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SROCC Chapter 5

Changing Ocean, Marine Ecosystems & Dependent Communities

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Natural Environment Research Council



Image: IPCC

Front cover

ipcc
INTERGOVERNMENTAL PANEL ON climate change

The Ocean and Cryosphere in a Changing Climate



WG I WG II



Back cover

ipcc
INTERGOVERNMENTAL PANEL ON climate change



WG I WG II



Extra heat in the Earth system

(93% in the ocean, 3% to cryosphere, 3% to land surface and only ~1% in the atmosphere)

From poles to equator

From beach to abyss



Ocean impacts

Observed and projected

CLIMATE

Extra heat in the Earth system

WEATHER

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Ocean impacts

Temperature increase

- Mixing & circulation
- Sea-level rise
- De-oxygenation
- Sea-ice cover
- Storms & heat waves
- Nutrient supply

Extra CO₂: Ocean acidification

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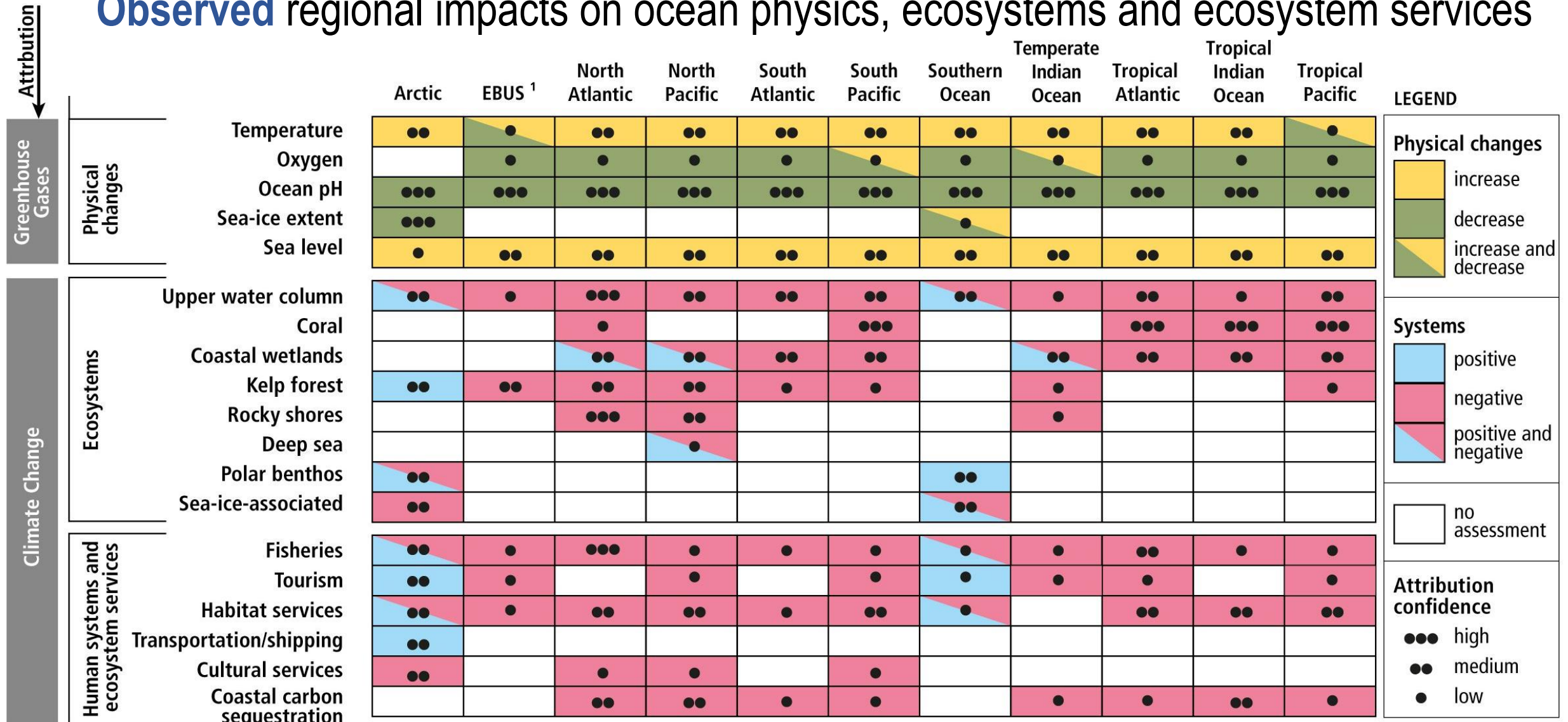
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Observed regional impacts on ocean physics, ecosystems and ecosystem services



¹ Eastern Boundary Upwelling Systems (Benguela Current, Canary Current, California Current, and Humboldt Current); {Box 5.3}

Observed regional impacts on ocean physics – also covered in other talks

Attribution

Greenhouse Gases

Physical changes

	Arctic	EBUS ¹	North Atlantic	North Pacific	South Atlantic	South Pacific	Southern Ocean	Temperate Indian Ocean	Tropical Atlantic	Tropical Indian Ocean	Tropical Pacific
Temperature	●●	●	●●	●●	●●	●●	●●	●●	●●	●●	●
Oxygen		●	●	●	●	●	●	●	●	●	●
Ocean pH	●●●	●●●	●●●	●●●	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Sea-ice extent	●●●						●				
Sea level	●	●●	●●	●●	●●	●●	●●	●●	●●	●●	●●

LEGEND

Physical changes

- ↑ increase
- ↓ decrease
- ↕ increase and decrease
- no assessment

Attribution confidence

- high
- medium
- low

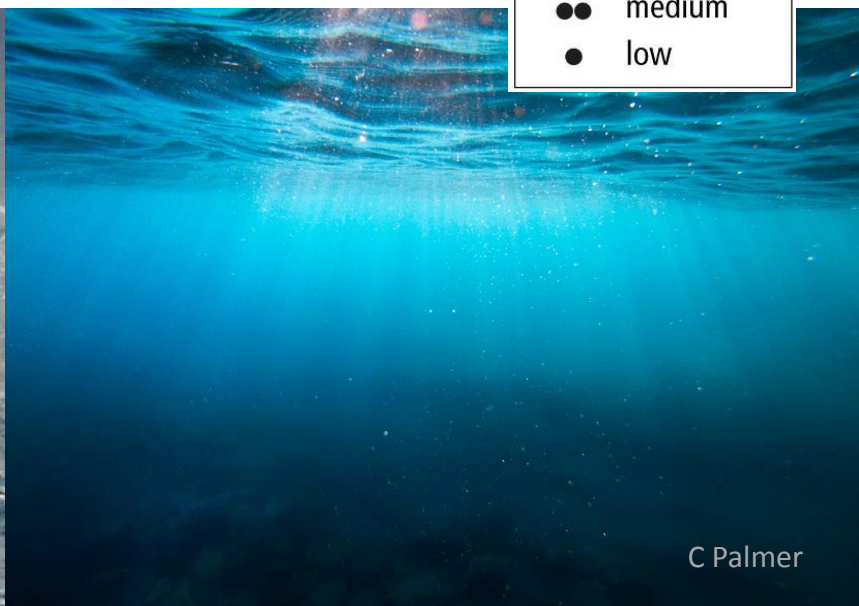
Summary of changes: 20↑ 20↓ 5↕ and confidence: 12 ●●● 19 ●● 14 ●



