

Implications of the Paris Agreement for the Ocean

Jean-Pierre Gattuso

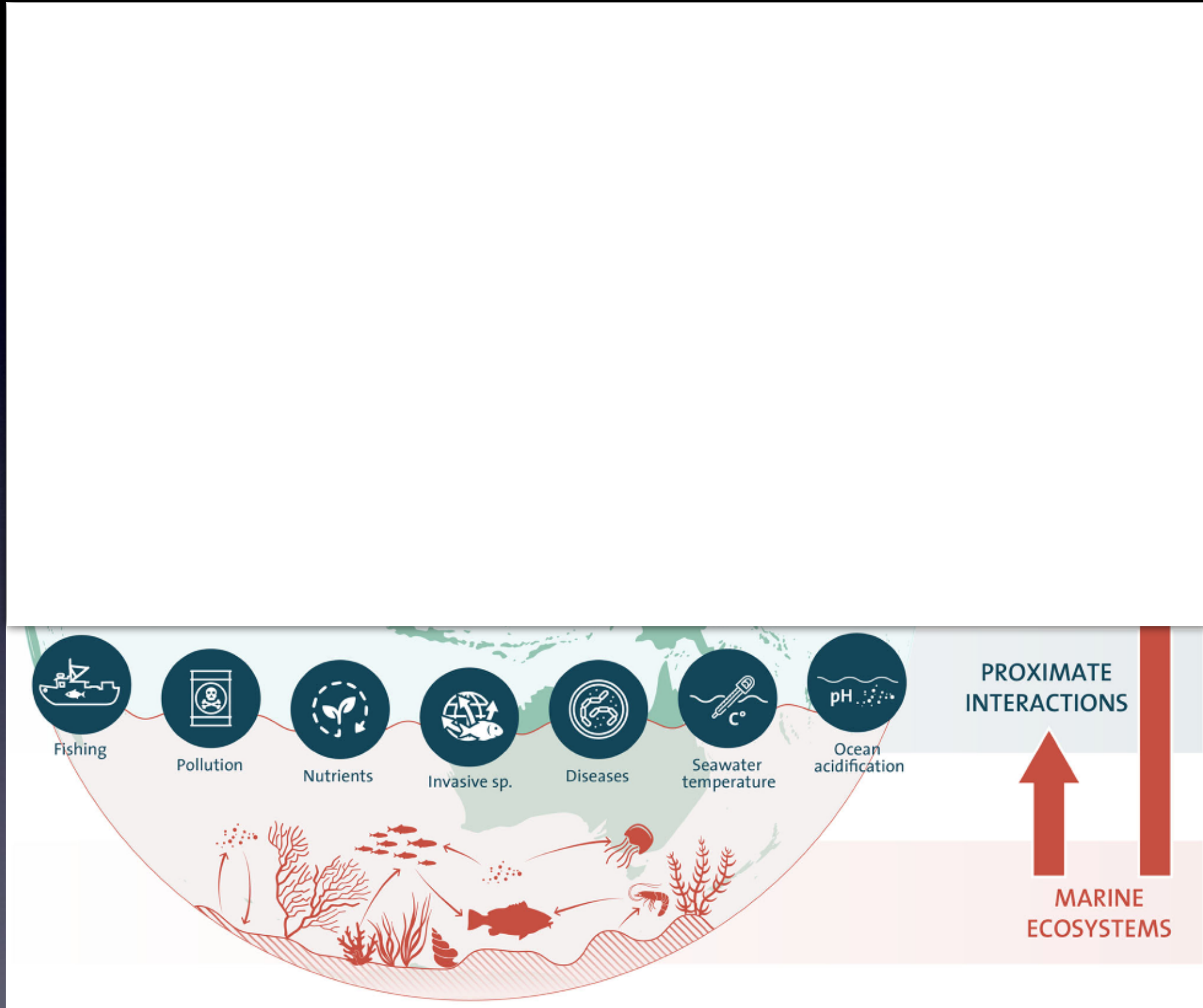
CNRS-Université Pierre et Marie Curie-Paris 6

Institute for Sustainable Development and International
Relations



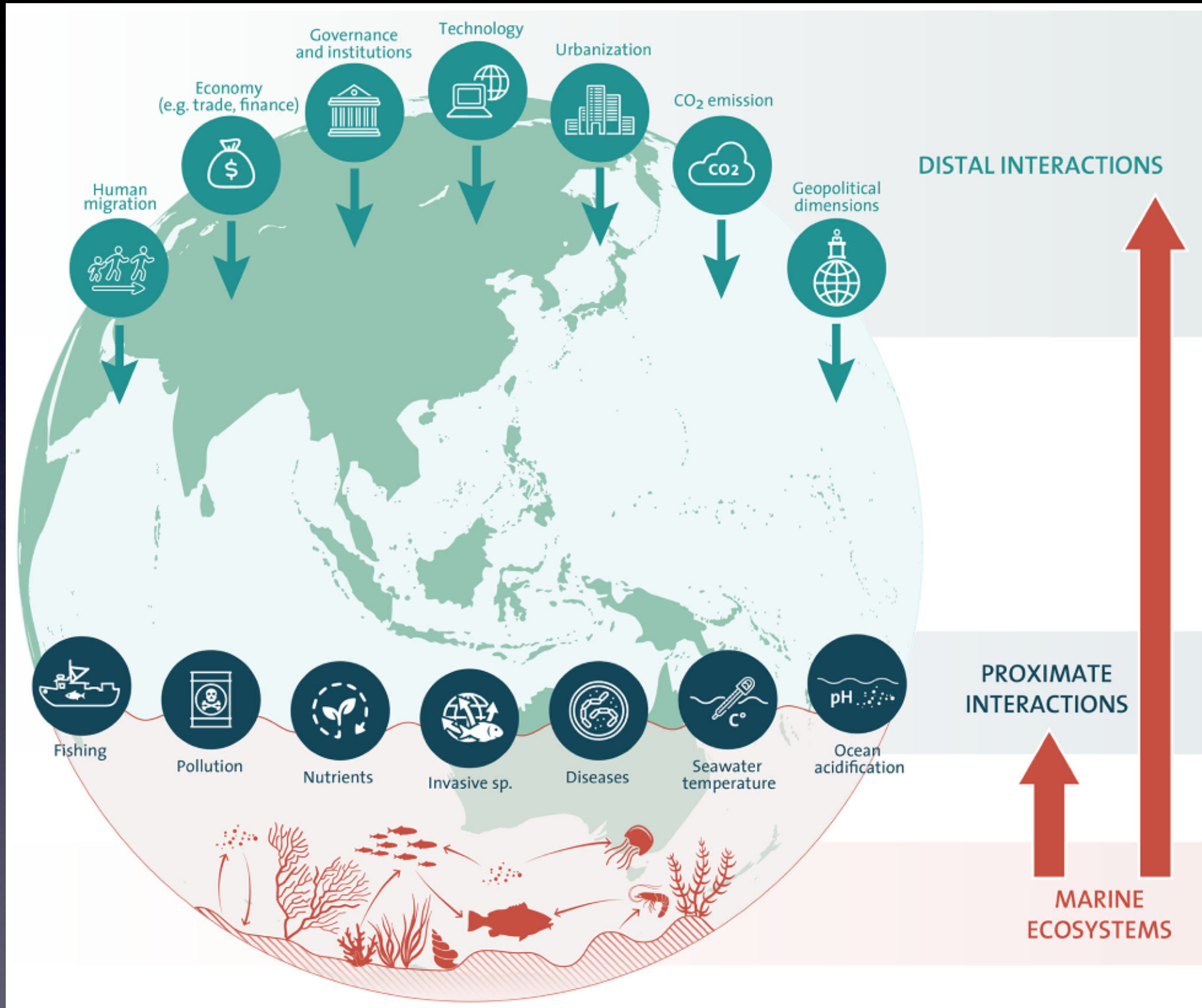
Key importance of the Ocean

Österbloom et al. (2016)

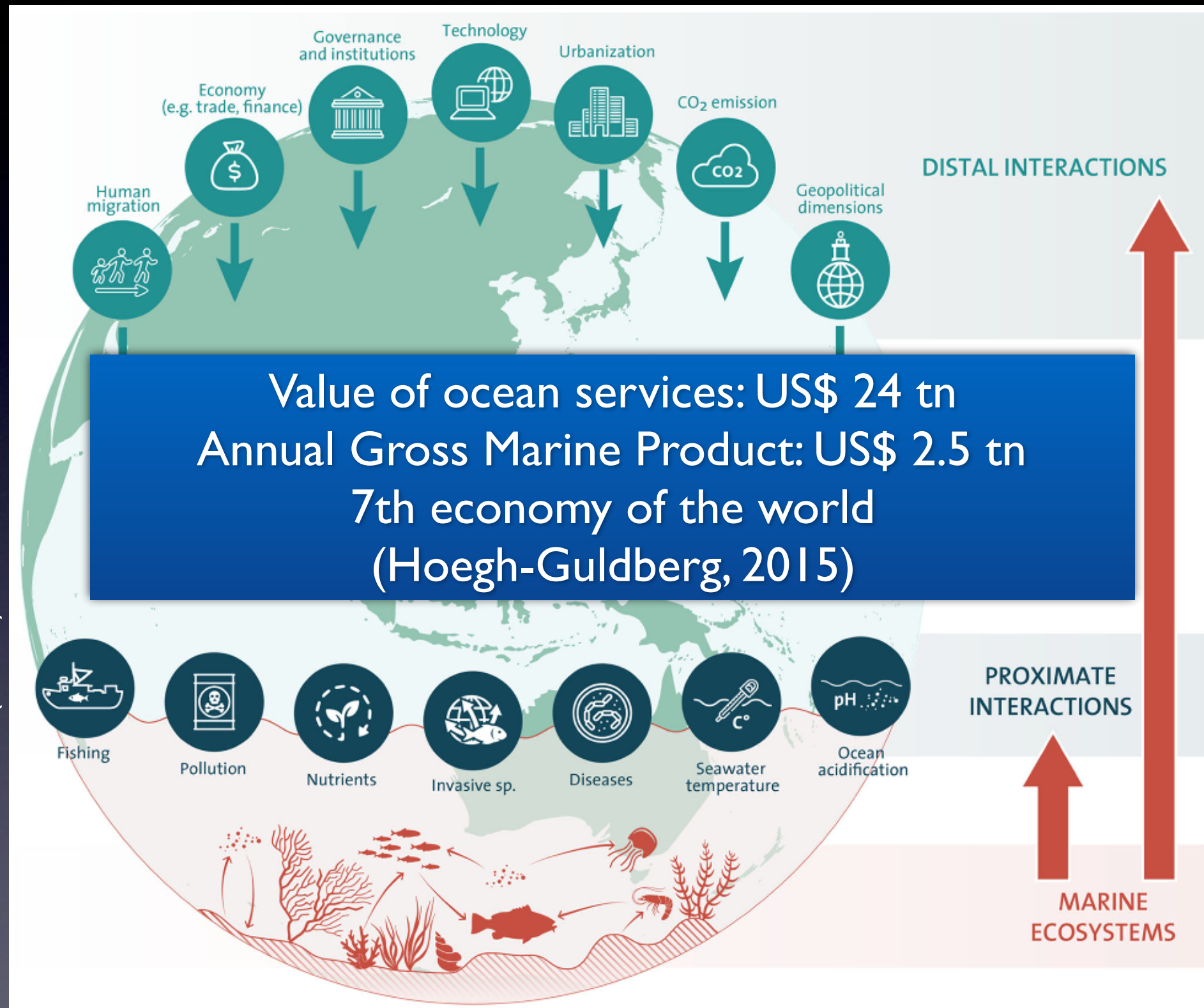


Key importance of the Ocean

Österbloom et al. (2016)



Key importance of the Ocean



Österbloom et al. (2016)

REVIEW

OCEANOGRAPHY

Contrasting futures for ocean and society from different anthropogenic CO₂ emissions scenarios

J.-P. Gattuso,^{1,2,3*} A. Magnan,³ R. Billé,⁴ W. W. L. Cheung,⁵ E. L. Howes,⁶ F. Joos,⁷ D. Allemand,^{8,9} L. Bopp,¹⁰ S. R. Cooley,¹¹ C. M. Eakin,¹² O. Hoegh-Guldberg,¹³ R. P. Kelly,¹⁴ H.-O. Pörtner,⁶ A. D. Rogers,¹⁵ J. M. Baxter,¹⁶ D. Laffoley,¹⁷ D. Osborn,¹⁸ A. Rankovic,^{3,19} J. Rochette,³ U. R. Sumaila,²⁰ S. Treyer,³ C. Turley²¹

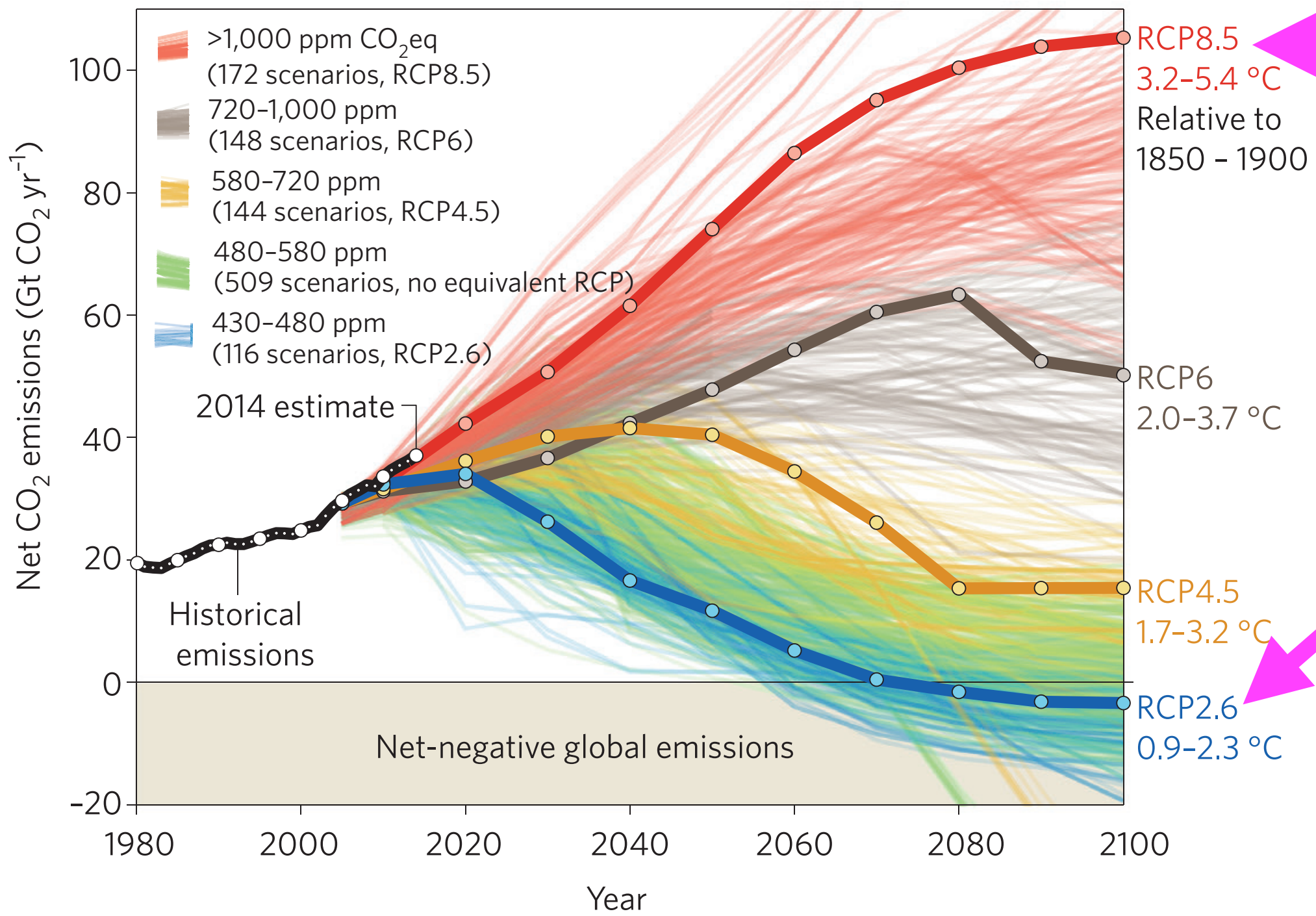
Science, July 2015

Implications of the Paris agreement for the ocean

Alexandre K. Magnan, Michel Colombier, Raphaël Billé, Fortunat Joos, Ove Hoegh-Guldberg, Hans-Otto Pörtner, Henri Waisman, Thomas Spencer and Jean-Pierre Gattuso

