UNIVERSITY of HOUSTON

# Marine Environment Intervention Technologies and Legal Issues

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Climate Intervention Law
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ipcc
INTERGOVERNMENTAL PANEL ON climate change

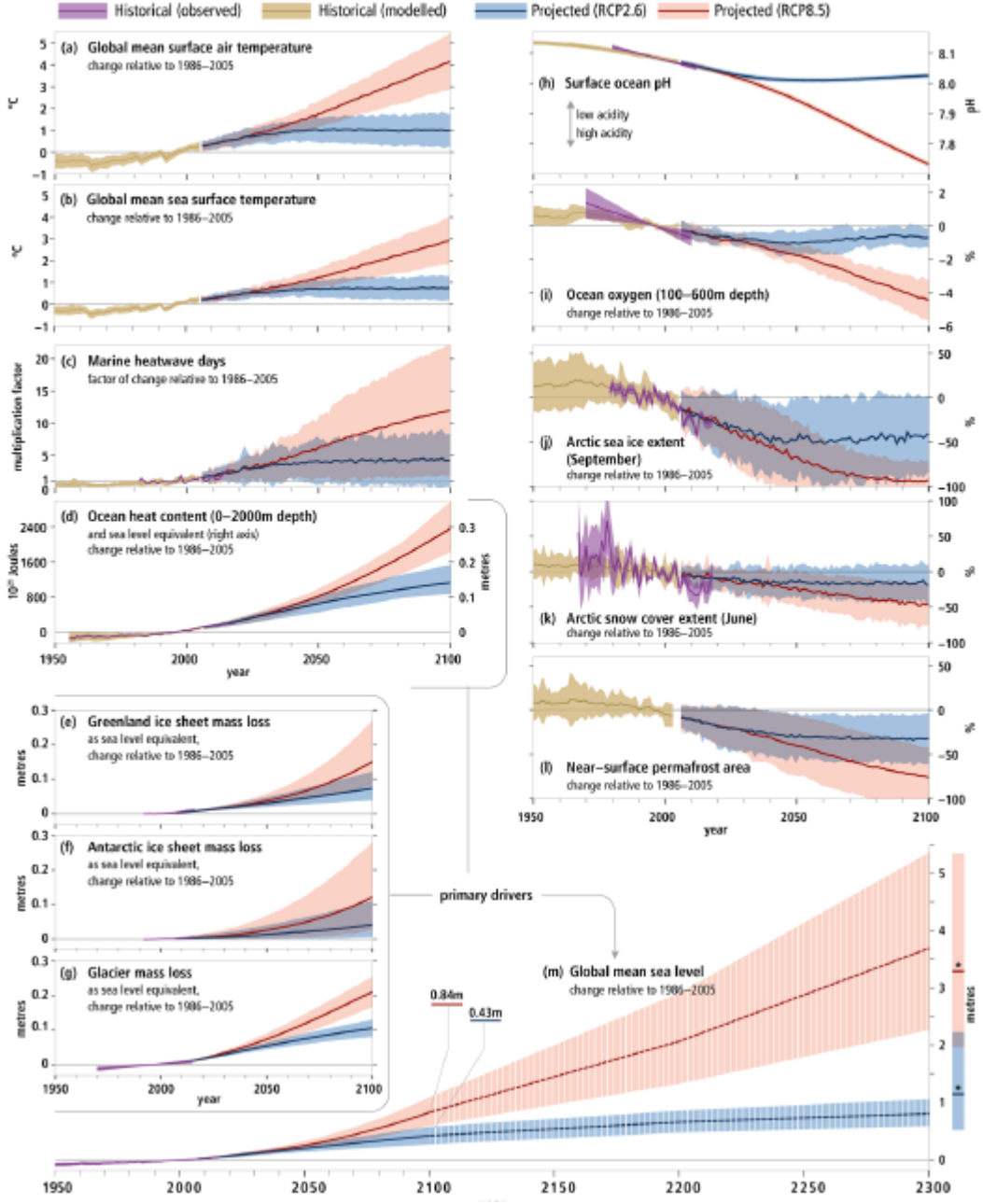
# The Ocean and Cryosphere in a Changing Climate

