

**PML**

Plymouth Marine  
Laboratory

Listen to the ocean

# Ocean Acidification and Warming and Current Nationally Determined Contributions

**Dr Carol Turley, OBE**



MARRAKECH COP22 | CMP12  
UN CLIMATE CHANGE CONFERENCE 2016

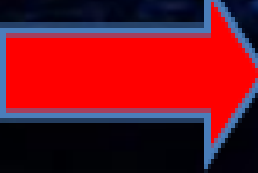


# Back to basics: the ocean absorbs over a quarter of man-made CO<sub>2</sub> emissions



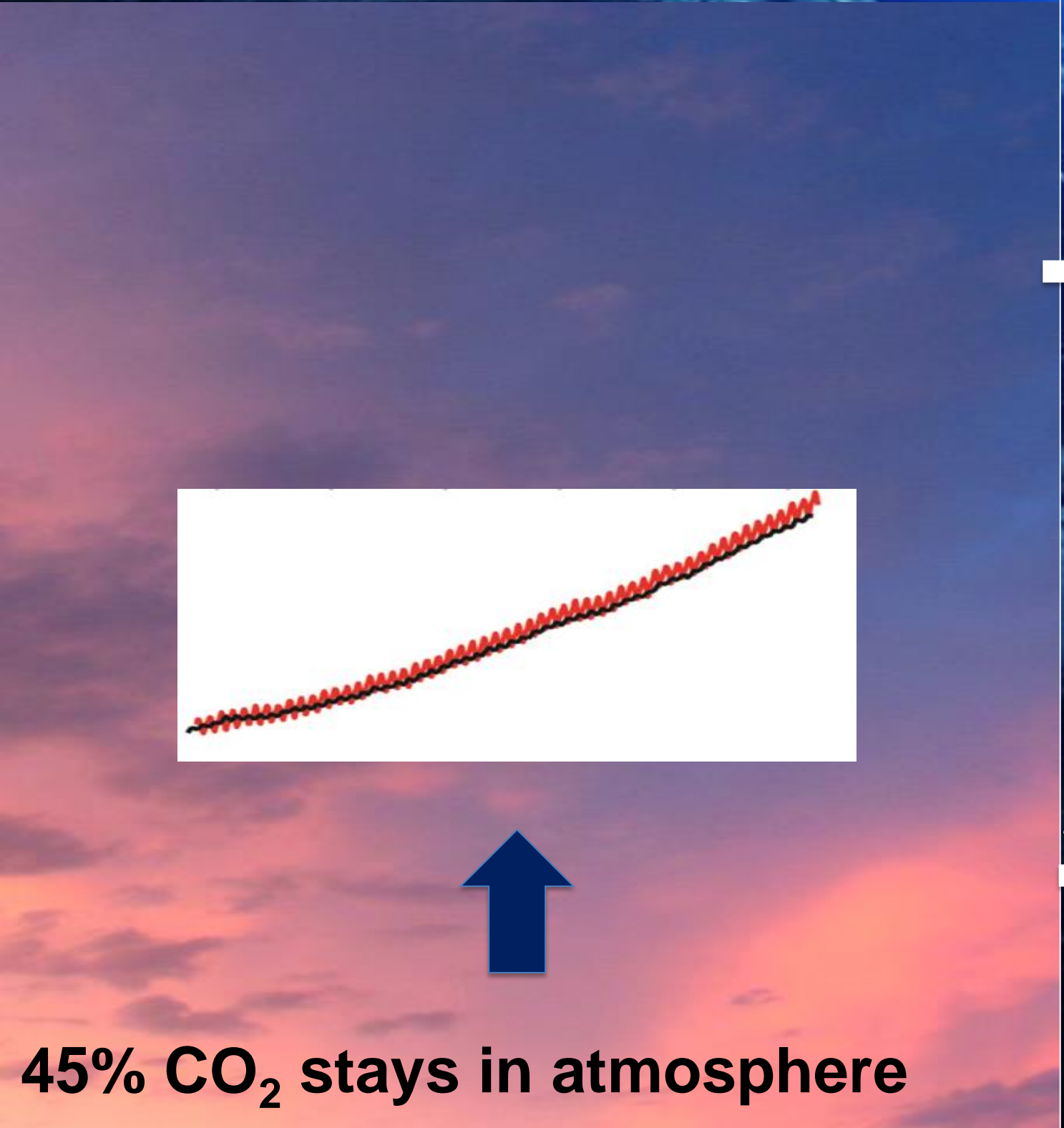
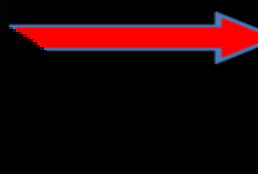
Fossil fuels