NASA



BAS



C Palmer

Observed regional impacts on ocean ecosystems

		Arctic	EBUS ¹	North Atlantic	North Pacific	South Atlantic	South Pacific	Southern Ocean	Temperate Indian Ocean	Tropical Atlantic	Tropical Indian Ocean	Tropical Pacific
Ecosystems	Upper water column	••	•	••••	••	••	••	••	•	••	•	••
	Coral			•			••••			••••	••••	••••
	Coastal wetlands			••	••	••	••		••	••	••	••
	Kelp forest	••	••	••	••	•	•		•			•
	Rocky shores			••••	••				•			
	Deep sea				•							
	Polar benthos	••						••				
Sea-ice-associated	••						••					

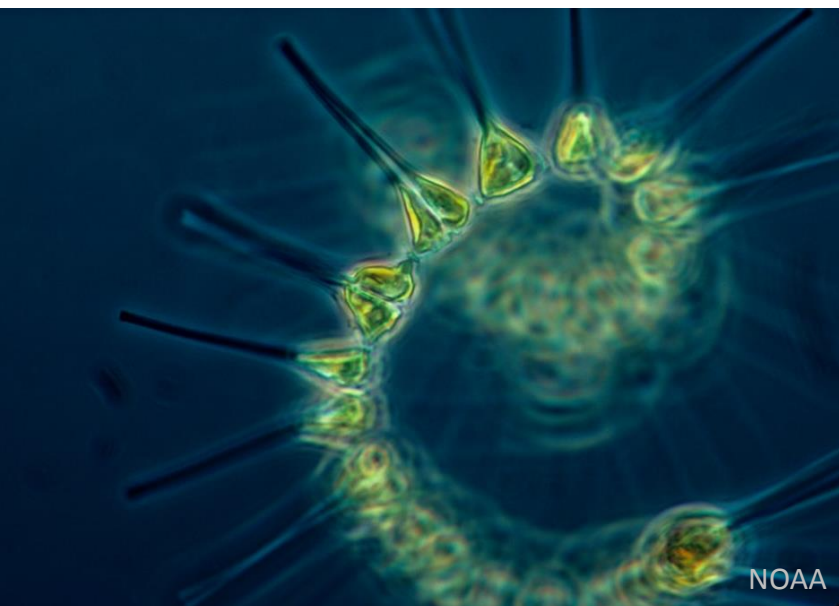
Changes

- + positive
- negative
- +/- positive and negative
- no assessment

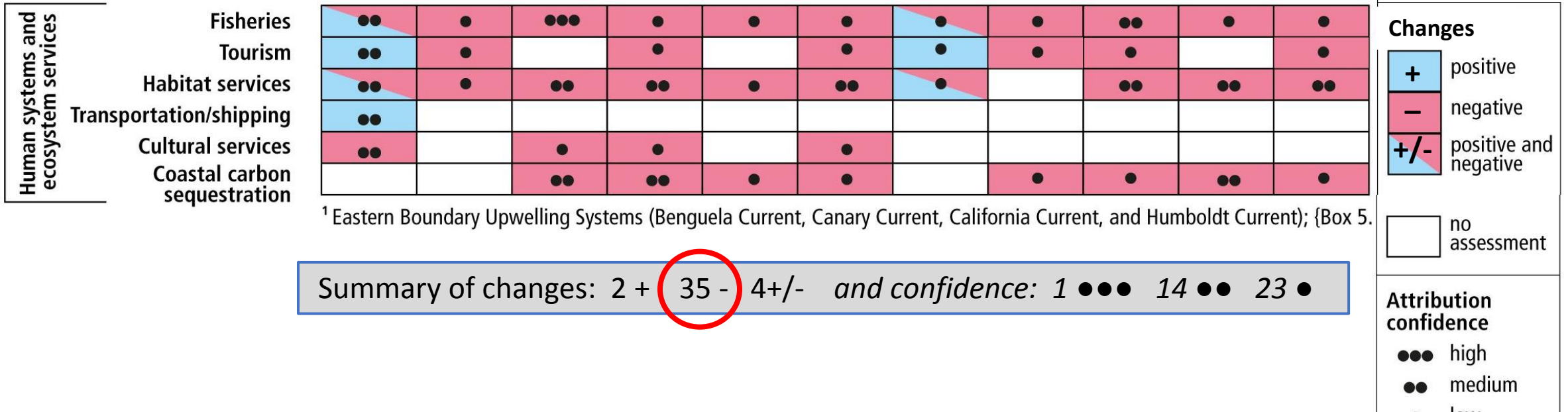
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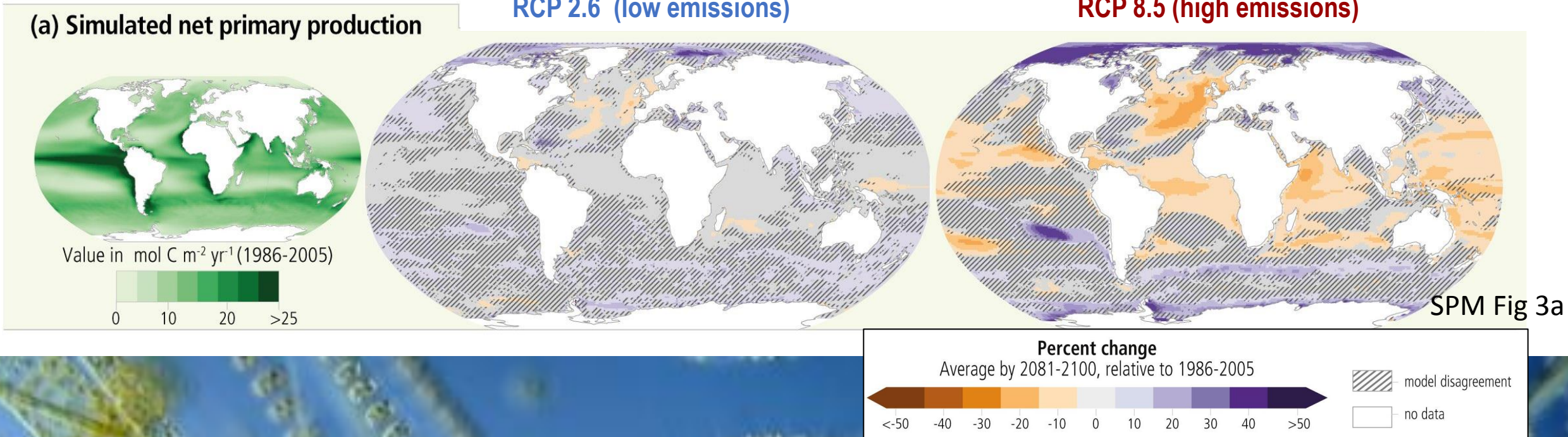
Summary of changes: 2 + 30 - 5 +/- and confidence: 6 ••• 24 •• 10 •



Observed regional impacts on ocean ecosystem services & human society



Current status and projected impacts on ocean ecosystems for two emission scenarios