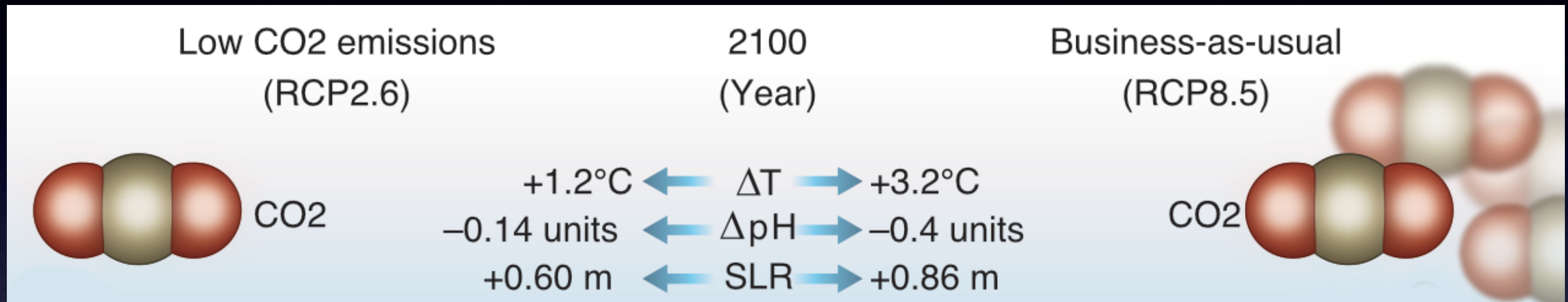
Nature Climate Change, May 2016

Future scenarios

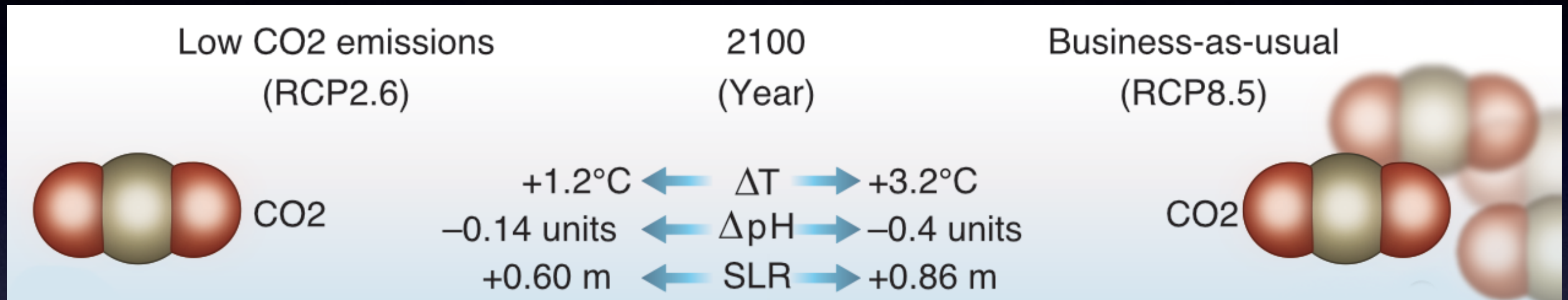


Fuss et al. (2014)

Physics and chemistry

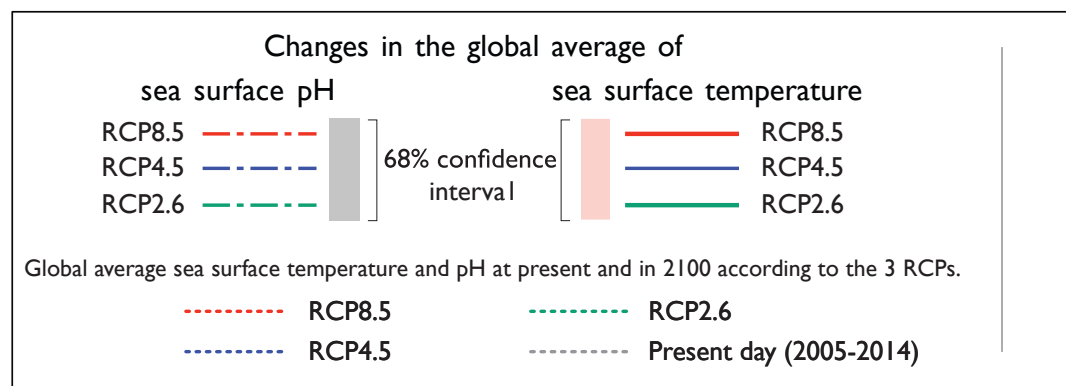
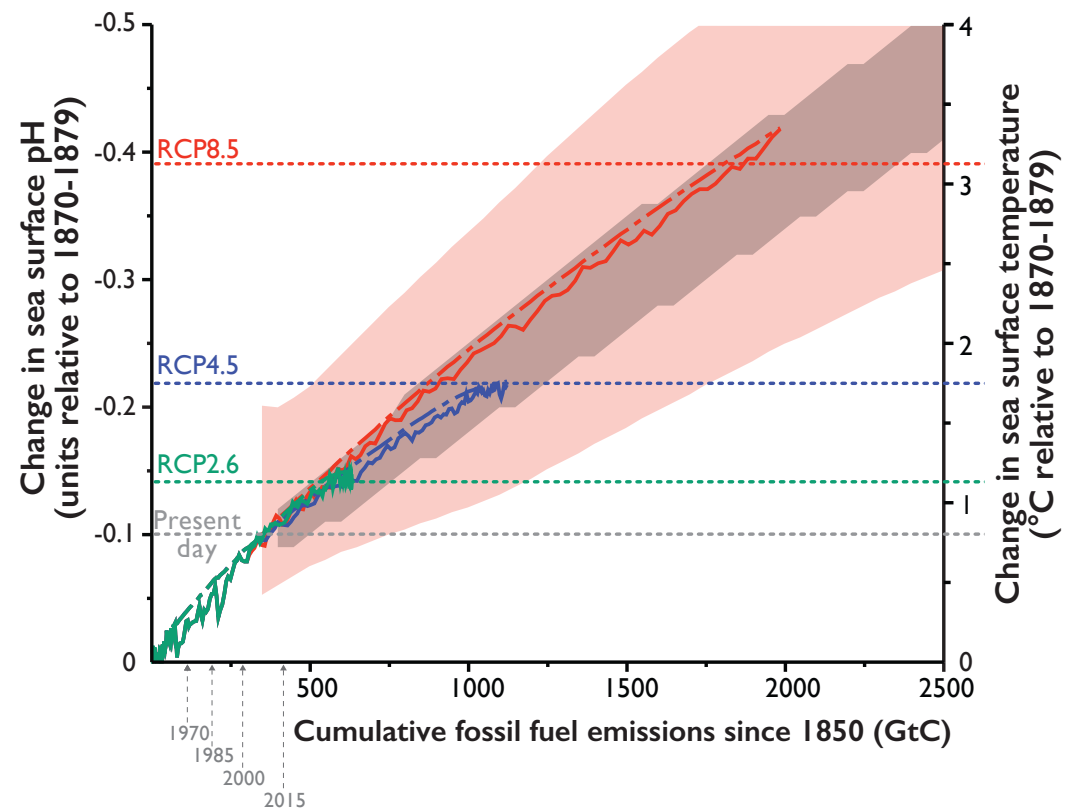


Physics and chemistry

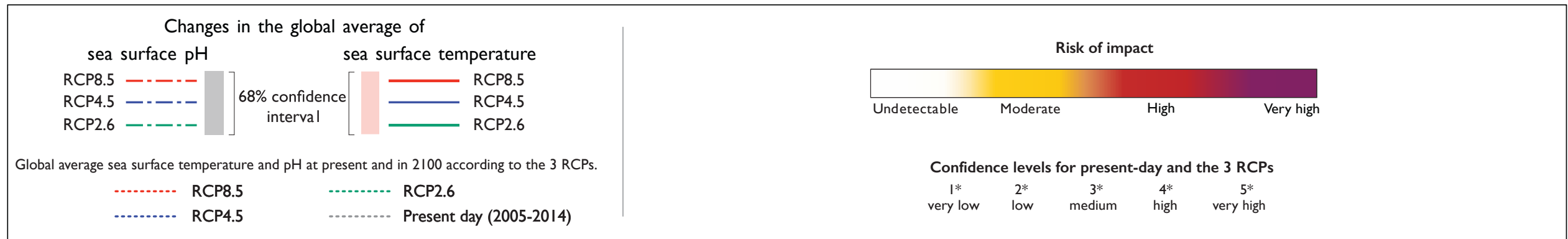
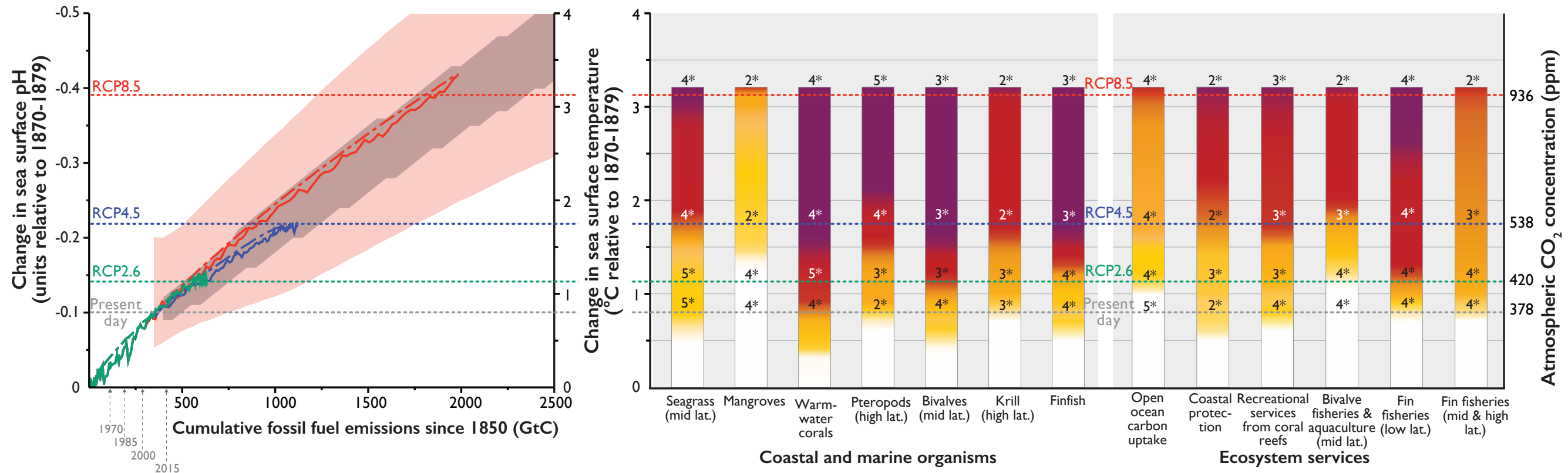


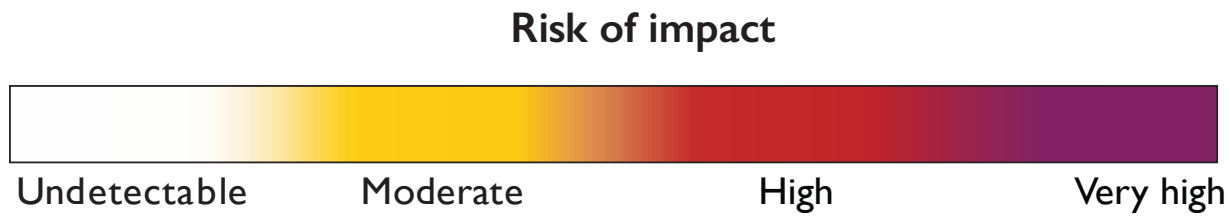
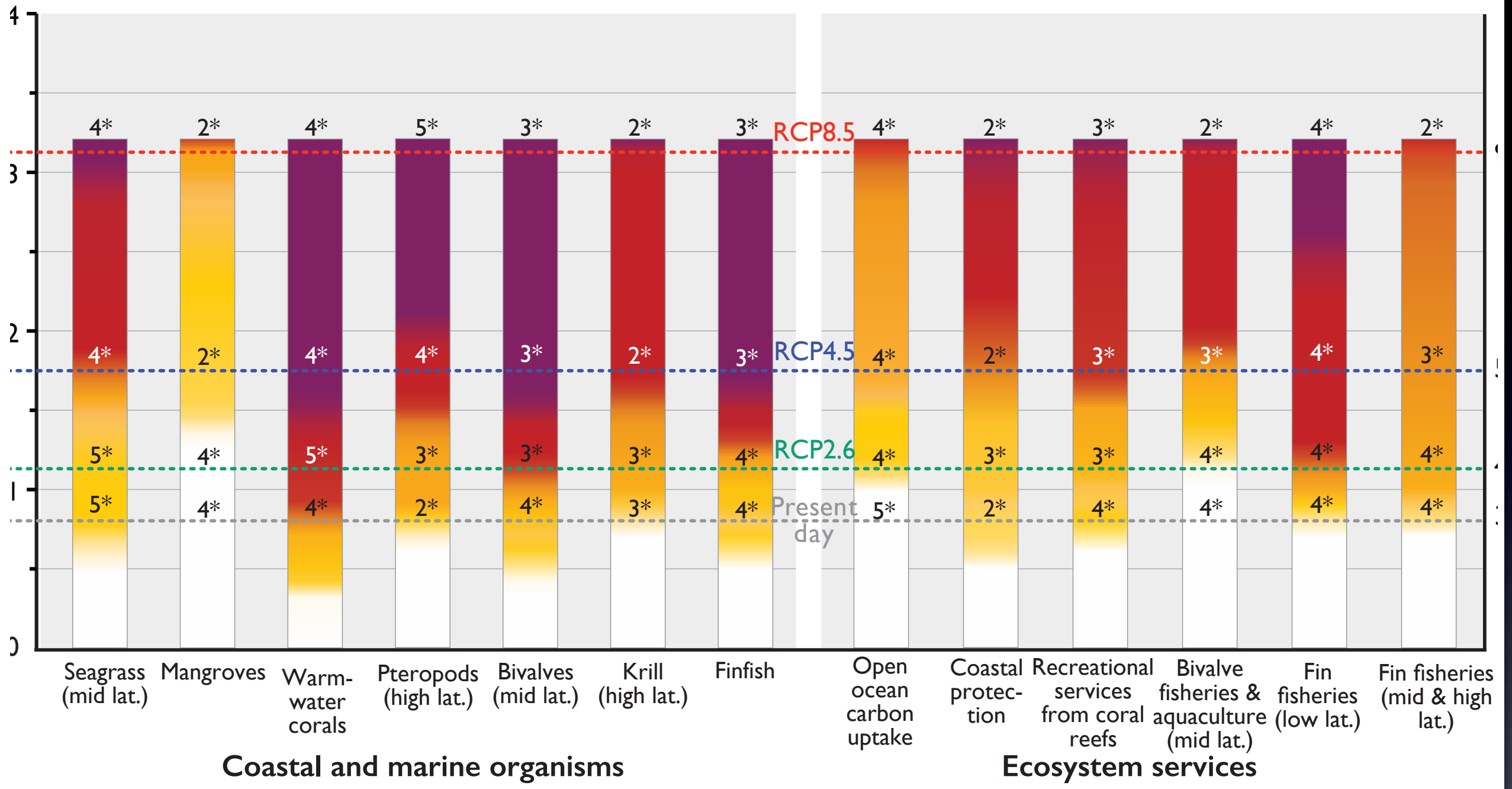
- Thresholds: +1.5 °C and -0.2 pH units relative to preindustrial
- RCP8.5: **69%** of the ocean surface will exceed both thresholds
- RCP2.6: < **1%**

Risks of impact on marine and coastal organisms and ecosystem services



Risks of impact on marine and coastal organisms and ecosystem services





Confidence levels for present-day and the 3 RCPs

1* 2* 3* 4* 5*

very low low medium high very high

4 key messages at COP21

1. Ocean strongly influences the climate system and important provider of key services
2. Impacts already detectable, high risk of impacts well before 2100, even with a low emission scenario
3. Immediate and substantial reduction of CO₂ emissions to prevent massive and mostly irreversible impacts
4. As CO₂ increases, the protection, adaptation, and repair options become fewer and less effective

IDDRI



This article is based on research that has received a financial support from the French government in the framework of the programme « Investissements d'avenir », managed by ANR (French national agency for research) under the reference ANR-10-LABX-14-01.

This is a product of "The Oceans 2015 Initiative", an expert group supported by the Prince Albert II of Monaco Foundation, the Ocean Acidification International Coordination Centre of the International Atomic Energy Agency, the BNP Paribas Foundation and the Monegasque Association for Ocean Acidification.

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POLICY BRIEF

N°04/15 SEPTEMBER 2015 | CLIMATE - OCEANS AND COASTAL ZONES

Intertwined ocean and climate: implications for international climate negotiations

Alexandre K. Magnan (IDDRI), Raphaël Billé (Secretariat of the Pacific Community), Sarah R. Cooley (Ocean Conservancy), Ryan Kelly (University of Washington), Hans-Otto Pörtner (Alfred Wegener Institute), Carol Turley (Plymouth Marine Laboratory), Jean-Pierre Gattuso (CNRS-INSU, Sorbonne Universités, IDDRI)

INTRODUCTION

The atmosphere and ocean are two components of the Earth system that are essential for life, yet humankind is altering both. Contemporary climate change is now a well-identified problem: anthropogenic causes, disturbance in extreme events patterns, gradual environmental changes, widespread impacts on life and natural resources, and multiple threats to human societies all around the world. But part of the problem remains largely unknown outside the scientific community: significant changes are also occurring in the ocean, threatening life and its sustainability on Earth.