91%



Deforestation

9%



45% CO<sub>2</sub> stays in atmosphere

27%



Land uptake

27%



Ocean uptake

# The ocean takes up 27% of carbon dioxide emissions: .... reducing atmospheric warming but causing ocean acidification

---

More atmospheric CO<sub>2</sub>  
means **increased ocean acidity**



Carbon dioxide

Water

Acid

27% of CO<sub>2</sub>

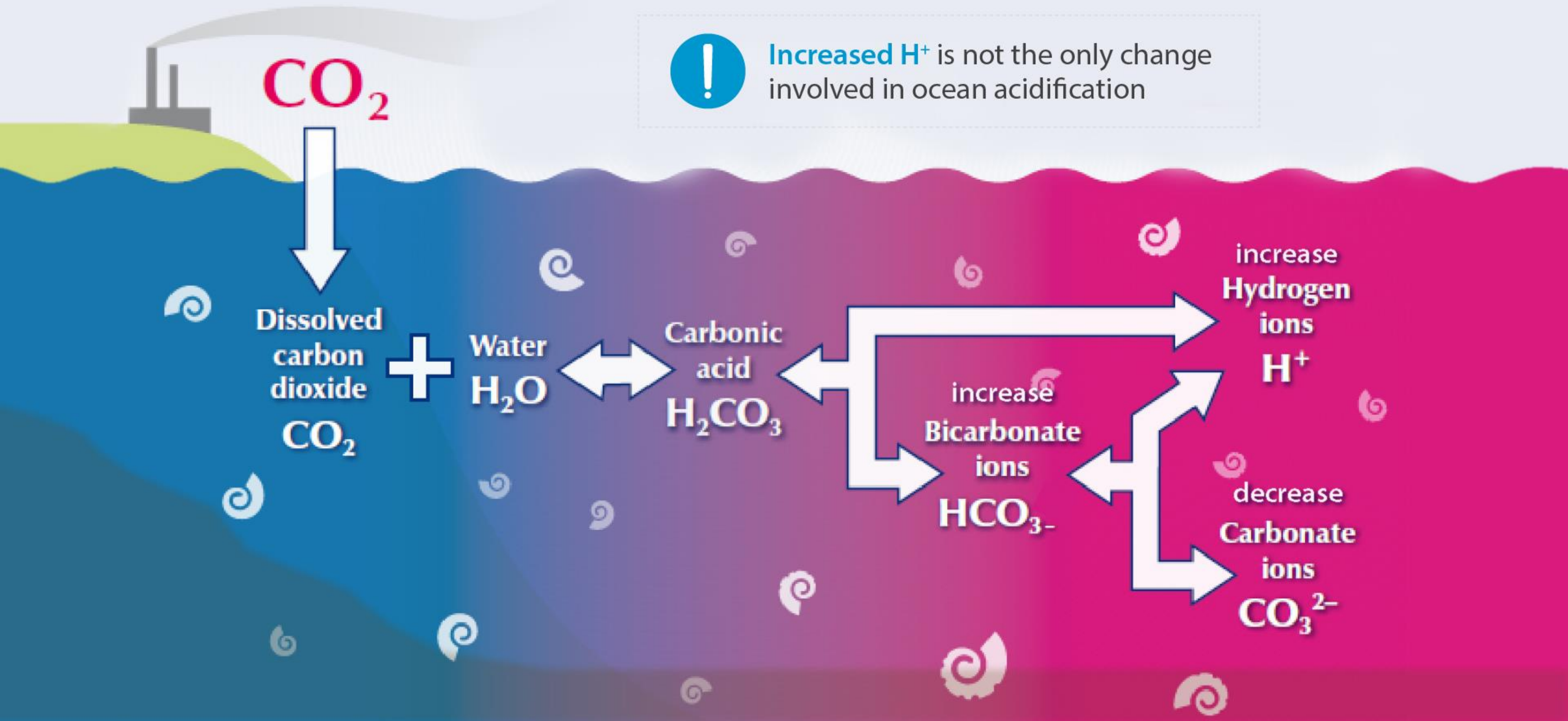


Ocean Acidification

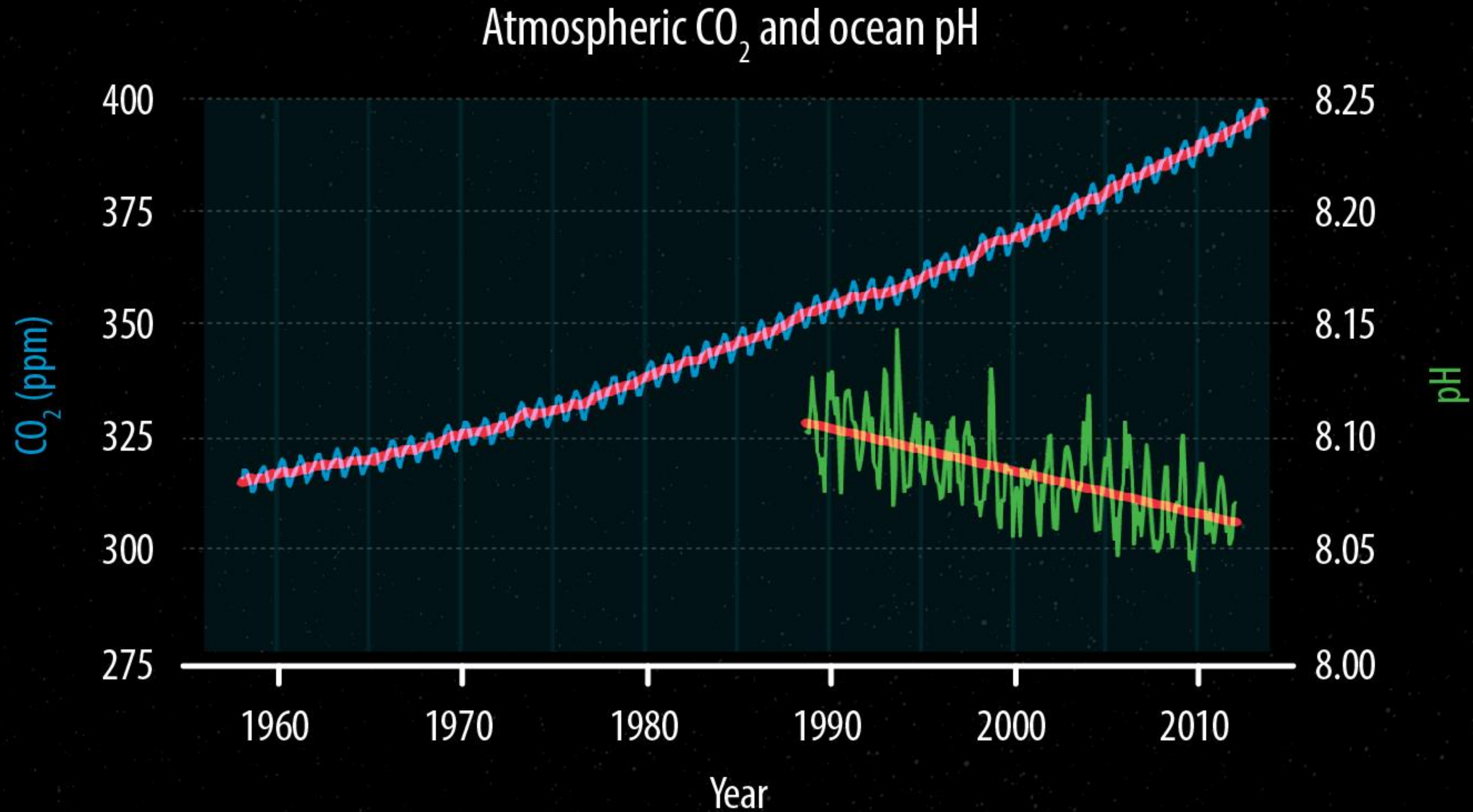
.... and **other major changes** to ocean carbon chemistry