This Summary for Policymakers was formally approved at the Second Joint Session of Working Groups I and II of the IPCC and accepted by the 51th Session of the IPCC, Principality of Monaco, 24th September 2019

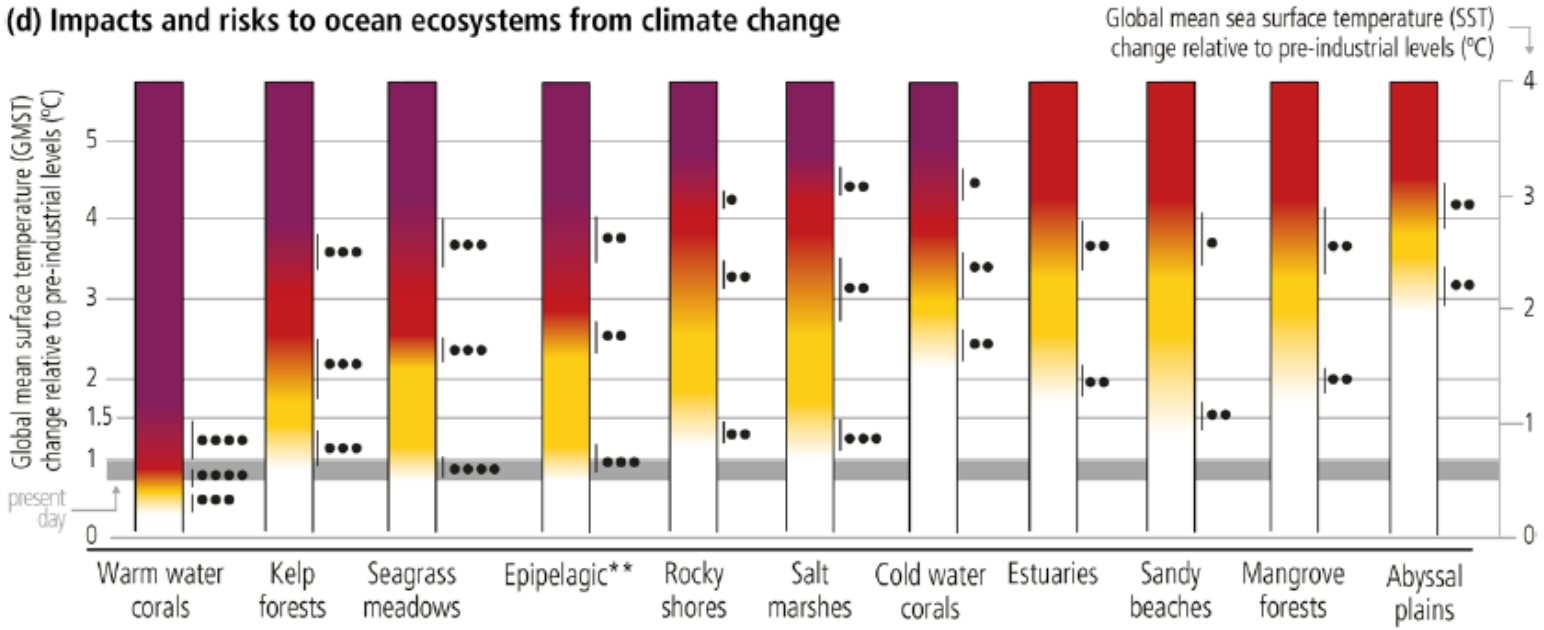
## Summary for Policymakers

# Past and future changes in the ocean and cryosphere

Historical changes (observed and modelled) and projections under RCP2.6 and RCP8.5 for key indicators