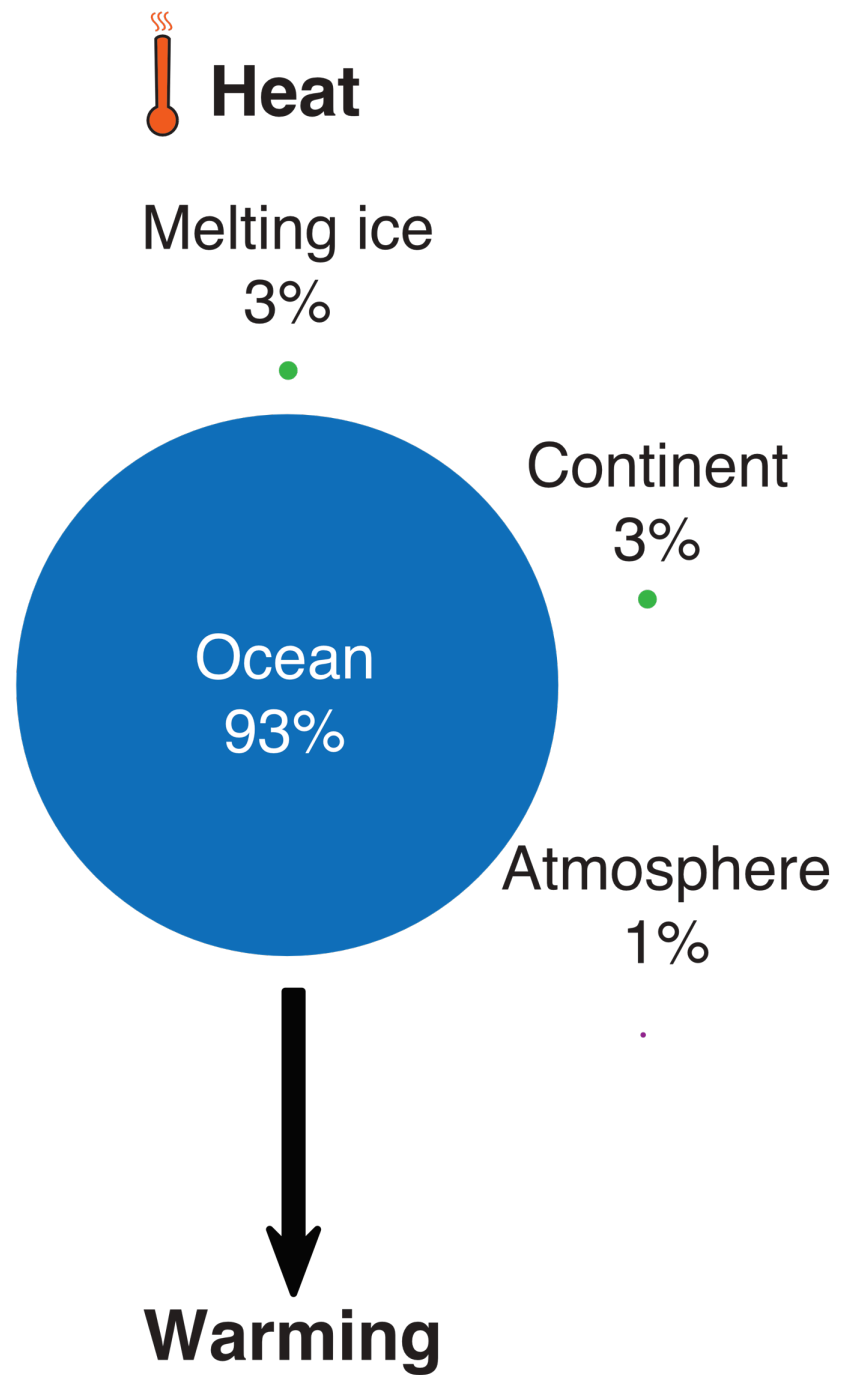
This Policy Brief explains the significance of these changes in the ocean. It is based on a scientific paper recently published in *Science* (Gattuso *et al.*, 2015), which synthesizes recent and future changes to the ocean and its ecosystems, as well as to the goods and services they provide to humans. Two contrasting CO₂ emission scenarios are considered: the high emissions scenario (also known as "business-as-usual" and as the Representative Concentration Pathway 8.5, RCP8.5) and a stringent emissions scenario (RCP2.6) consistent with the Copenhagen Accord¹ of keeping mean global temperature increase below 2°C in 2100.

1. Copenhagen Accord, *Decision 2/CP.15: Copenhagen accord* (United Nations Framework Convention on Climate Change, Geneva, 2009).

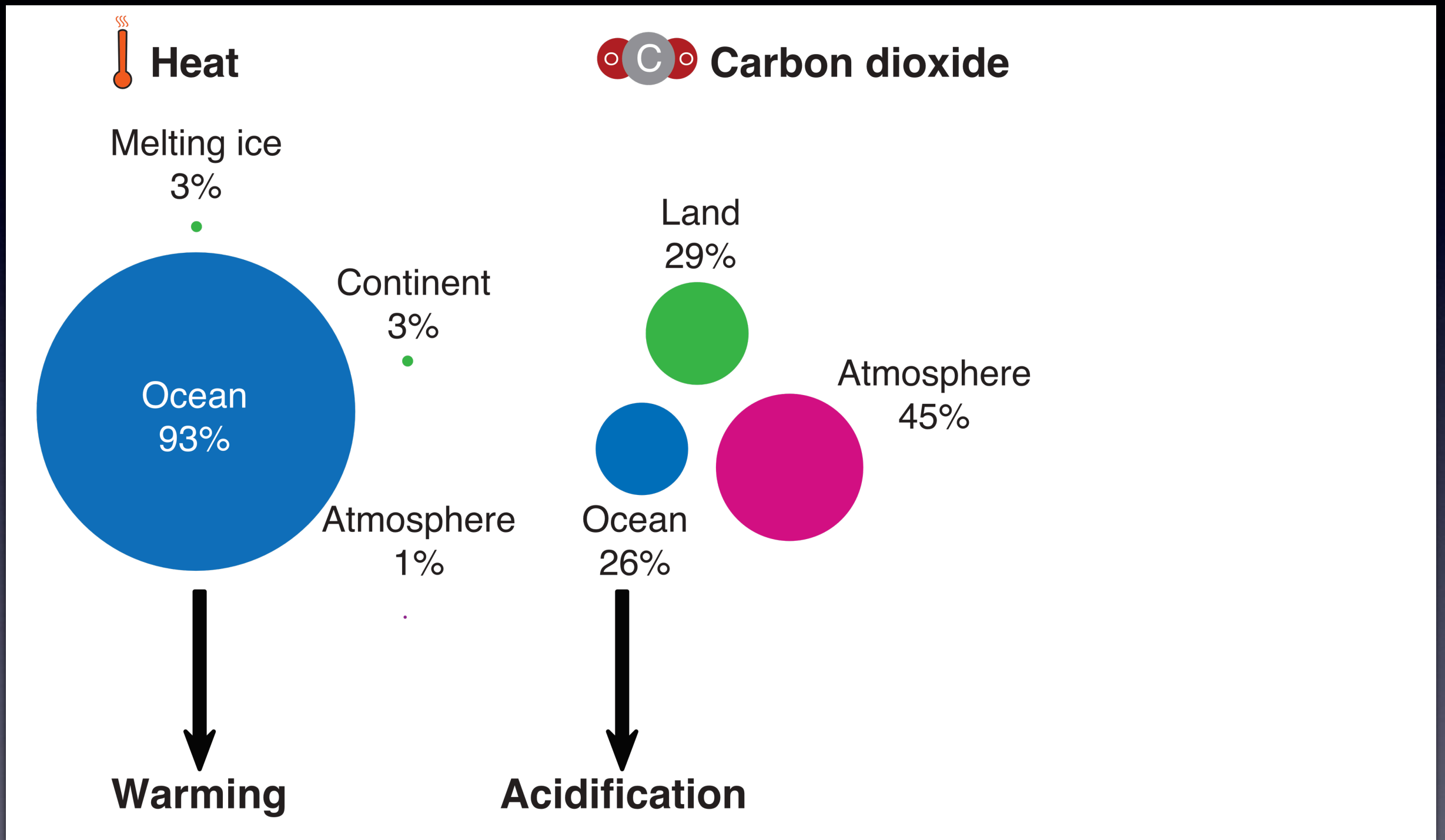
KEY MESSAGES

- Climate and ocean are inseparable: the ocean moderates anthropogenic climate change by absorbing significant proportions of the heat and CO₂ that accumulate in the atmosphere, as well as by receiving all water from melting ice.
- This climate-regulating function happens at the cost of profound alterations of the ocean's physics and chemistry, leading to ocean warming and acidification, as well as to sea level rise. These changes significantly affect the ocean's ecology (organisms and ecosystems) and eventually marine and coastal human activities (fisheries, aquaculture, tourism, health...).
- As atmospheric CO₂ increases, possible human responses become fewer and less effective.
- This scientific statement provides further compelling arguments for immediate and ambitious CO₂ emissions reduction at the international level. This conclusion applies to COP21 as well as to the post-2015 climate regime at large.

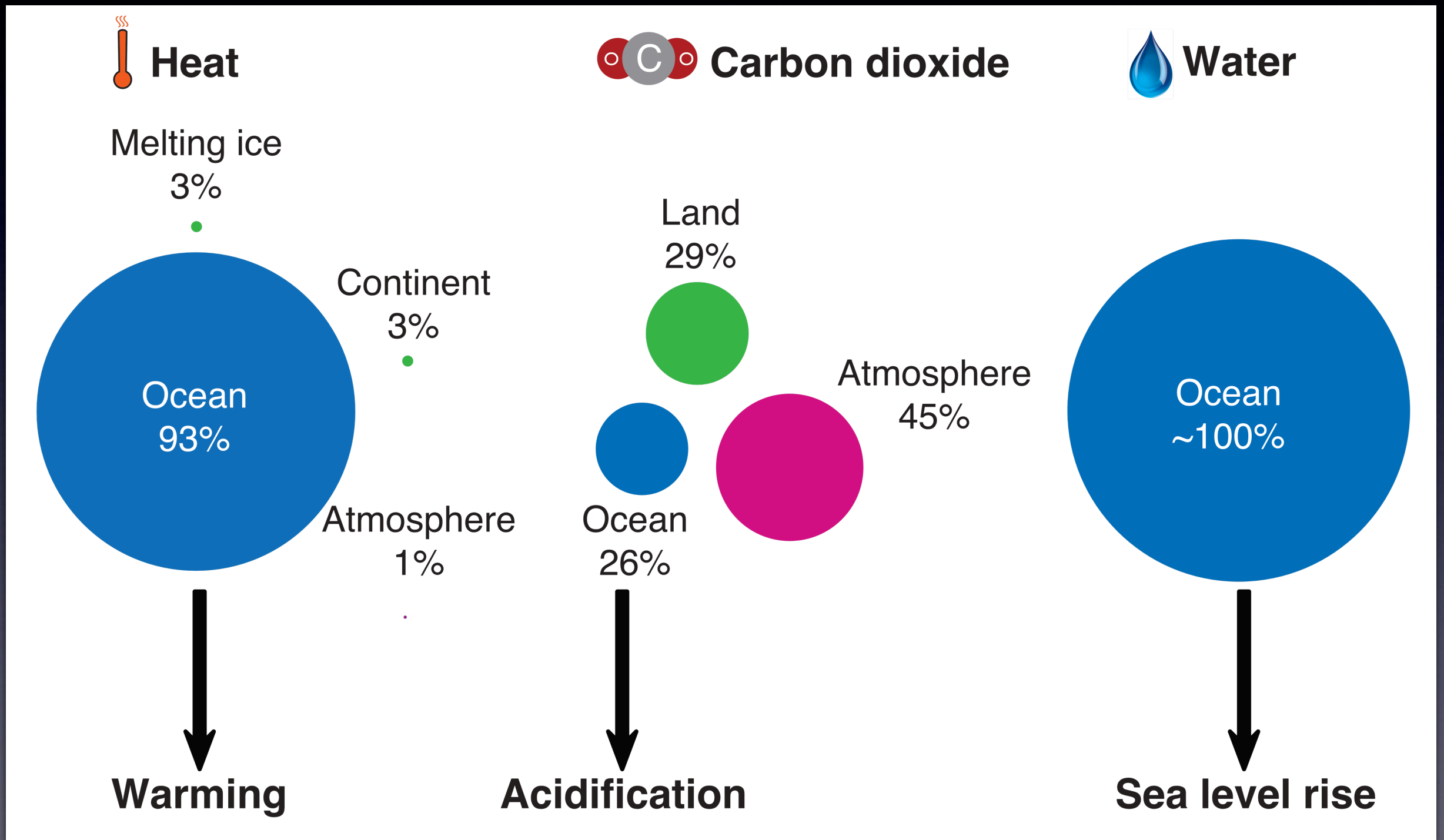
Ocean: actor and victim of climate change



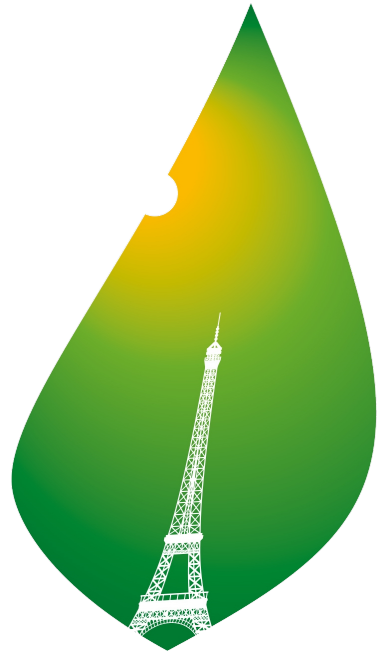
Ocean: actor and victim of climate change



Ocean: actor and victim of climate change



Paris Agreement



COP21 • CMP11

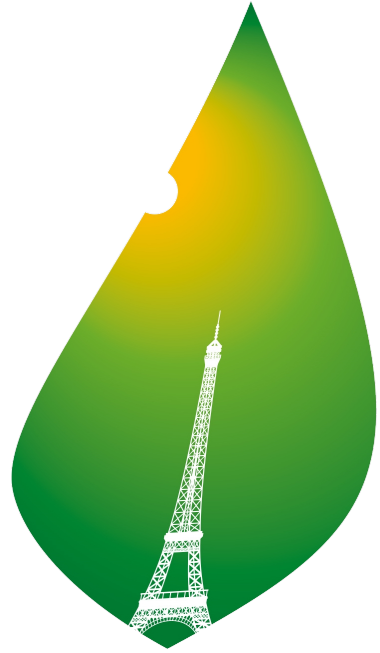
PARIS 2015

UN CLIMATE CHANGE CONFERENCE



“Holding the increase in the global average temperature to well below 2 °C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5 °C above pre-industrial levels...”