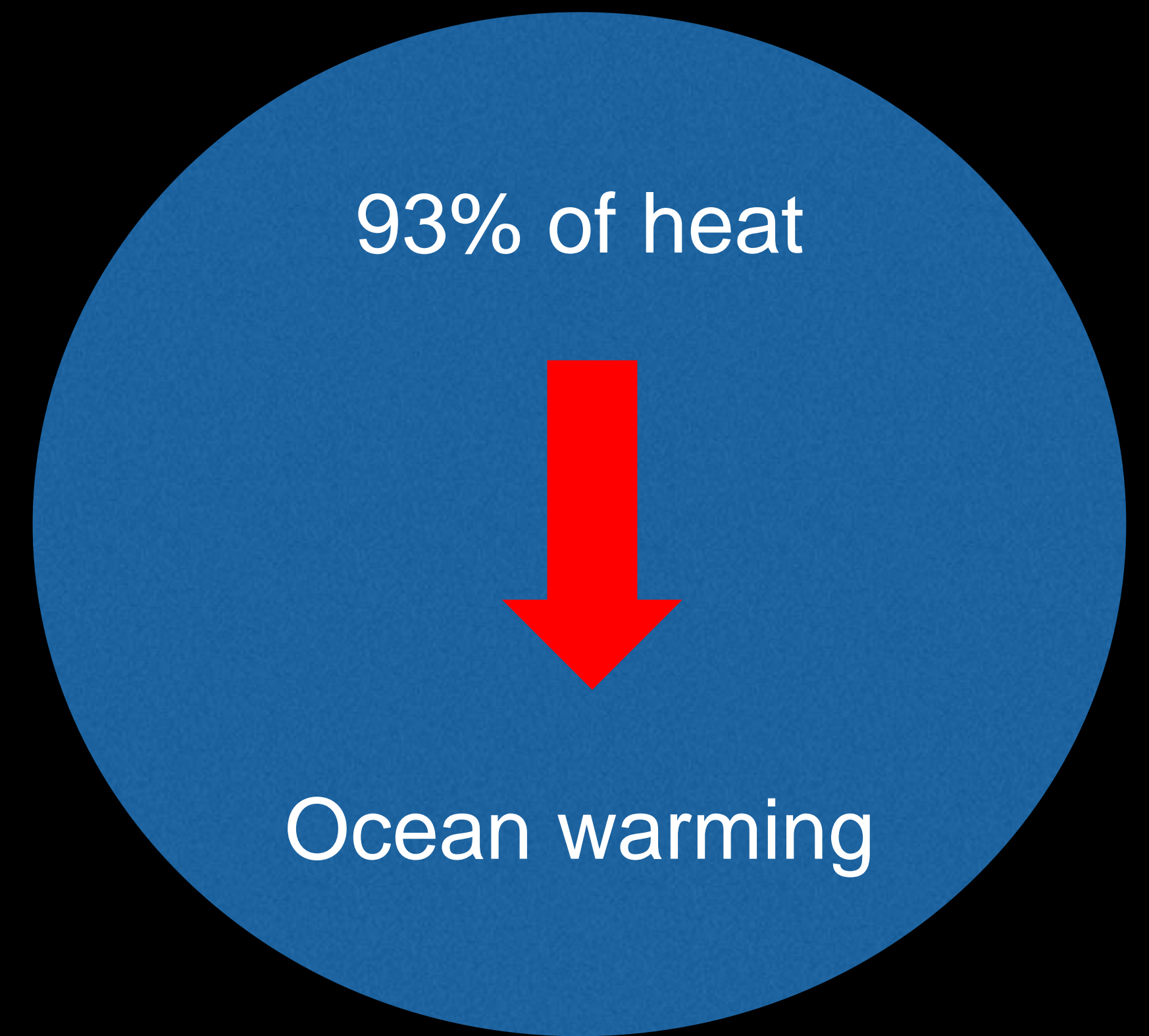
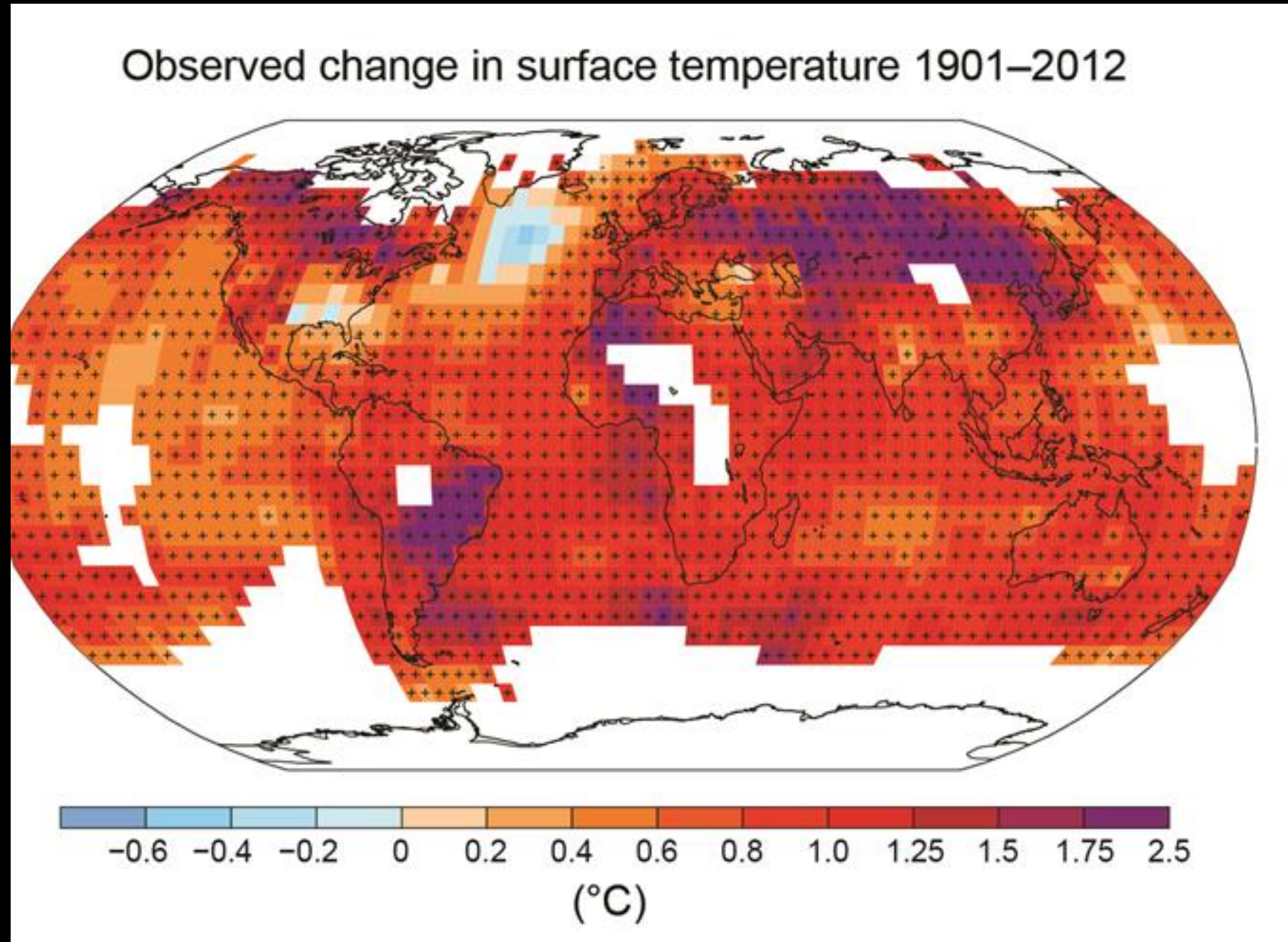
**Increased  $H^+$**  is not the only change involved in ocean acidification



