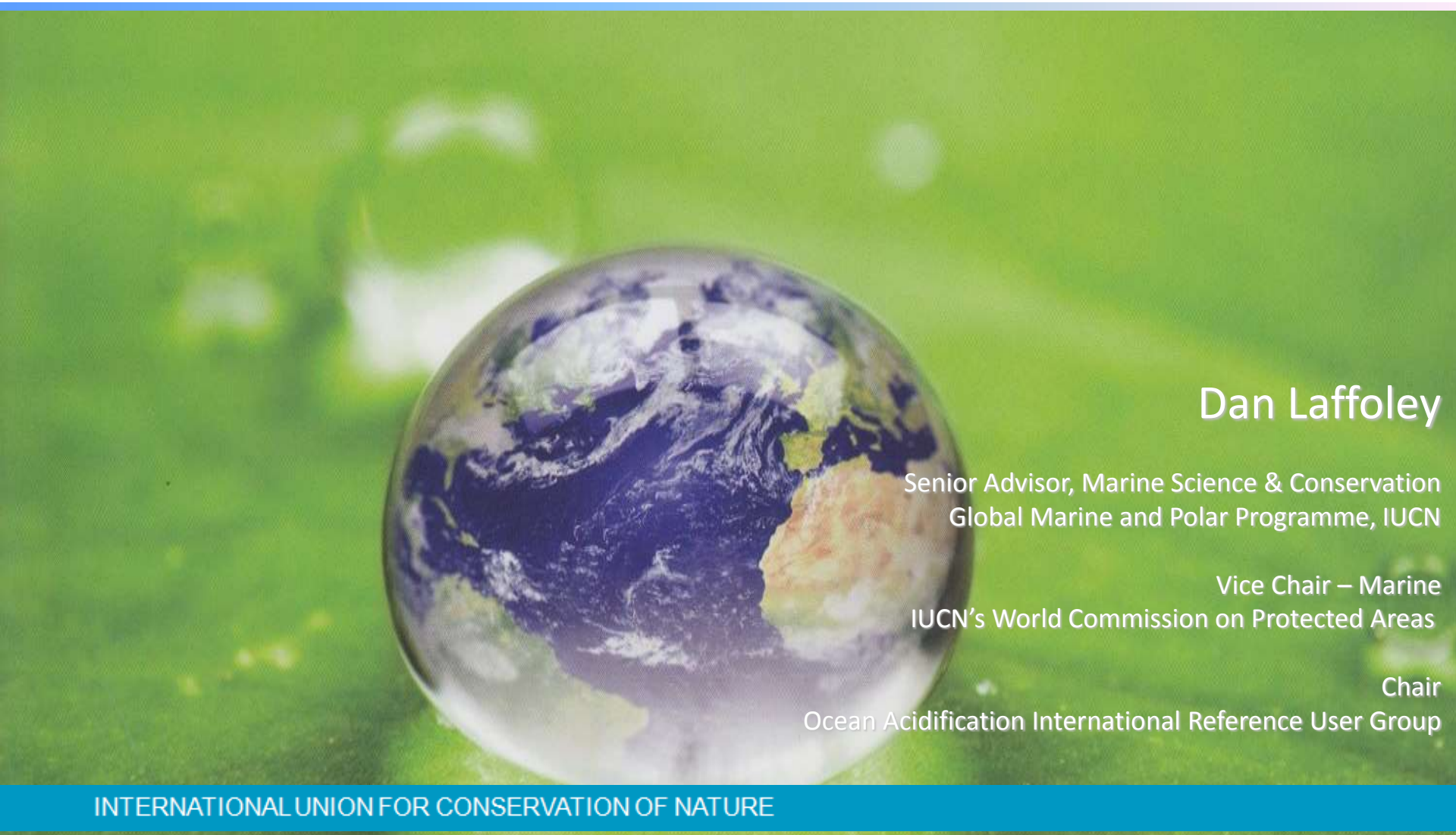
Reykjavík, Iceland, 19th September 2016

The Ocean – the future we want

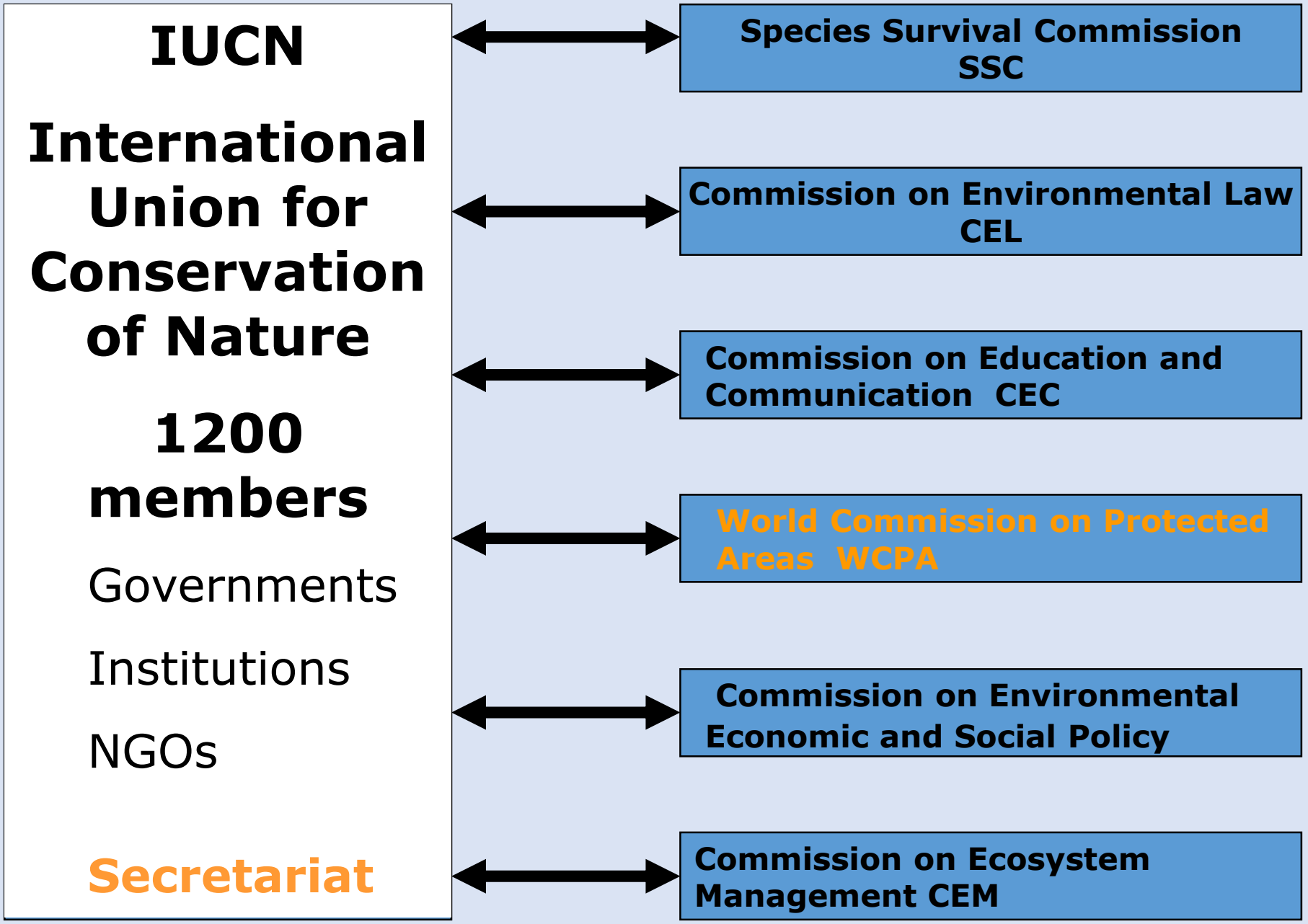


Dan Laffoley

Senior Advisor, Marine Science & Conservation
Global Marine and Polar Programme, IUCN

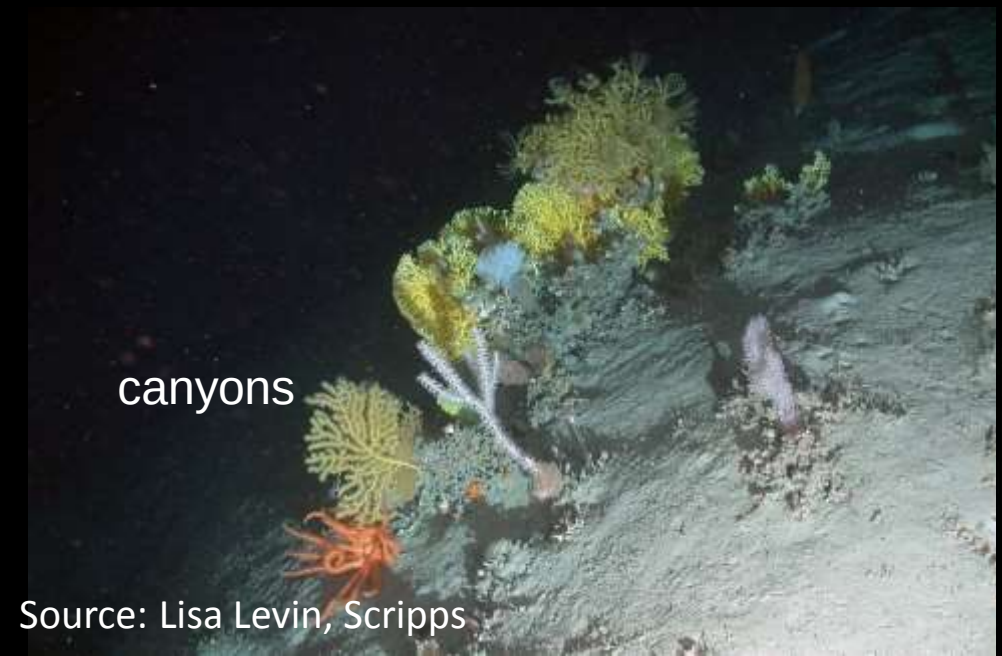
Vice Chair – Marine
IUCN's World Commission on Protected Areas

Chair
Ocean Acidification International Reference User Group

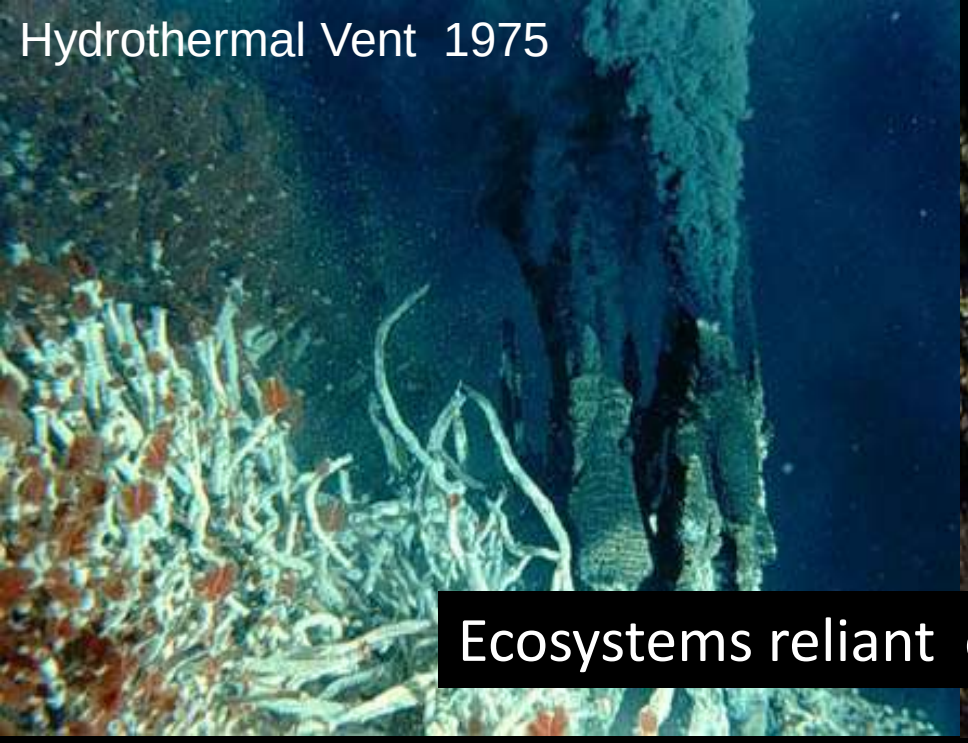

IUCN
International Union for Conservation of Nature
1200 members
Governments
Institutions
NGOs
Secretariat
Species Survival Commission SSC
Commission on Environmental Law CEL
Commission on Education and Communication CEC
World Commission on Protected Areas WCPA
Commission on Environmental Economic and Social Policy
Commission on Ecosystem Management CEM