## (d) Impacts and risks to ocean ecosystems from climate change




**Level of added impacts/risks**

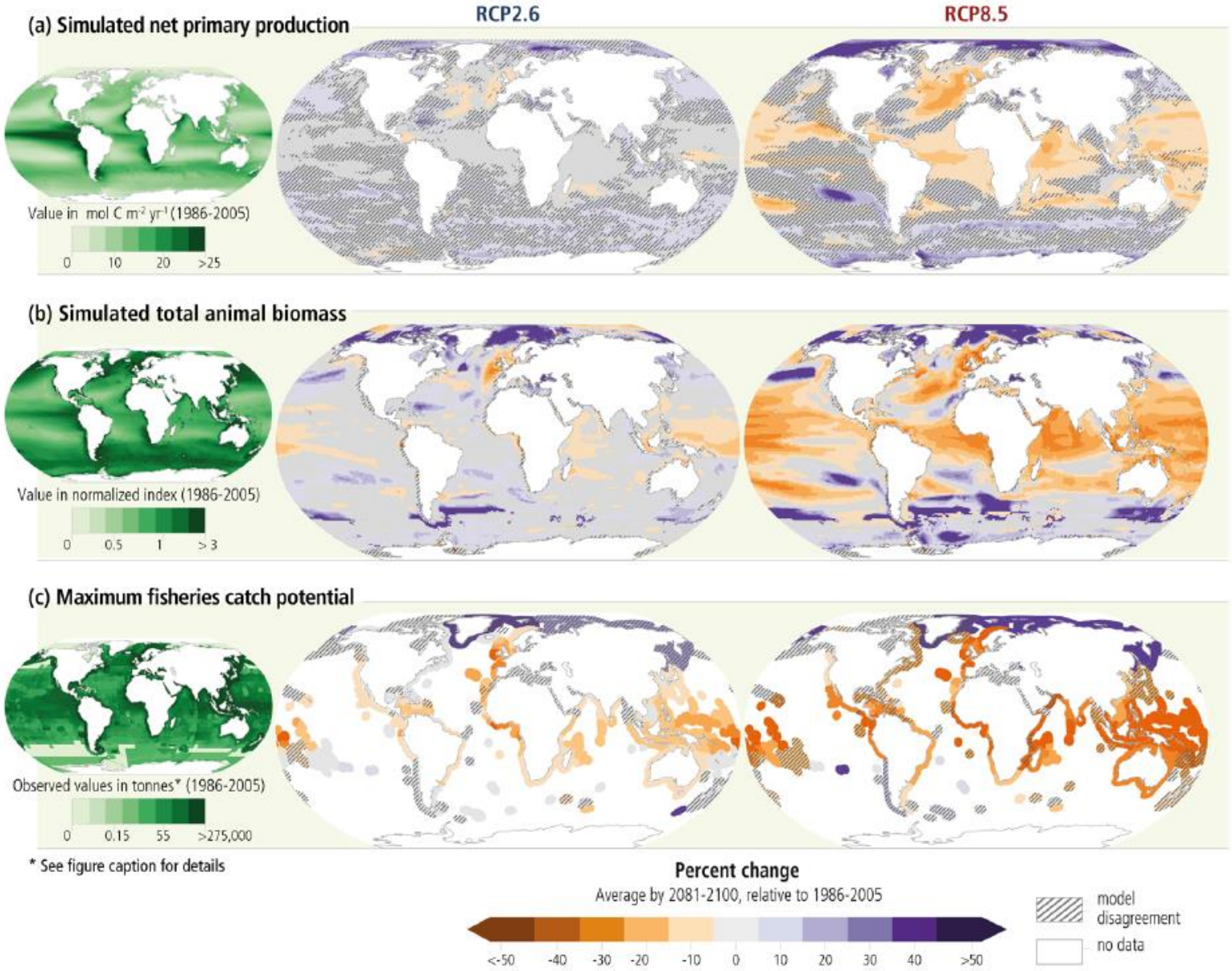
- **Very high** — Purple: Very high probability of severe impacts/ risks and the presence of significant irreversibility or the persistence of climate-related hazards, combined with persistence of climate-related hazards, combined with limited ability to adapt due to the nature of the hazard or impacts/risks.
- **High** — Red: Significant and widespread impacts/risks.
- **Moderate** — Yellow: Impacts/risks are detectable and attributable to climate change with at least medium confidence.
- **Undetectable** — White: Impacts/risks are undetectable.

