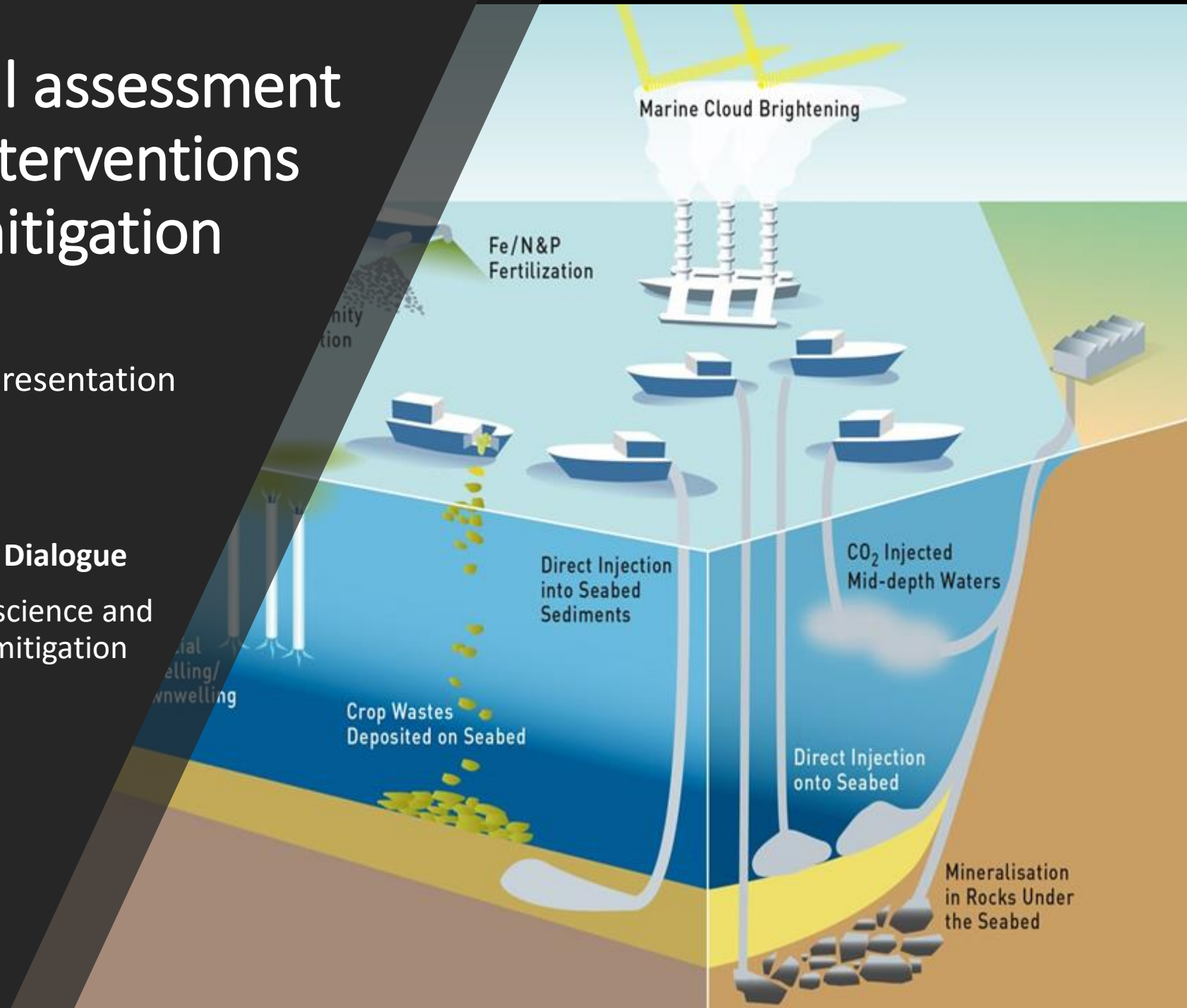
Scientific and societal assessment of potential ocean interventions for climate change mitigation

IOC – IMO - WMO - GESAMP - C2G Presentation

Twelfth Meeting of the SBSTA Research Dialogue

Science for global net-zero: Updates on science and enhancing understanding to accelerate mitigation and adaptation