Paris Agreement



COP21 • CMP11

PARIS 2015

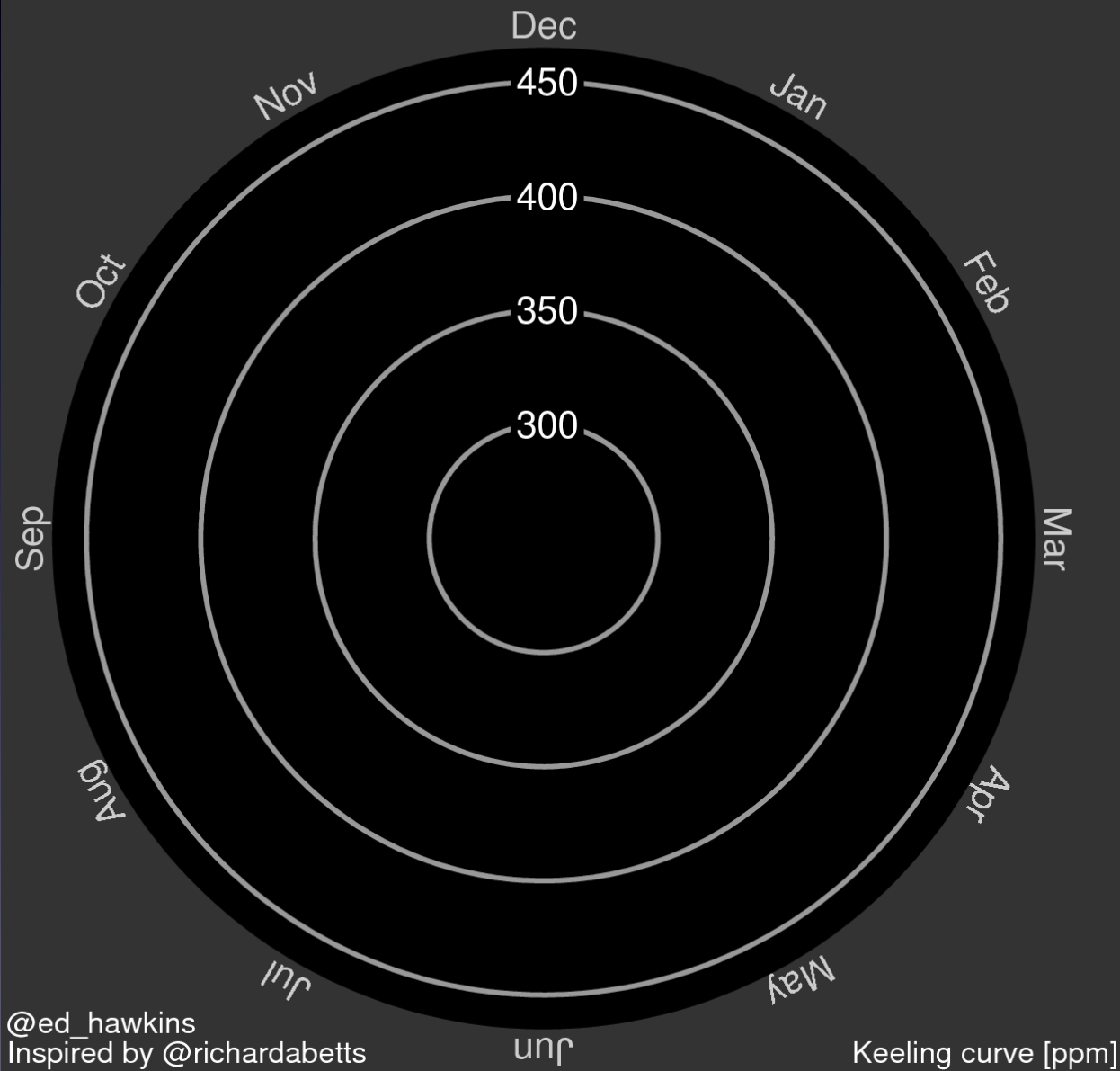
UN CLIMATE CHANGE CONFERENCE



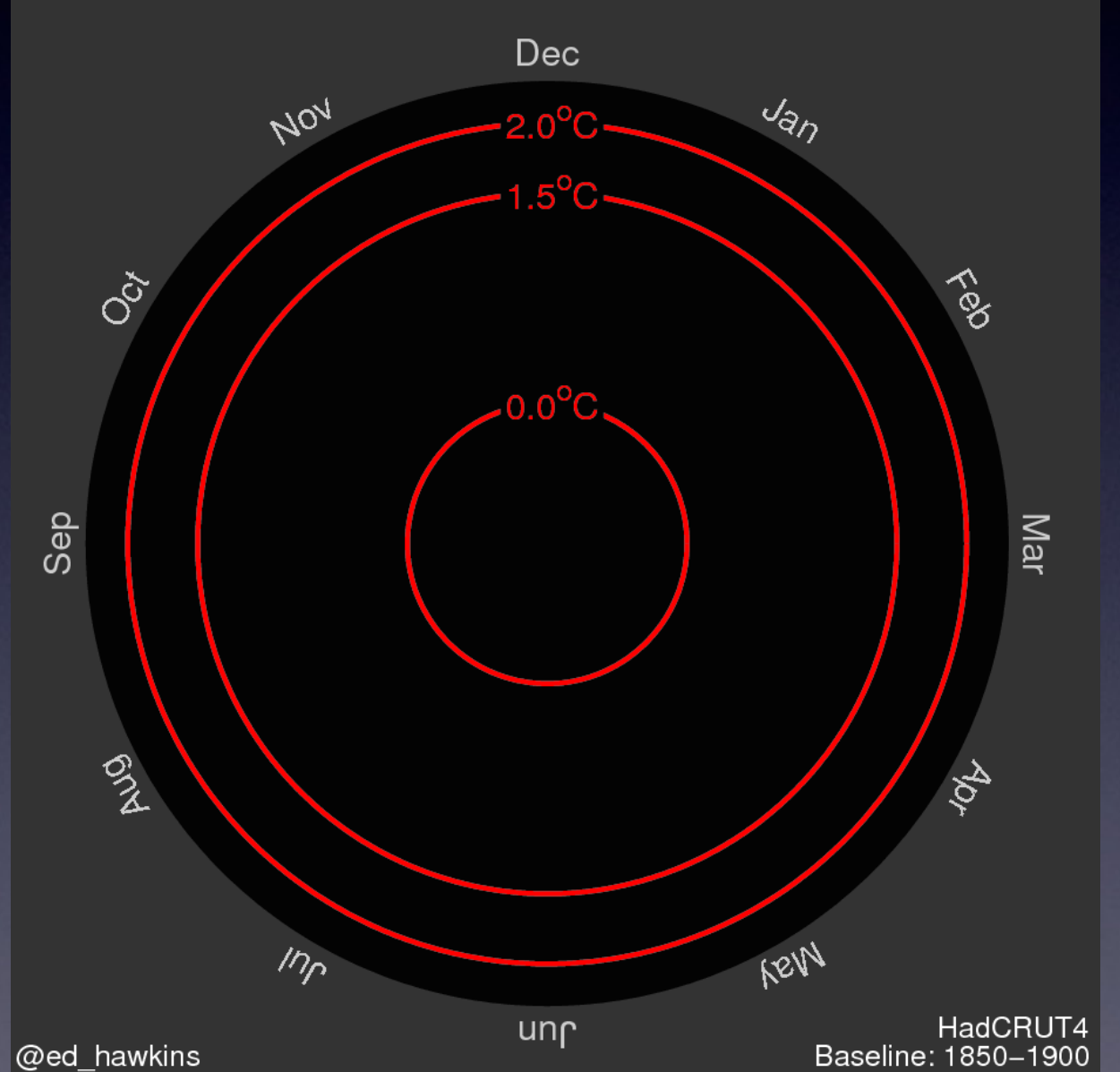
1.5 °C mostly based on
ocean matters

Very challenging objective

Atmospheric CO₂ concentration (1958–2016)

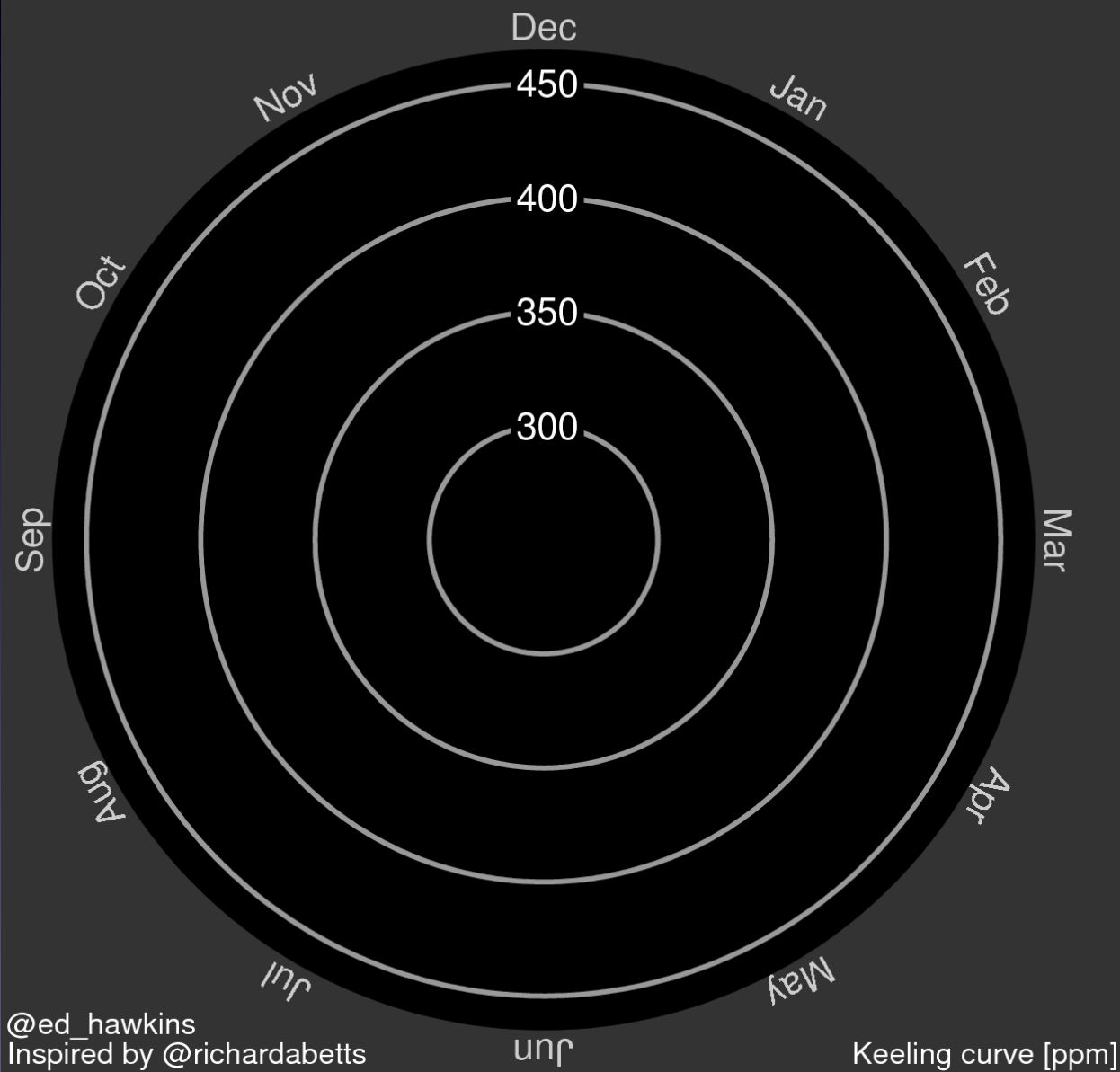


Global temperature change (1850–2016)

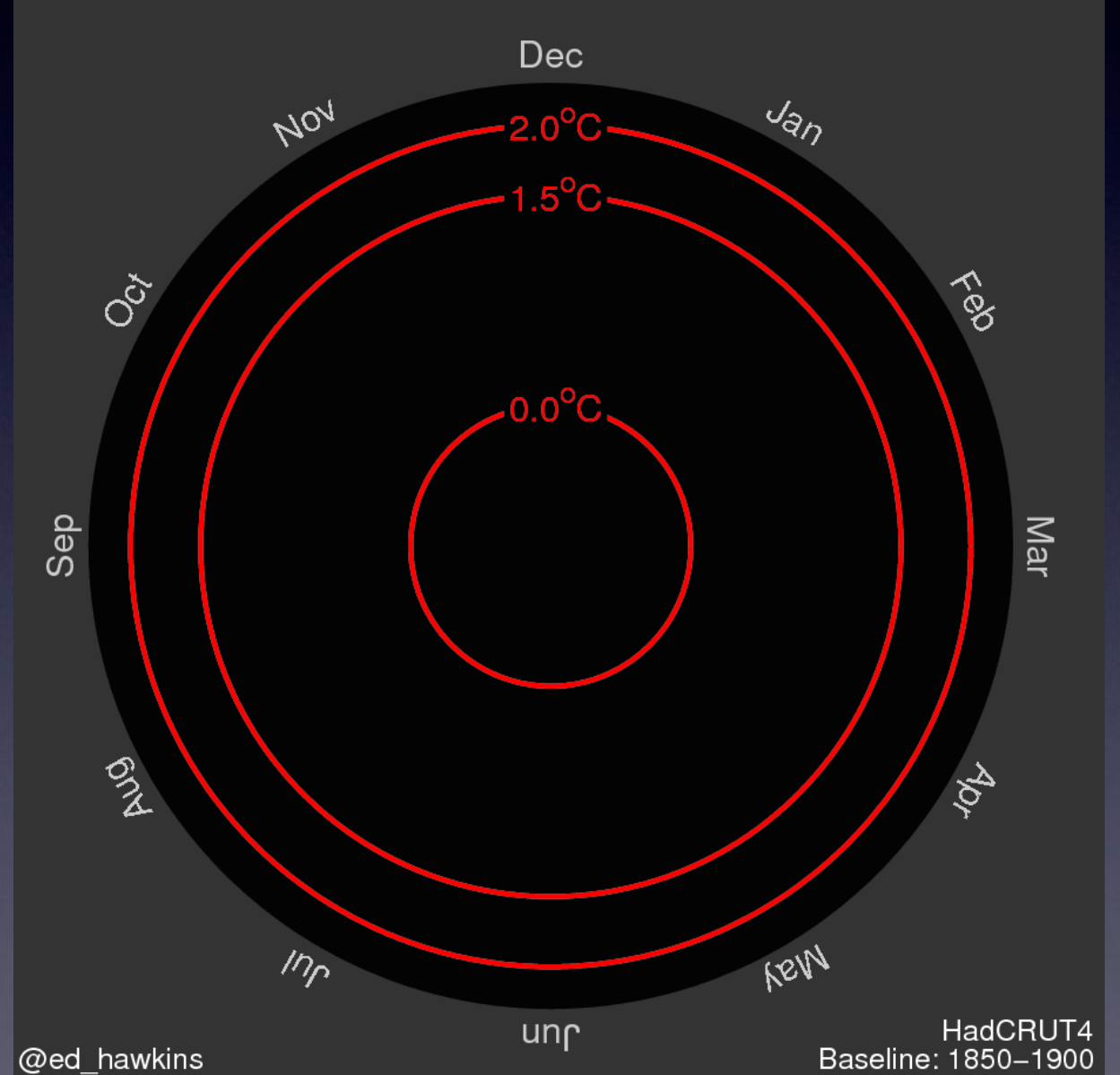


Very challenging objective

Atmospheric CO₂ concentration (1958–2016)

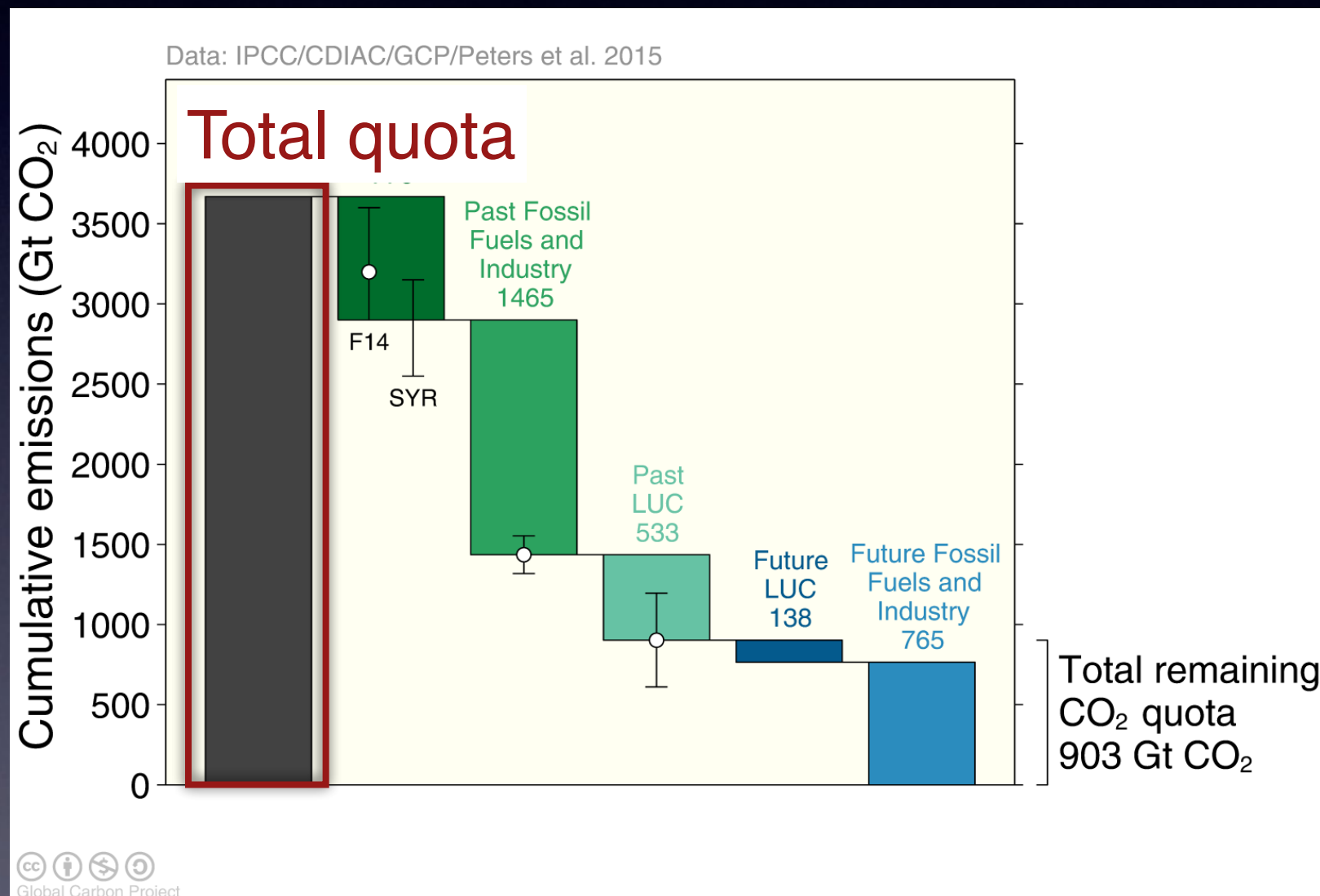


Global temperature change (1850–2016)