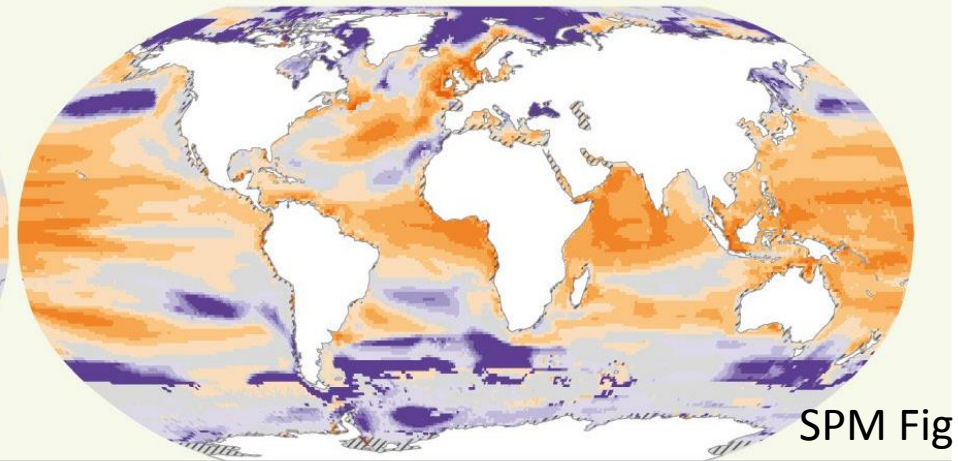
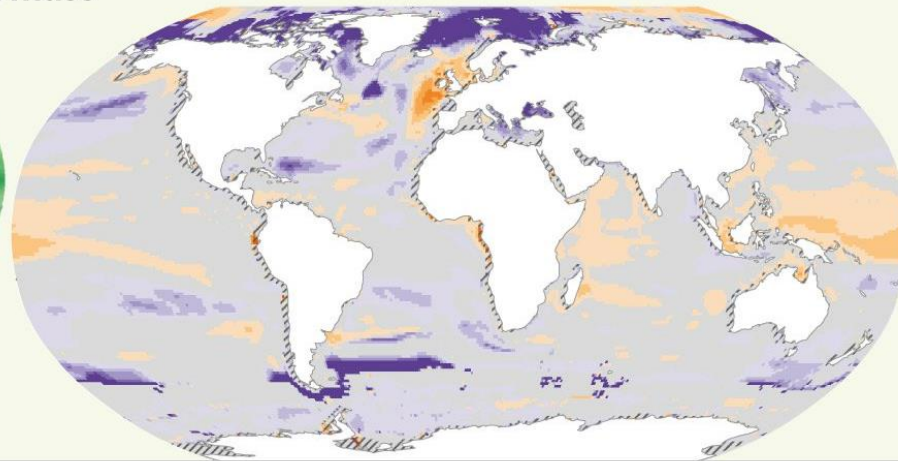
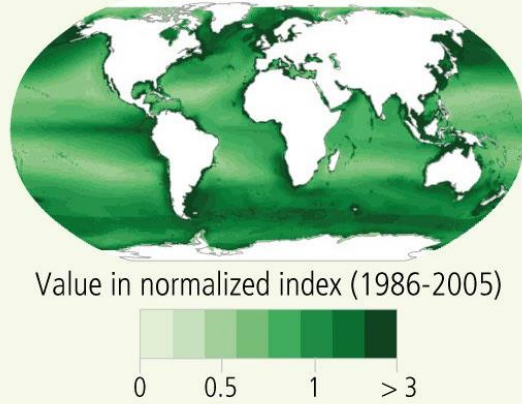
SPM Fig 3a

Current status and projected impacts on ocean ecosystems for two emission scenarios

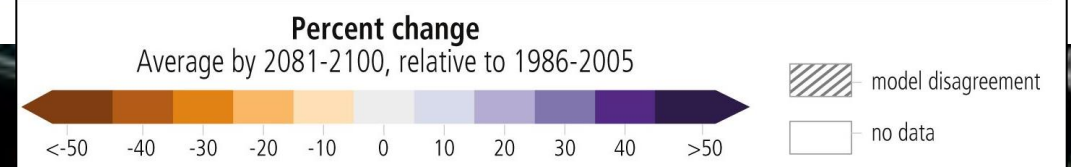
(b) Simulated total animal biomass

RCP 2.6 (low emissions)

RCP 8.5 (high emissions)



SPM Fig 3b

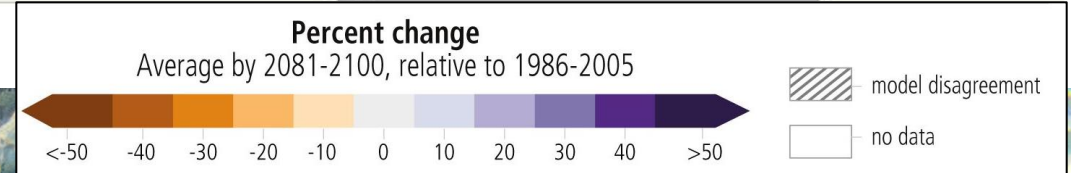
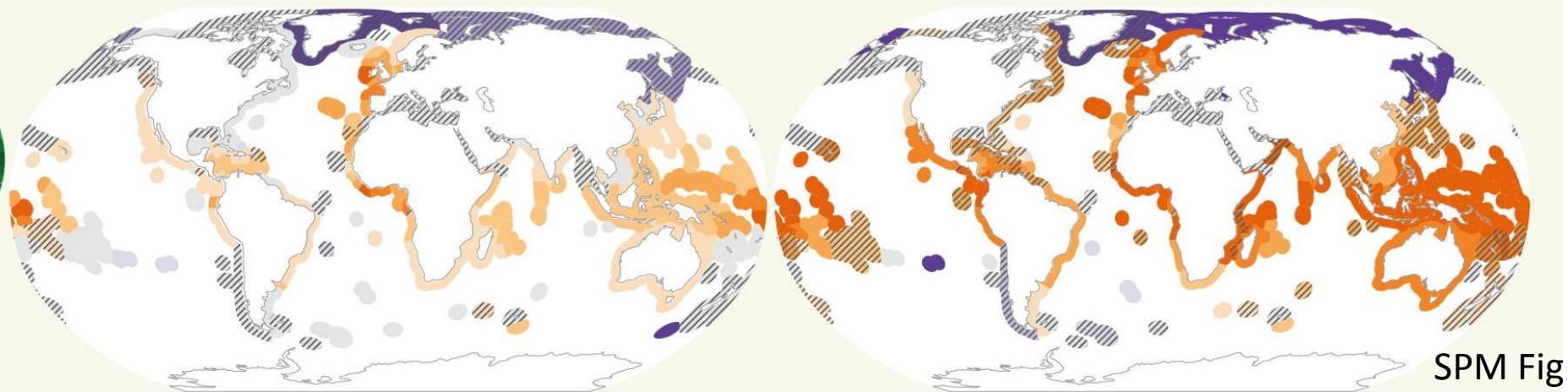
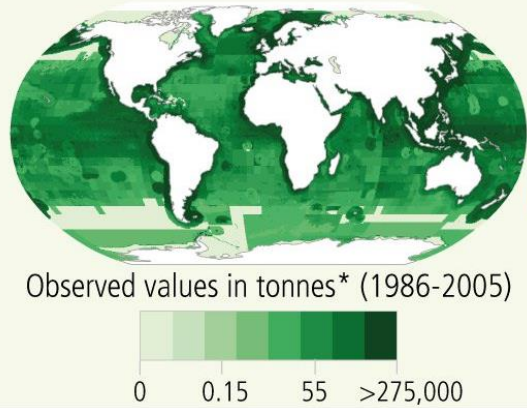


Current status and projected impacts on ocean ecosystems for two emission scenarios

