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The London Convention and Protocol: Adapting to Address the Ocean-Climate Crisis

Chris Vivian | ORCID: 0000-0001-5329-811X
United Nations Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP), Burnham on Crouch, Essex, United Kingdom
Corresponding author
chris.vivian2@btinternet.com

Linda Del Savio | ORCID: 0000-0002-3220-2585
Research Institute for Sustainability – Helmholtz Centre Potsdam (RIFS), Potsdam, Germany
linda.del.savio@rifs-potsdam.de

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Abstract

The international community is confronted with urgent questions relating to the protection of the marine environment, as well as climate change mitigation. In this vein, ocean interventions, such as ocean fertilisation and carbon capture and sequestration in sub-sea geological formations have gained popularity in order to accelerate the uptake of anthropogenic carbon dioxide. The interaction of such technologies with the ocean environment can potentially cause unintended effects beyond sequestration and storage of atmospheric carbon, hence clear regulations, adapting to emerging technologies and based on public international law, are indispensable and to be based on scientific evidence and research.

Keywords

climate change mitigation – ocean-climate nexus – London Convention and Protocol – carbon dioxide removal – marine geoengineering

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Introduction

The international community is confronted with urgent questions relating to the protection of the marine environment and climate change mitigation.[1] Since the special report on the impacts of global warming of 1.5 °C above pre-industrial levels,[2] the Intergovernmental Panel on Climate Change (IPCC) has maintained that carbon dioxide removal in tandem with ongoing emissions reduction is needed to achieve carbon neutrality by 2050 in order to limit warming to 1.5 °C or 2.0 °C. On this basis, ocean interventions for accelerated uptake of anthropogenic carbon dioxide (CO_2) such as ocean fertilisation (OF) and carbon capture and sequestration in sub-sea geological formations (CCS-SSGF) have been put forth by the scientific community as potential technical options for enhancing carbon sequestration in the ocean environment.

However, the deployment of such techniques poses risks with potentially detrimental effects on the marine environment (ref. Key Definition 1). As such, it is worth reflecting on these climate change mitigation techniques and the hubristic belief, rooted in the Stockholm Declaration of 1972,[3] that science and technology, while perhaps having created industrialisation and consequently today's triple planetary crisis, also has the potential to shape the world to better suit the needs of humankind. While OF and CCS-SSGF techniques may fit closely with this belief, the associated costs and risks of these activities for the marine environment are considered in the context of today's discourse.

> **Key Definition 1: Ocean Fertilisation.** OF was developed in 1990 by John Martin, as a method for stimulating algae growth and investigating the related marine biogeochemistry. The uptake takes place in the surface waters, in which the dissolved CO_2 is bound into biomass by

1 The authors wish to thank the reviewers for their invaluable comments, as well as the International Maritime Organization and the World Maritime University for organising the academic conference, Protecting the Ocean – Moving Forward at 50: London Convention & Stockholm Declaration. This work benefitted from discussions with colleagues on GESAMP Working Group 41 (www.gesamp.org/work/groups/41), as well as with RIFS colleague Lina Röschel.

2 Intergovernmental Panel on Climate Change (IPCC), *Global Warming of 1.5 °C. An IPCC Special Report on the Impacts of Global Warming of 1.5 °C Above Pre-Industrial Levels and Related Global Greenhouse Gas Emission Pathways, in the Context of Strengthening the Global Response to the Threat of Climate Change, Sustainable Development and Efforts to Eradicate Poverty* (Cambridge University Press, Cambridge, 2018) 3–24, doi: 10.1017/9781009157940.001.

3 Declaration of the United Nations Conference on the Human Environment, Stockholm, 16 June 1972, UN Doc A/CONF48/14/Rev.1 (1972), reprinted in 11 *ILM* 1416 (1972) para 1 [Stockholm Declaration].

photosynthesis of microscopic algae (phytoplankton). Part of this mass is metabolised by the zooplankton to CO_2 and water and the rest, once it dies, sinks to greater depths, which is called the biological carbon pump. The aim of OF is to increase this process through artificial nutrient additions such as ferrous iron distributed in liquid form into a ship's wake, among other possible methods of fertilisation. There are risks associated with OF through the input of additional substances into the ocean and possible side effects, such as ocean acidification. Dealing with these risks is crucial for the future of OF and requires further research.

