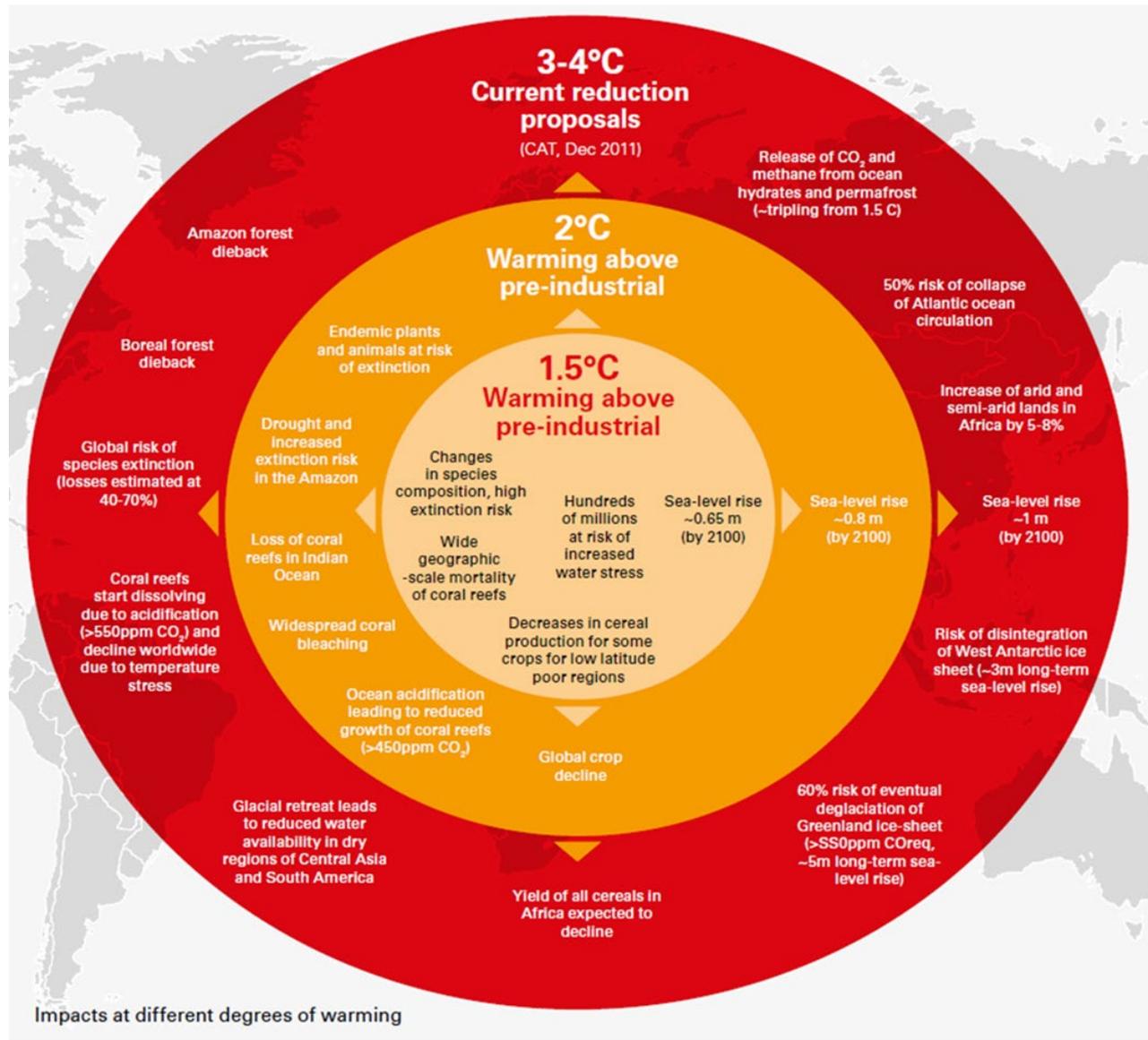




# Marine Geoengineering Options and Potential Governance

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**Wil Burns, Co-Executive Director**  
**Stetson University College of Law**  
**October 16, 2020**



Impacts at different degrees of warming

# “Climate Geoengineering”

*Geoengineering is the deliberate large-scale intervention in the Earth’s natural systems to counteract climate change.*

## **Oxford Geoengineering Programme**

*Attempted large scale human control of either biogeochemical cycles or the climate itself.*

**Robert G. Watts, Engineering Response to Global Climate Change (1997)**

# Categories of Geoengineering

## **Solar Radiation Management [SRM]**

Options that aim to reflect a small proportion of the Sun's energy back into space, counteracting the temperature rise caused by increased levels of greenhouse gases in the atmosphere that absorb energy and raise temperatures.

## **Carbon Dioxide Removal [CDR]**

Options that aim to remove carbon dioxide from the atmosphere and sequester or utilize it, directly countering the greenhouse effect that raises temperatures.