24-25 November 2020

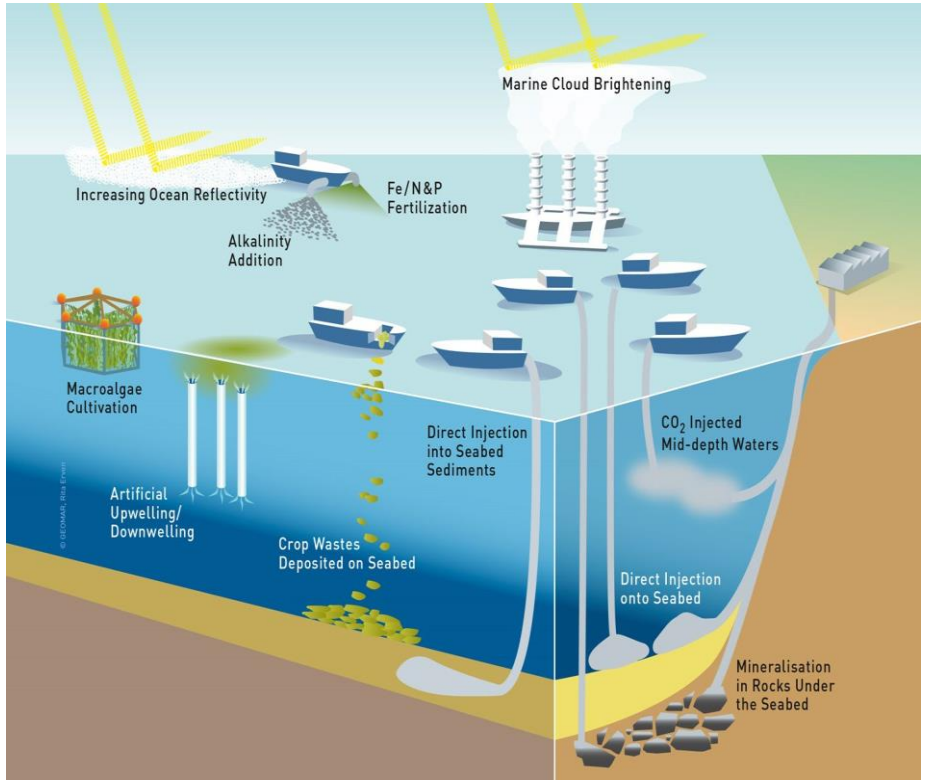


Ocean interventions for climate change mitigation

The Paris Agreement calls for a dual approach to limiting warming to 2C or less using both emissions reductions and the enhancement of sinks for greenhouse gases.

WHY USE THE MARINE ENVIRONMENT?

- The vast scale, depth and surface area of the ocean are viewed by those interested in climate intervention as properties with potential to devise and develop marine climate intervention approaches.
- ~25% of anthropogenic CO_2 emissions is taken up by the ocean and over the last twenty years proposals have emerged on the potential to enhance this uptake e.g. through marine climate intervention.



"deliberate intervention in the planetary environment of a nature and scale intended to counteract anthropogenic climate change and its impacts".