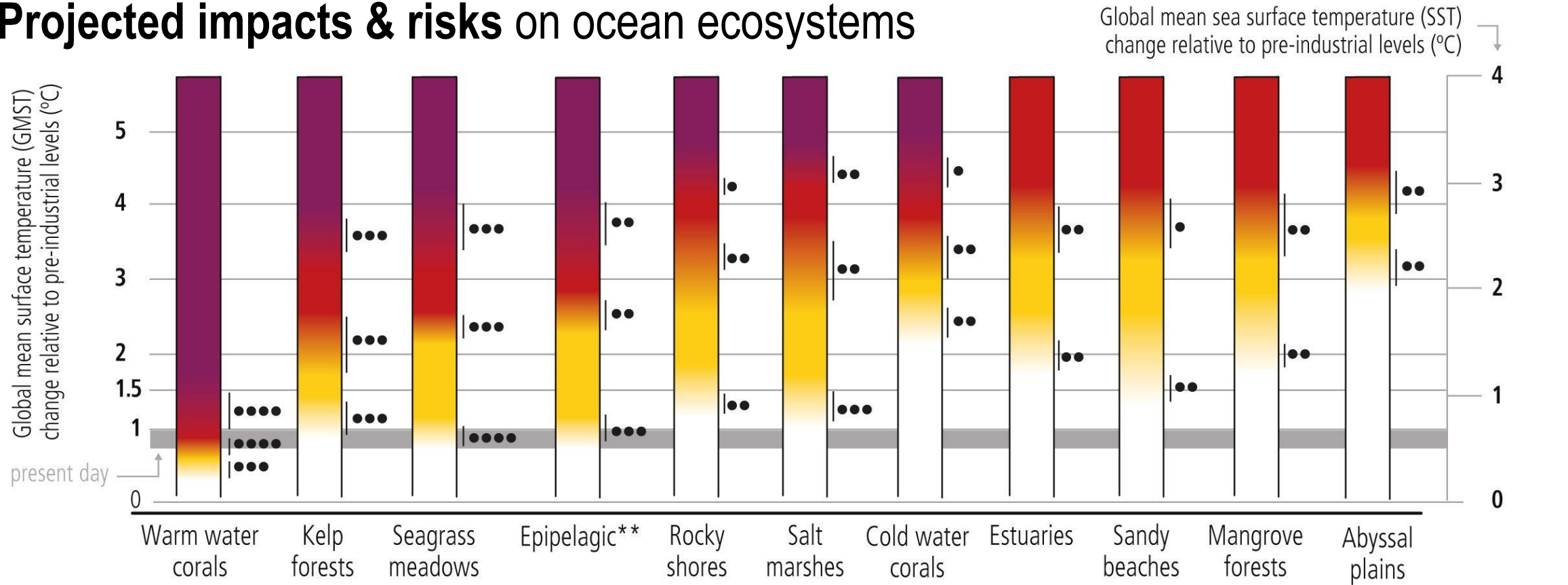
(c) Maximum fisheries catch potential

RCP 2.6 (low emissions)

RCP 8.5 (high emissions)