# Scientific/Political Support

- If the world cannot slow emissions or the effects of climate change are more extreme or occur sooner than expected, there may be demands to pursue additional climate-intervention technologies about which scientists need a better understanding,  
**Ralph J. Cicerone, President, National Academy of Sciences (2015)**
- Many low-GHG concentration scenarios rely on two [geoengineering] techniques, afforestation and biomass energy with carbon dioxide capture and storage, which some studies consider to be comparable with conventional mitigation methods  
**IPCC AR5, WGIII, Ch. 6 (2014)**
- Action is urgently needs on both emissions cuts and clear eyes research and assessment of Shortwave-Radiation Management.  
**Dr. David Keith, Harvard University (2009)**
- The first modelling results . . . call for active scientific research of the kind of geo-engineering.  
**Dr. Paul J. Crutzen, Max Planck Institute for Chemistry (2006)**
- [Geoengineering option] should not be off the table . . .  
**John Holdren, chief climate change advisor to President Obama (2009)**
- The future is bright for geoengineering.  
**Randy Weber (R-TX), Chair, Energy Subcommittee of the House Committee on Science, Space and Technology (2017)**



# ROADMAP

- SRM marine geoengineering options: potential benefits and risks
- Carbon dioxide removal geoengineering options: potential benefits and risks;
- Governance options for marine geoengineering approaches at the international level

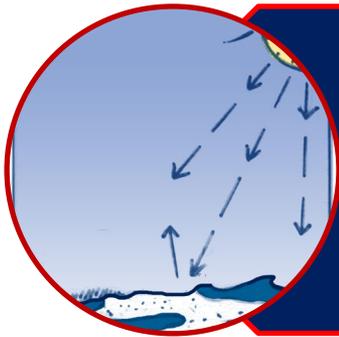




**SRM Options**

# Cloud-Brightening Vessels?

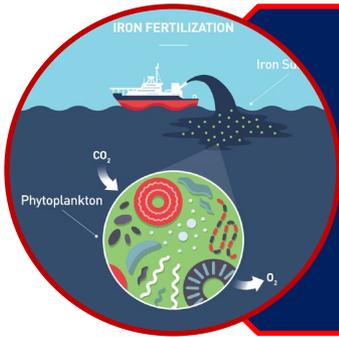




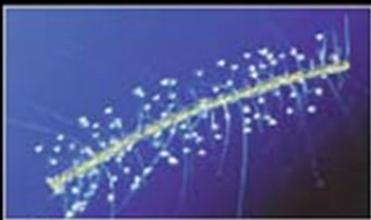
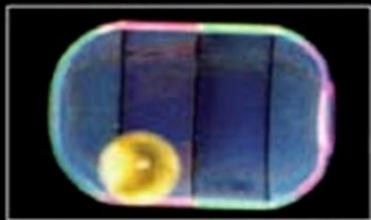
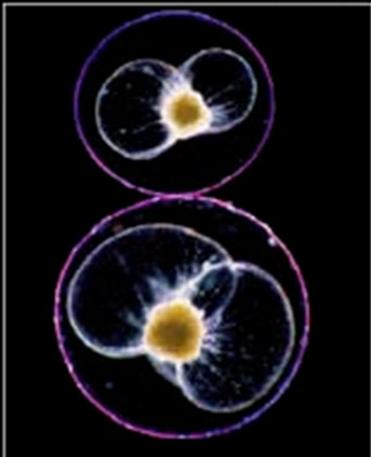
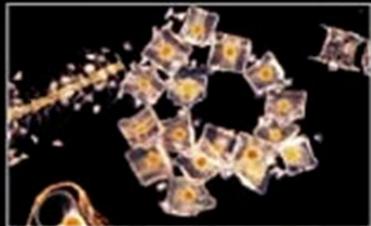
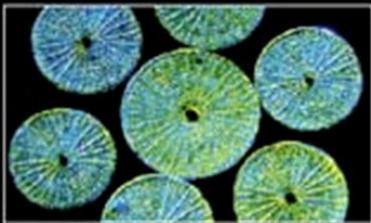
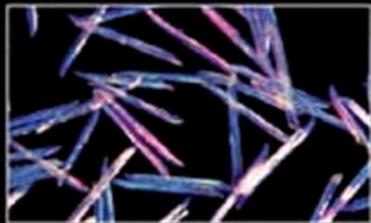
# Microbubbles/Foam