GESAMP

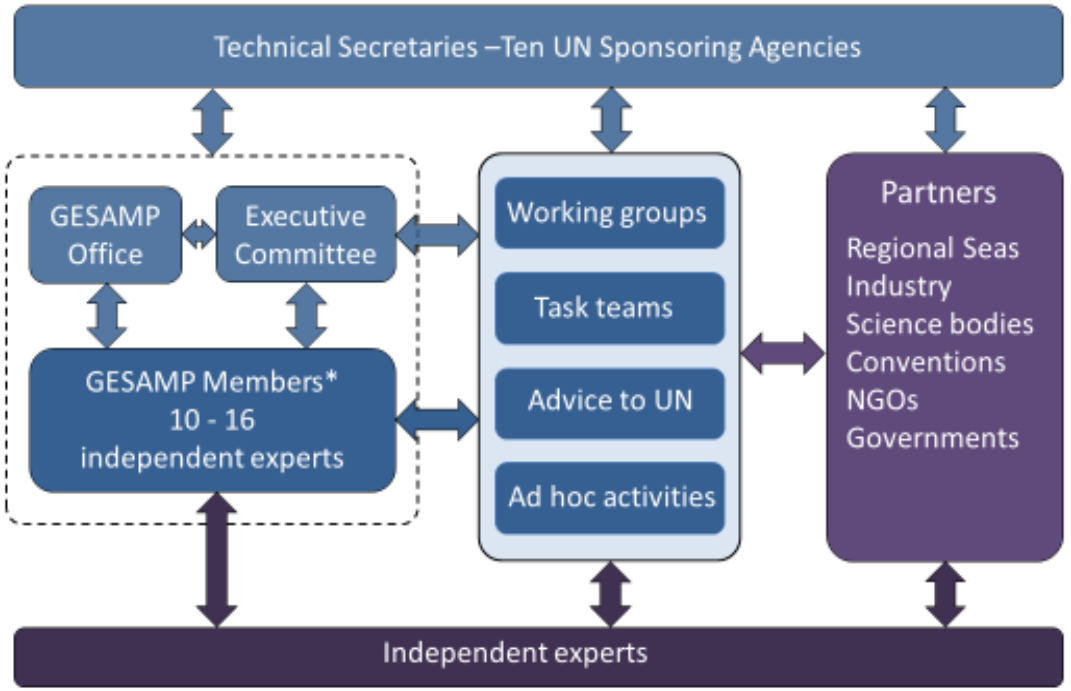
The Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection

GESAMP
Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection

An inter-agency body of the United Nations established in 1969

Purpose: '*to provide authoritative, independent, interdisciplinary scientific advice to organizations and governments to support the protection and sustainable use of the marine environment.*'

How GESAMP functions



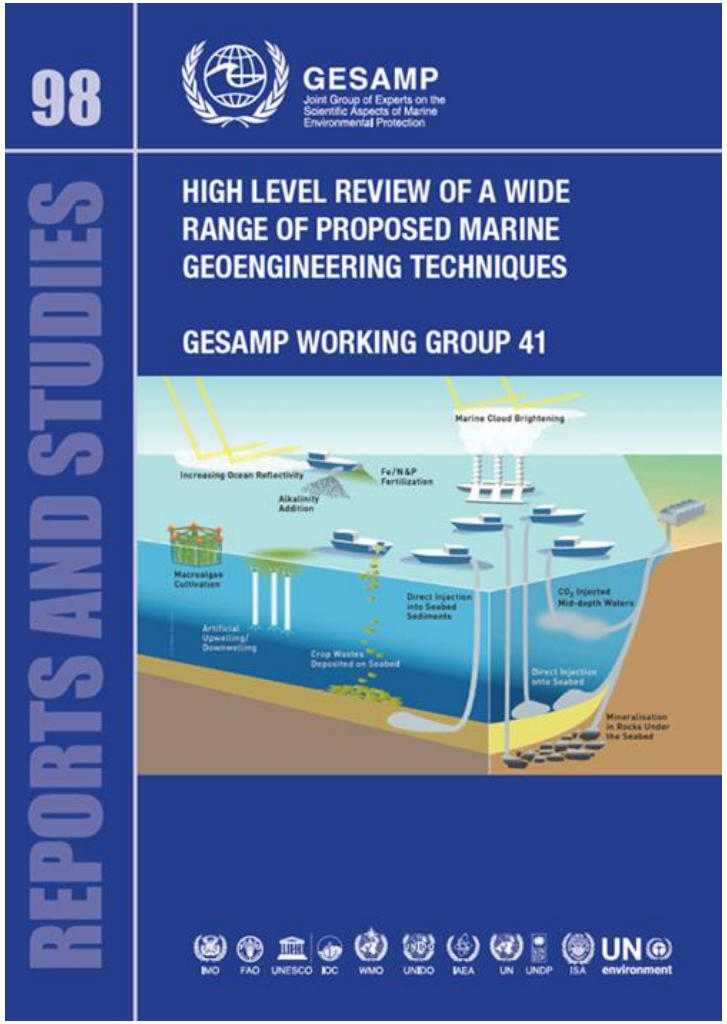
IMO INTERNATIONAL MARITIME ORGANIZATION · FAO · UNESCO · IOC · WMO · UNIDO · IAEA · UN · UNDP · ISA · UN environment