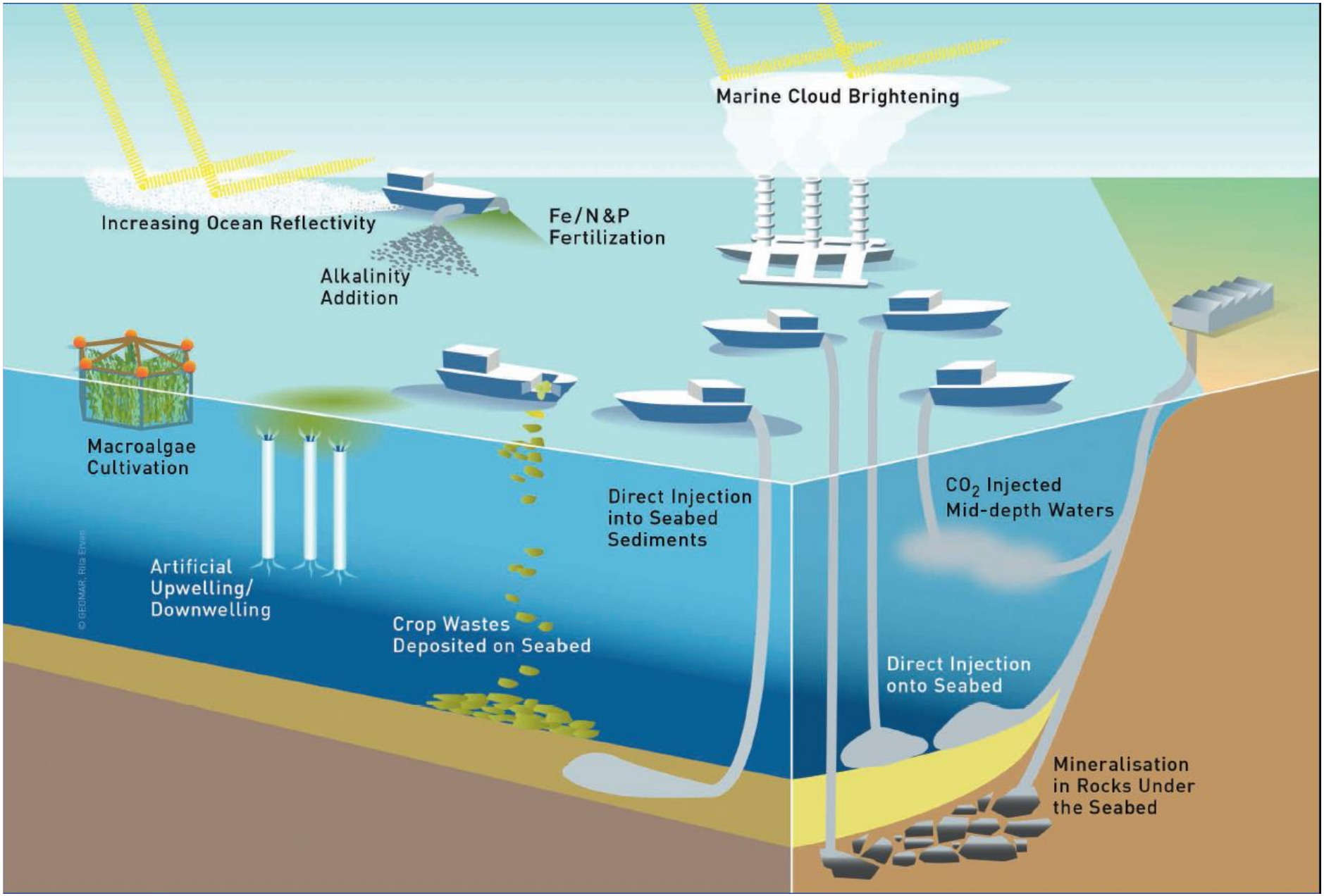
**Confidence level for transition**

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

**see figure caption for definition

# Projected changes, impacts and risks for ocean ecosystems as a result of climate change




Marine Cloud Brightening
Increasing Ocean Reflectivity
Fe/N&P
Fertilization
Alkalinity
Addition
Macroalgae
Cultivation