# Ocean Iron Fertilization



3D  
PHYTOPLANKTON

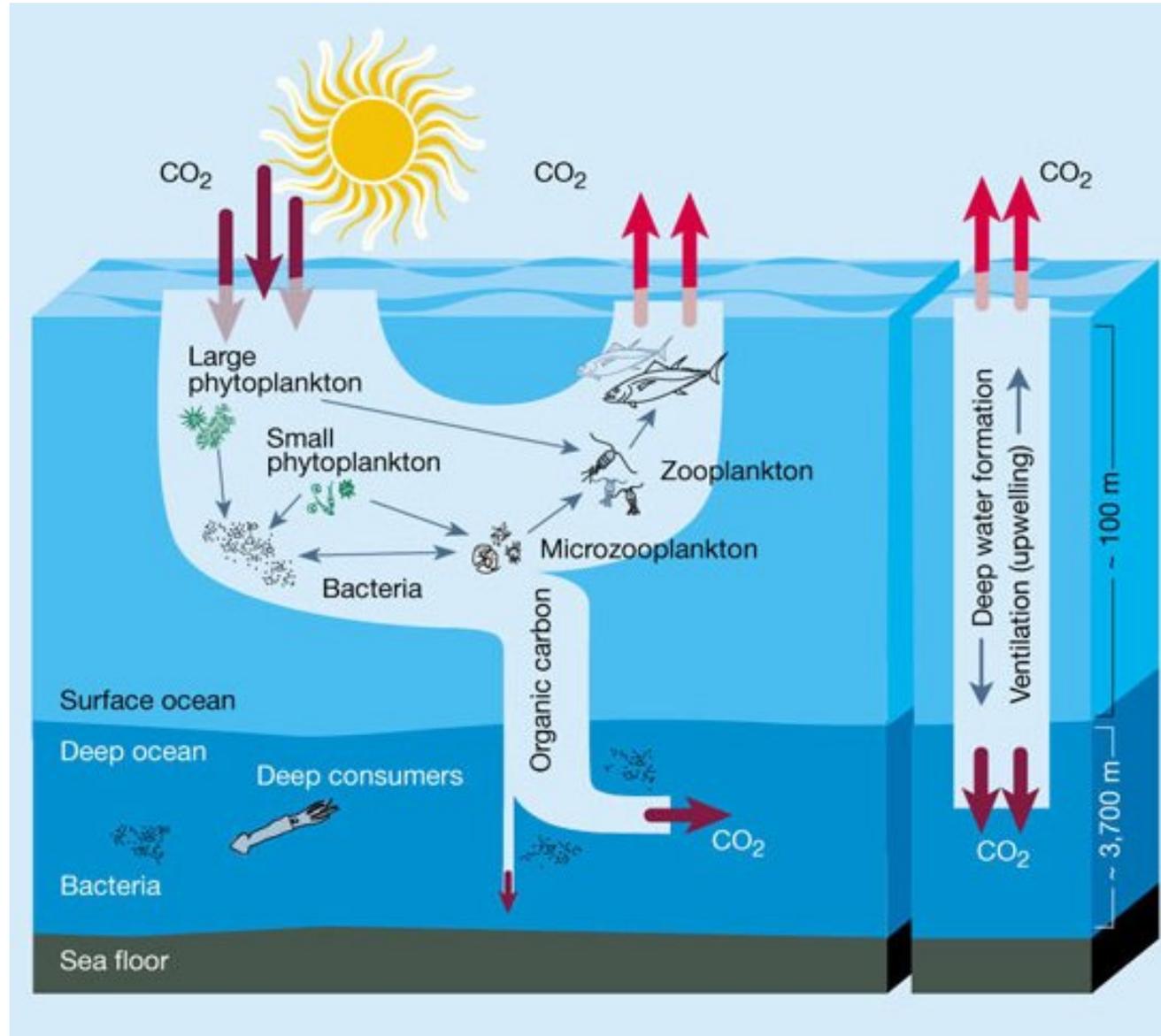
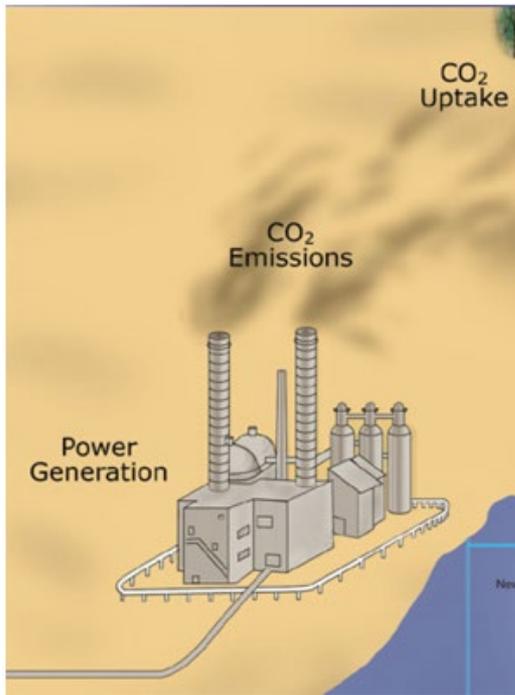