Therefore, this article explores the regulation of CCS-SSGF and OF under the 1972 Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (LC)[4] and the 1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (LP).[5] Practical developments under these regulatory instruments and through United Nations Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP) Working Group 41 (ref. Key Definition 2) will be outlined. It is further argued that due to the interdisciplinary nature of the topic, economic, political, and moral arguments, as well as a broader ocean governance perspective, shaping the international debate must be acknowledged.[6]

Key Definition 2: GESAMP Working Group 41. The UN Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP), an inter-agency body advising the UN system on the scientific aspects of marine environmental protection, established Working Group 41 on Ocean Interventions for Climate Change Mitigation (previously marine geoengineering) in 2015 under the lead of the International

4 Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972 (London, 29 December 1972, in force 30 August 1975) 1046 *UNTS* 138 [London Convention/LC].

5 1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London, 7 November 1996, in force 24 March 2006) [2006] ATS 11 [London Protocol/LP].

6 This perspective includes legal aspects, as well as the role of institutions, State and non-State actors and other instruments that govern the issue of concern. P Pattberg and O Widerberg, 'Global environmental governance' in P Pattberg and F Zelli (eds), *Encyclopedia of Global Environmental Governance and Politics* (Edward Elgar Publishing, Cheltenham, 2015) 28–35; L Röschel and B Neumann, 'Ocean-based negative emissions technologies: A governance framework review' (2023) 10 *Frontiers Marine Science*, doi: 10.3389/fmars.2023.995130.

Maritime Organization (IMO), co-chaired by Dr Chris Vivian and Professor Philip Boyd. The work of the GESAMP WG 41 comprises preparing scientific reports and studies, as well as providing scientific advice to LC/LP Parties and other sponsoring agencies on the protection and preservation of the marine environment.

Carbon Capture and Sequestration in Sub-Seabed Geological Structures

The LC Parties first considered CCS-SSGF at their meeting in 2004, that is, prior to the LP entering in force in March 2006. Following this approach, CO_2 is pumped into the SSGF from platforms like those used for oil/gas exploration and exploitation. The LC Parties recognised that elevated levels of CO_2 in the atmosphere contribute to climate change and ocean acidification and that CO_2 sequestration was one of a range of options to address this problem. They established an inter-sessional correspondence group to consider legal issues and requested the Scientific Group to assess the potential environmental risks and benefits for the marine environment of CCS-SSGF.

Based on the outcome of those deliberations, in 2006 the LP Parties adopted amendments to Annex 1 to the Protocol to regulate CCS-SSGF.[7] In 2009 the LP Parties amended Article 6 banning the export of waste in order to permit the export of carbon dioxide streams for disposal in accordance with Annex 1,[8] provided that an agreement or arrangement had been entered into by the countries concerned. By 2019 only six Parties had ratified the amendment. At their 2019 meeting the LP Parties stated that the 2009 amendment to Article 6 was a crucial element of the 2006 amendments (permitting storage of CO_2 in SSGF) that could make CCS a success as a climate change mitigation technology and contribute to meeting the climate targets set in the Paris Agreement. They then agreed to a proposal to allow the provisional application of the 2009 amendment to Article 6,[9] pending its entry into force, according to Article 25 of the Vienna Convention on the Law of Treaties.[10]

7 On the Amendment to Include CO_2 Sequestration in Sub-Seabed Geological Formations in Annex 1 to the London Protocol, IMO Resolution LP.1(1) (2 November 2006).

8 On the Amendment to Article 6 of the London Protocol, IMO Resolution LP.3(4) (30 October 2009).

9 On the Provisional Application of the 2009 Amendment to Article 6 of the London Protocol, IMO Resolution LP.5(14) (11 October 2019).

10 Vienna Convention on the Law of Treaties (Vienna, 23 May 1969, in force 27 January 1980) 1155 *UNTS* 331.

Marine Geoengineering and the Case of Ocean Fertilisation

Marine geoengineering (ref. Key Definition 3), in particular OF, a carbon dioxide removal (CDR) technology, aims to remove CO_2 from the atmosphere.

> **Key Definition 3: Geoengineering**. The concept of geoengineering is presented in different scientific and legal sources as a large-scale and far-reaching manipulation of nature by humans to mitigate anthropogenic climate change. The term, initially introduced by Italian physicist Cesare Marchetti in 1976, gained prominence in 2006 when the Nobel Laureate and atmospheric chemist Paul Crutzen attracted international attention by presenting solar radiation management (SRM) as a geoengineering approach to be used when rapid climate warming is developing but only to be deployed when net advantages are proven. The IPCC no longer uses the term geoengineering but directly refers to its two strands, SRM and CDR.