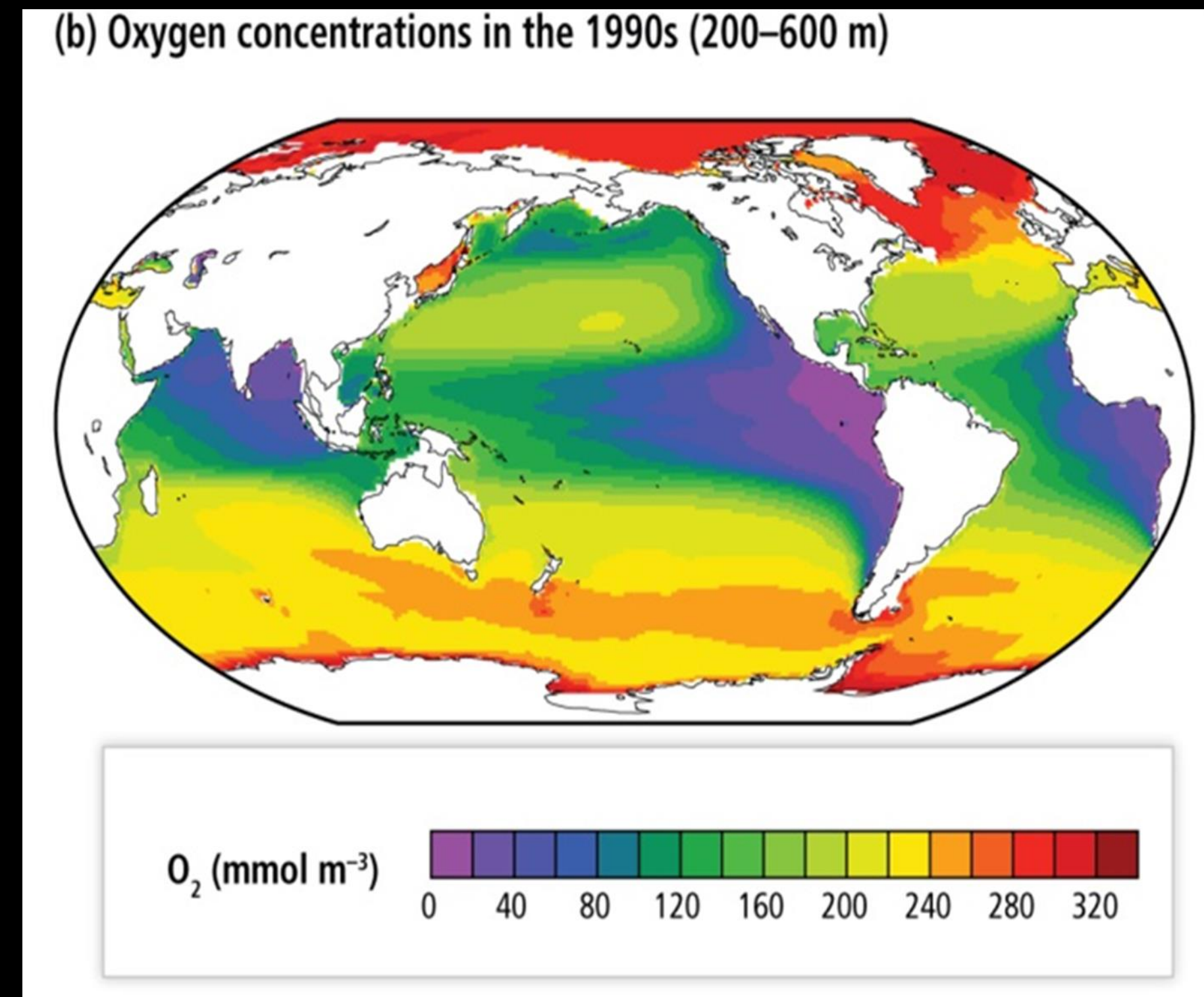
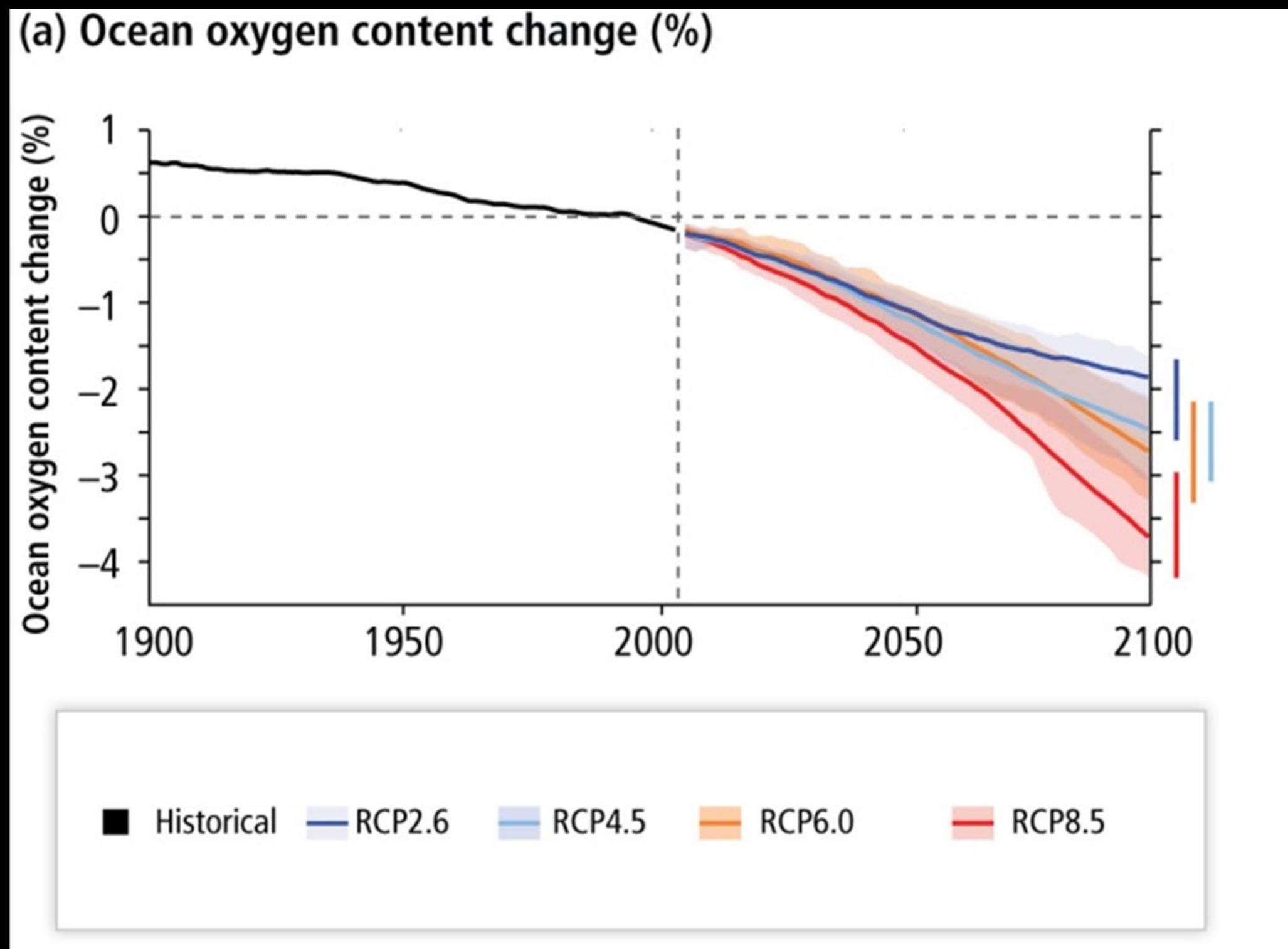
# Ocean acidification is happening **now and measurable**