www.imagequest3d.com

# Phytoplankton



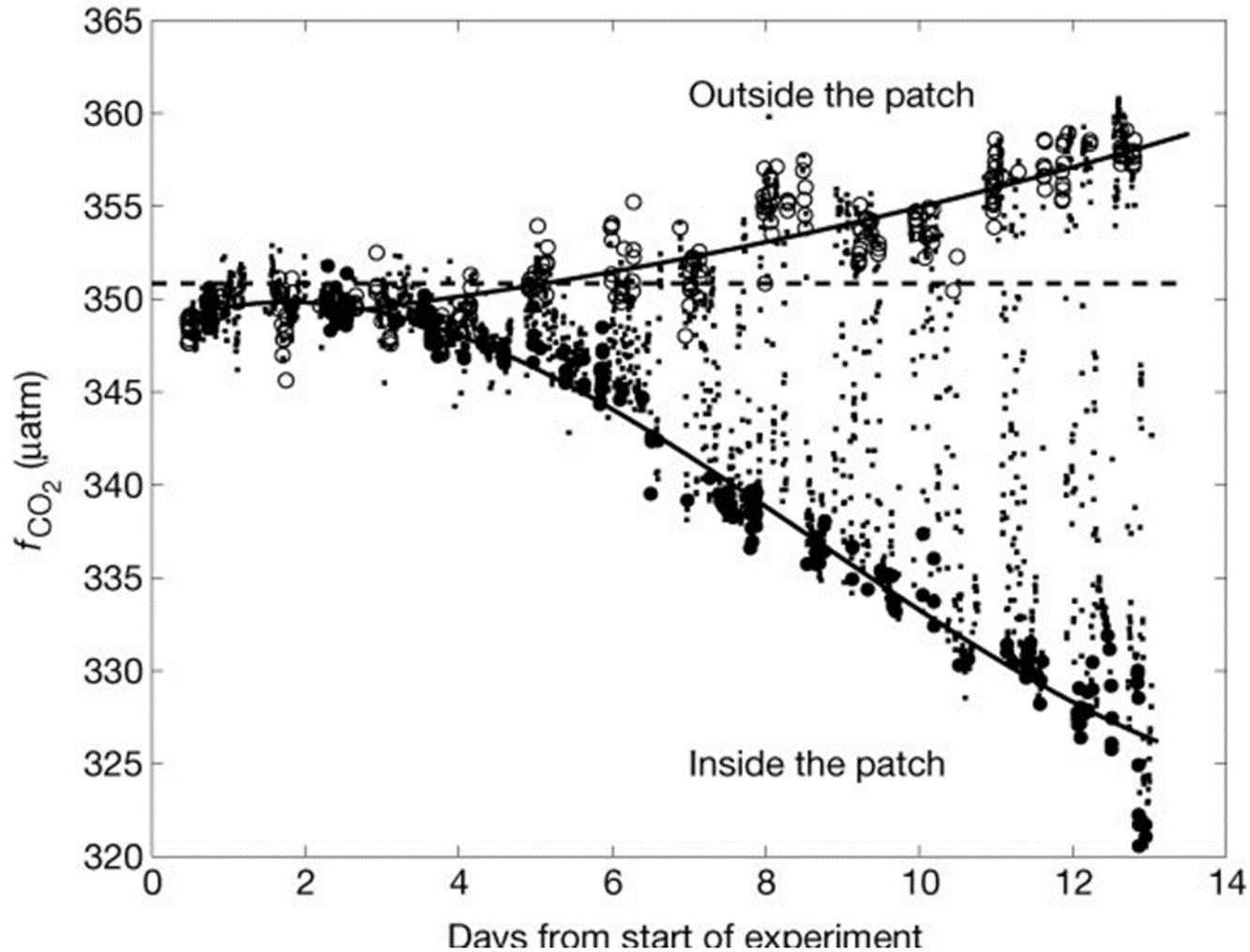
# The Ocean's "Biological Pump"