The remaining carbon quota for 66% chance $<2^{\circ}\text{C}$

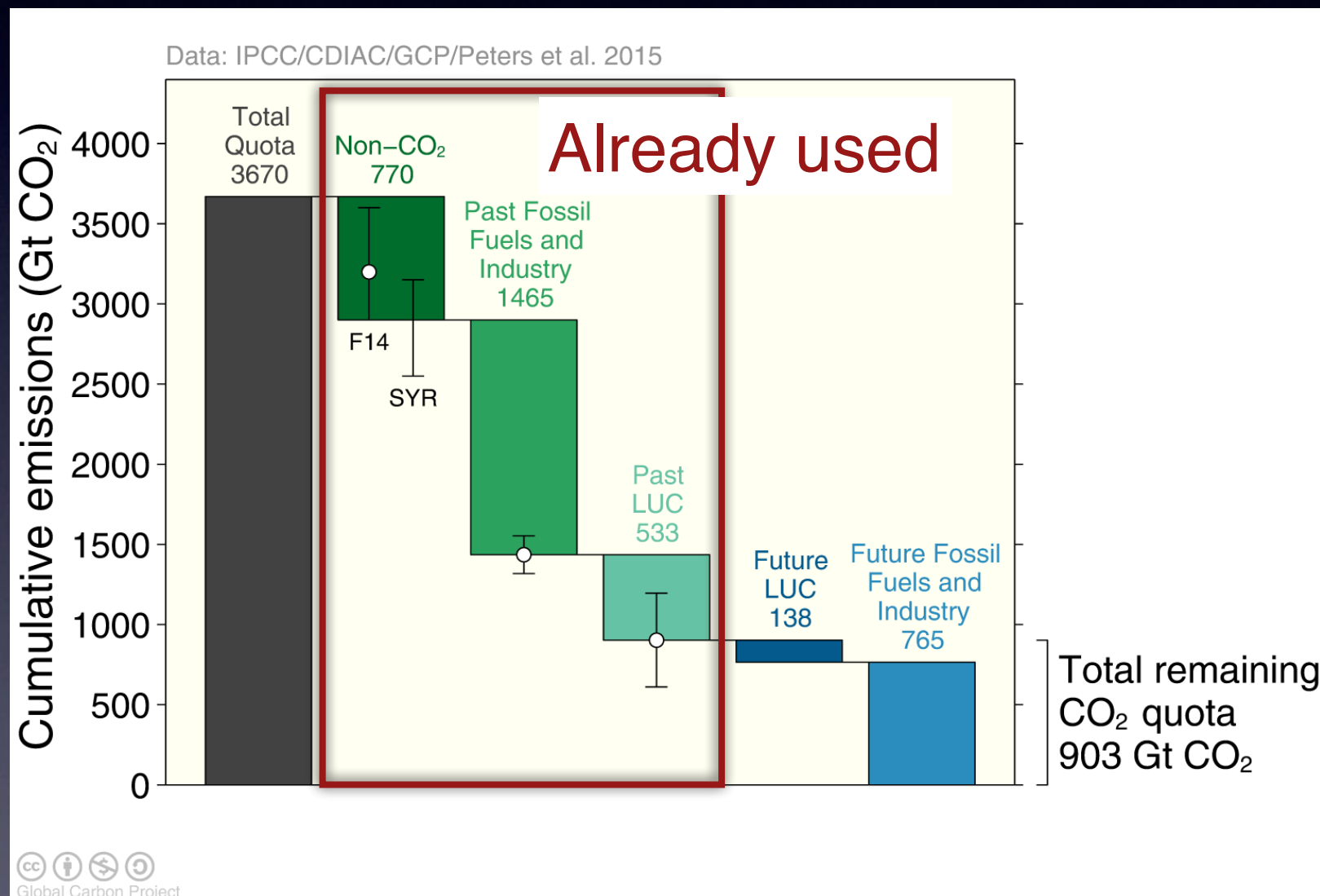
The remaining carbon quota for 66% chance $<2^{\circ}\text{C}$



Grey: Total quota for 2°C . Green: Removed from quota. Blue: remaining quota.
With projected 2015 emissions, this remaining quota drops to 865 Gt CO₂

Source: [Peters et al 2015](#); [Global Carbon Budget 2015](#)

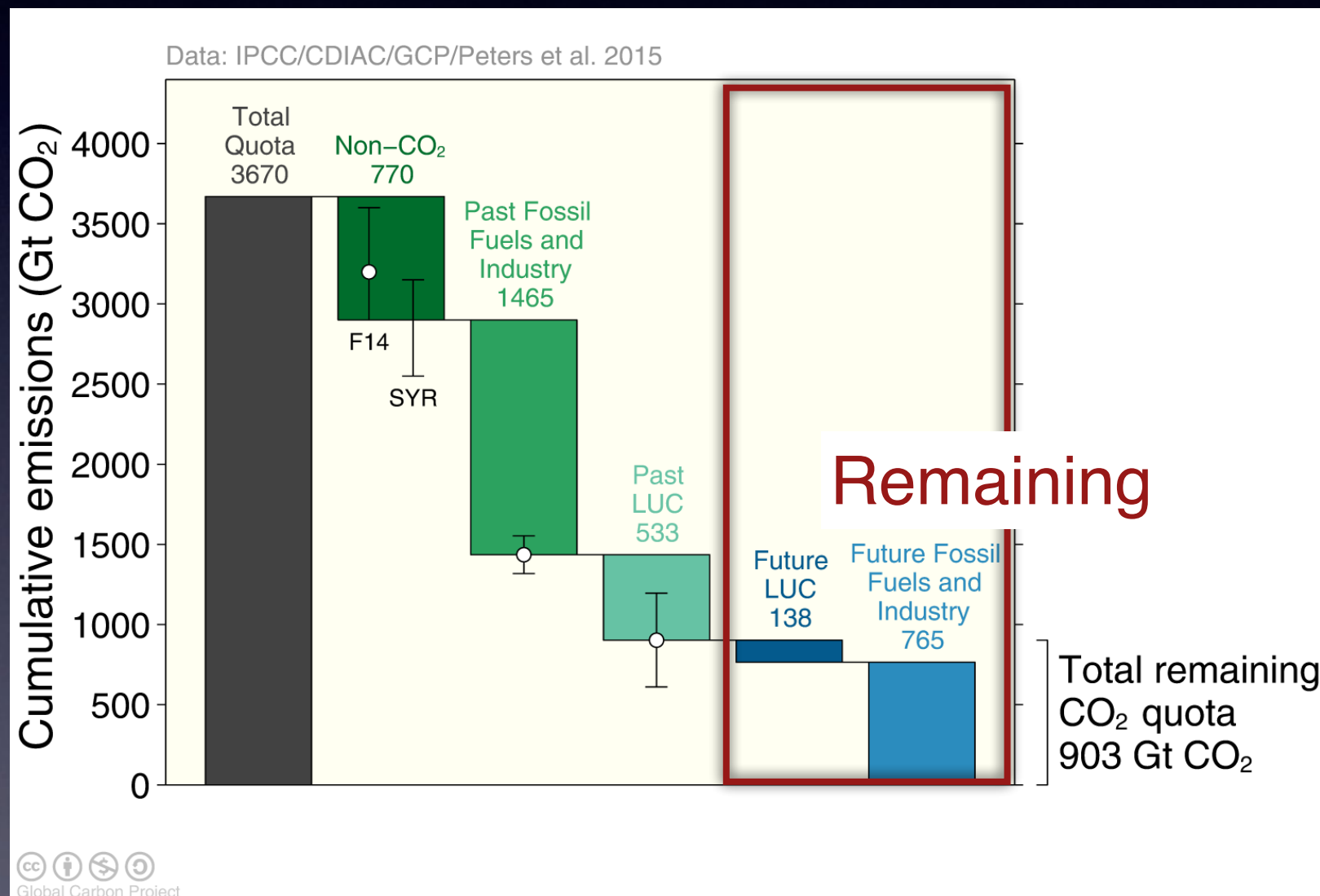
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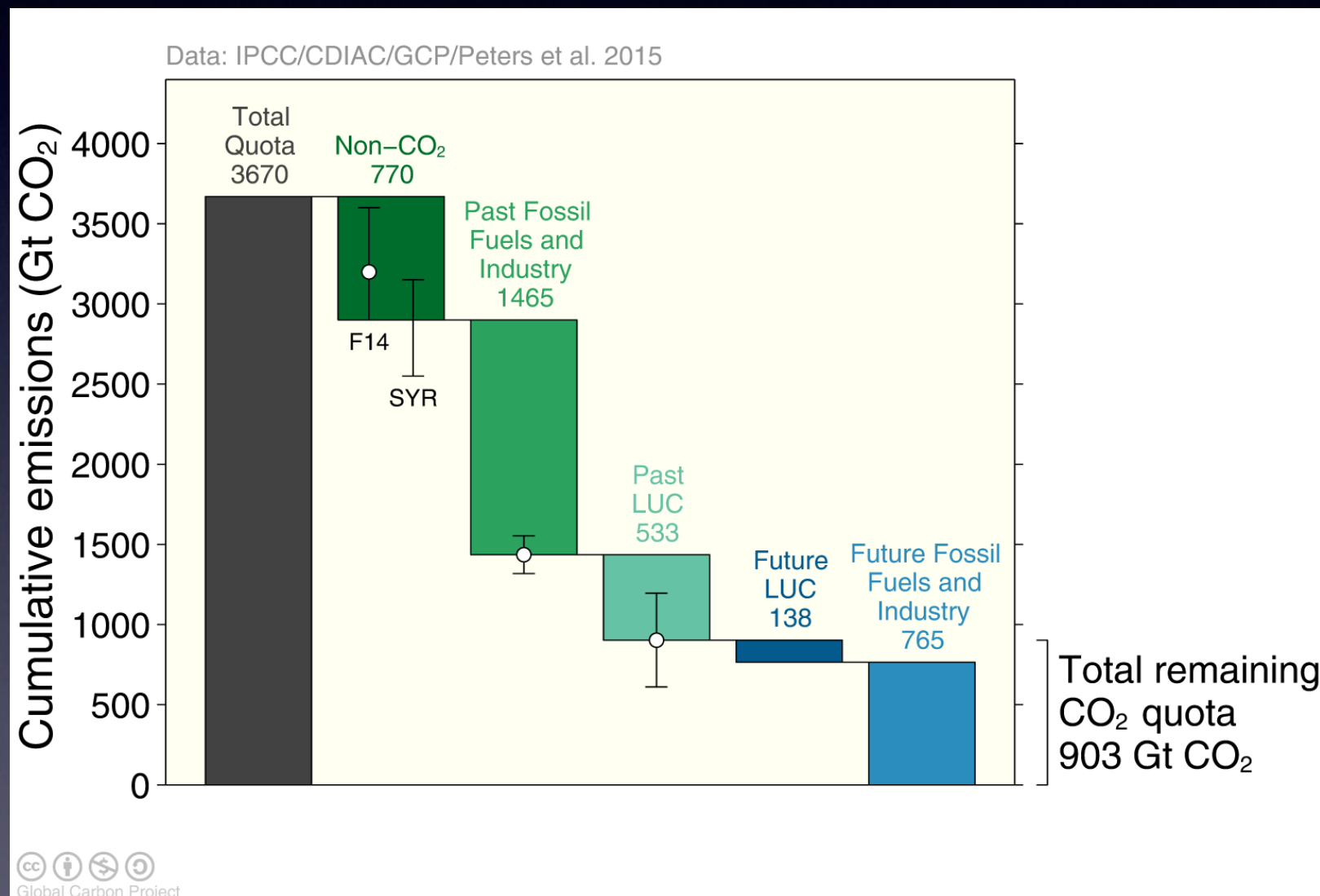


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The remaining carbon quota for 66% chance $<2^{\circ}\text{C}$

The total remaining emissions from 2014 to keep global average temperature below 2°C (900 Gt CO_2) will be used in around 20 years at current emission rates



Grey: Total quota for 2°C . Green: Removed from quota. Blue: remaining quota. With projected 2015 emissions, this remaining quota drops to 865 Gt CO_2

Source: [Peters et al 2015](#); [Global Carbon Budget 2015](#)



What it means?

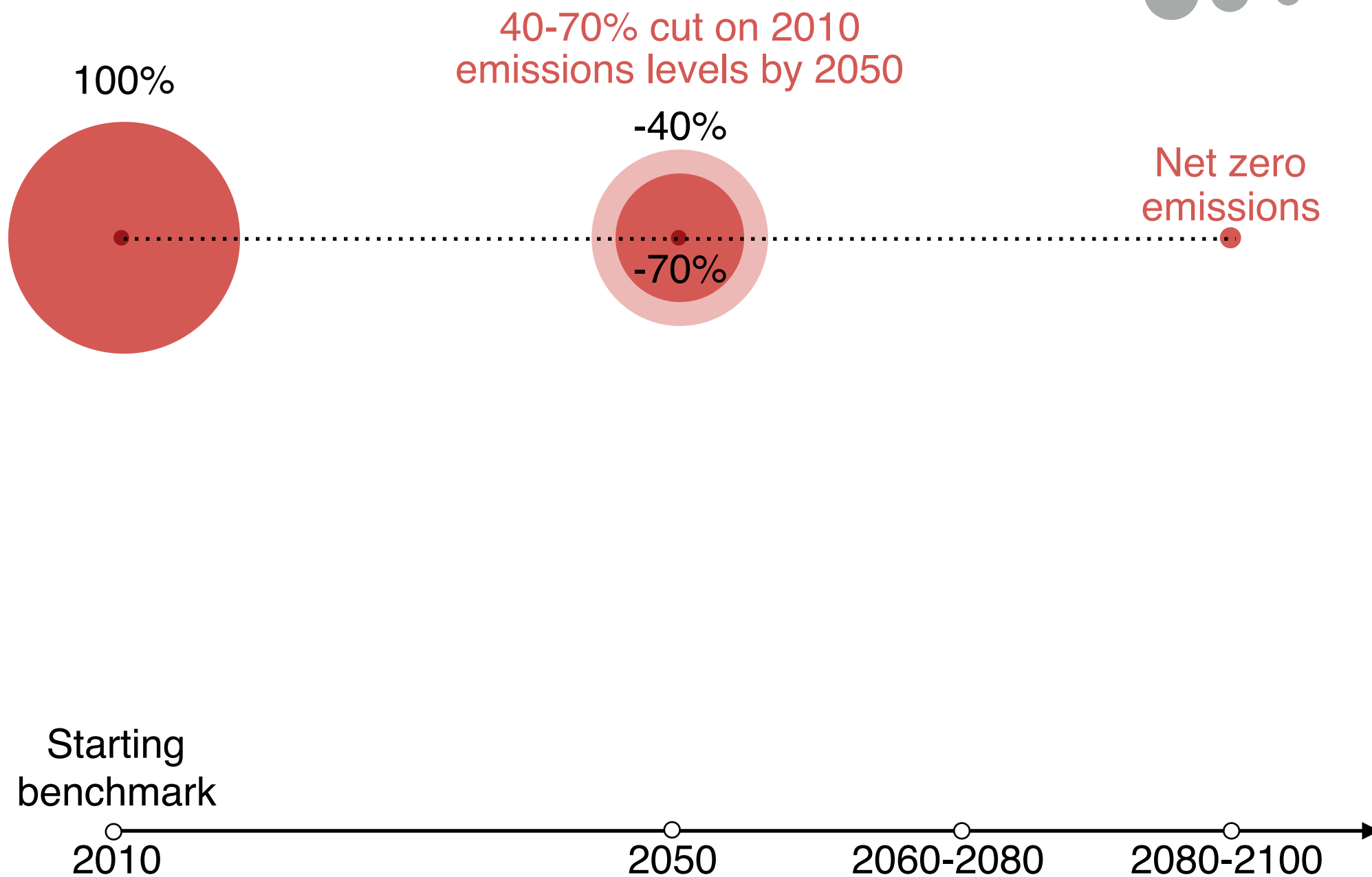
Recommendations from Climate Analytics based on IPCC reports

Greenhouse gas emissions



2°C target

66% chance of limiting warming to below 2°C in the 21st century



Redrawn from Carbon Brief

What it means?