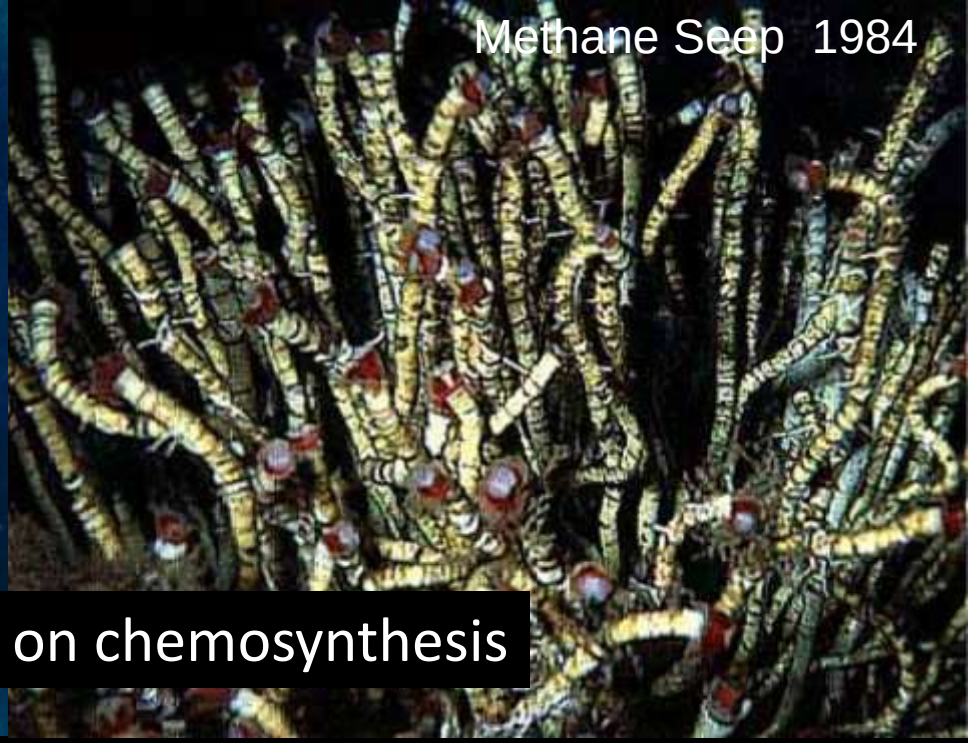
Source: Lisa Levin, Scripps

Varied deep sea habitats



Source: Lisa Levin, Scripps





Ecosystems reliant on chemosynthesis

Whale Fall 1989

Source: Lisa Levin, Scripps

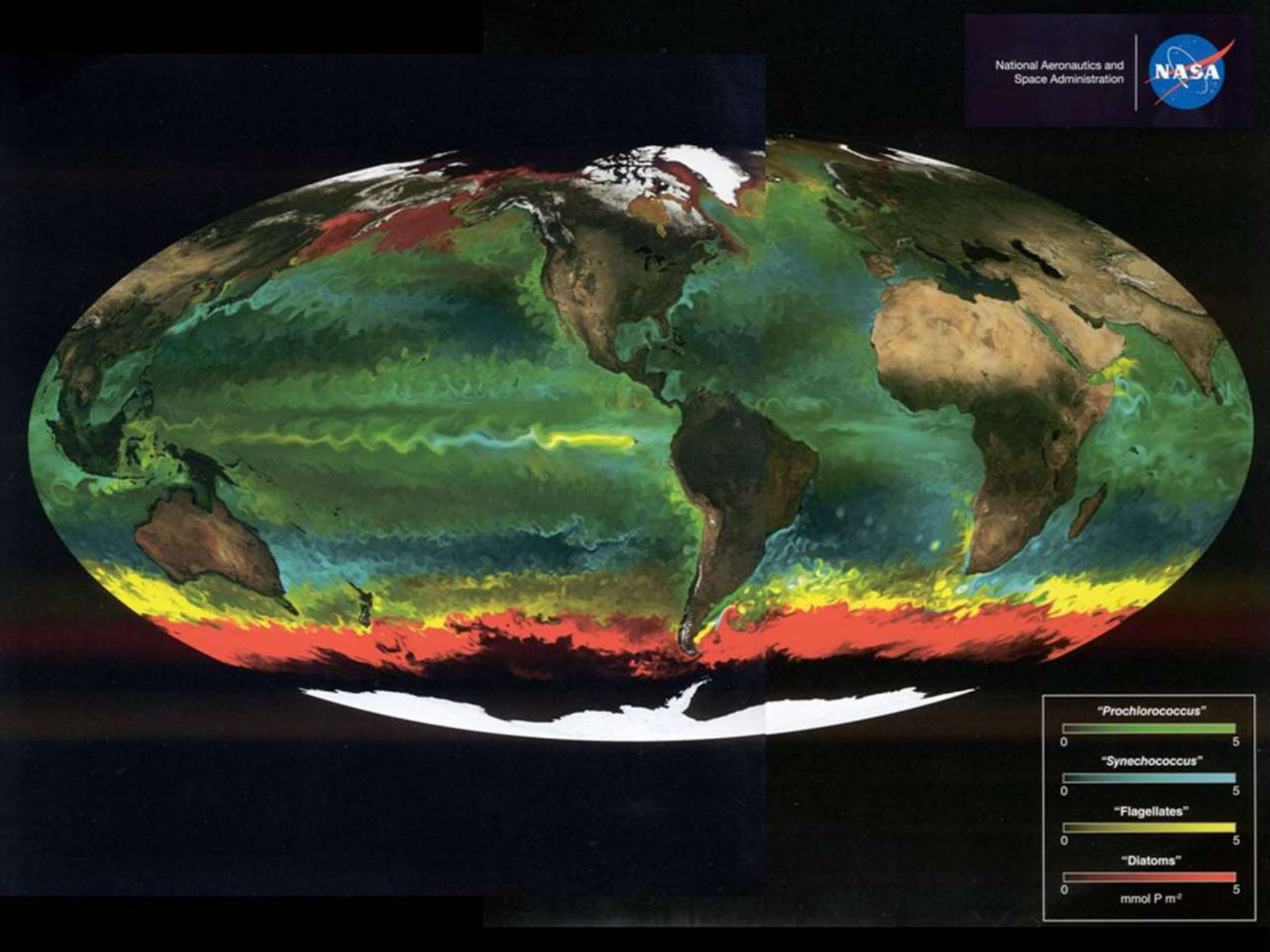
Ocean wildlife spectacles

Photo credit: R.Harcourt

Photo credit: Don Kincaid

Courtesy Elliott Norse

NASA


National Aeronautics and Space Administration
NASA
"Prochlorococcus"
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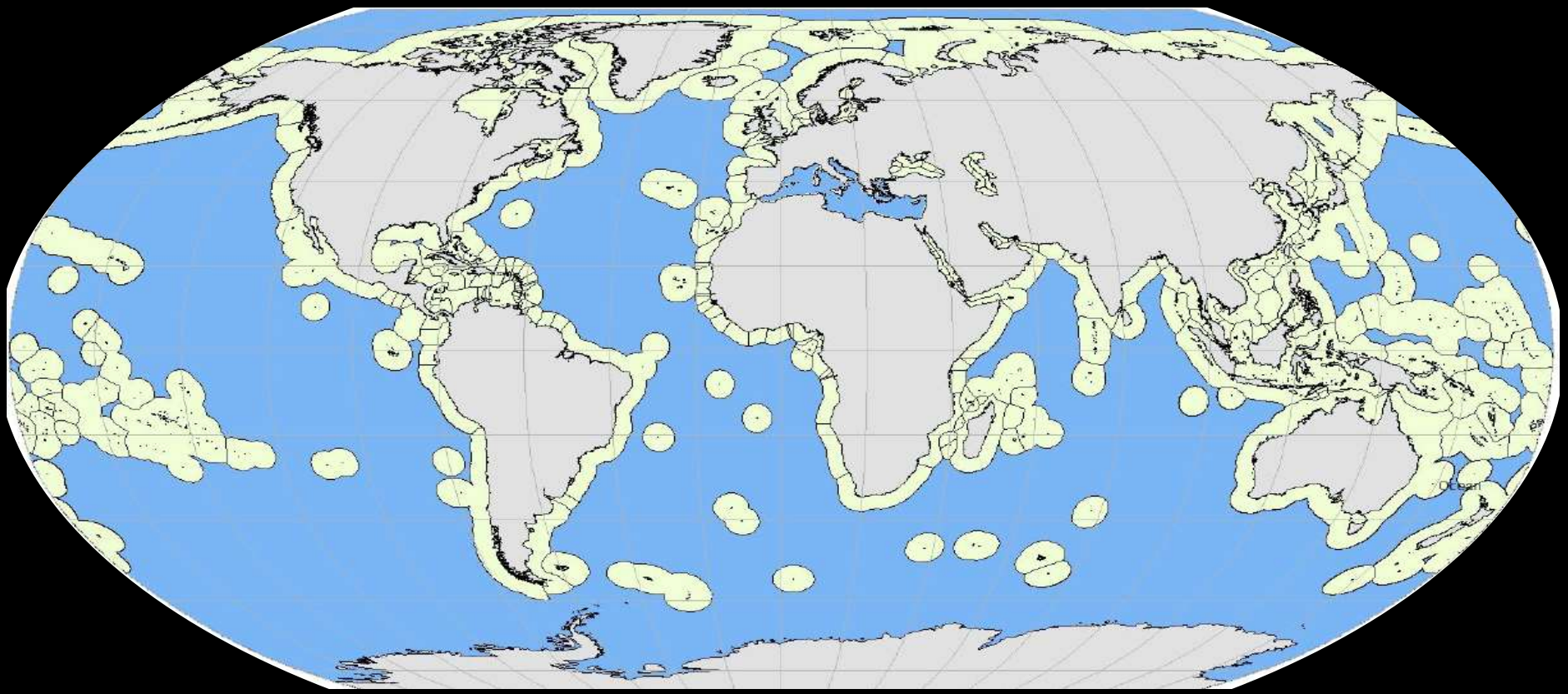
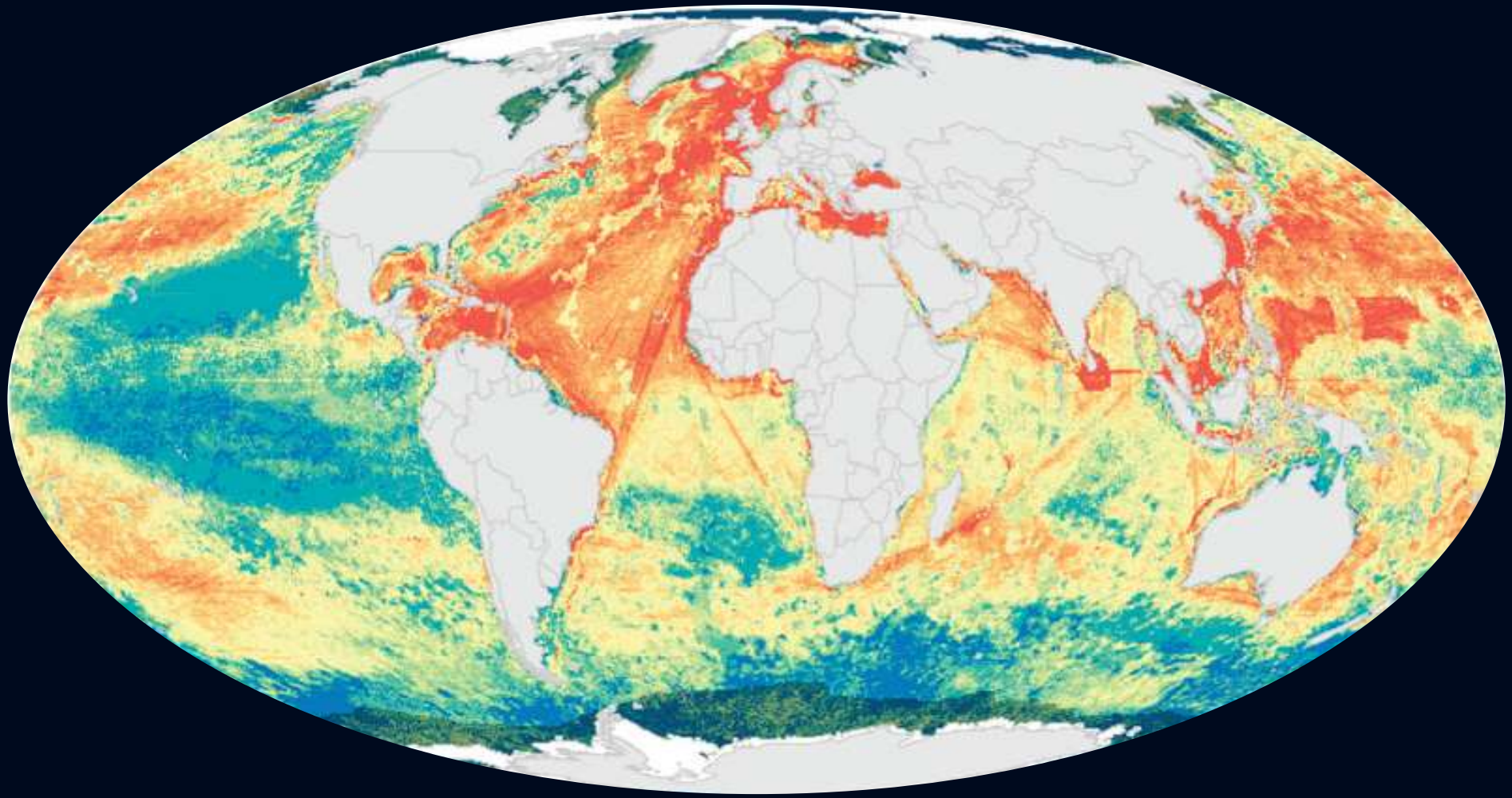