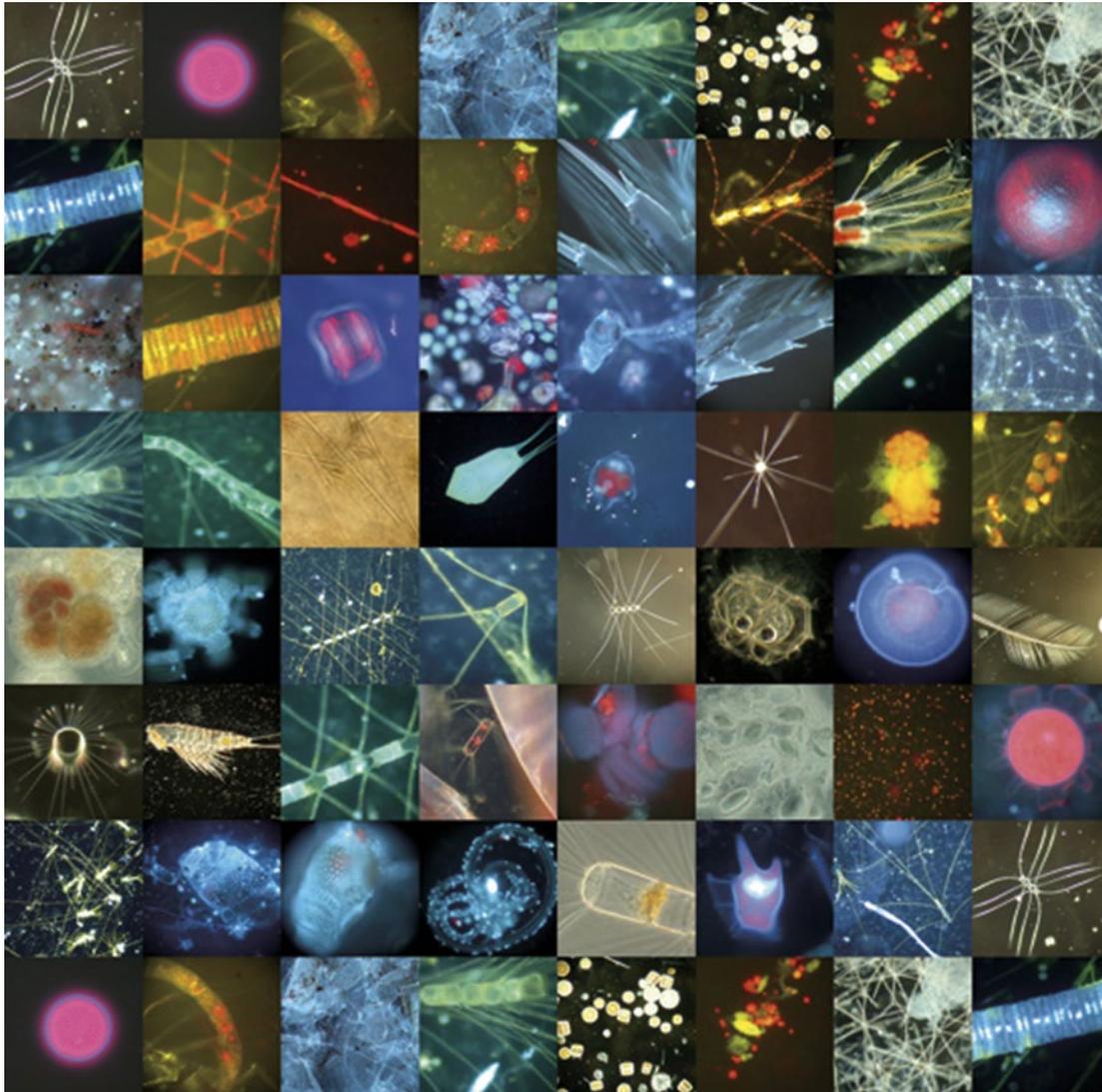
# Southern Ocean



# Correlation of Algae Concentration and CO<sub>2</sub> Concentrations