# The ocean is absorbing nearly all the heat from global warming: .....causing it to warm



# Ocean oxygen concentrations are decreasing: ...due to warming waters increasing stratification ... dead zones with low oxygen will increase



# Climate scenarios and impacts:

CO <sub>2</sub> emissions	Δ air surface temperature (°C)
Present day	1.1
RCP 2.6	1.5
NDCs: Climate Action Tracker	2.7
NDCs: Climate Interactive	3.5
RCP8.5	4.2

} PA Goal

} NDCs

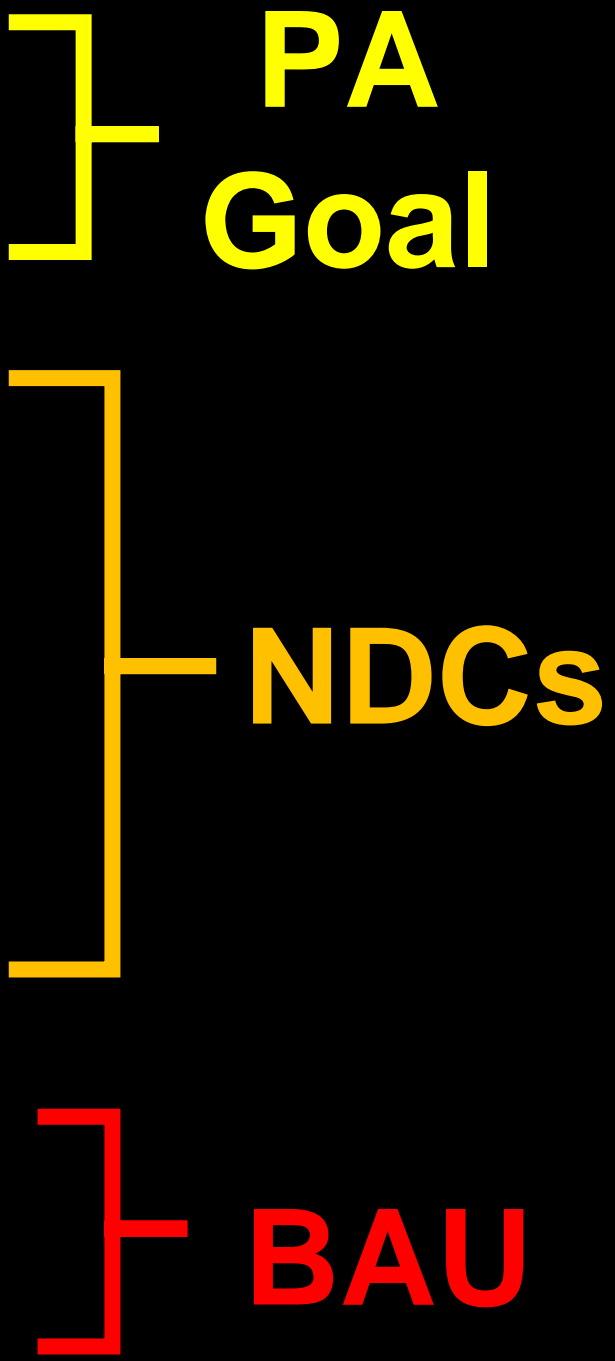
} BAU

Global mean values in 2090-2099 relative to 1870-1899



# Climate scenarios and impacts:

CO <sub>2</sub> emissions	Δ air surface temperature (°C)	Δ sea surface temperature (°C)
Present day	1.1	0.83
RCP 2.6	1.5	1.13
NDCs: Climate Action Tracker	2.7	2.03
NDCs: Climate Interactive	3.5	2.63
RCP8.5	4.2	3.15