High Seas

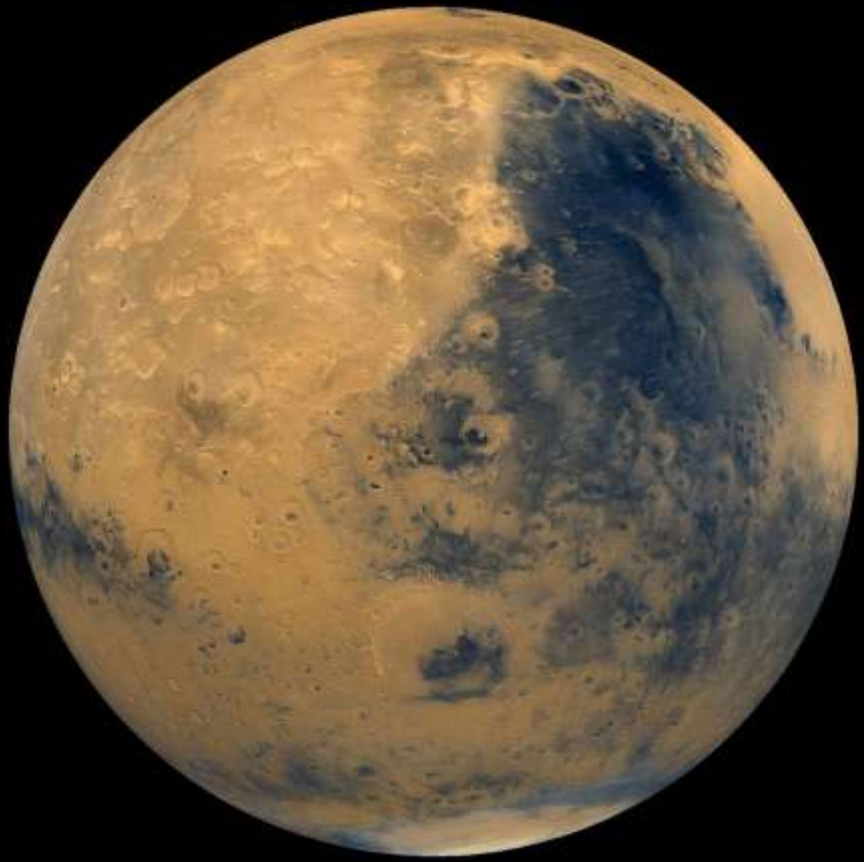
Exclusive Economic Zones

MARINE CONSERVATION INSTITUTE

Ben Halpern et al, Nature, 2015



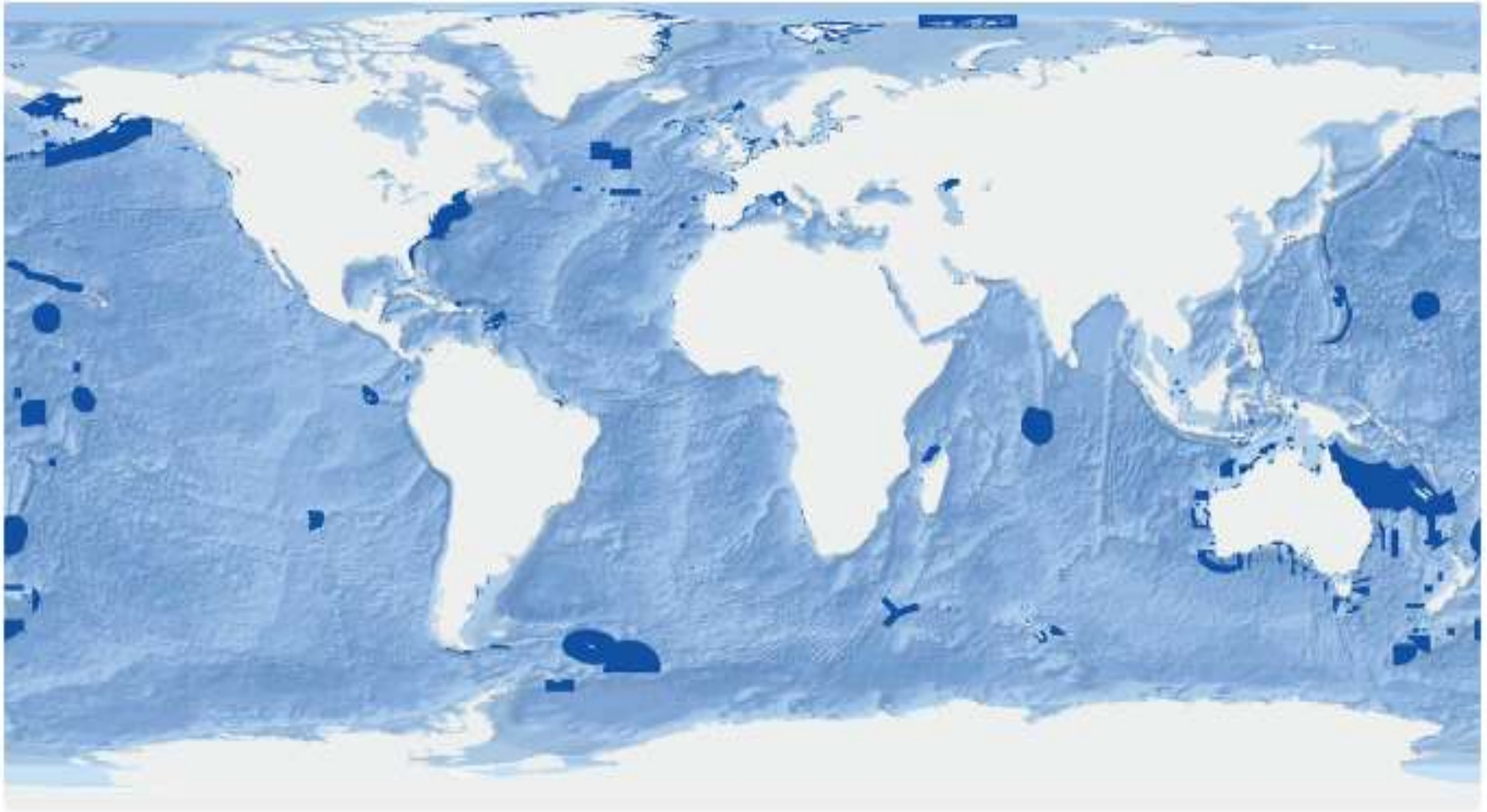
http://www.nature.com/ncomms/2015/150714/ncomms8615/full/ncomms8615.html



NASA

Official MPA Map

protected planet



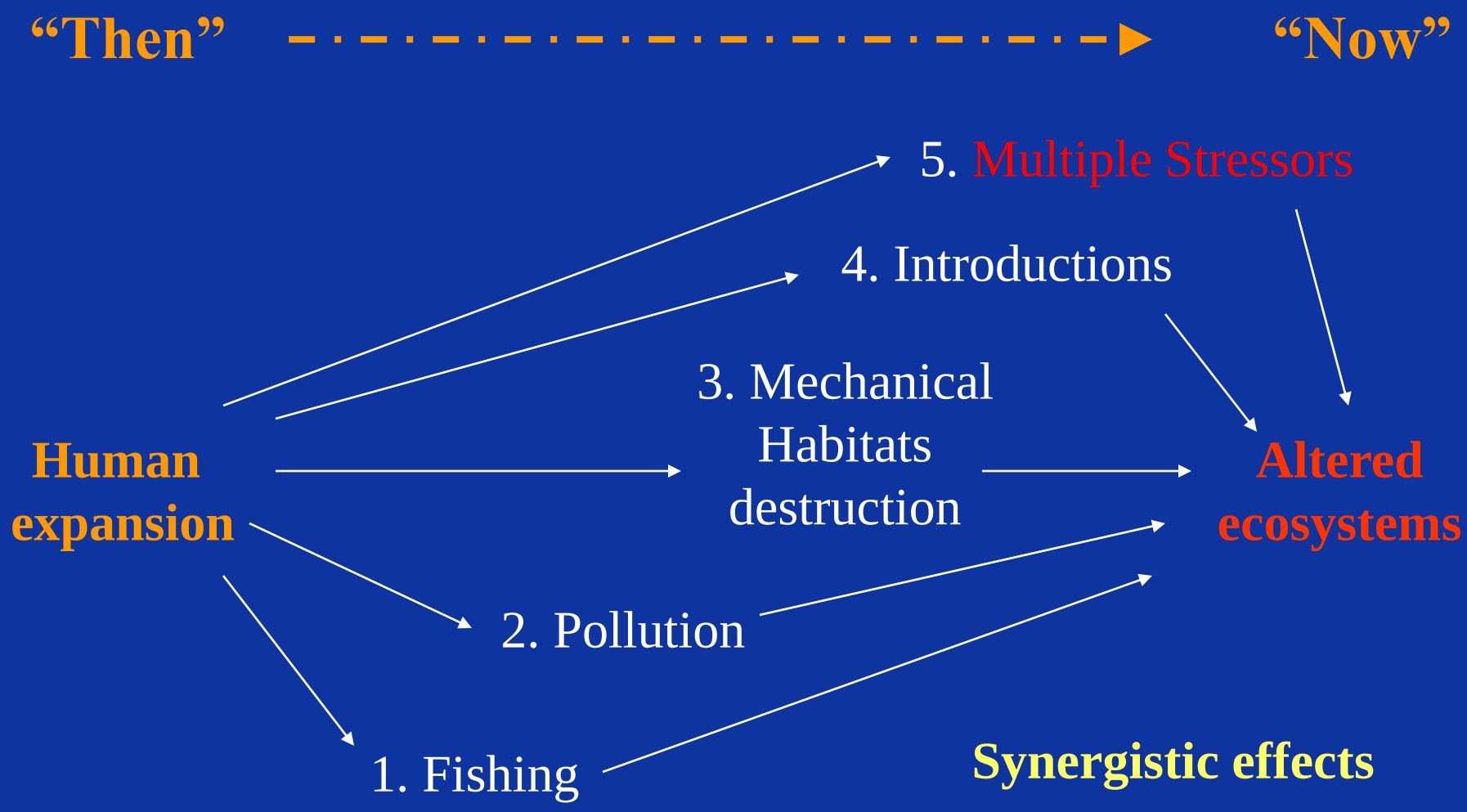
Source: IUCN and UNEP-WCMC (2016). The World Database on Protected Areas (WDPA) [On-line], April 2016, Cambridge, UK: UNEP-WCMC. Available at www.protectedplanet.net