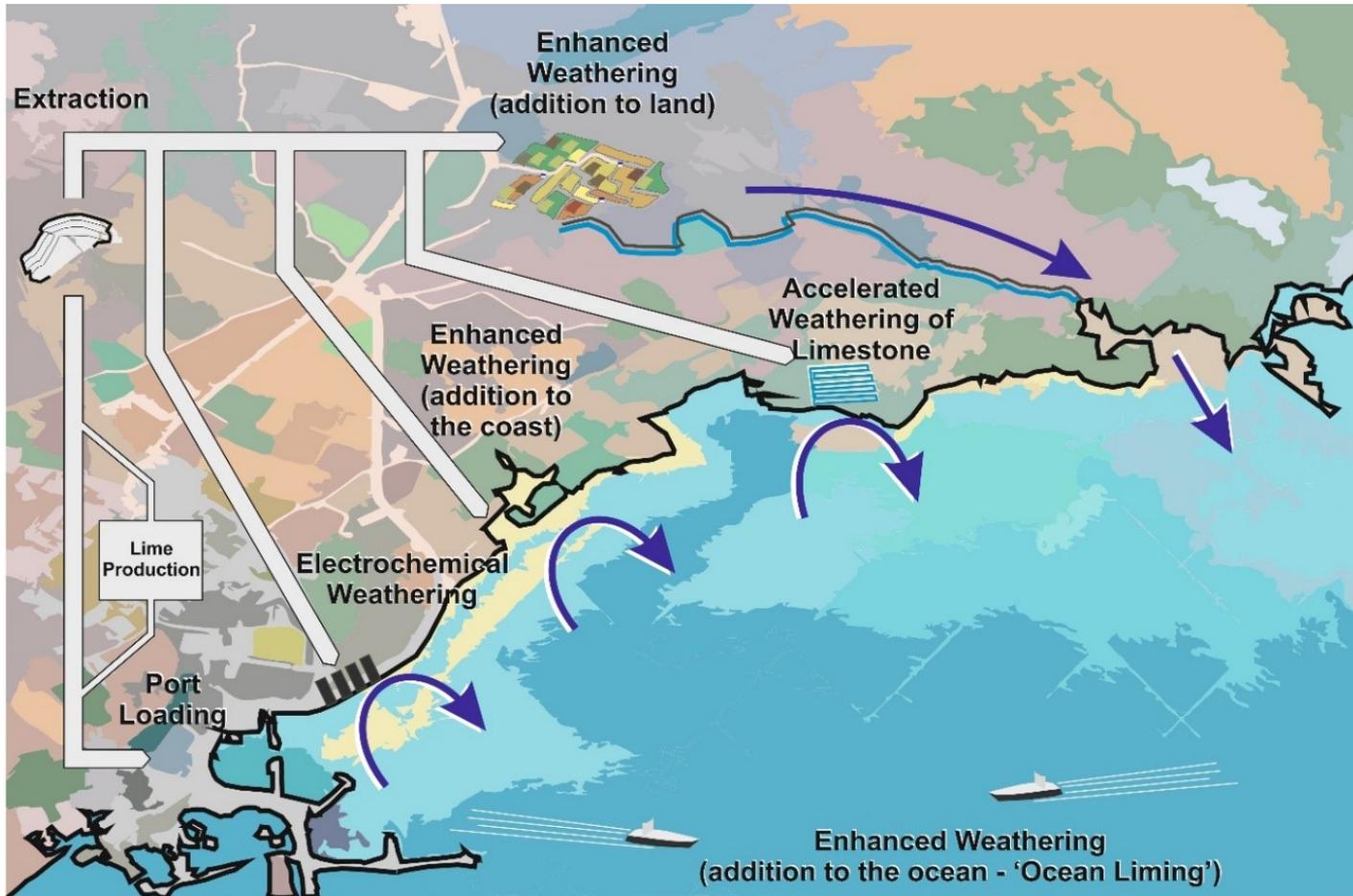


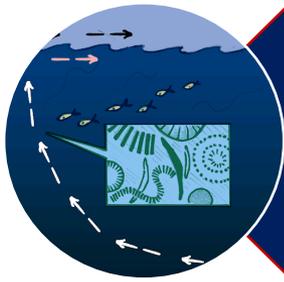
# Planktonic Collage: What Plankton Species Might Ocean Iron Fertilization Favor?