Direct Injection
into Seabed
Sediments
$CO_2$ Injected
Mid-depth Waters
Artificial
Upwelling/
Downwelling
Crop Wastes
Deposited on Seabed
Direct Injection
onto Seabed
Mineralisation
in Rocks Under
the Seabed
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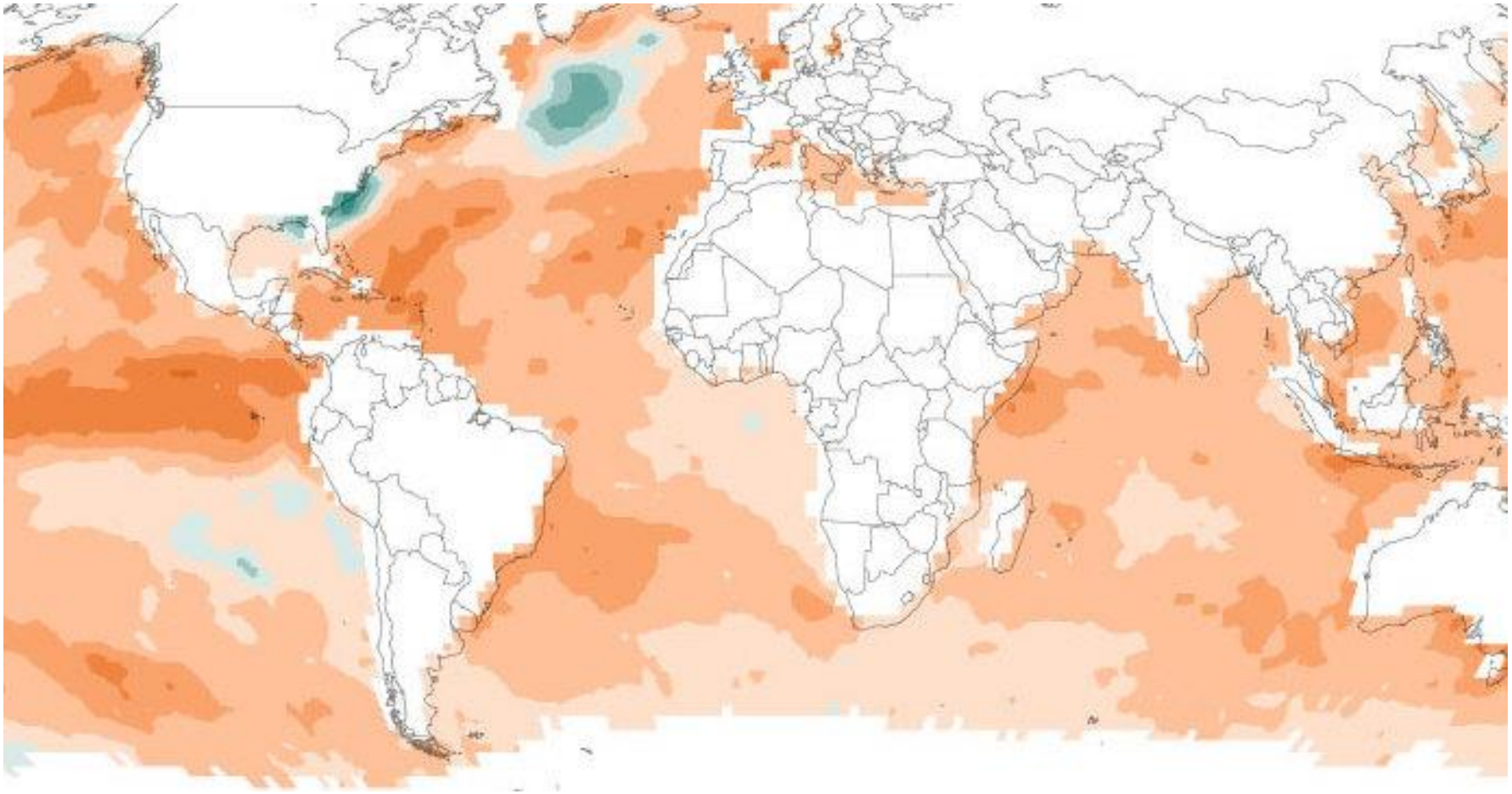
# Review - International Laws for Using the Ocean to Alter the Atmosphere