UNEP WCMC

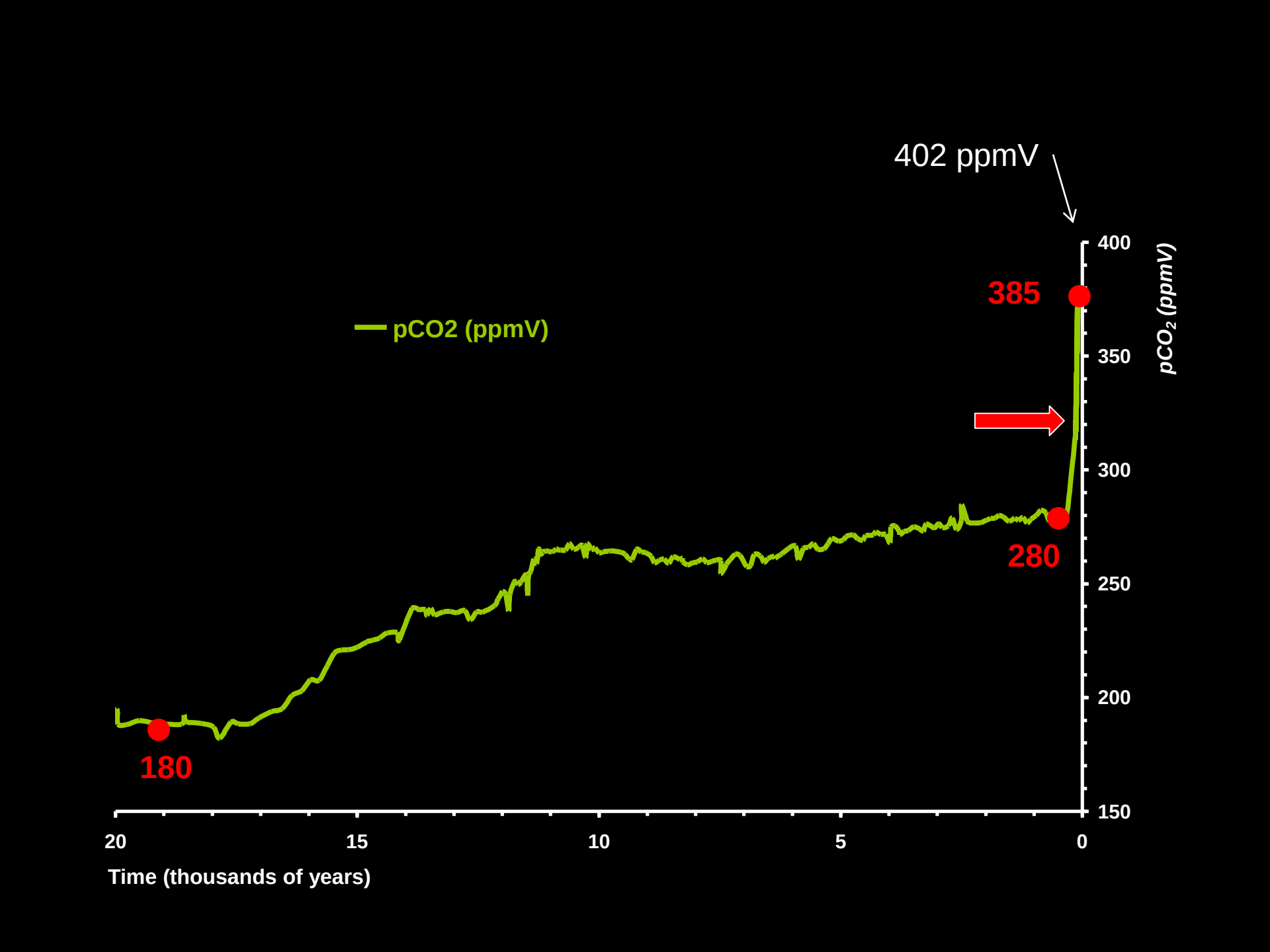
4.1% of the Global Ocean covered by marine protected areas
Exclusively No Take = 0.91%

IUCN WCPA

The Ocean: the future we may get

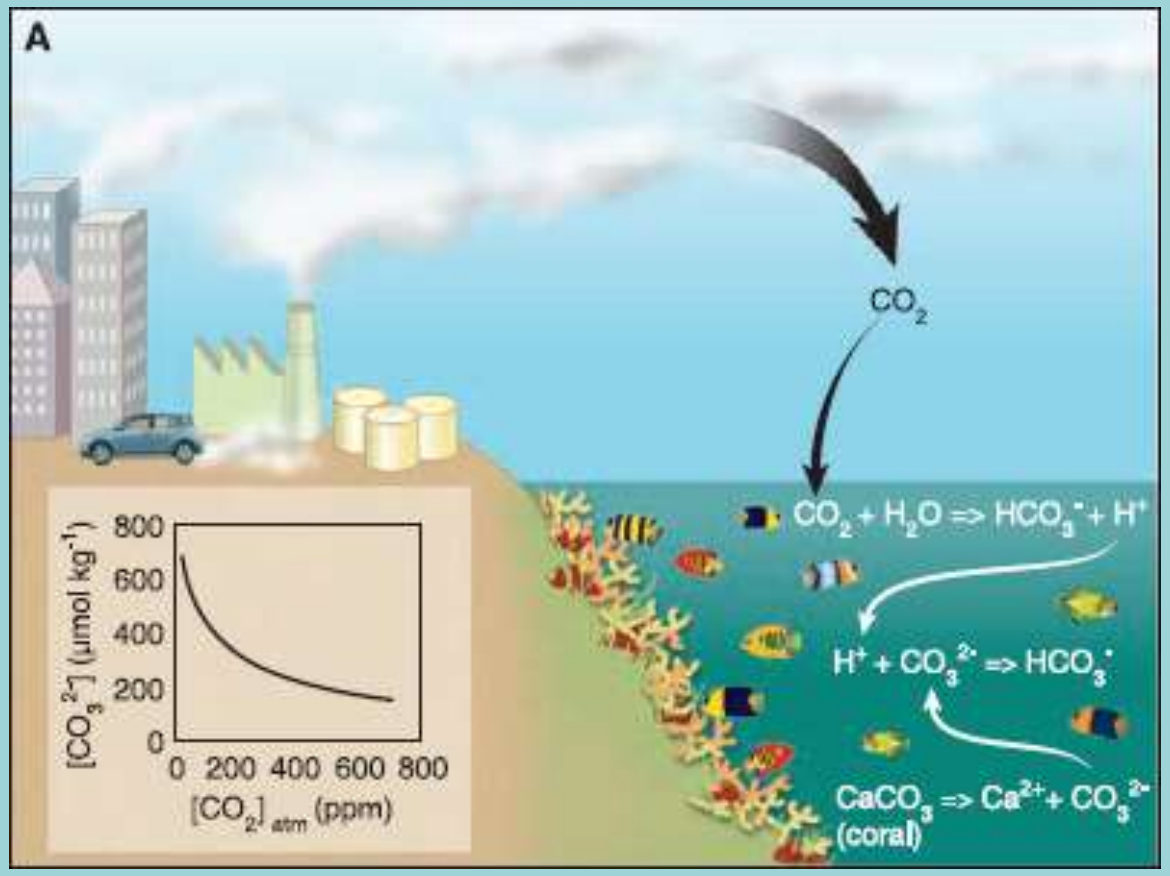


Adapted from Jackson, 2001

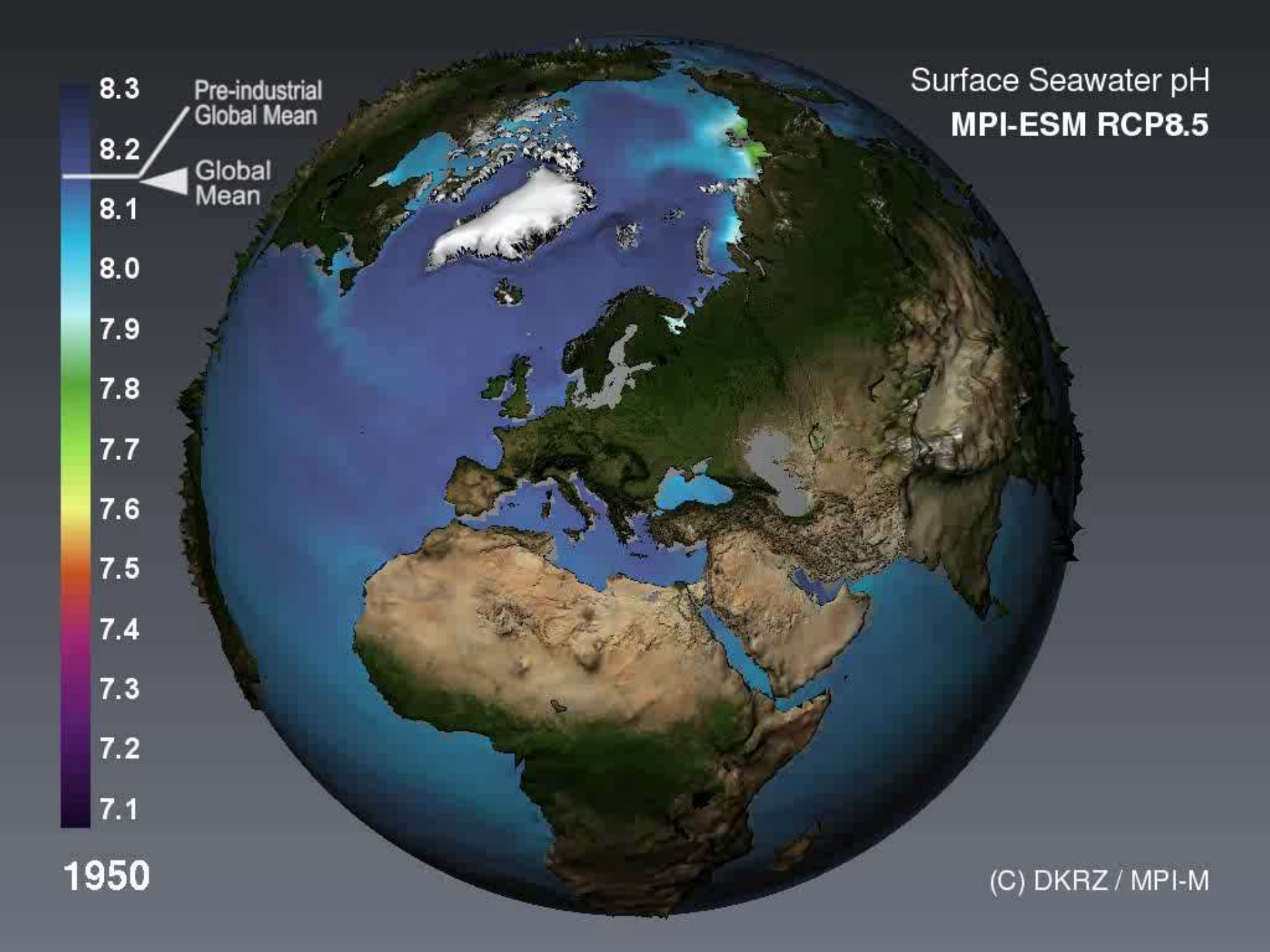

402 ppmV
pCO2 (ppmV)
385
280
180
400
350
300
250
200
150
pCO2 (ppmV)
20
15
10
5
0
Time (thousands of years)

Ocean acidification: CO_2 is converted to carbonic acid in seawater which then lowers pH and converts carbonate to bicarbonate

Result is a reduction in the availability of aragonite, the form of calcium carbonate that corals build their skeletons from.