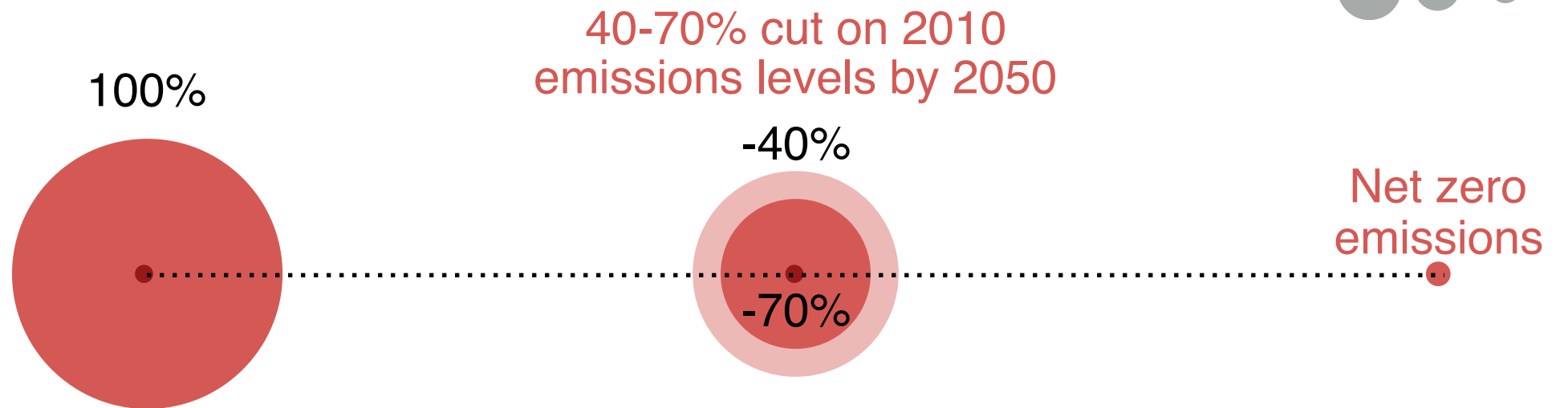
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Greenhouse gas emissions



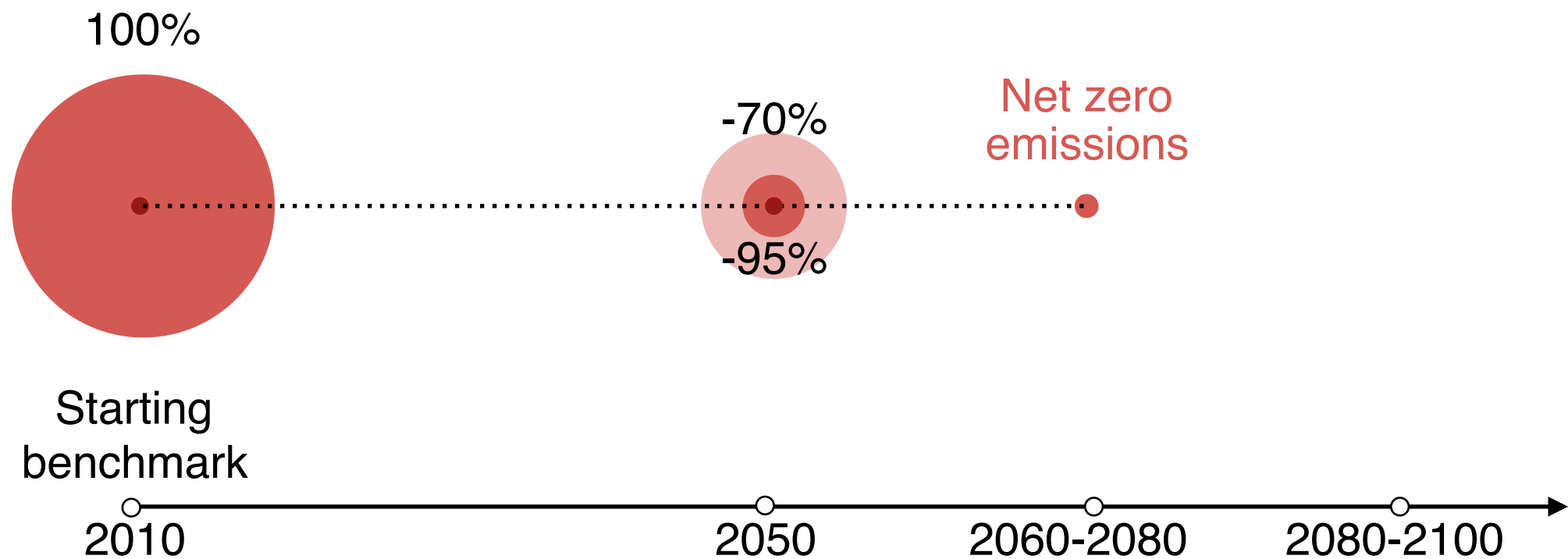
2°C target

66% chance of limiting warming to below 2°C in the 21st century



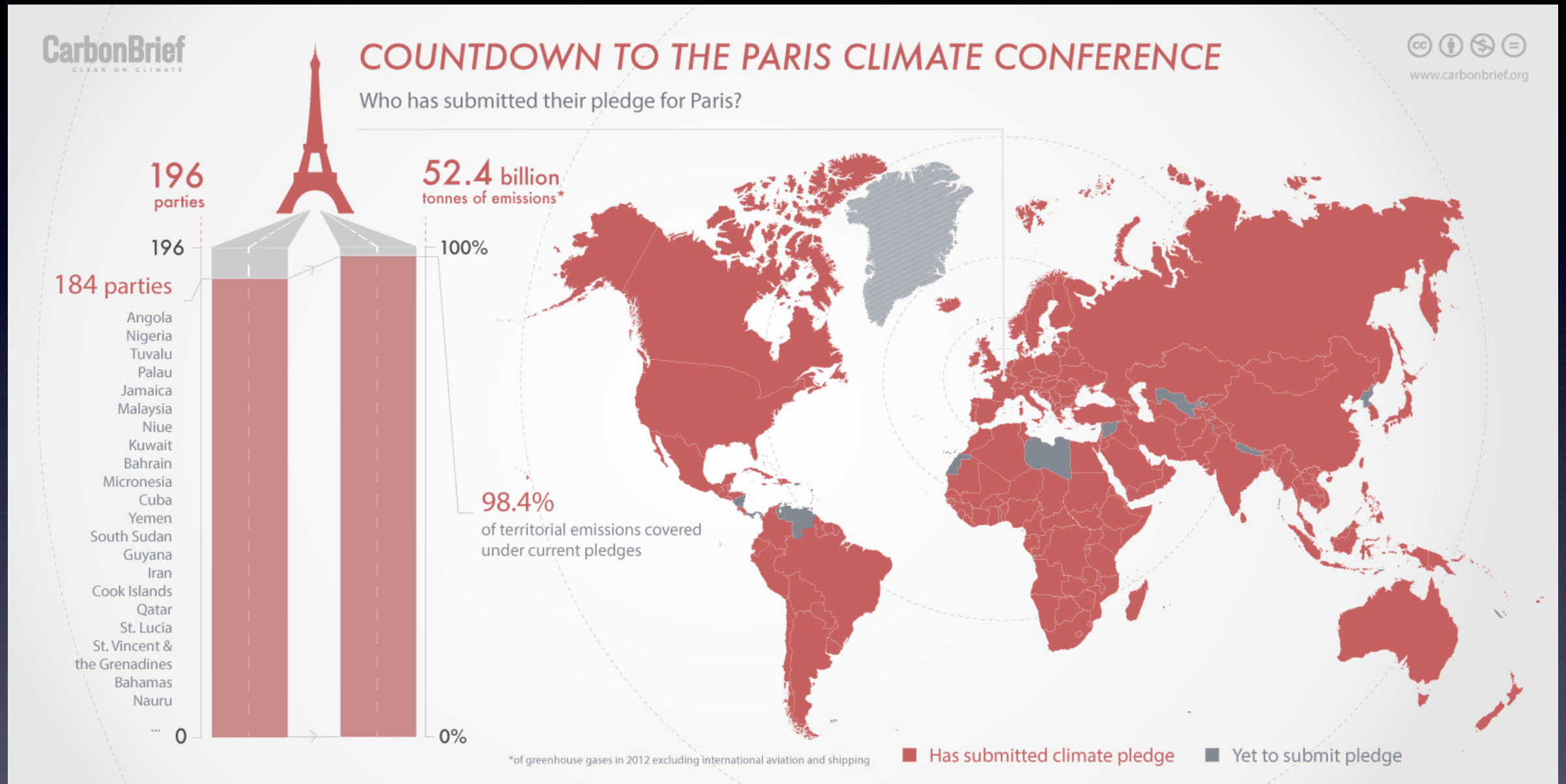
1.5°C target

More than 50% chance of limiting warming to below 1.5°C in 2100





On the road to COP21: INDCs

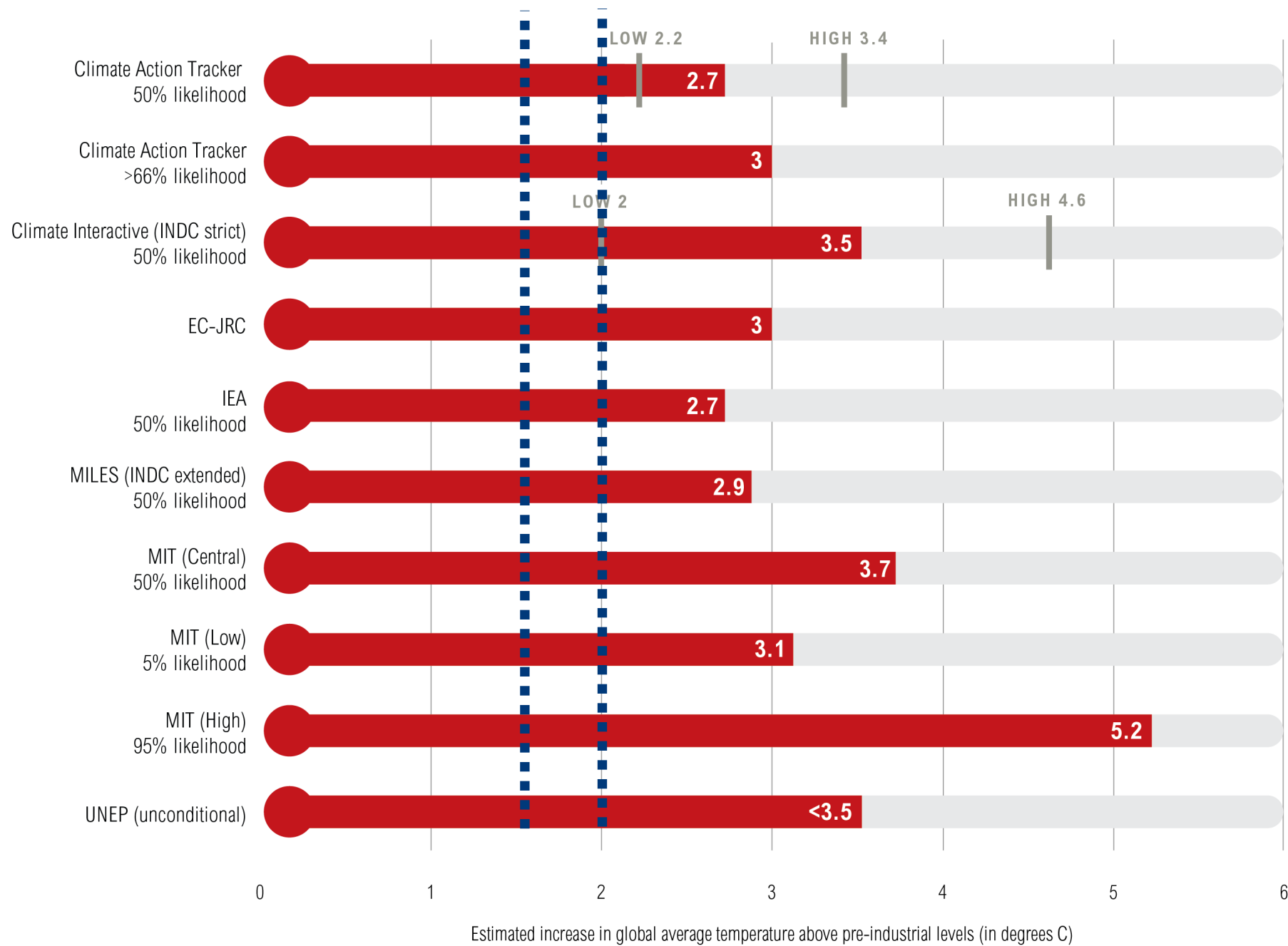


The Carbon Brief

INDC: Intended Nationally Determined Contributions

Temperature rise with current INDCs

Estimates for Global Temperature Rise with INDCs



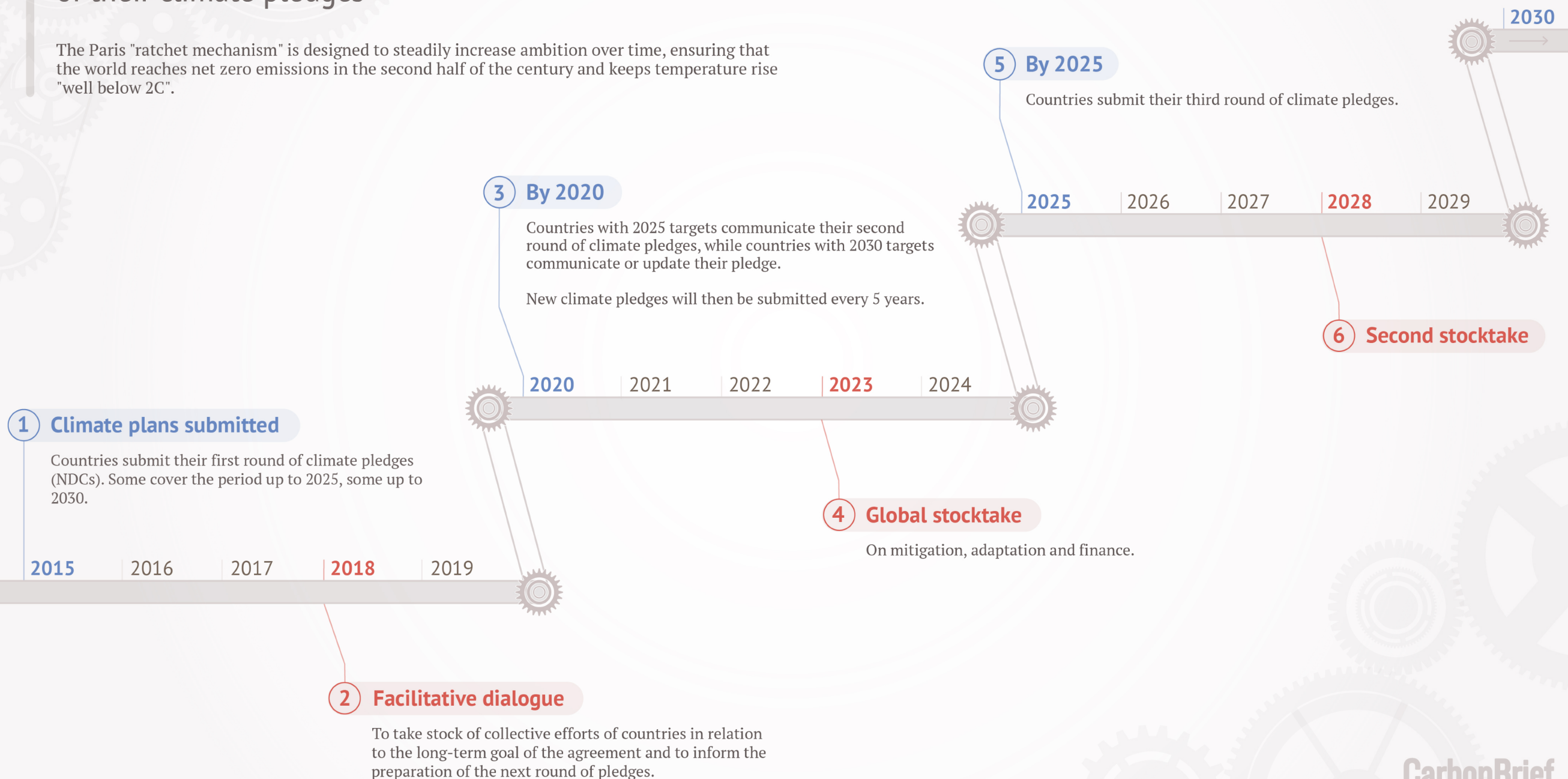
Note: "Likelihood" refers to the probability of limiting global warming to a specified temperature by 2100. For instance, >66% likelihood provides a "likely" chance that warming will not exceed the given temperature.

<http://bit.ly/indc-temp>

Ratchet mechanism

Timeline: How countries plan to raise the ambition of their climate pledges

The Paris "ratchet mechanism" is designed to steadily increase ambition over time, ensuring that the world reaches net zero emissions in the second half of the century and keeps temperature rise "well below 2C".



Ratchet mechanism

Timeline: How countries plan to raise the ambition of their climate pledges

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High quality science needed to inform negotiators

1 Climate plans submitted

Countries submit their first round of climate pledges (NDCs). Some cover the period up to 2025, some up to 2030.

2015 | 2016 | 2017 | **2018** | 2019

2 Facilitative dialogue

To take stock of collective efforts of countries in relation to the long-term goal of the agreement and to inform the preparation of the next round of pledges.

2020 | 2021 | 2022 | **2023** | 2024

4 Global stocktake

On mitigation, adaptation and finance.

5 By 2025

Countries submit their third round of climate pledges.

2027 | **2028** | 2029

6 Second stocktake

2030

How much fossil fuel must stay underground?

To have a 66% chance to remain below 2°C

How much fossil fuel must stay underground?