Projected impacts & risks on ocean ecosystems

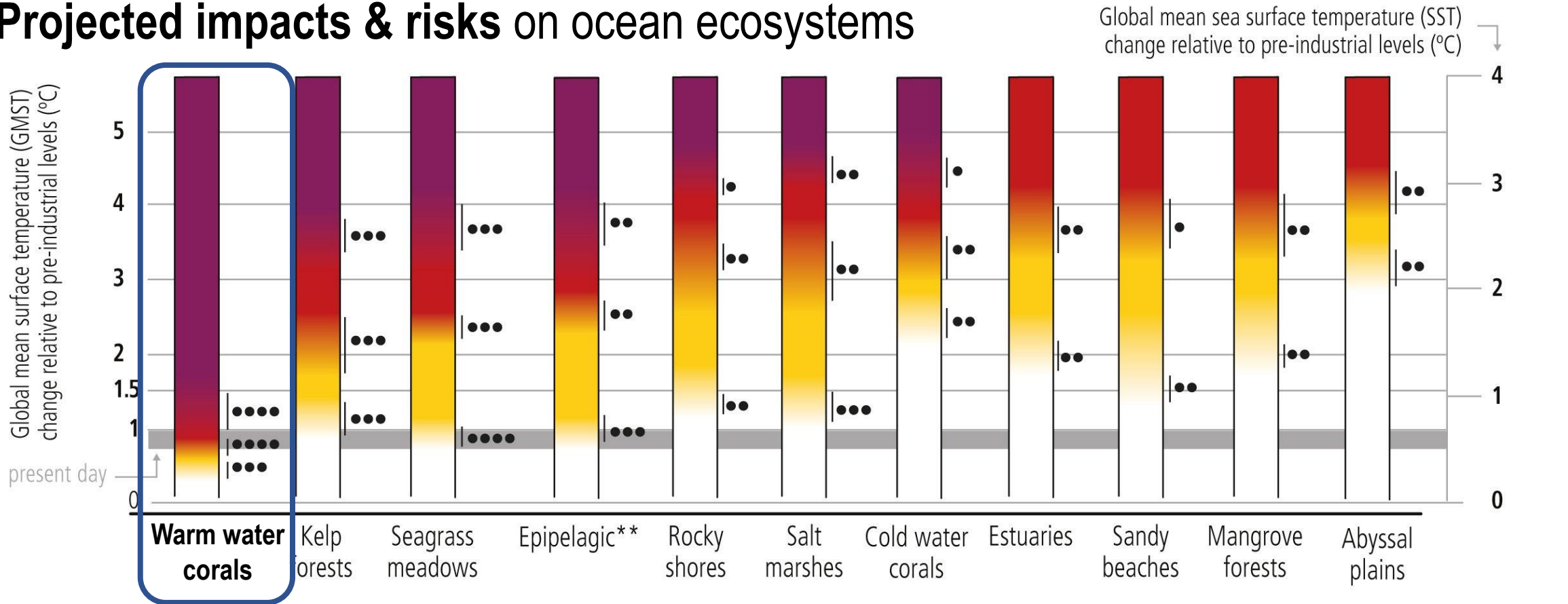


SPM Fig 3d

Confidence level for transition

- = Very high
- = High
- = Medium
- = Low
- | = Transition range

Projected impacts & risks on ocean ecosystems

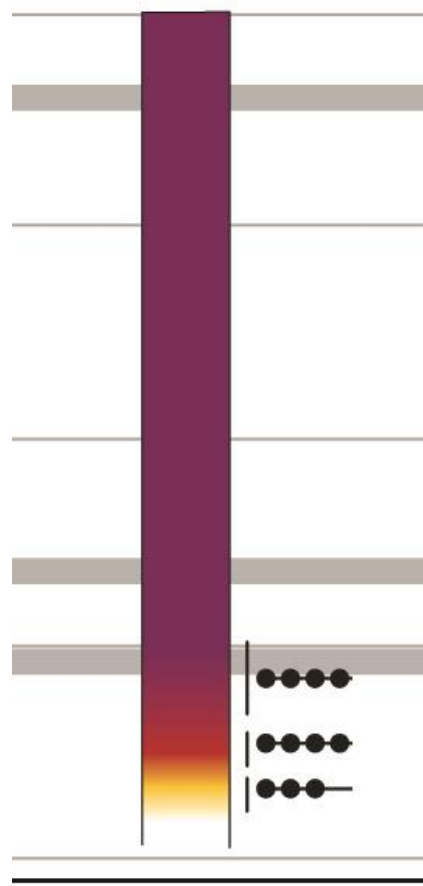
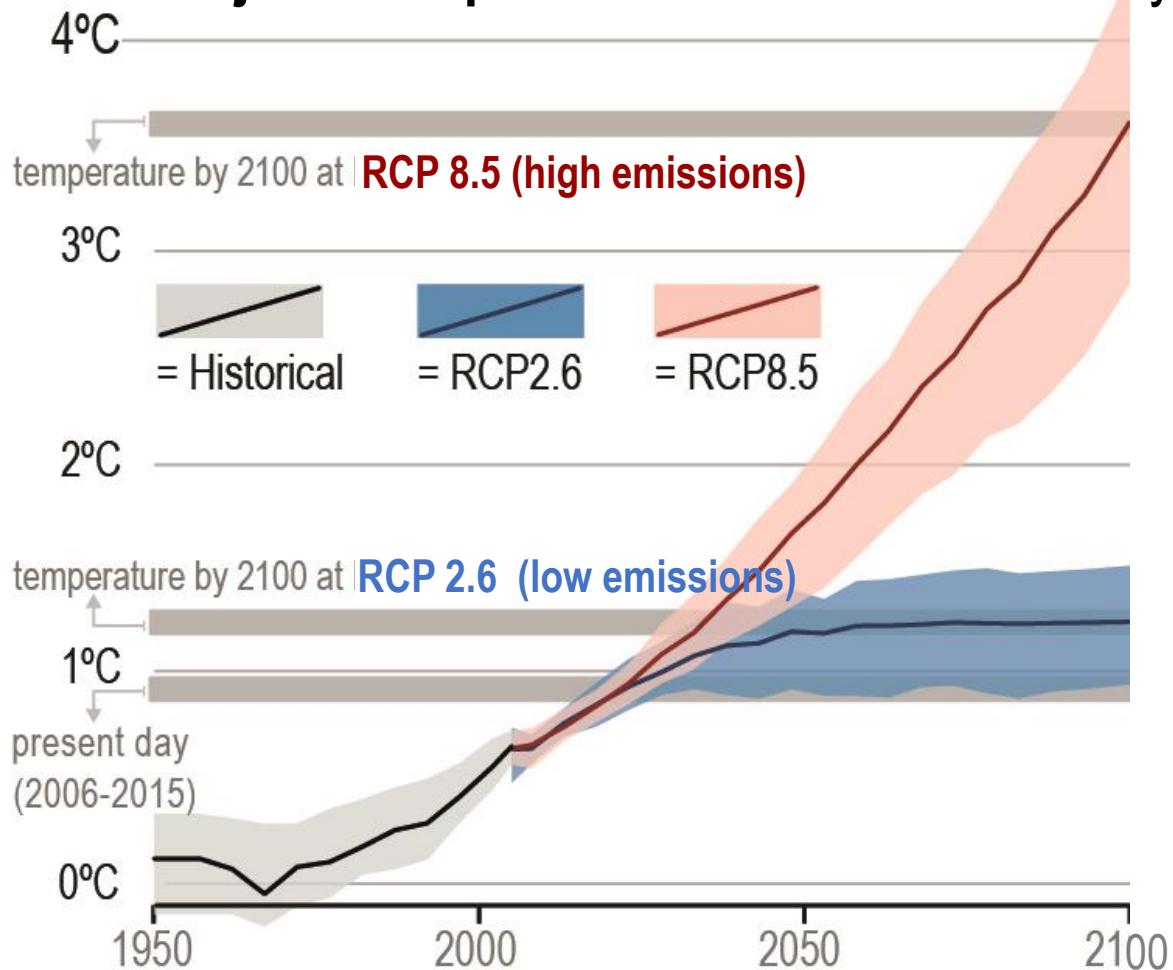


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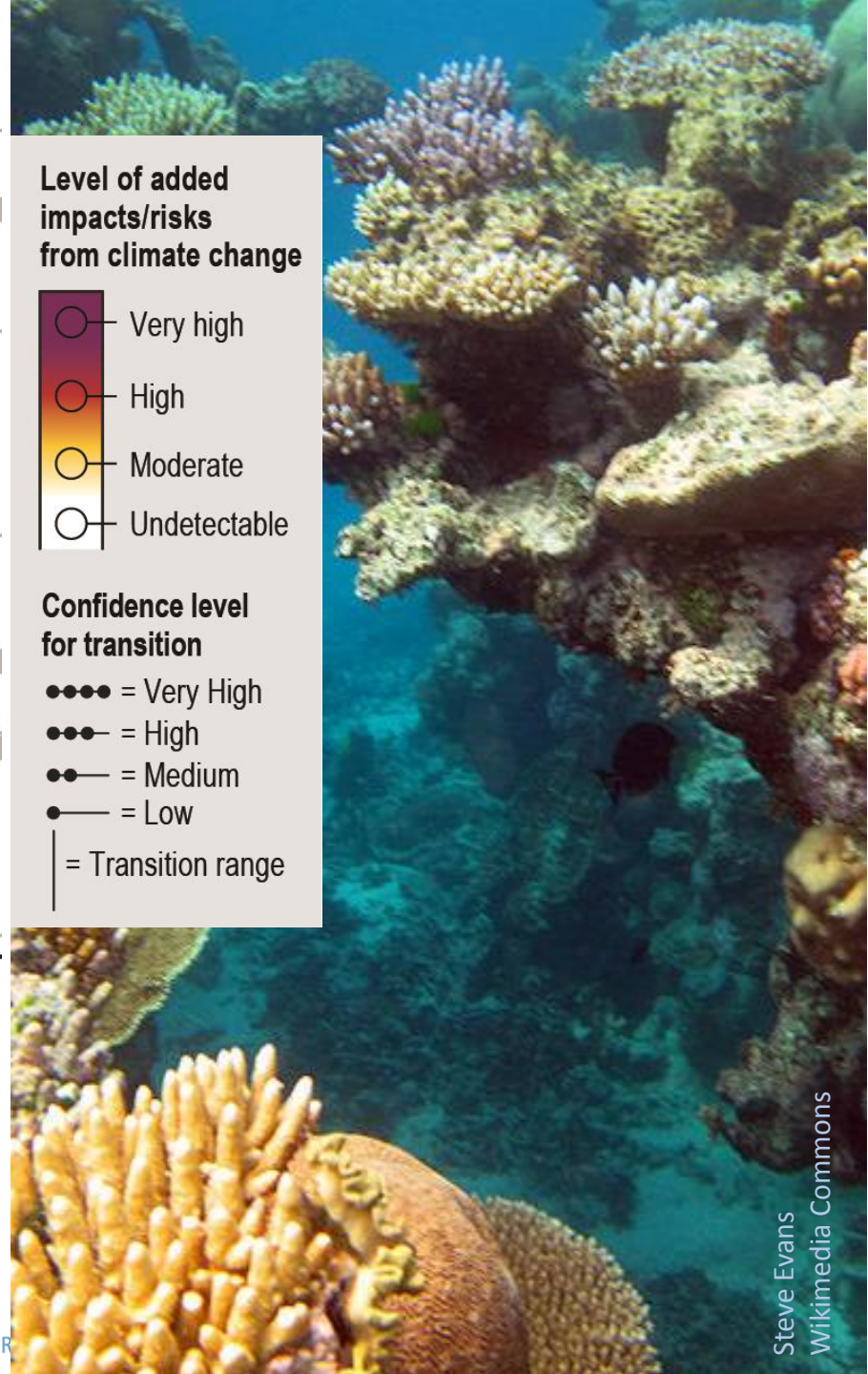