Courtesy of Alex Rogers, IPSO


Surface Seawater pH
MPI-ESM RCP8.5
8.3
8.2
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7.9
7.8
7.7
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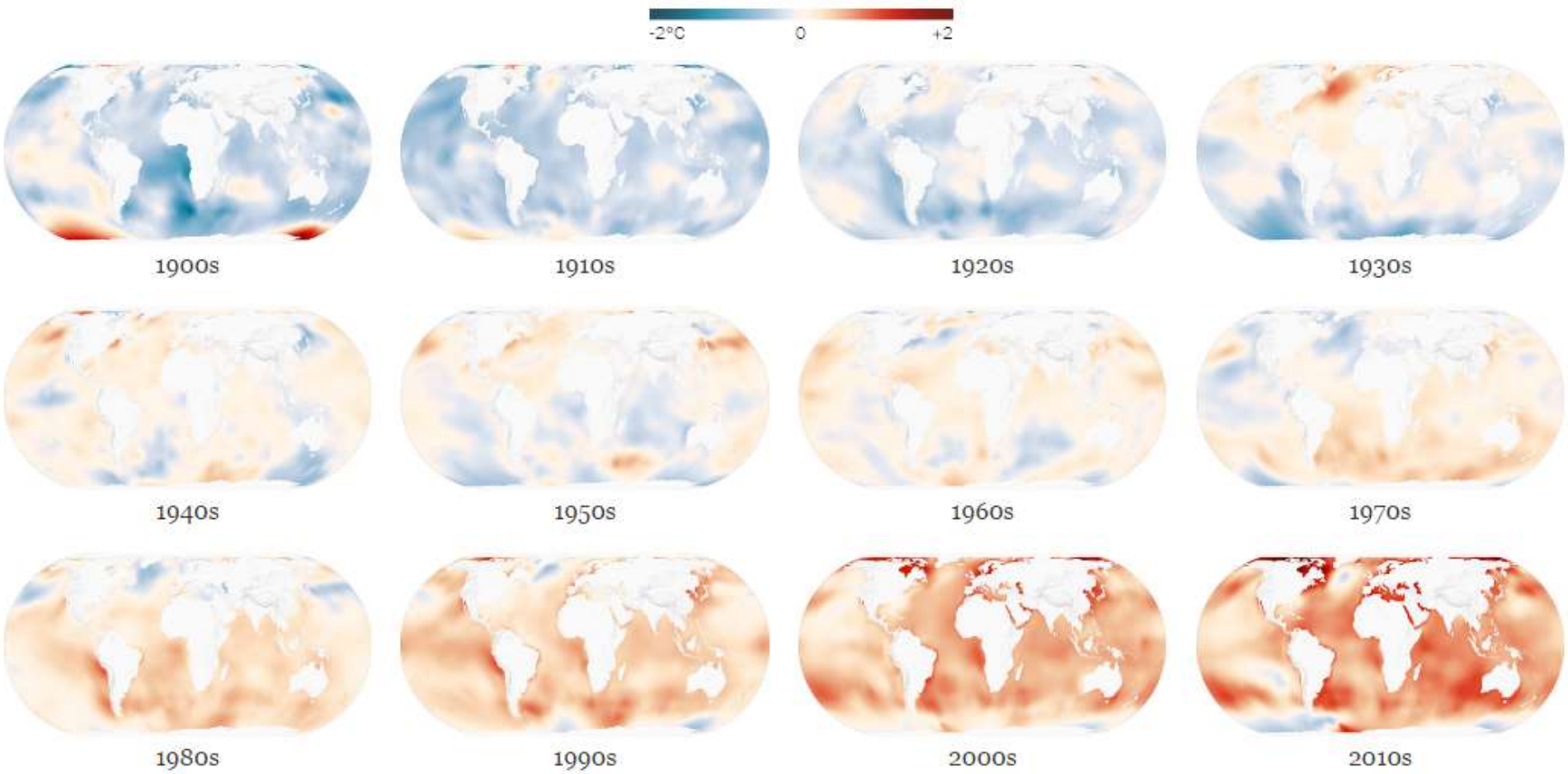
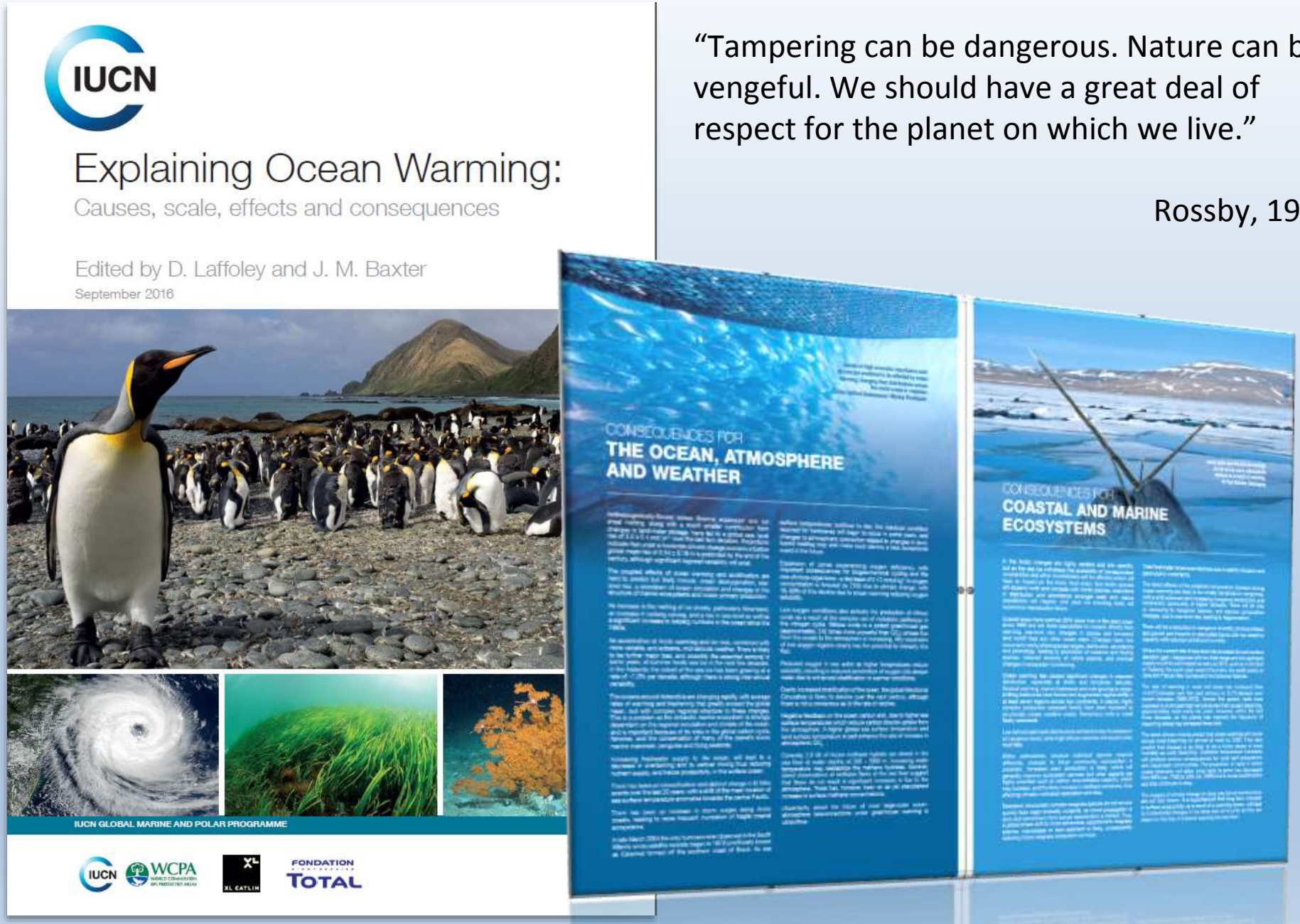
7.4
7.3
7.2
7.1
Pre-industrial Global Mean
Global Mean
1950
(C) DKRZ / MPI-M

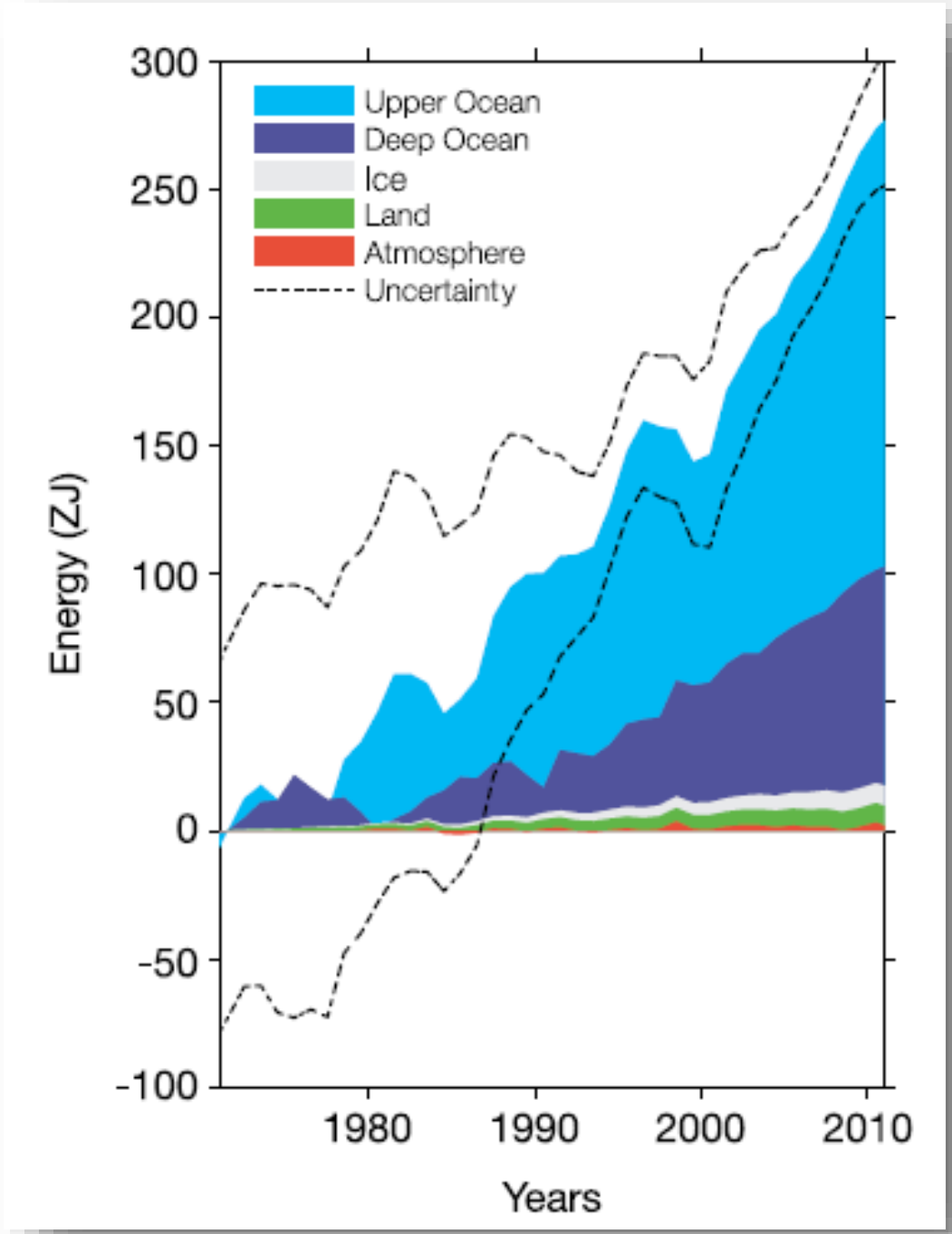


Sources: National Oceanic and Atmospheric Administration



"Tampering can be dangerous. Nature can be vengeful. We should have a great deal of respect for the planet on which we live."