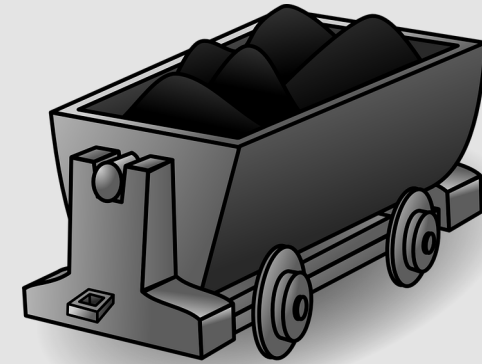
To have a 66% chance to remain below 2°C



52%
of natural
gas
reserves



35%
of oil
reserves

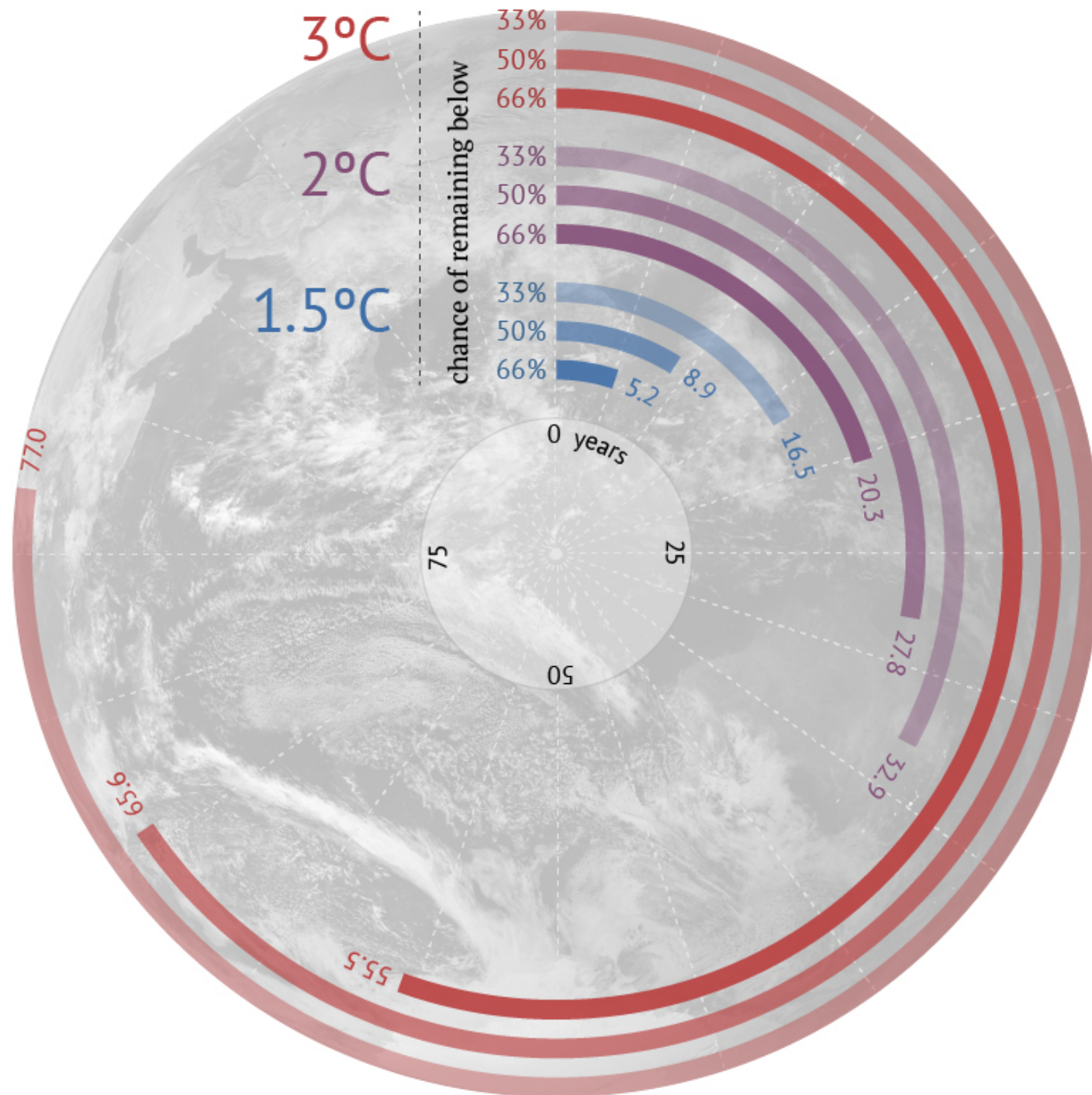


88%
of coal
reserves

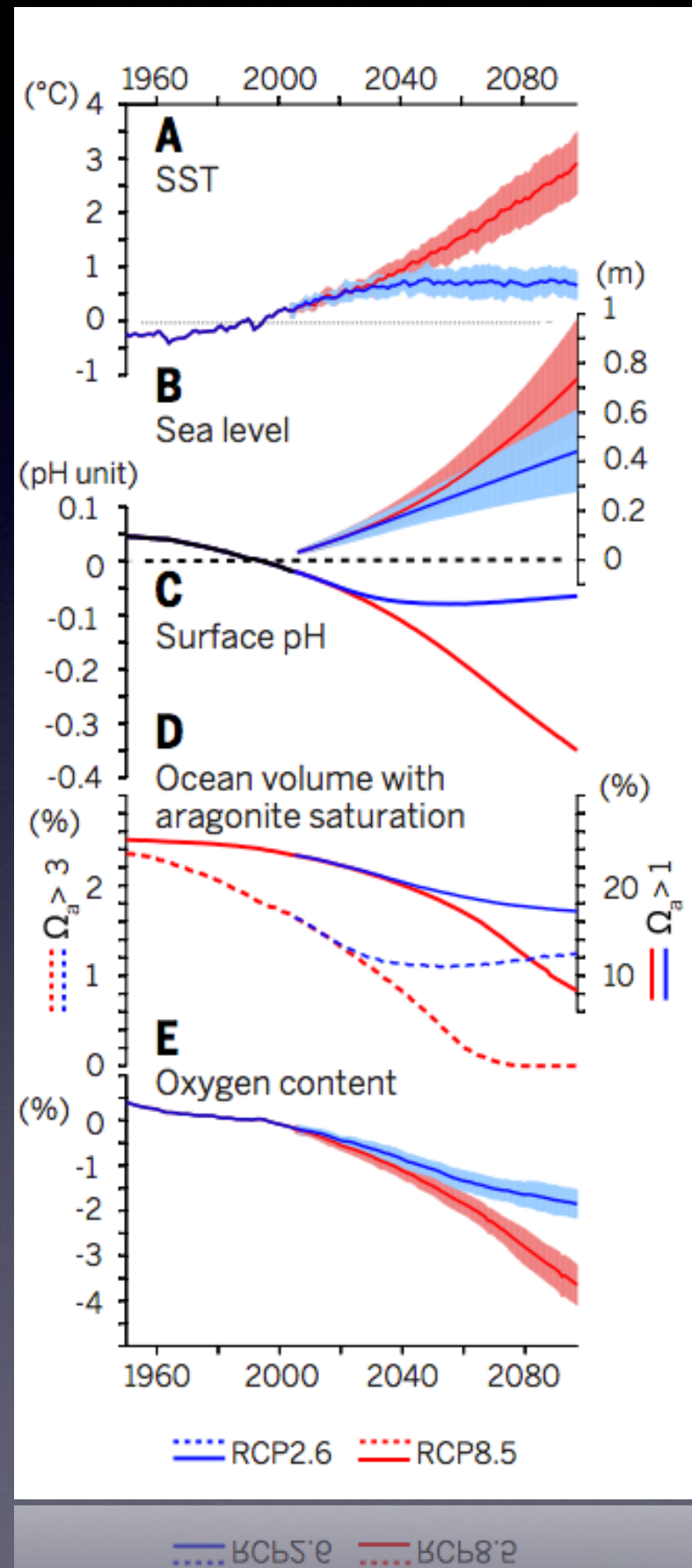
Redrawn from Carbon Brief (data from McGlade & Ekins, 2015)

Carbon Countdown

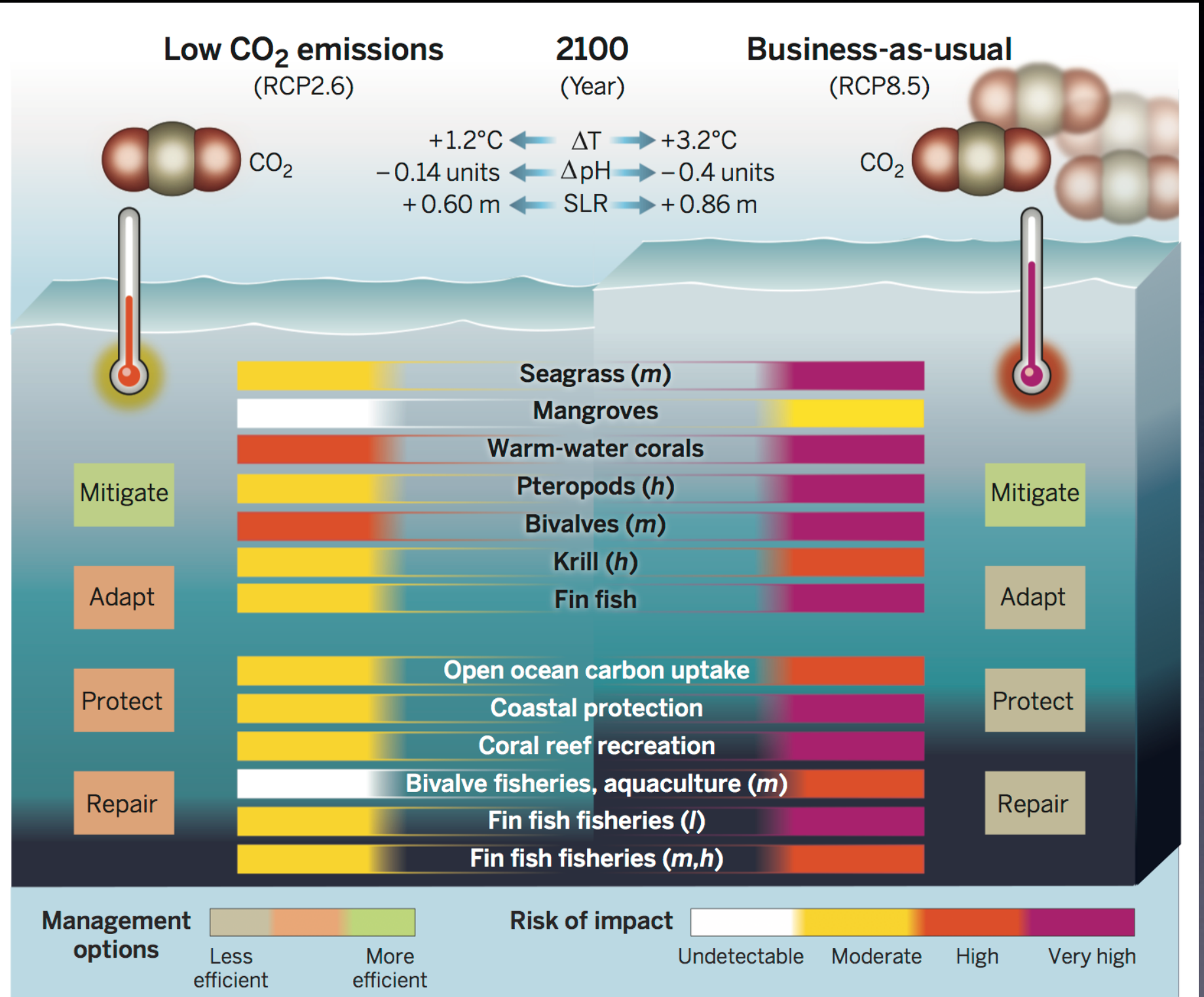
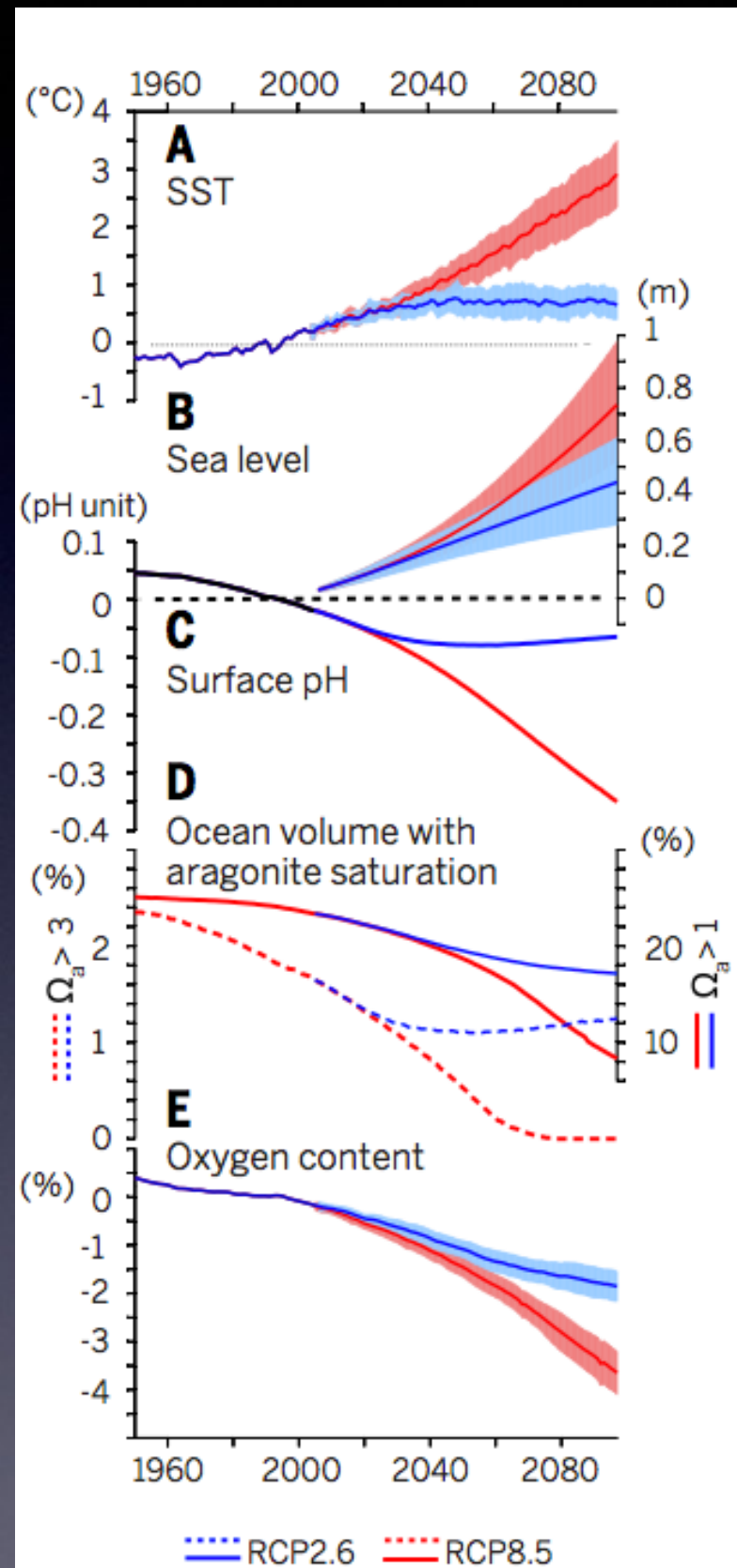
How many years of current emissions would use up the IPCC's carbon budgets for different levels of warming?