Level of added impacts/risks from climate change

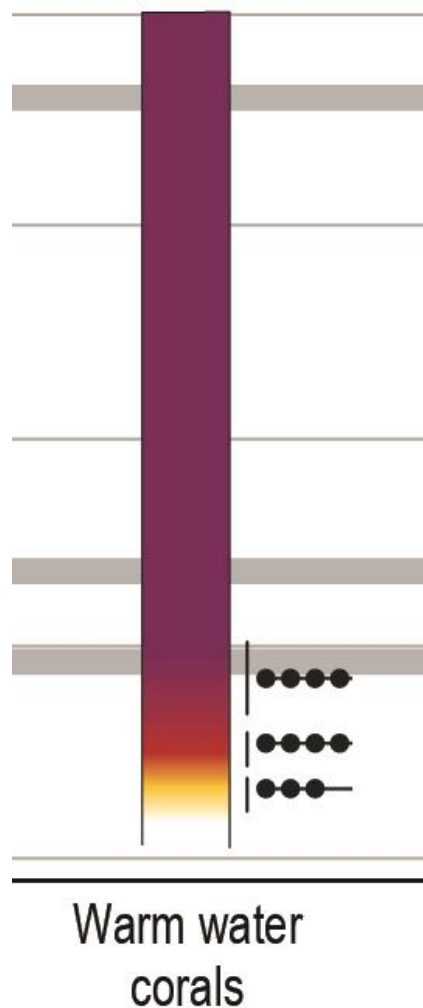
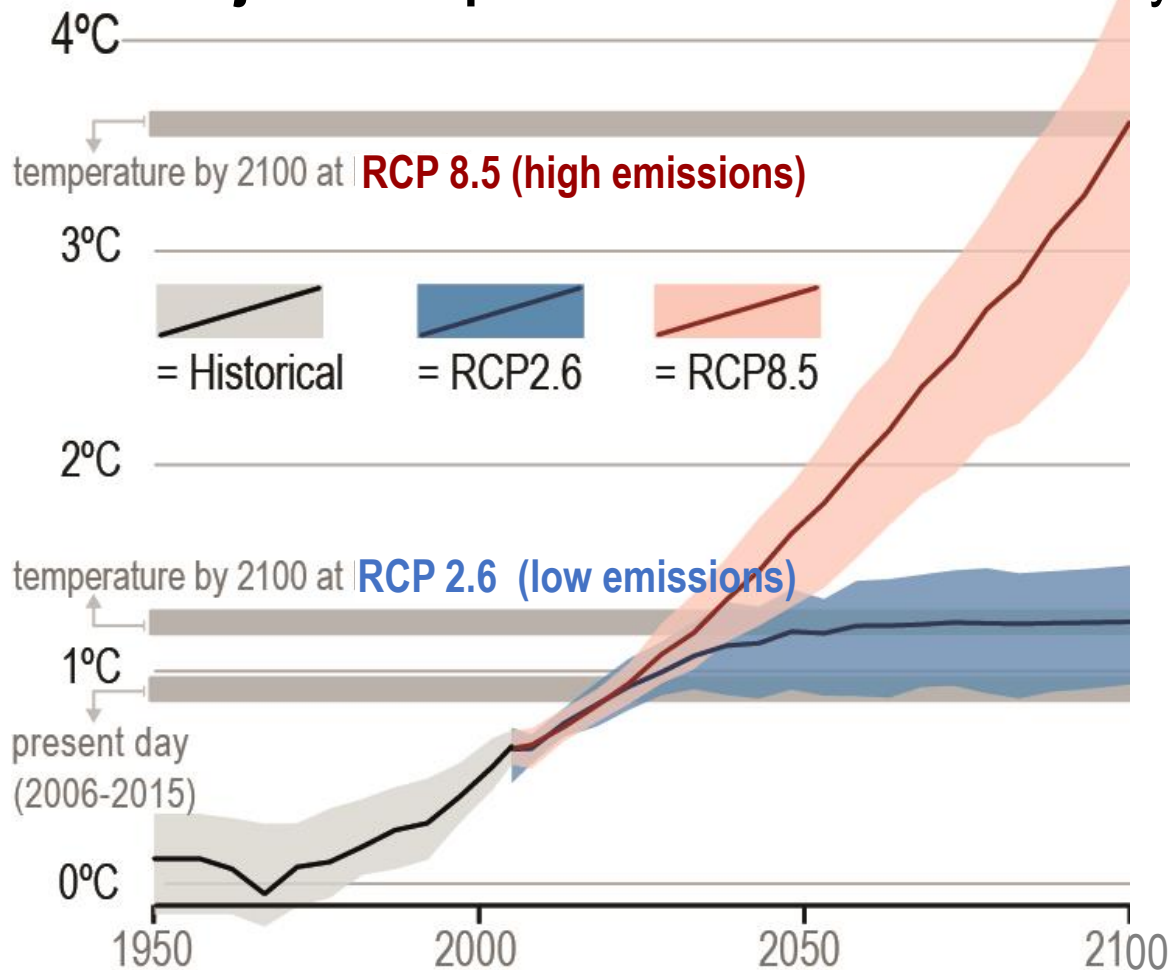
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Projected impacts & risks on ocean ecosystems