Rossby, 1956


Upper Ocean
Deep Ocean
Ice
Land
Atmosphere
Uncertainty
300
250
200
150
100
50
0
-50
-100
Energy (ZJ)
1980
1990
2000
2010
Years

Australian Government
Department of the Environment and Energy
Australian Antarctic Division

ACE
CRC
ANTARCTIC CLIMATE
& ECOSYSTEMS CRC

ANCORS
UNIVERSITY OF WOLLONGONG AUSTRALIA

BIOLOGICAL
SCIENCES
WITH
PLYMOUTH
UNIVERSITY

British
Antarctic Survey

CONSERVATION
INTERNATIONAL

NOAA
CORAL REEF WATCH

FAU
FLORIDA ATLANTIC
UNIVERSITY

FLORIDA STATE UNIVERSITY
1851

IMAS

MacArthur Green

THE MARINE BIOLOGICAL
ASSOCIATION

Marine Institute
PLYMOUTH UNIVERSITY

NEREUS PROGRAM

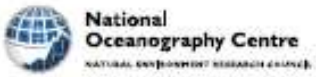
SAMS

Smithsonian Environmental
Research Center

UNIVERSITÀ
POLITECNICA
DELLE MARCHE

WMU
WORLD MARITIME UNIVERSITY

ISMAR


National
Oceanography Centre

SAHFOS

stazione
zoologica
anton dohrn
napoli

UNIVERSITÀ
DEL SALENTO

The
University
Of
Sheffield.

UNIVERSITY OF
Southampton

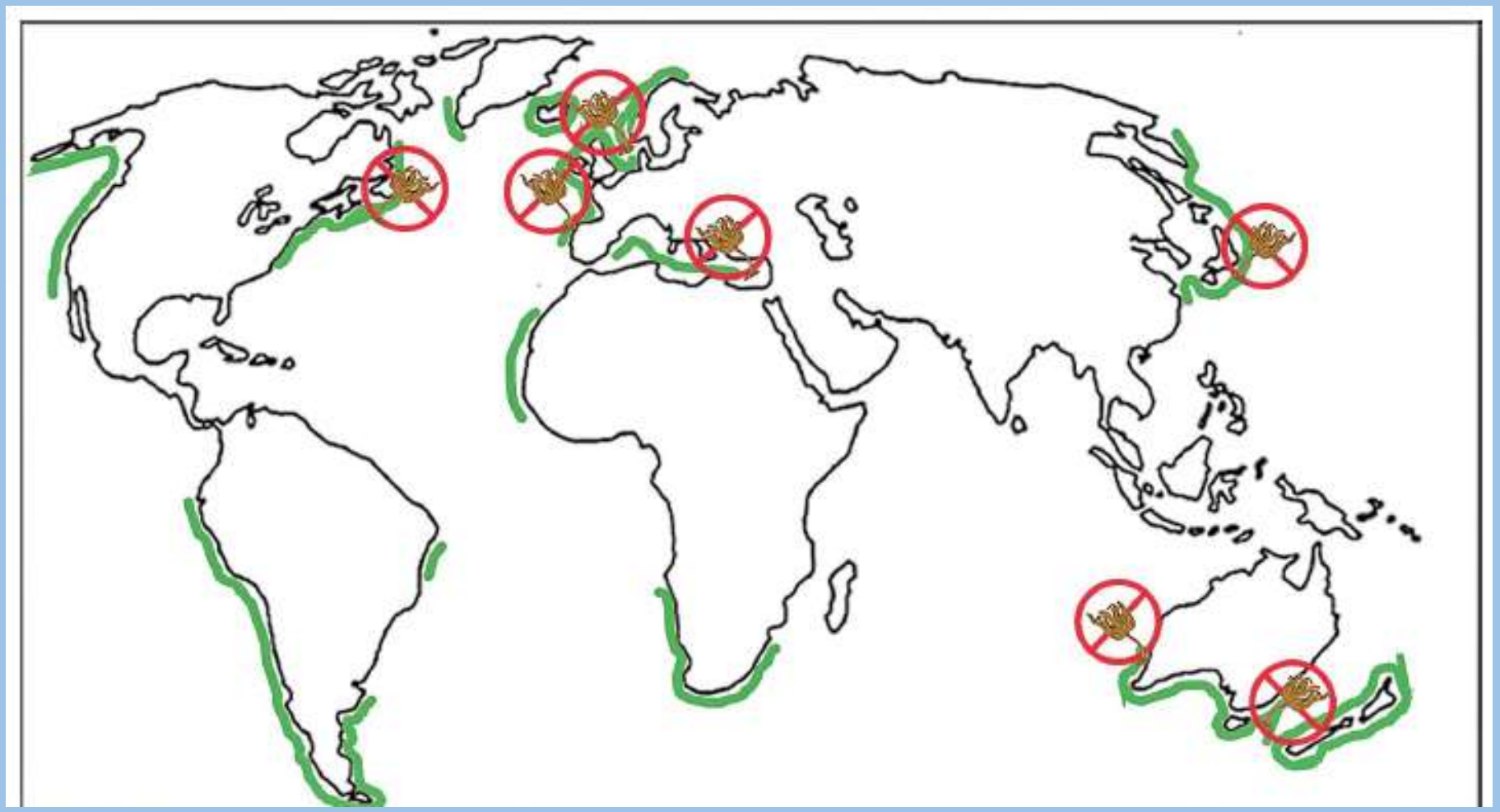
UNIVERSITY of
TASMANIA
AUSTRALIA

THE UNIVERSITY OF
WESTERN
AUSTRALIA

Table 1.1 Effects, responses and interactions of ocean warming

Ocean warming effect	Current response
Changes in heat storage (Ocean Heat Content, OHC)	Increasing uptake of heat by the ocean as a response to the Earth's Energy Imbalance (EEI), buffering global warming Rising water temperatures at all depths Shallowing of the pycnocline Intensification of El Niño (ENSO) events
Changes in the strength/position of currents and heat transport.	Increased poleward heat transport in western boundary currents of the subtropical gyres Ditto in baroclinic shelf edge currents
Warming of adjacent land masses.	Warmer land surface temperatures Melting permafrost Retreating mountain glaciers and surface melting of the Greenland Ice sheet Terrestrial vegetation changing Increased extent and magnitude of forest fires
Rising sea levels due to direct thermosteric (heat expansion of water) plus other temperature related contributions from melting ice sheets and glaciers	Permanent land inundation, coastal erosion, flooding from storm surges, salt water intrusion into aquifers, loss of some coral atolls and islands.
A melting cryosphere (frozen world)	Basal melting and thinning of ice shelves in Antarctica destabilizing dammed up ice sheet glaciers Increasing overall Antarctic ice mass and sea ice Accelerated mass loss of the Greenland Ice Sheet including basal melting of marine terminating glaciers Accelerating reduction of sea ice in the Arctic and in the

Kelp forest losses



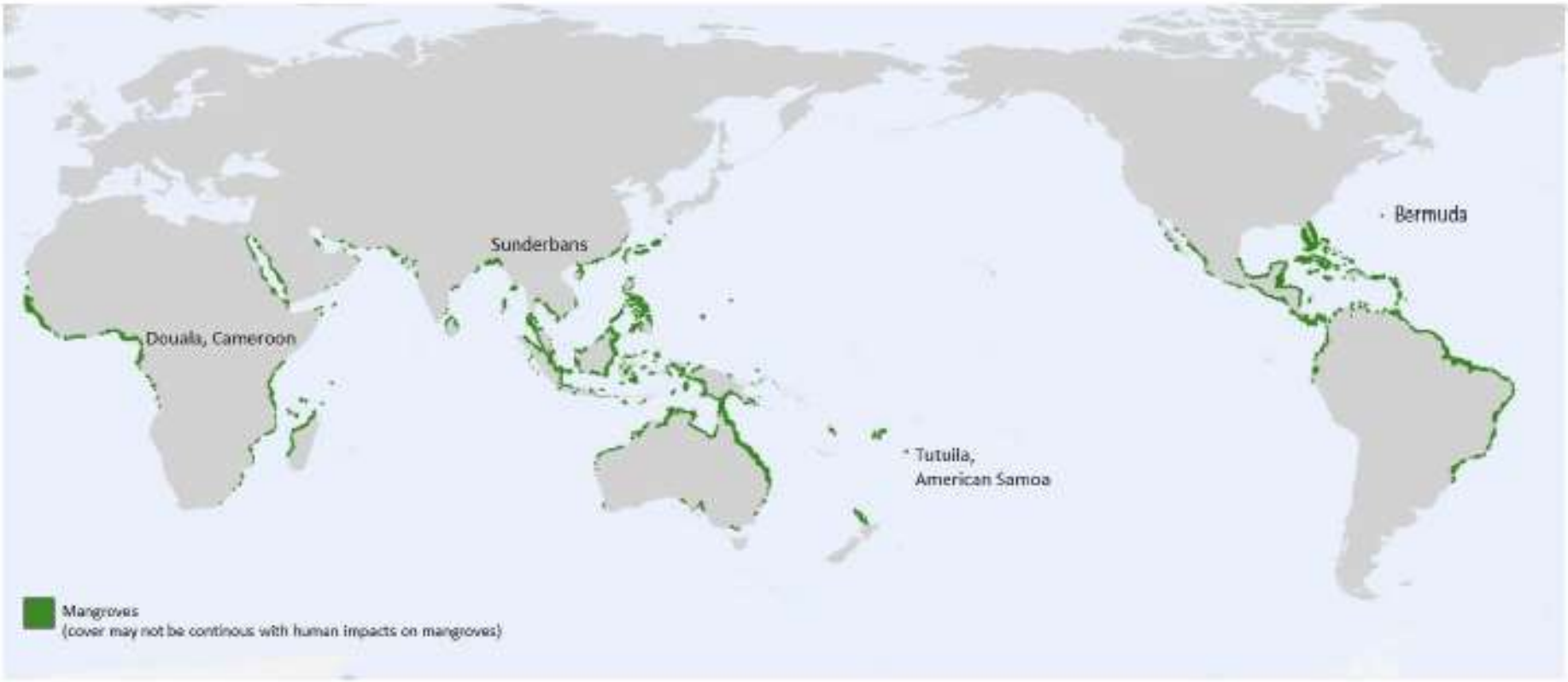


Figure 3.6.7 Locations with seaward edge dieback of mangroves owing to relative sea-level rise.