- Paris Agreement
- UN Convention on the Law of the Sea (UNCLOS)
- Customary International Law
- London Convention/London Protocol
- *Do these laws still apply if an actor alters the ocean to benefit the ocean itself, rather than indirectly affect the atmosphere?*

# Climate Change and Marine Impacts

- Sea level rise (will discuss polar impacts later)
- Acidification
- Increased Upwelling
- Hotspots
- Marine heat waves



# Additional International Instruments for Direct Alteration of Marine Environments

- Convention on Biological Diversity (1993)
  - Three goals:
    - Conservation of biological diversity
    - Sustainable use of elements of biological diversity
    - Fair and equitable sharing of benefits from use of genetic resources
  - Biodiversity deemed “a common concern of mankind”
  - Precautionary principle extended

# The CBD and Marine Environment Intervention

- COP Decision X/33 (Oct. 2010)
  - Para. i(2) – parties agree to ensure that “no climate-related geo-engineering activities that may affect biodiversity take place until there is an adequate scientific basis to justify such activities”
  - Exception for “small scale scientific research studies in controlled setting” with thorough prior impact review”
  - Note – footnote 3 includes solar insolation and CCS “on a large scale that may affect biodiversity,” but expressly excludes CCS

# Marine Intervention Technologies

- Direct Alkalinization
- Accelerated weathering
- Direct CO2 removal from seawater
- Marine Cloud Brightening
- Artificial upwelling

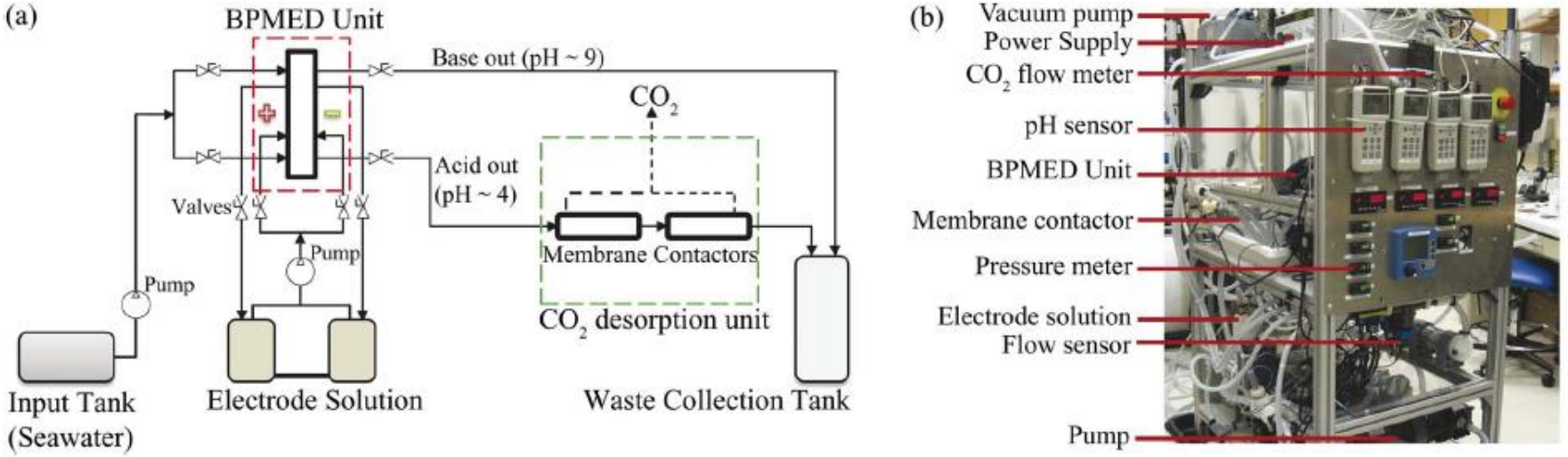



**Fig. 1** (a) Schematic of the experimental setup. BPMED = bipolar membrane electrodialysis. (b) Photo of experimental setup.

# Applications

- Can a state add large quantities of alkaline materials to its coastal waters to offset acidification?
  - “Dumping”? “Pollution”?
  - Do climate treaties have anything to say?
- Could Marine Cloud Brightening trigger any international legal limits? What factors would matter?
- What if marine intervention might aid an endangered species? Improve its habitat?