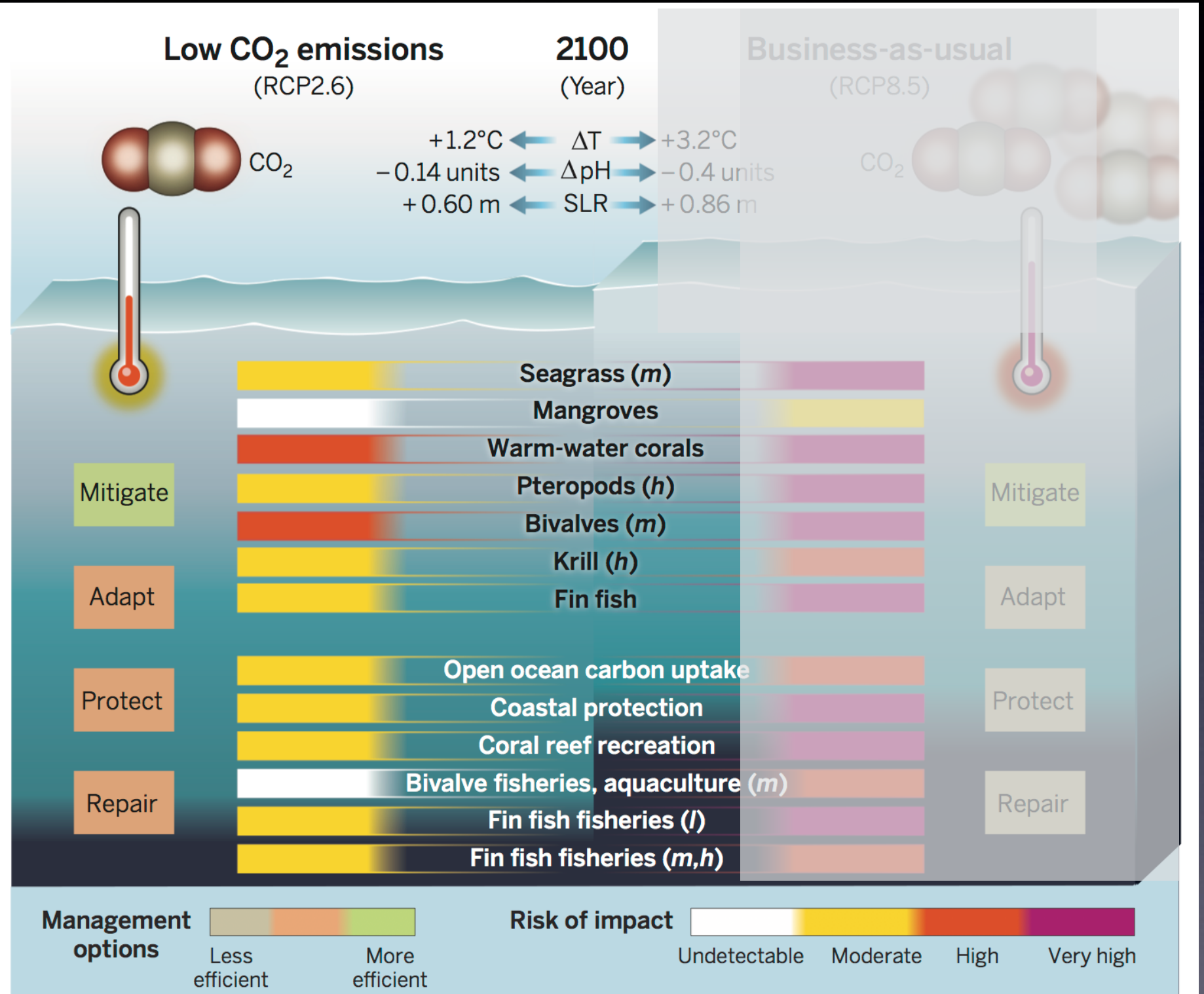
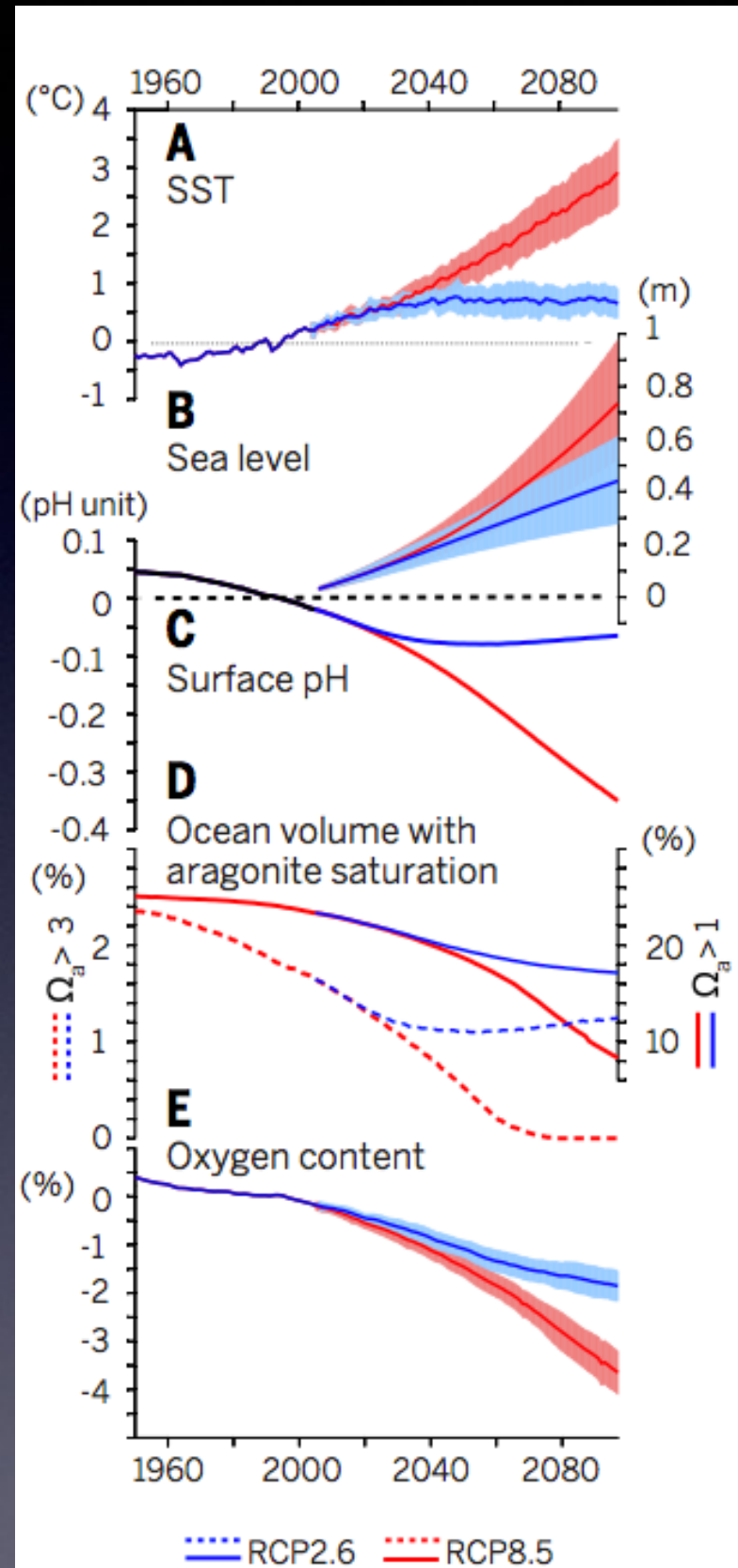
What does it mean for the ocean?



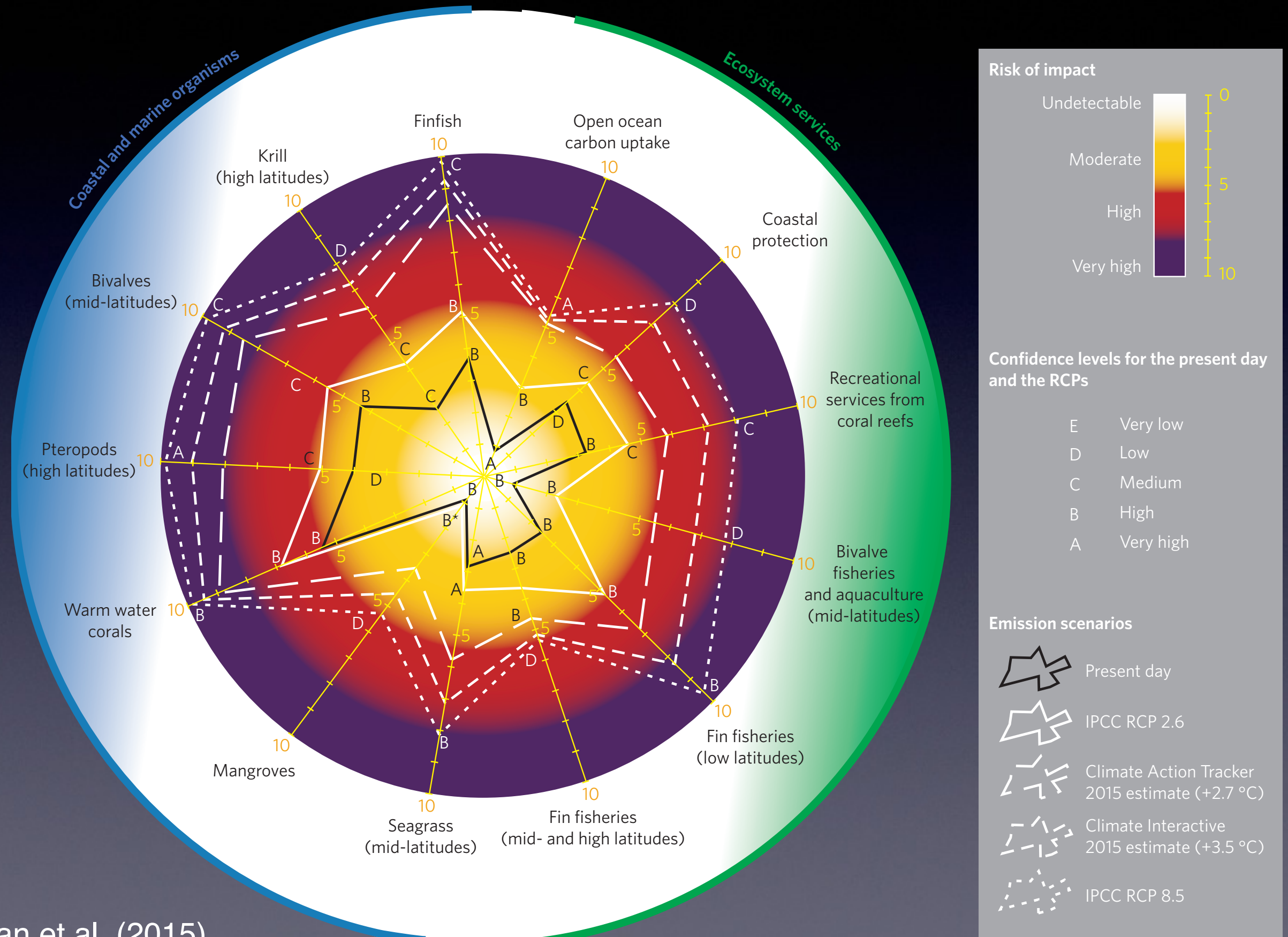
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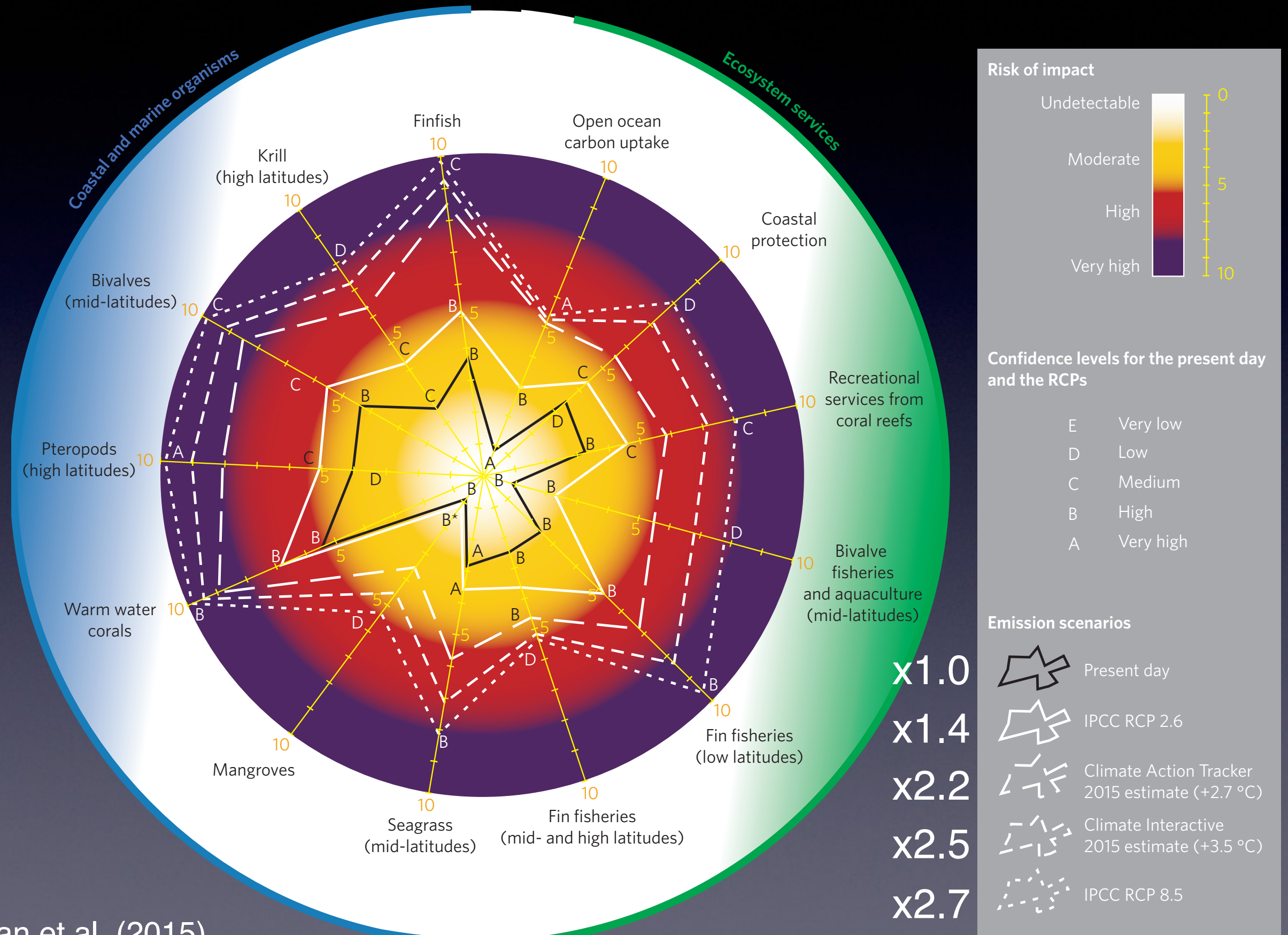
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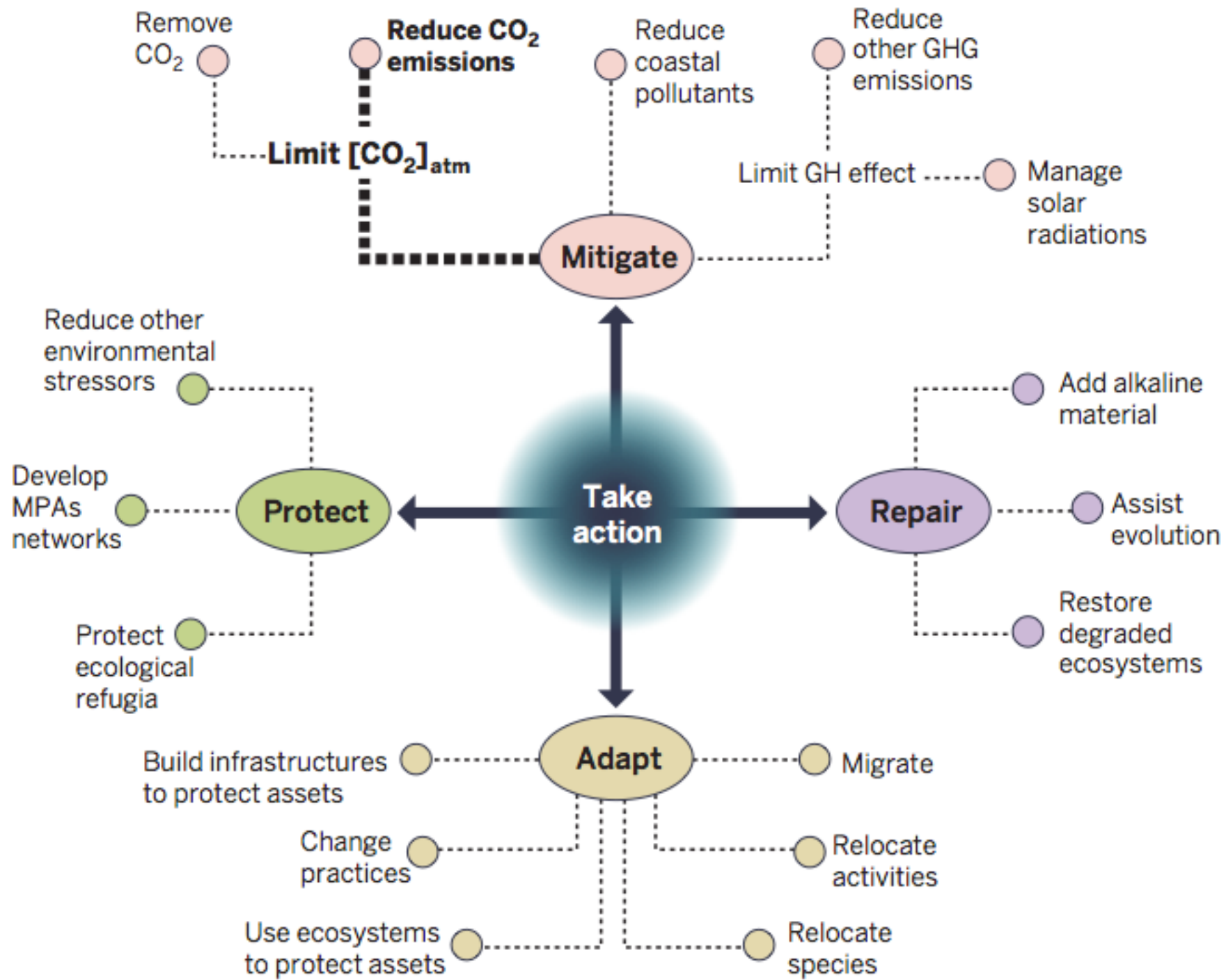
Future risks of impact



Future risks of impact



Solutions



- This presentation: <https://db.tt/VKfZ1hUw>
- More information on products of The Oceans 2015 Initiative: <http://bit.ly/1M6YiS6>



OCEANS 2015 INITIATIVE



Ocean Acidification
International
Coordination Centre
OA-ICC



FONDATION
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