GESAMP Working Group 41 on 'Ocean Interventions for Climate Change Mitigation' (formerly the Working Group on Marine Geoengineering)

WG 41 objectives:

1. Better understand the potential environmental and socio-economic impacts of different marine climate intervention approaches: and
2. To provide advice to the London Protocol Parties to assist them in identifying those marine climate intervention techniques that it might be sensible to consider for listing in the new annex 4 of the Protocol

LC&P
LONDON CONVENTION AND PROTOCOL



WG 41 first phase:

Carried out a '***High level review of a wide range of proposed marine geoengineering techniques***', published in March 2019.

This is the first study to comprehensively examine the many proposed ways in the marine environment to remove CO_2 from the atmosphere or boost the reflection of incoming solar radiation to space (termed "albedo modification") - or, in some cases, both.

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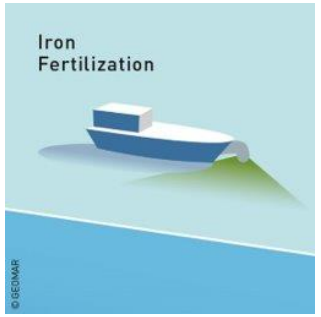
- The assessment catalogued 27 approaches and detailed 8 illustrative examples from the categories spanning Carbon Dioxide Removal (CDR), Albedo Modification (AM), and hybrid (i.e., for purposes extending beyond just CDR or AM) technologies
- The assessment framework for ocean fertilization developed by the London Convention and Protocol Parties was used as a template for assessing the different approaches in the study
- Information available on the approaches varied widely from just concepts to multiple scientific papers
- There was insufficient information on the approaches examined to permit a robust scientific assessment and therefore insufficient knowledge for evidence-based decision-making



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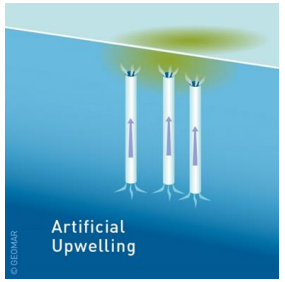
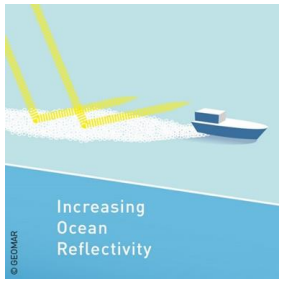
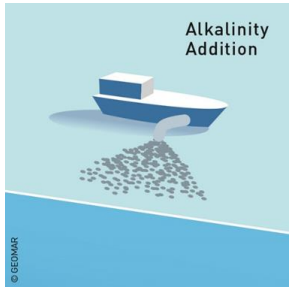
- WG 41 did not find compelling evidence at this time for the practical implementation of any marine climate intervention techniques for enhancement of carbon sequestration by the ocean!



- To overcome this major knowledge deficit, WG41 attempted to provide guidelines for proponents of climate intervention approaches on the steps needed to support an evidence-based assessment