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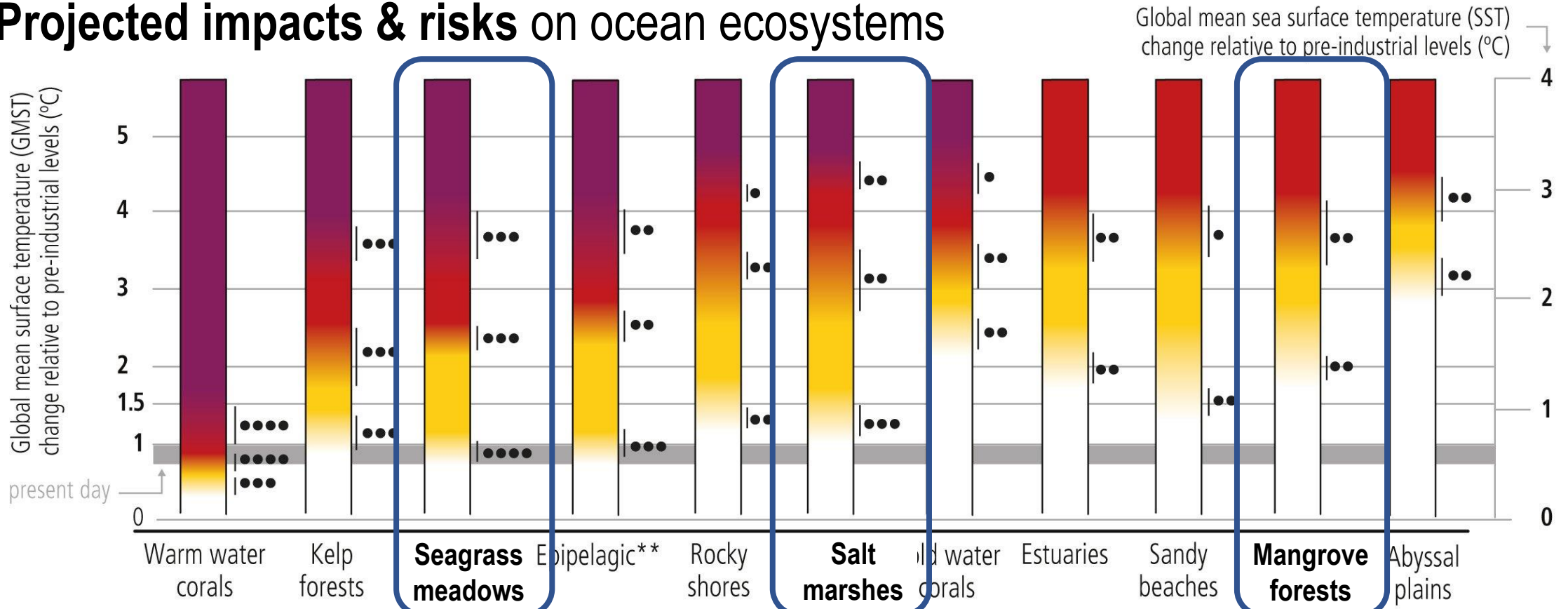
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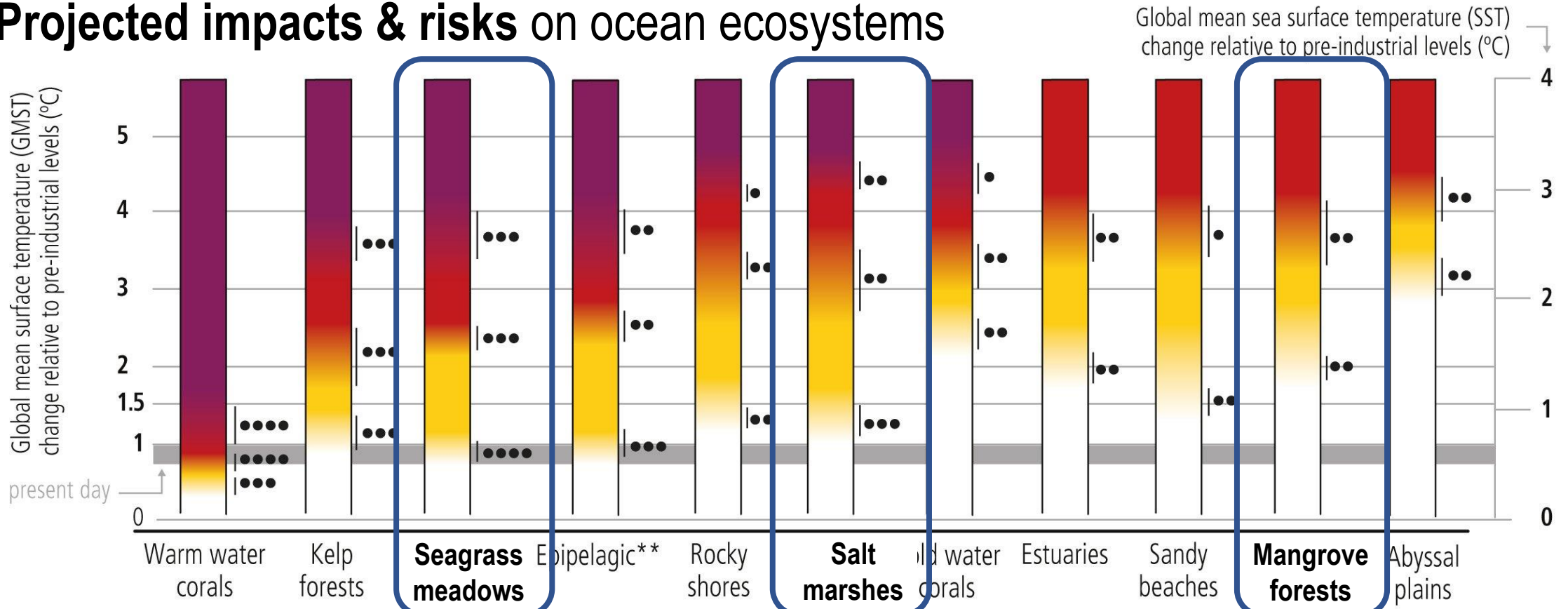
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Warm water corals are already being seriously affected by warming (heat waves causing coral bleaching), ocean acidification and storm damage – as well as pollution and other stressors