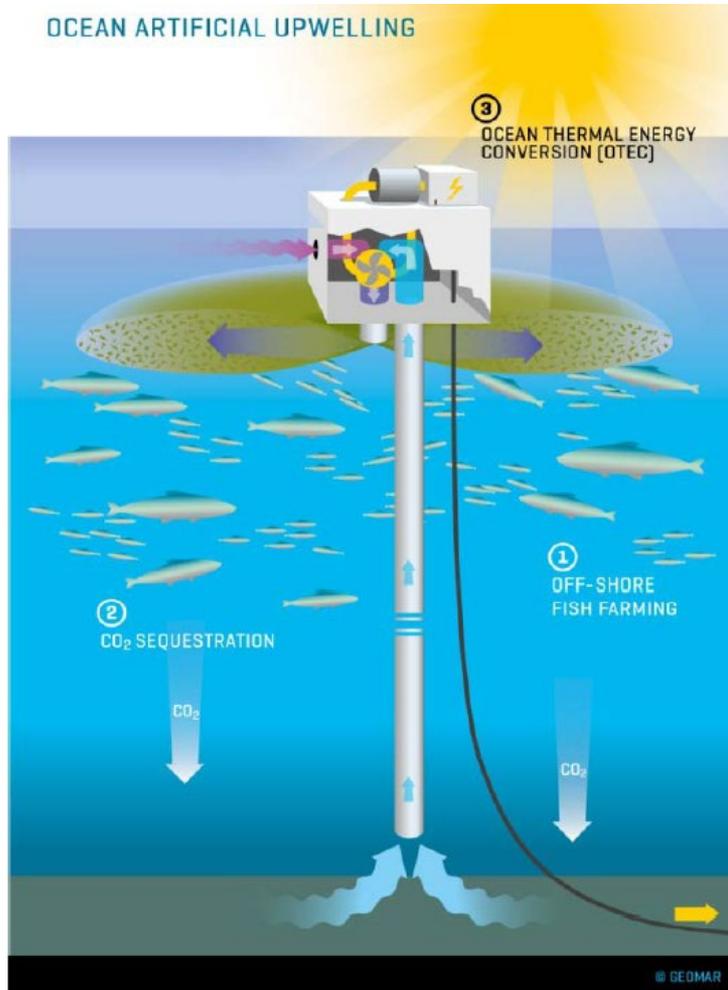


# Ocean Alkalinity Enhancement





# Artificial Upwelling





# London Dumping Convention (1972)

## RESOLUTION LC-LP.1(2008) ON THE REGULATION OF OCEAN FERTILIZATION

3. AGREE that in order to provide for legitimate scientific research, such research should be regarded as placement of matter for a purpose other than the mere disposal thereof under Article III.1(b)(ii) of the London Convention and Article 1.4.2.2 of the London Protocol;
4. AGREE that scientific research proposals should be assessed on a case-by-case basis using an assessment framework to be developed by the Scientific Groups under the London Convention and Protocol . . .
8. AGREE that, given the present state of knowledge, ocean fertilization activities other than legitimate scientific research should not be allowed. To this end, such other activities should be considered as contrary to the aims of the Convention and Protocol and not currently qualify for any exemption from the definition of dumping in Article III.1(b) of the Convention and Article 1.4.2 of the Protocol; [emphasis added]

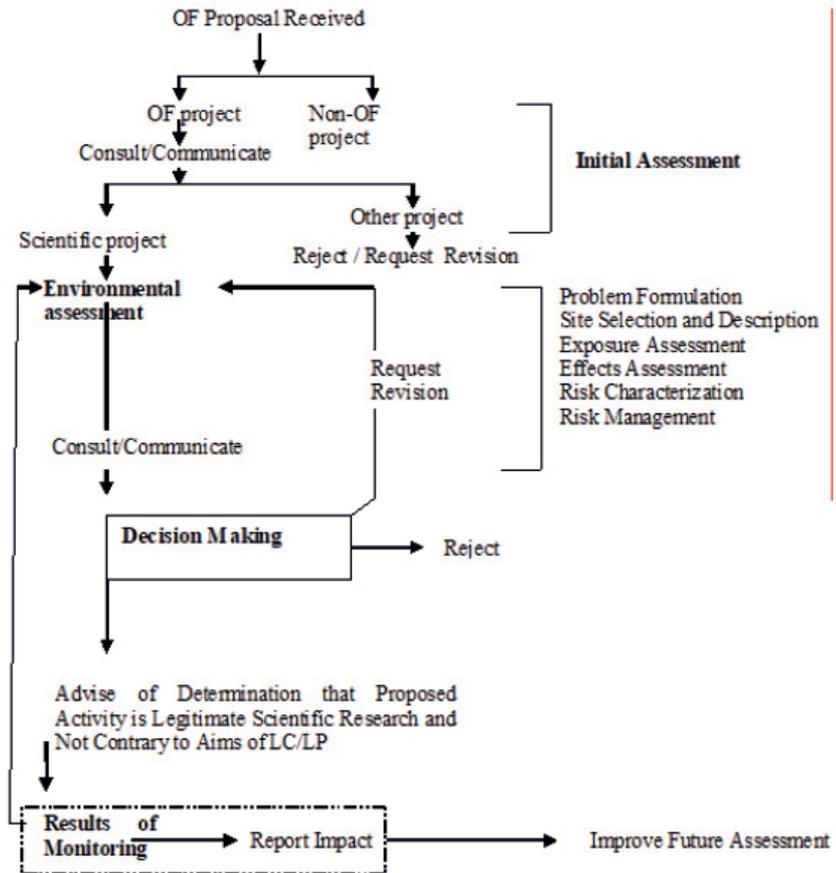


# London Dumping Convention (1972)

## ASSESSMENT FRAMEWORK FOR SCIENTIFIC RESEARCH INVOLVING OCEAN FERTILIZATION (2010)

### • Elements of environmental assessment:

- Problem formulation
- Site selection and description
- Exposure assessment
- Effects assessment
- Risk Characterization
- Risk Management
- Decision Making
- Results of Monitoring



Sections

2

3

4





## Resolution LP.4(8) on the Amendment to the London Protocol of Matter for Ocean Fertilization and Other Marine Geoengineering Activities (2013)

- Expanded potential purview of regulation to all potential “marine geoengineering” activities, i.e. “deliberate intervention in marine environment to manipulate nature processes;”
- Mandated issuance of permits by Parties before such activities occurred, including the mandate to limit or reduce pollution as far as “practicable;”
- In case of OIF (and by implication, other geo. options), permits only to be issued for “legitimate scientific research” and projects not intended for commercial gain;
- Establishment of an assessment framework similar to 2010 voluntary framework, including elements for ongoing consultation with other Parties potentially affected in areas in their jurisdiction or the global commons, assessment of potential impacts of activities, risk management to minimize potential impacts, monitoring, and reporting to the Secretariat, and subsequently to other Parties.