The LC/LP Parties were first confronted with ocean iron fertilisation (OIF) in 2007, following the announcement by a Californian company (Planktos Corporation) that it would conduct a commercial experimental project offshore of the Galapagos Islands and subsequently in the Canaries.[11] As a result, the 2007 Scientific Groups (SGS) meeting agreed a 'Statement of Concern',[12] which the LC/LP governing bodies endorsed at their 2007 meeting.[13] As such, the LC and LP were considered applicable instruments due to their objective to protect and preserve the marine environment from all sources of pollution by dumping of wastes and other matter. Based on this objective, the LC prohibits dumping of substances listed in Annex I,[14] whereas the LP prohibits all dumping except for wastes or other matter listed in Annex I, the 'reverse list'. Although ferrous sulphate, which has been used for OIF, is not listed in

11 R Butler, 'Planktos kills iron fertilization project due to environmental opposition' available at https://news.mongabay.com/2008/02/planktos-kills-iron-fertilization-project-due-to-environmental-opposition/; accessed 22 February 2024.

12 Statement of Concern Regarding Iron Fertilization of the Oceans to Sequester CO_2, IMO Doc LC-LP.1/Circ. 14 (13 July 2007).

13 Report of the Twenty-Ninth Consultative Meeting of Contracting Parties to the LC and the Second Meeting of the Contracting Parties to the LP, IMO Doc LC 29/17 (5 November 2007).

14 Article III(1)(a)(i) LC defines dumping as 'any deliberate disposal at sea of wastes or other matter' and Article III(1)(b)(ii) excludes the 'placement of matter for a purpose other than mere disposal thereof, provided that such placement is not contrary to the aims of this Convention'.

Annex I of the LC, its use must not contradict the objective of the LC through impairment of human health, living resources, or marine life, as per Article II in conjunction with Article I. The LP, which will replace the LC, contains similar provisions.

As a response to the Planktos case, the 2008 meeting of the LC/LP governing bodies adopted resolution LC-LP.1,[15] which, although non-binding, led to OF being considered under the LC/LP regime. As per paragraph 8 of LC-LP.1, OF experiments should be considered inconsistent with the objectives of the LC/LP regime unless they meet the criterion of 'legitimate' scientific research. In that case they do not qualify as dumping, but as the placement of substances for a purpose other than mere disposal, and are thus permissible through a case-by-case assessment. To clarify what can be understood as 'legitimate' research, an Ocean Fertilization Assessment Framework for scientific research was drawn up and adopted in 2010.[16] On this basis, research projects must meet high requirements that correspond to criteria of scientific purpose and of non-commercial nature. In addition, an environmental impact assessment, based on the risk assessment paradigm, must be carried out prior to the experiment and consent should be sought from all countries with jurisdiction and/or in the region of potential impact. Such assessments are carried out by the relevant permitting authorities of the Parties who can require more stringent measures (Article 3.4 LP).

Further, OF regulation was achieved with resolution LP.4(8),[17] which prohibits marine geoengineering activities, unless listed in Annex 4 and authorised under a permit. The latter can be issued after the activity has undergone an assessment and must comply with the provisions in Annex 5 (Generic Assessment Framework) and any adopted Specific Assessment Framework. As of now, OF is the only marine geoengineering activity listed under Annex 4. A background factor influencing the resolution was the 2012 Haida Gwaii OF project[18] which was criticised by the international community, but was pos-

15 On the Regulation of Ocean Fertilization, IMO Resolution LC-LP.1 (31 October 2008).

16 On the Assessment Framework for Scientific Research Involving Ocean Fertilization, IMO Resolution LC-LP.2 (14 October 2010).

17 On the Amendment to the London Protocol to Regulate the Placement of Matter for Ocean Fertilization and Other Marine Geoengineering Activities, IMO Resolution LP.4(8) (18 October 2013).