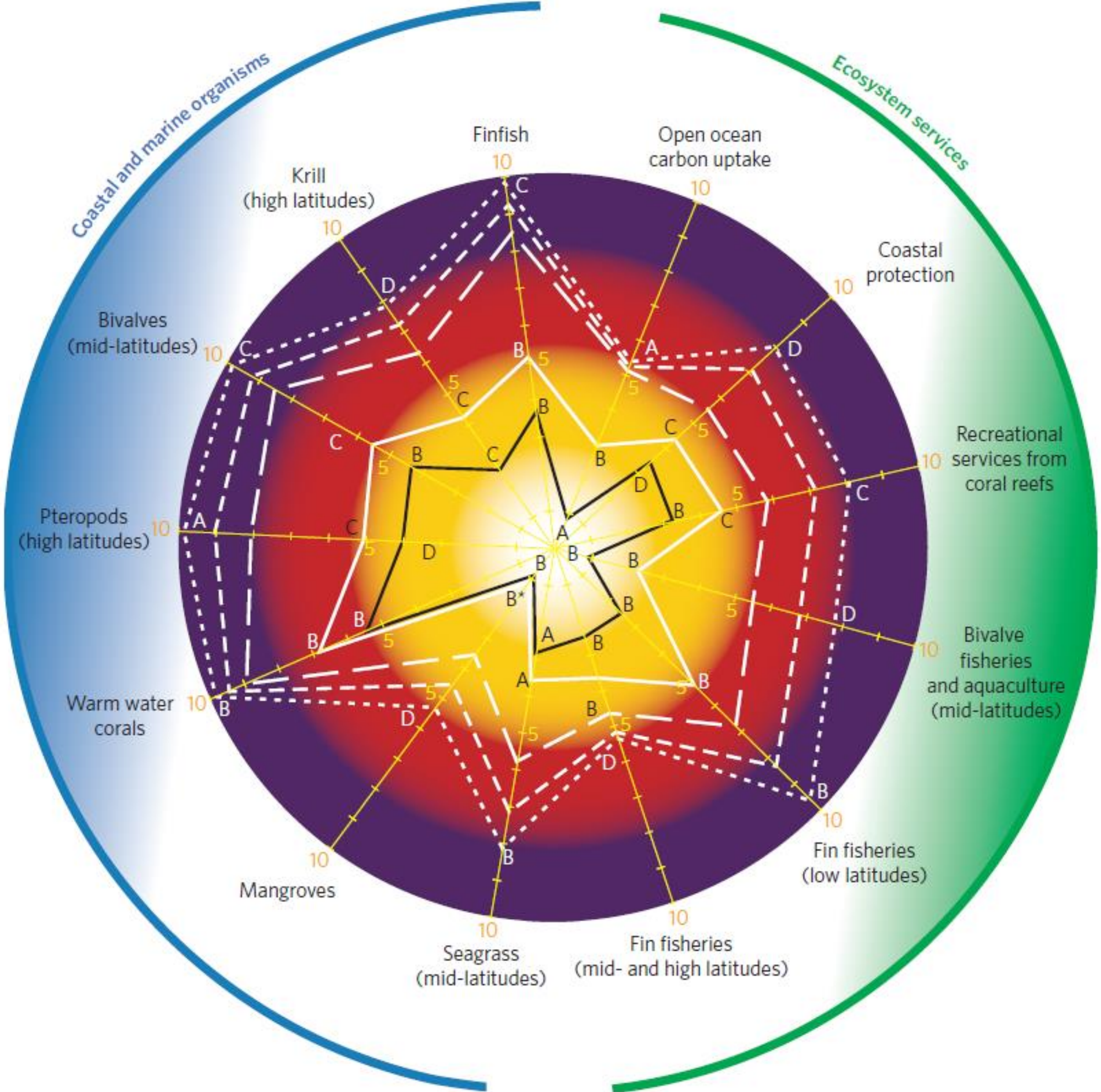
Global mean values in 2090-2099 relative to 1870-1899

# Climate scenarios and impacts:

CO <sub>2</sub> emissions	Δ air surface temperature (°C)	Δ sea surface temperature (°C)	Δ surface ocean pH
Present day	1.1	0.83	-0.11
RCP 2.6	1.5	1.13	-0.15
NDCs: Climate Action Tracker	2.7	2.03	-0.26
NDCs: Climate Interactive	3.5	2.63	-0.34
RCP8.5	4.2	3.15	-0.41

] PA Goal  
 ] NDCs  
 ] BAU

Global mean values in 2090-2099 relative to 1870-1899



**Risk of impact**

Undetectable 0  
 Moderate 5  
 High 10  
 Very high 10

**Confidence levels for the present day and the RCPs**

E Very low  
 D Low  
 C Medium  
 B High  
 A Very high

**Emission scenarios**

Present day  
 IPCC RCP 2.6  
 Climate Action Tracker 2015 estimate (+2.7 °C)  
 Climate Interactive 2015 estimate (+3.5 °C)  
 IPCC RCP 8.5

# Climate scenarios and impacts: Current NDCs are not enough

CO <sub>2</sub> emissions	Δ air surface temperature (°C)	Δ sea surface temperature (°C)	Δ surface ocean pH
Present day	1.1	0.83	-0.11
RCP 2.6	1.5	1.13	-0.15
NDCs: Climate Action Tracker	2.7	2.03	-0.26
NDCs: Climate Interactive	3.5	2.63	-0.34
RCP8.5	4.2	3.15	-0.41

] PA Goal  
 ] NDCs  
 ] BAU

Global mean values in 2090-2099 relative to 1870-1899

**Thank you!**

**And thanks to all the scientists that have contributed to this presentation**

**ct@pml.ac.uk**

