundance.
4 6 7 8 A general northward range shift is taking Atlantic white-sided dolphins out of UK waters. At the same time, striped dolphins are moving in from the south.
1 6 7 Short-beaked common dolphins are being sighted in the Northern North Sea and northernmost part of the Scottish Continental Shelf more regularly.
5 Wintering numbers of little egret are increasing on estuaries in north-west England.
5 6 The northwards movement of the non-native Asian club tunicate *Styela clava* has accelerated in the last decade in response to rising sea temperatures.
5 The non-native Chilean oyster *Ostrea chilensis* is increasing in abundance and distribution in response to rising sea temperatures and high plankton availability coinciding with their breeding season.
3 4 5 Numbers of intertidal topshells *Phorcus (Osilinus) lineatus* and *Gibbula umbilicalis* are increasing in response to rising sea temperatures.
4 5 Population densities of intertidal species, e.g. the honeycomb worm *Sabellaria alveolata*, brown alga *Bifurcaria bifurcata* and limpet *Patella depressa*, are increasing in response to rising sea temperatures.
4 Bristol Channel crustaceans have shown an increase in abundance of mysid shrimps (*Schistomysis spiritus, Gastrosaccus spinifer, Mesodopsis slabberi* and *Neomysis integer*) and prawns (*Crangon crangon, Pandalus montagui* and *Palaemon serratus*), in response to rising sea temperatures.
3 4 CI Warm-water species are being increasingly targeted by recreational anglers, for example triggerfish on inshore wrecks.
2 3 5 The timing of spawning in sole has shifted earlier at a rate of 1.5 weeks per decade since 1970.
What could happen
1 7 A warmer northern North Sea will favour deeper-water, warm-water species (e.g. hake) but drive out cold-water species (e.g. haddock).
1 7 White-beaked dolphin, harbour porpoise and minke whale abundances may decline.
2 3 4 5 6 Warming sea temperatures will mean the non-native Pacific oyster *Crassostrea gigas* continues to expand northwards and increase in abundance, to the detriment of native oyster *Ostrea edulis* and other bivalve species.
1 7 8 The melting of Arctic sea-ice will further encourage the use of polar transit routes between Europe and Asia by commercial ships.
1 6 7 By the end of this century, populations of horse mackerel and anchovy are expected to increase in northern waters.
1 2 Climate projections suggest fish species distribution will shift northwards at a faster rate, from a current rate of approximately 20 km per decade to an average of 27 km per decade by 2050.
1 2 The highest number of properties at risk from coastal flooding is likely to be around Yorkshire and the Humber Estuary.
8 Atlantic North-West Approaches, Rockall Trough and Faroe/Shetland Channel
8 Atlantic North-West Approaches, Rockall Trough and Faroe/Shetland Channel
7 Scottish Continental Shelf
1 Northern North Sea
6 Minches and Western Scotland
2 Southern North Sea
5 Irish Sea
3 Eastern Channel
4 Western Channel and Celtic Sea
CI Channel Islands
Bathymetry © Steve Gontarek, SAMS