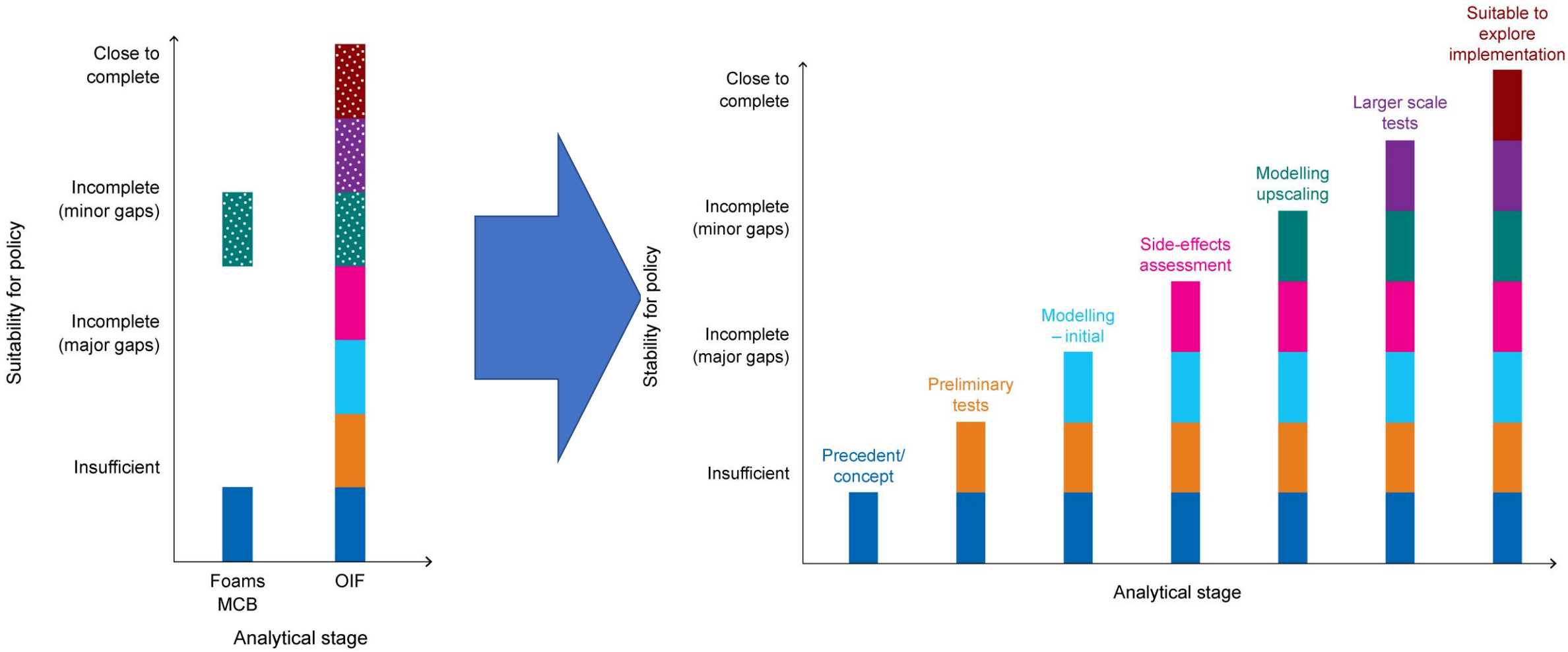


- Despite widespread knowledge gaps, 8 illustrative approaches were evaluated using 8 criteria



Key recommendation:

A coordinated framework for proposing marine climate intervention activities, submitting supporting evidence, and integrating independent expert assessment must be developed. Incentives should be considered for proposers of ocean interventions for climate change mitigation to comprehensively report their approaches in the permanent public record.



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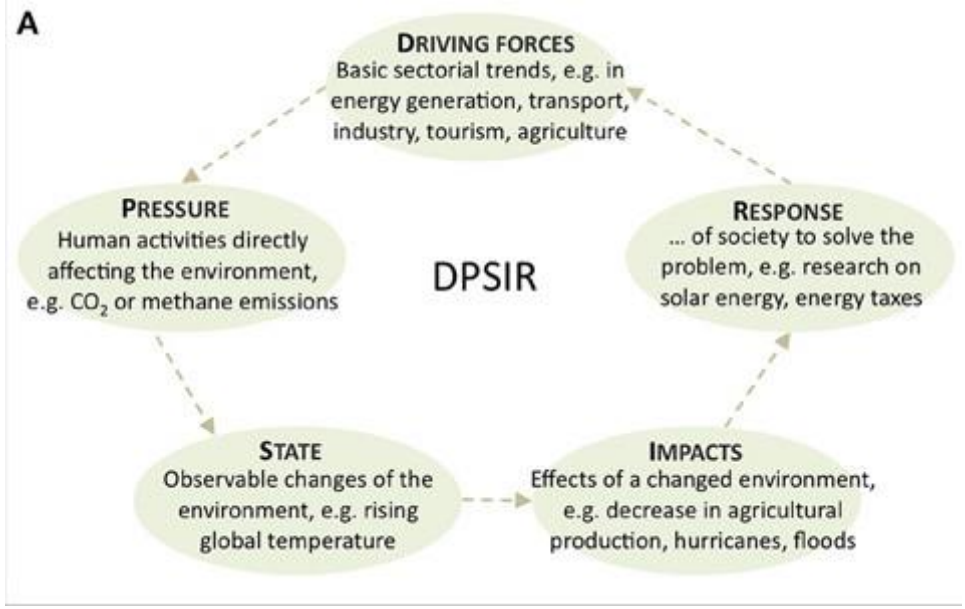
Another key recommendation from the report being taken forward in WG41's new Terms of Reference:

- To develop a framework to integrate inputs from natural sciences and societal disciplines into a holistic assessment of ocean interventions for climate change mitigation or other purposes consistent with the London Protocol's definition of marine geoengineering, to be used by regulators, policy-makers, funders or anyone considering or permitting proposals, exploring the use of a systems approach framework e.g. Elliott *et al.* (2020).



Drivers-Pressures-State change-Impact-Response (DPSIR) framework Patricio et al. Front. Mar. Sci., 14 September 2016

Elliott, M., Borja, A. and Cormier, R. (2020) Managing marine resources sustainably: A proposed integrated systems analysis approach. Ocean and Coastal Management 197, 105315. https://doi.org/10.1016/j.ocecoaman.2020.105315

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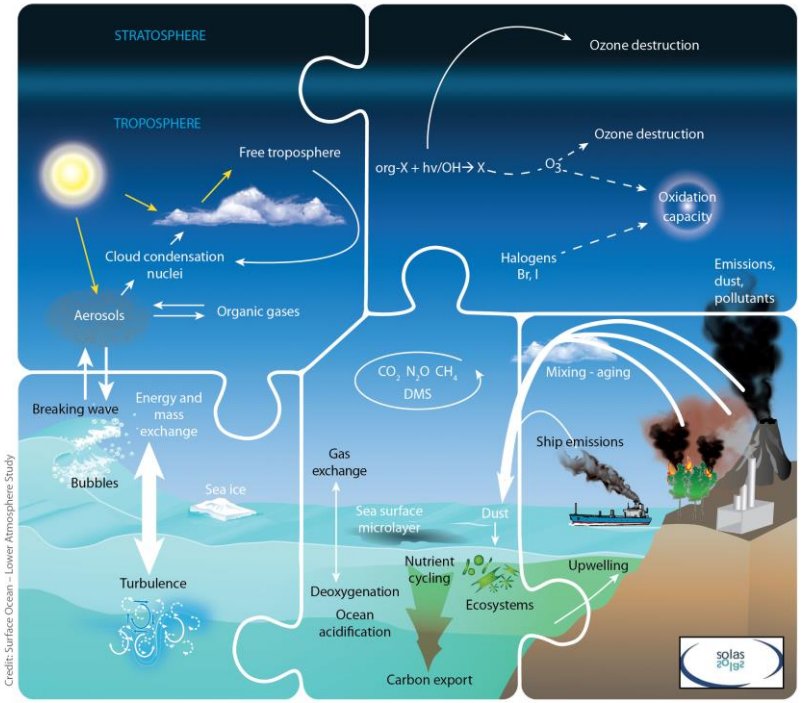
Another new goal is to stimulate information gathering to fill the widespread knowledge gaps, enabling robust scientific assessment and improved modelling simulations, at ocean basin scale and multiple decades.

This requires better dialogue between modellers and observationalists/experimentalists to improve model accuracy.

For example **SOLAS** – an ongoing multidecadal international project
Sponsored by SCOR, WCRP, Future Earth and ICACGP

*Understanding the **key biogeochemical-physical interactions and feedbacks between the ocean and atmosphere**, and how this affects and is affected by climate and environmental change*



And the WCRP sponsored **CDR-MIP modelling project**

The Carbon Dioxide Removal Model Intercomparison Project (CDR-MIP) brings together models of the Earth system in a common framework to explore the potential, impacts, and challenges of CDR. CDR-MIP experiments include

CDR-induced climate "reversibility"
CDR potential of proposed approaches - e.g. afforestation/reforestation and ocean alkalinization.