# CBD, 10<sup>TH</sup> COP (2010)

## X/33. Biodiversity and climate change

(w) Ensure . . . in the absence of science based, global, transparent and effective control and regulatory mechanisms for geo-engineering, and in accordance with the precautionary approach and Article 14 of the Convention, that no climate-related geo-engineering activities that may affect biodiversity take place, until there is an adequate scientific basis on which to justify such activities and appropriate consideration of the associated risks for the environment and biodiversity and associated social, economic and cultural impacts, with the exception of small scale scientific research studies that would be conducted in a controlled setting in accordance with Article 3 of the Convention, and only if they are justified by the need to gather specific scientific data and are subject to a thorough prior assessment of the potential impacts on the environment; [emphasis added]



# UNCLOS

## **Article 238 Right to conduct marine scientific research**

All States, irrespective of their geographical location, and competent international organizations have the right to conduct marine scientific research subject to the rights and duties of other States as provided for in this Convention.

## **Article 239 Promotion of marine scientific research**

States and competent international organizations shall promote and facilitate the development and conduct of marine scientific research in accordance with this Convention.

## **Article 245 Marine scientific research in the territorial sea**

Coastal States, in the exercise of their sovereignty, have the exclusive right to regulate, authorize and conduct marine scientific research in their territorial sea. Marine scientific research therein shall be conducted only with the express consent of and under the conditions set forth by the coastal State.

## **Article 246 Marine scientific research in the exclusive economic zone and on the continental shelf**

1. Coastal States, in the exercise of their jurisdiction, have the right to regulate, authorize and conduct marine scientific research in their exclusive economic zone and on their continental shelf in accordance with the relevant provisions of this Convention.
2. Marine scientific research in the exclusive economic zone and on the continental shelf shall be conducted with the consent of the coastal State. [emphasis added]

## **Article 257 Marine scientific research in the water column beyond the exclusive economic zone**

All States, irrespective of their geographical location, and competent international organizations have the right, in conformity with this Convention, to conduct marine scientific research in the water column beyond the limits of the exclusive economic zone. [emphasis added]

## Article 263 Responsibility and liability

1. States and competent international organizations shall be responsible for ensuring that marine scientific research, whether undertaken by them or on their behalf, is conducted in accordance with this Convention.
2. States and competent international organizations shall be responsible and liable for the measures they take in contravention of this Convention in respect of marine scientific research conducted by other States, their natural or juridical persons or by competent international organizations, and shall provide compensation for damage resulting from such measures.



# UNCLOS

## Article 194: Measures to Prevent, Reduce and Control Pollution of the Marine Environment

1. States shall take, individually or jointly as appropriate, all measures consistent with this Convention that are necessary to prevent, reduce and control pollution of the marine environment from any source, using for this purpose the best practicable means at their disposal and in accordance with their capabilities, and they shall endeavour to harmonize their policies in this connection.



## Article 1(1)(4): Use of Terms

(4) "pollution of the marine environment" means the introduction by man, directly or indirectly, of substances or energy into the marine environment, including estuaries, which results or is likely to result in such deleterious effects as harm to living resources and marine life . . . .

## Article 235

1. States are responsible for the fulfilment of their international obligations concerning the protection and preservation of the marine environment. They shall be liable in accordance with international law.
2. States shall ensure that recourse is available in accordance with their legal systems for prompt and adequate compensation or other relief in respect of damage caused by pollution of the marine environment by natural or juridical persons under their jurisdiction. [emphasis added]

## **4. Measures such as area-based management tools, including marine protected areas**

### 4. Objectives of area-based management tools, including marine protected areas

The text would set out objectives of area-based management tools, including marine protected areas, in areas beyond national jurisdiction for the conservation and sustainable use of marine biological diversity.

## 5.Environmental impact assessments

### 5.1 Obligation to conduct environmental impact assessments

Drawing from article 206 of the Convention and customary international law, the text would set out the obligation for States to assess the potential effects of planned activities under their jurisdiction or control in areas beyond national jurisdiction.



# Paris Agreement (2015)

## Article 4

2. Each Party shall prepare, communicate and maintain successive nationally determined contributions that it intends to achieve. Parties shall pursue domestic mitigation measures, with the aim of achieving the objectives of such contributions. [emphasis added]



# UNFCCC (1992)

## Article 4: Commitments

2. The developed country Parties and other Parties included in Annex I commit themselves specifically as provided for in the following:

(a) Each of these Parties shall adopt national policies and take corresponding measures on the mitigation of climate change, by limiting its anthropogenic emissions of greenhouse gases and protecting and enhancing its greenhouse gas sinks and reservoirs. [emphasis added]



# Paris Agreement (2015)

## Preamble

Recognizing that Parties may be affected not only by climate change, but also by the impacts of the measures taken in response to it,

\*\*\*

*Noting* the importance of ensuring the integrity of all ecosystems, including oceans, and the protection of biodiversity . . . [emphasis added]

\*\*\*

Emphasizing the intrinsic relationship that climate change actions, responses and impacts have with equitable access to sustainable development and eradication of poverty . . . [emphasis added]



INSTITUTE *for* CARBON REMOVAL  
LAW AND POLICY