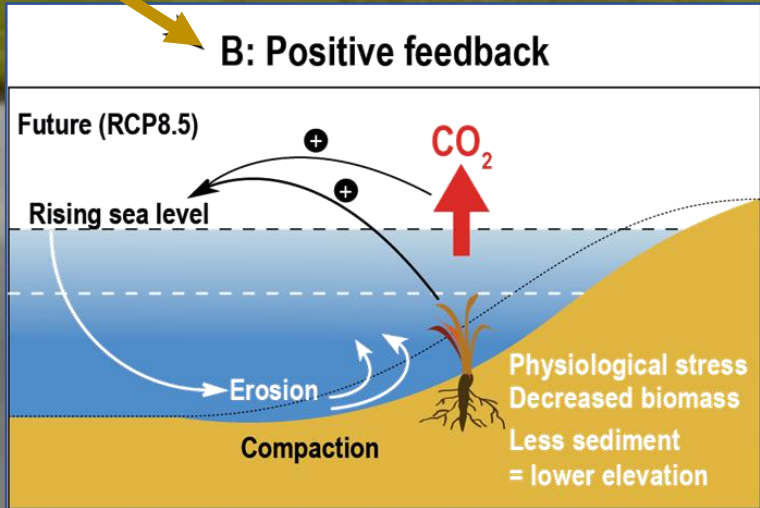
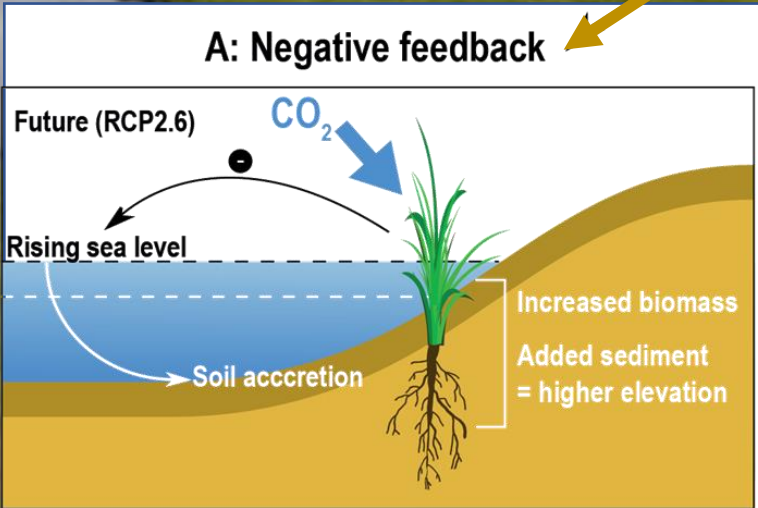
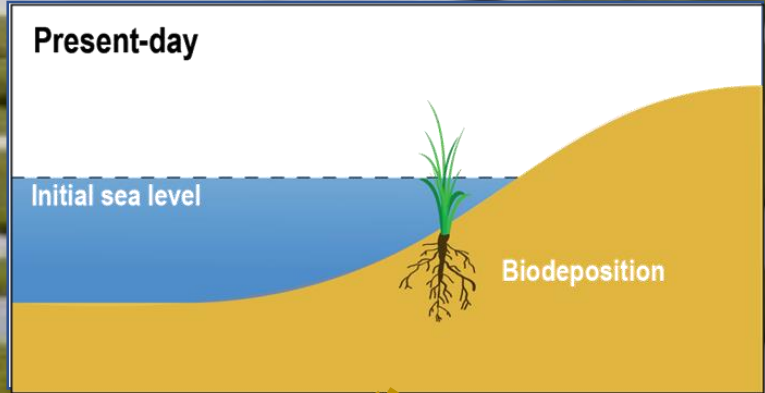
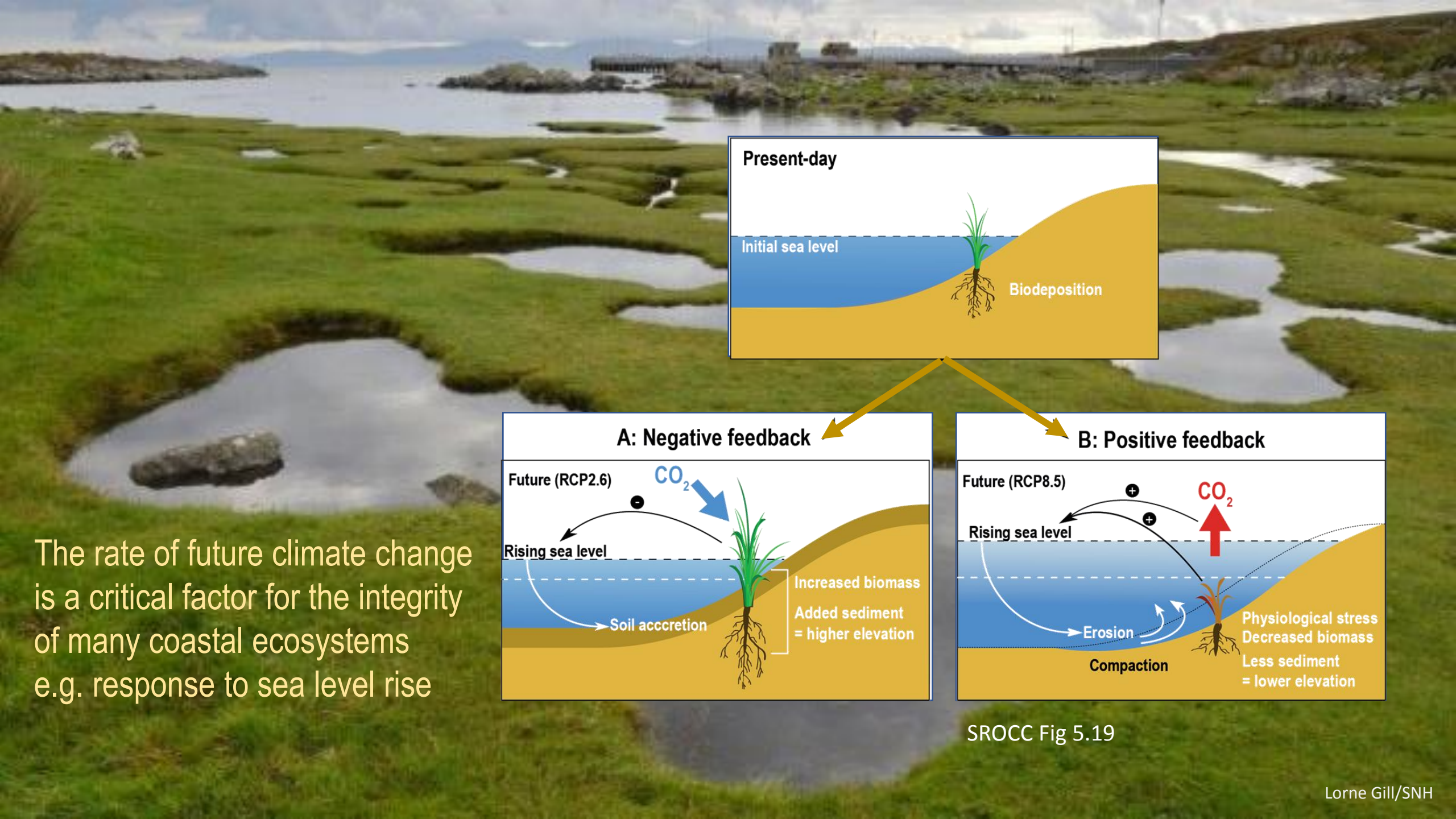
Projected impacts & risks on ocean ecosystems



Projected impacts & risks on ocean ecosystems



'blue carbon' ecosystems provide coastal protection, carbon storage & biodiversity support



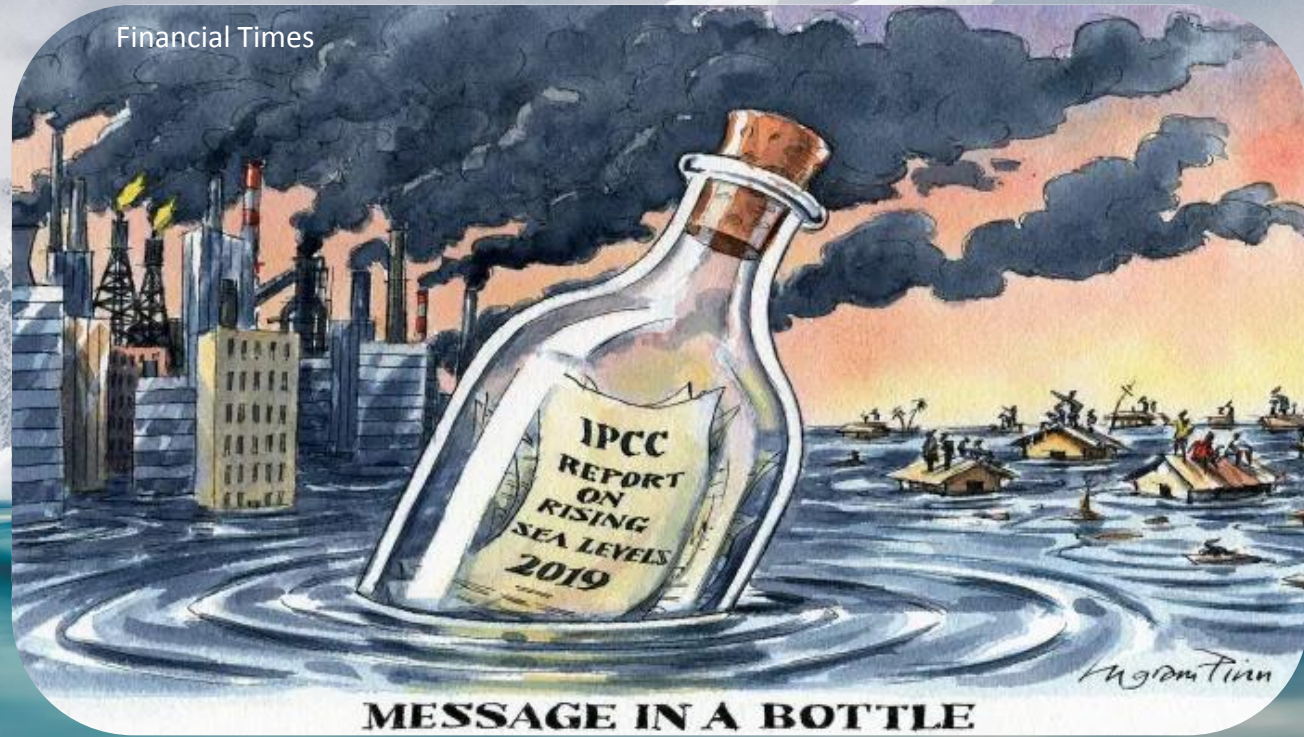
The rate of future climate change is a critical factor for the integrity of many coastal ecosystems e.g. response to sea level rise

SROCC Fig 5.19



"This assessment reveals the benefits of ambitious mitigation and effective adaptation for sustainable development ... [and] highlights the urgency of prioritising timely, coordinated and enduring action (*very high confidence*)" SROCC SPM C4.7





Thanks for your attention!

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