Rik Wanninkhof, Co-Chair
Chris Sabine, Co-Chair

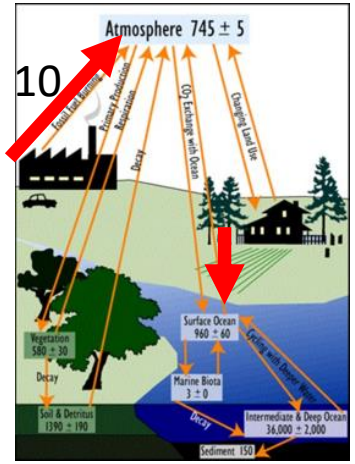
Integrated Ocean Carbon Research, IOC-R

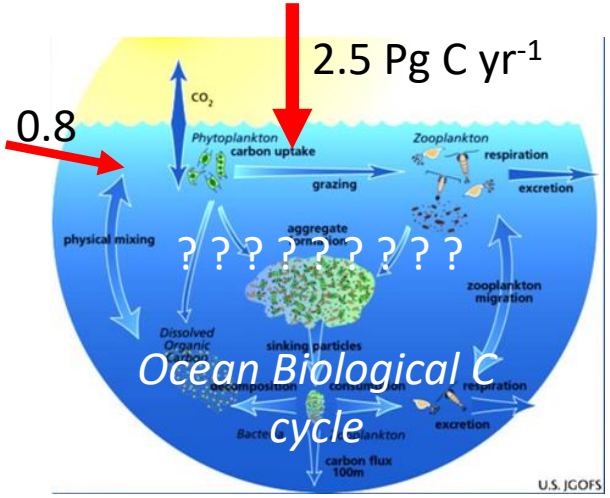
United Nations Educational, Scientific and Cultural Organization
Intergovernmental Oceanographic Commission

- Will the ocean uptake of anthropogenic carbon dioxide (CO_2) continue as primarily an abiotic process?
- What is the role of biology in the ocean carbon cycle?
- What are the exchanges of carbon between the land-ocean continuum and how are they evolving over time?
- How are humans altering the ocean carbon cycle, and what are the feedbacks?

Current

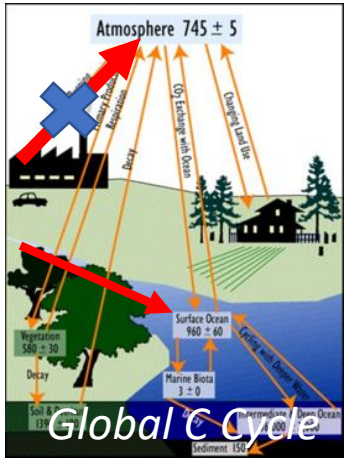
Decreasing uncertainty and understand processes

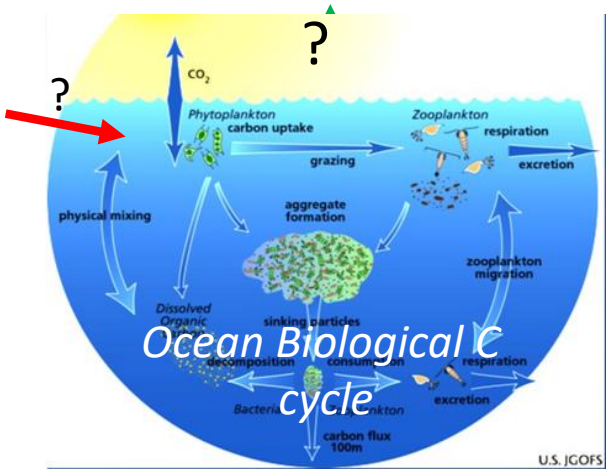




Future

Climate Mitigation and Ocean Ecosystem Health





Some Key Marine CDR Governance Challenges

Marine CDR techniques could occur within exclusive economic zones, territorial seas or the global commons giving rise to complex governance issues.

Effective governance would likely include broad participation in decision-making; transparency and access to information; as well as regulation at the international, national, and subnational levels

- Ensuring appropriate codes for conduct, safeguards and policy direction for research.
- Monitoring and attribution of impacts.
- Aligning multiple applicable governance frameworks.
- Effectively engaging stakeholders in meaningful dialogue.
- Resolving who decides when/if/under what conditions to move from research to deployment.
- Understanding the balance between the potential for harm and benefits of deployment.

Learn more from C2G's Marine Briefs and C2GLearn on-demand

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