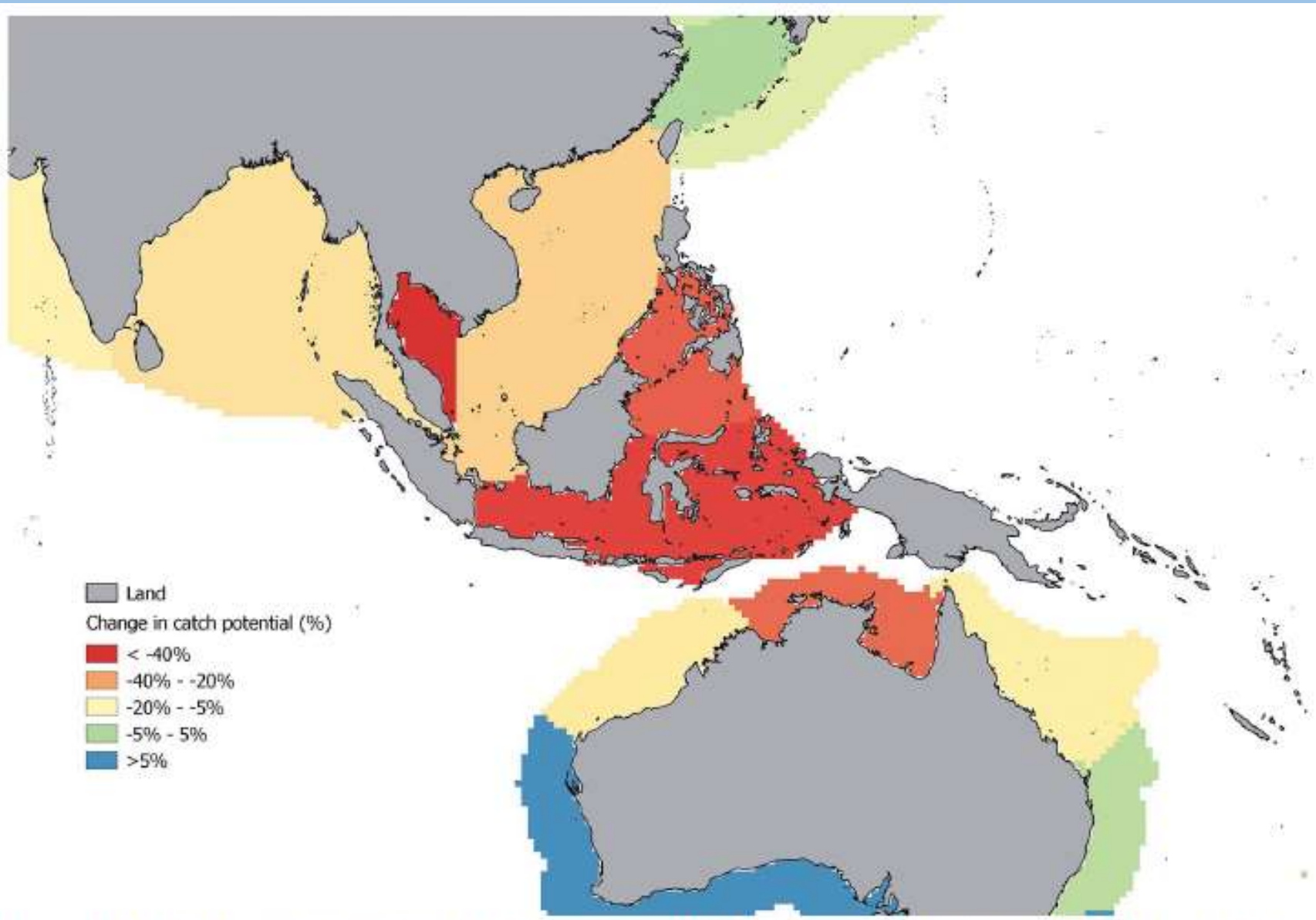


Figure 4.5.5 Multi-model ensemble projections of mean percentage changes in potential fish catch from South-east Asia by 2050, relative to recent catch levels (1971–2000), under the RCP 8.5 emissions scenario (source: Cheung *et al.*, 2016a).

A warming ocean

Since the 1970s, the Earth's ocean has absorbed more than 93% of the enhanced heating arising from human activities. This extra heat is causing changes in the ocean, which are beginning to alter species, ecosystems,and ecological processes.

Disease outbreaks

Warming water temperatures are changing the distribution of pathogens around the world. There are early signs that these changes are impacting human health.

Shifts in timing of key biological events

Changes in the seasonal availability of plankton mean that plankton food stocks are becoming more unpredictable for the marine life that feeds on them.

Global scale change

Change is being observed from polar to tropical regions, and from coasts to seabeds - not just coral reefs.

Vulnerable societies

Mangrove, seagrass and coral reef ecosystems that provide vital coastal protection and food security for seaside communities are being lost or degraded, and making people less resilient to environmental change.

Species on the move

Plankton, jellyfish, fishes, turtles and seabirds - especially those in the tropics - are being driven to the poles to keep within favourable environmental conditions. These shifts are putting global food security at risk.

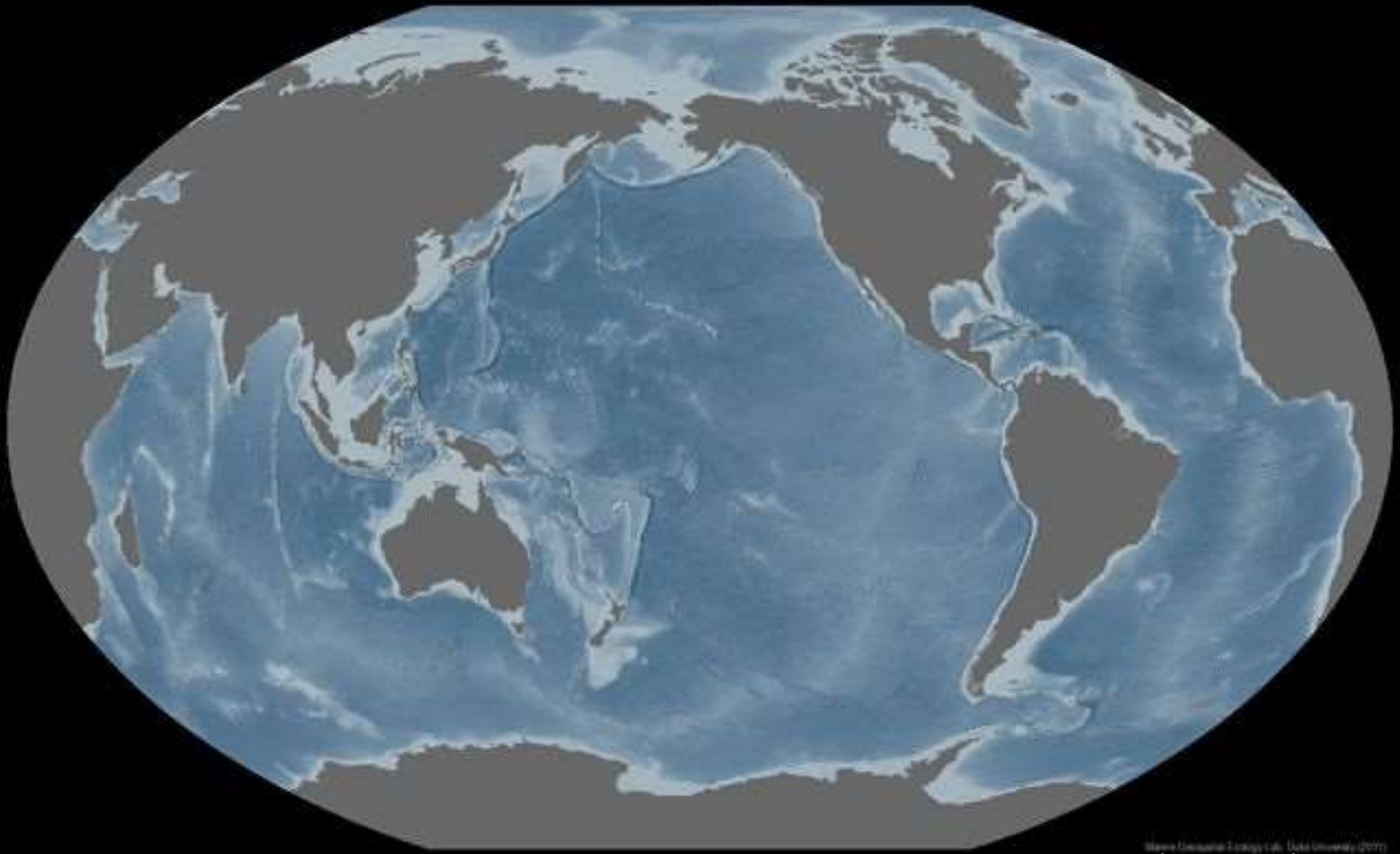
Disappearing breeding grounds

Seabirds, turtles and other species are losing breeding grounds, which is reducing their breeding success.

IUCN

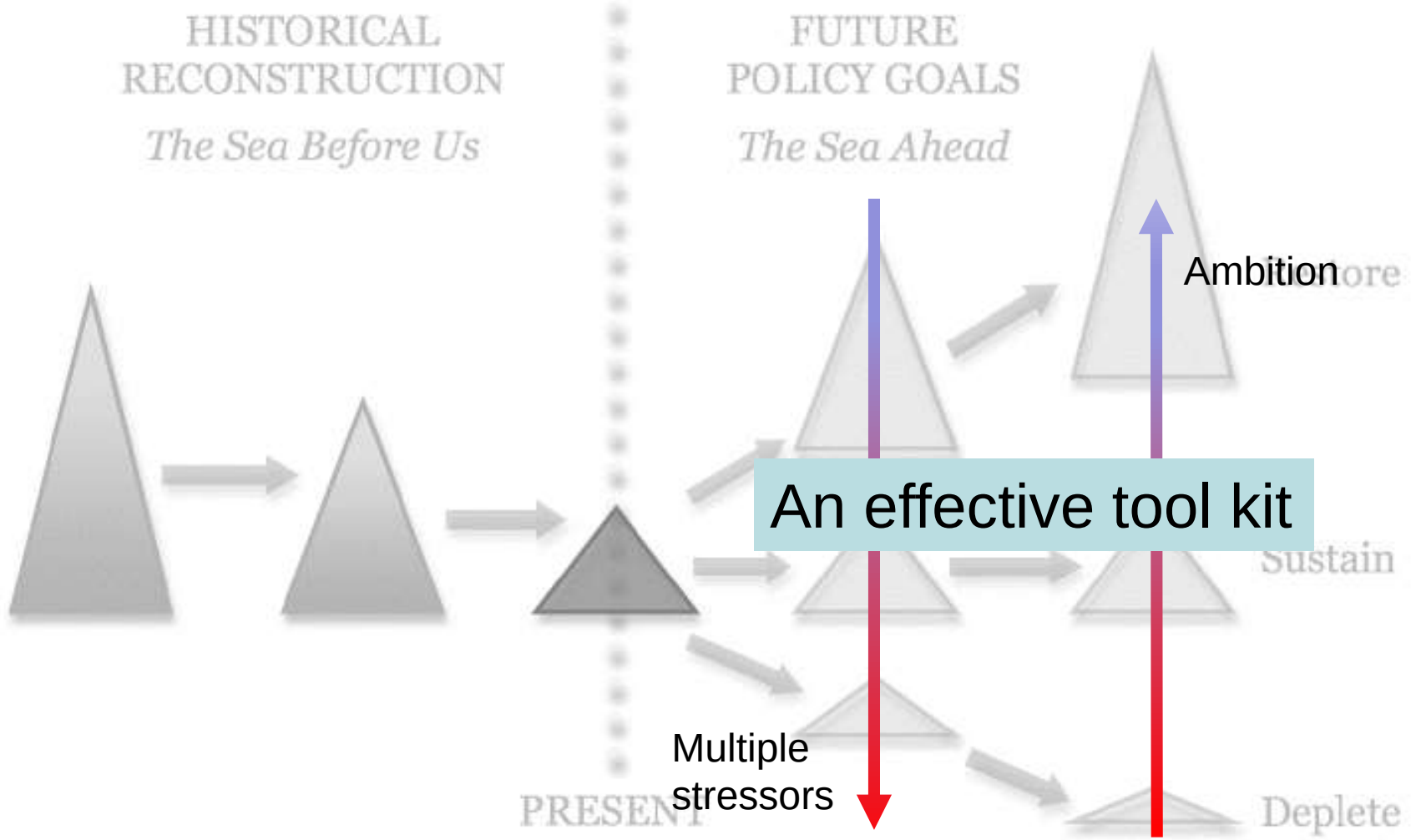
Copyright: IUCN. Source: Laffoley, D., & Baxter, J.M. 2016. Explaining ocean warming: Causes, scale, effects and consequences. Full Report. Gland, Switzerland: IUCN. Icons courtesy of Diana Kleine (mangrove - rhizophora stylosa), Jane Thomas (seabird), and Tracey Saxby (fish school and plankton community), Integration and Application Network, University of Maryland Center for Environmental Science (ian.umces.edu/imagelibrary/). Infographic design: Matea Osti, IUCN.

The Ocean: the future we want



Credit: Jesse Cleary

The added challenges



Adapted from Pitcher & Lam (2010) Ecology and Society 15

Many actions can be taken

- Reducing stressors – including cut CO_2 emissions
- Build/re-build resilience in the ocean
- Build the knowledge base
- Protect more – breathing space and areas to seed recovery
- Provide effective governance for all the ocean
- Change the status quo - remove perverse incentives
- Deliver more sustainable actions, greater transparency
- Involve more people: new alliances, better connections
- Invest more: engaging people in new ways

The open ocean - Current Legal Regime

- 1982 Law of the Sea Convention (UNCLOS)
- 1992 UN Fish Stocks Agreement
- 1994 Implementation Agreement for “the Area” (creating the Int’l Seabed Authority)

Gaps Under UNCLOS

- Coordinating mechanism for the establishment, monitoring and enforcement of MPAs
- Coordinating mechanism for conducting and review of EIAS
- Regulation of new and emerging uses
- Management of impacts, including cumulative impacts across sectors

Next Steps

- PrepCom 2: Aug. 26-Sept. 9
- PrepCom 3 & 4: TBD in 2017
- Intersessional meeting & workshops
- By Dec. 2017: PrepCom will report on their progress on draft text
- By Sept. 2018: UNGA will decide whether to convene an intergovernmental conference.
- New treaty by 2020????

Inshore waters - New Guidance under the Convention on Biological Diversity

CBD Aichi Target 11:

"By 2020, at least 17 per cent of terrestrial and inland water areas, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas ***and other effective area-based conservation measures****, and integrated into the wider landscapes and seascapes."*

Opportunities

- OECMs may usefully augment the current system of protected areas, including enhancing ecological representation, landscape/seascape connectivity and buffer zones around protected areas.
- Clear guidance on OECMs might bring increasing numbers of actors and governance models into more formal conservation networks.
- Recognizing OECMs, their biodiversity values and conservation outcomes might give them greater visibility and status, and enhance their security against threats.
- If an area is recognized as an OECM, it might change the mindset of the people governing and managing that area towards strengthening their focus on conservation outcomes.
- With a common understanding of the core traits of an OECM, accurate data can be collected.

Timetable for releasing guidance

- Workshops in Cambridge, UK and Vilm, Germany –spring and summer 2016
- Daft guidance - autumn 2016
- Field testing – spring 2017
- Final workshop – Canada spring 2017
- Refine guidance - summer and autumn 2017
- Release guidance – winter 2017

National-scale efforts

- Collecting knowledge – gathering thoughts - preparing a plan

Snapshots of marine climate change impacts

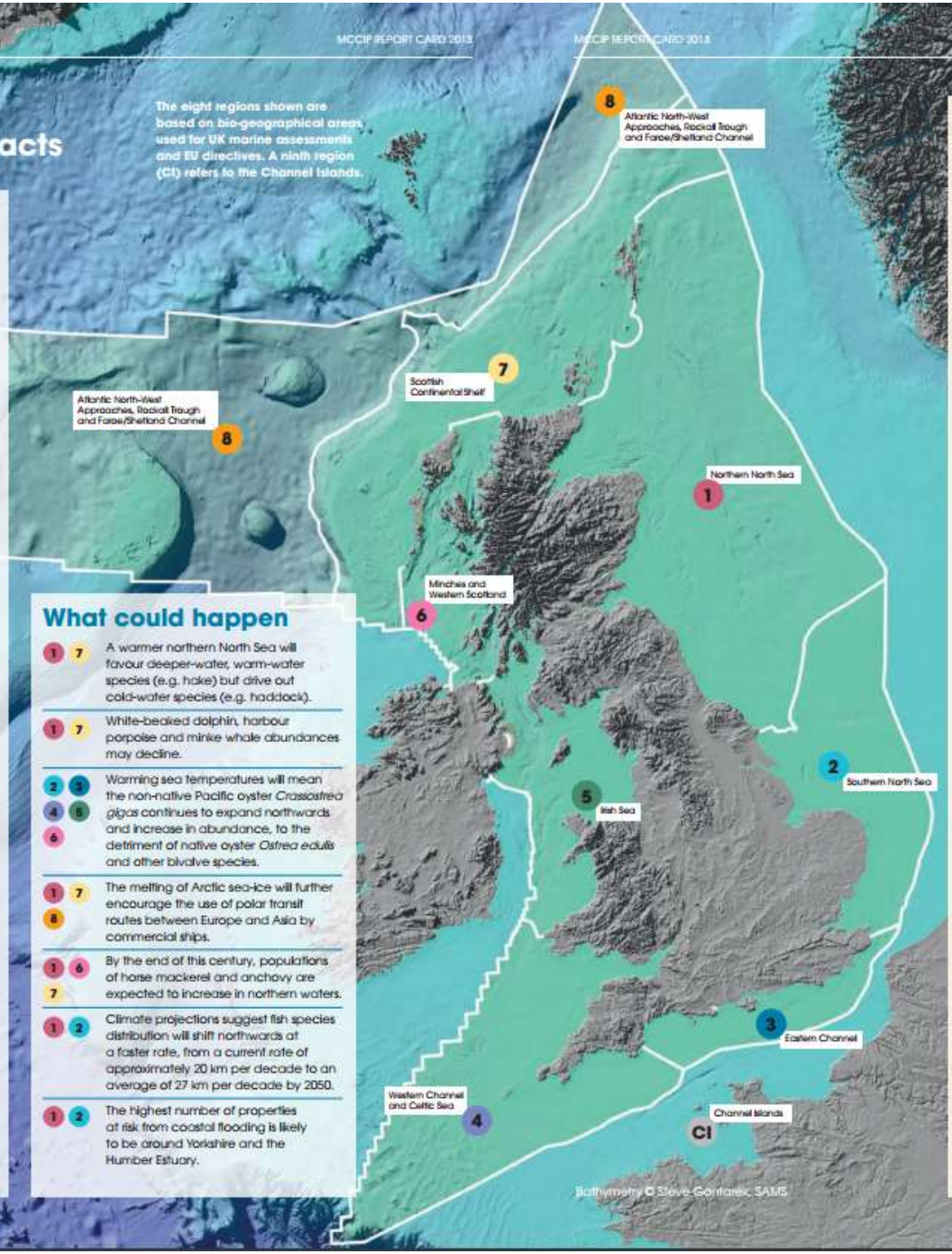
The eight regions shown are based on bio-geographical areas used for UK marine assessments and EU directives. A ninth region (CI) refers to the Channel Islands.

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, Mesopodopsis 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

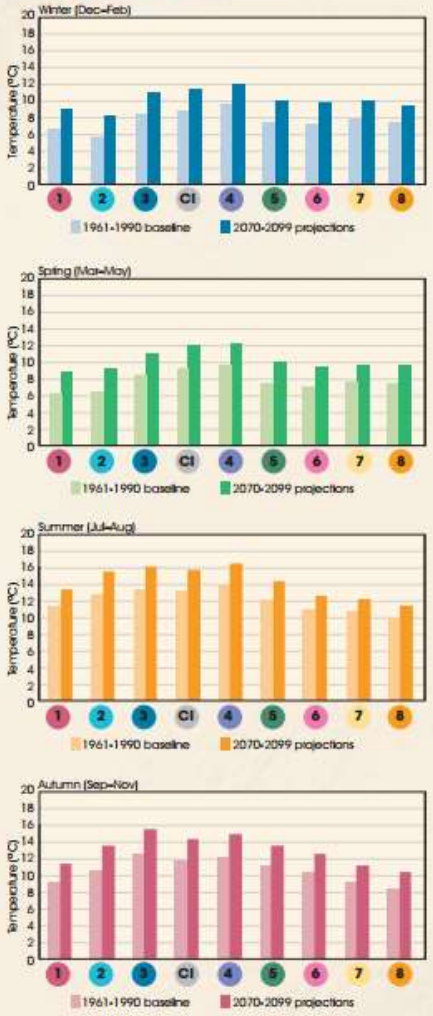
- 1 7 — A warmer northern North Sea will favour deeper-water, warm-water species (e.g. hake) but drive out cold-water species (e.g. haddock).
- 1 7 — White-beaked dolphin, harbour porpoise and minke whale abundances may decline.
- 2 3 4 5 6 — Warming sea temperatures will mean the non-native Pacific 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.

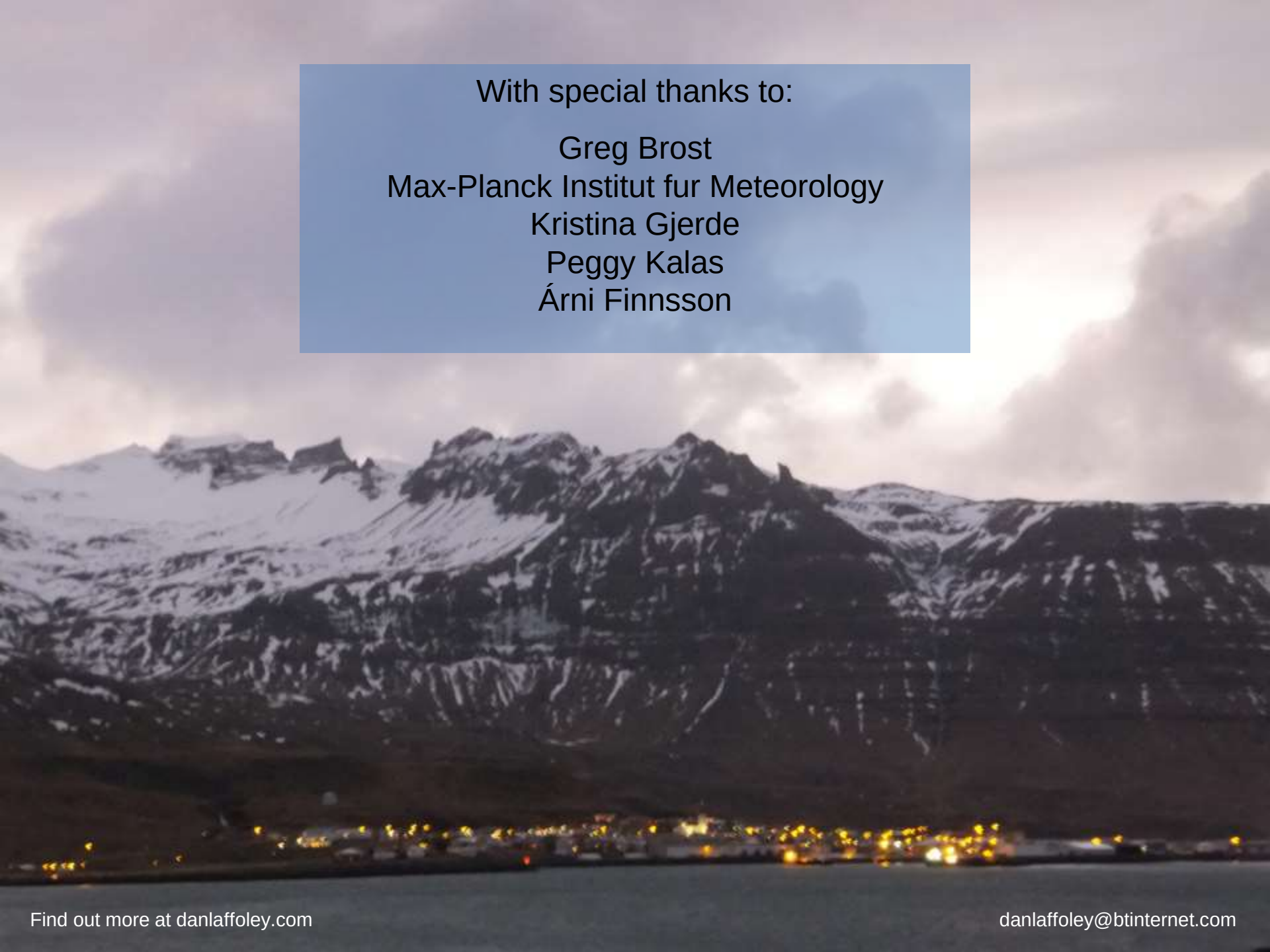


Future sea-surface temperature

Seasonal mean sea-surface temperature projections for the 2070-2099 period (compared with a 1961-1990 baseline) for each region. Changes are based on the UK Climate Projections (UKCP09) under a medium emissions (IPCC A1B) scenario. Data courtesy of Met Office Hadley Centre.

Seasonal mean sea-surface temperature





With special thanks to:

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Max-Planck Institut fur Meteorology
Kristina Gjerde
Peggy Kalas
Árni Finnsson

danlaffoley@btinternet.com