18 Statement of Concern Regarding the Iron Fertilization in Ocean Waters West of Canada, Annex 7 in Report of the Thirty-Fourth Consultative Meeting of the London Convention and the Seventh Meeting of Contracting Parties to the London Protocol, IMO Doc LC 34/15 (23 November 2012); 'Haida Salmon Restoration Corporation' (Wikipedia) available at https://en.wikipedia.org/wiki/Haida_Salmon_Restoration_Corporation#:~:text=120%20

sible because the Assessment Framework was not binding. The resolution also contains the first international legal definition of marine geoengineering as a 'deliberate intervention in the marine environment to manipulate natural processes, including to counteract anthropogenic climate change and/or its impacts, and that has the potential to result in deleterious effects, especially where those effects may be widespread, long lasting or severe'. This definition allows for activities other than those undertaken for climate change mitigation to qualify as such in the future. Furthermore, as per the first para of Article 1 'Definitions' of Resolution LP.4(8), OF is defined as any human activity with the principal intention of stimulating primary productivity in the ocean and as per para 1.3 of Annex 4 'Marine Geoengineering Activities' of Resolution LP.4(8), fulfils the criterion of legitimate scientific research, which excludes commercial use. Following this legal development on the regulation of ocean interventions for climate change mitigation and pending the entry into force of the 2013 amendment,[19] further research has been carried out, shaping negotiations for future regulation and deployment and calling for evidence-based decision-making and scientific advice, as provided by GESAMP.

The 2019 published study,[20] based on GESAMP's first phase of work, which started in 2016, reviewed and evaluated marine geoengineering techniques to provide information, guidelines, and policy recommendations on the subject. The second phase of work focuses on providing a better understanding of environmental and societal impacts of ocean interventions, developing an interdisciplinary framework for a holistic assessment of ocean interventions, and advising the LC/LP Parties on those potentially qualifying as marine geoengineering techniques listed under Annex 4 LP.[21] Based on the GESAMP WG 41 2019 report, advice was submitted to the 2021 LC/LP SGs meeting and subsequently to the 2022 LC/LP SGs meeting, suggesting marine geoengineering techniques to be considered for potential listing under Annex 4 LP. After consideration

tons%20of%20iron%20compound,confirmed%20by%20NASA%20satellite%20imagery; accessed 2 July 2024.

19 The amendment will enter into force and become legally binding upon ratification by two thirds of the Parties, as per Article 21 of the LP (n 5).

20 GESAMP, *High Level Review of a Wide Range of Proposed Marine Geoengineering Techniques* (PW Boyd and CMG Vivian, eds) (IMO/FAO/UNESCO-IOC/UNIDO/WMO/IAEA/UN/UN Environment/ UNDP/ISA Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection), GESAMP Reports and Studies No. 98 (IMO, London, 2019).

21 GESAMP, 'Terms of reference and work plan for the second phase of the GESAMP Working Group 41 on Ocean Interventions for Climate Change Mitigation' (2020) available at http://www.gesamp.org/site/assets/files/1723/new_tor_wg41_as_approved.pdf; accessed 22 February 2024.

in the 2021 and 2022 SGS meetings and by a SGS Correspondence Group, the SGS submitted their recommendations to the 2022 Governing Bodies Meeting, identifying the following four marine geoengineering techniques to be considered for listing: (i) enhancing ocean alkalinity by adding alkaline material directly to the ocean or by electrochemistry and (ii) macroalgae cultivation for sequestration including artificial upwelling, representing CDR techniques, as well as (iii) marine cloud brightening and (iv) microbubbles/reflective particles/material, reflecting SRM techniques.

The 2022 Governing Bodies Meeting adopted a statement on marine geoengineering and established a Legal Intersessional Correspondence Group to consider the four techniques suggested by the SGS.[22] It also re-established the Intersessional Correspondence Group under the SGS to continue its work on listing additional techniques in Annex 4, assessing, for example, the Generic Assessment Framework in Annex 5 and raising awareness of the LC/LP work, especially the 2023 amendment. The 2023 Governing Bodies Meeting adopted a further statement on marine geoengineering that reiterated their concerns about marine engineering techniques.[23]

Conclusion: Protecting the Ocean and Mitigating Climate Change

Ocean interventions, such as CCS-SSGF and OF have become an integral part of the ocean-climate debate due to their potential to mitigate climate change, as well as the associated risks of causing harm to the marine environment. As research and discussions within multilateral frameworks including the United Nations Framework Convention on Climate Change, the Convention on Biological Diversity, and LC/LP continue to evolve, a more comprehensive approach to regulating ocean intervention techniques should be pursued, allowing for critical reflection on science as panacea. Clear regulations, adapting to emerging technologies, are indispensable and should be based on scientific evidence and research, for example, as provided through GESAMP Working Group 41. Based on the established regulatory framework for marine

22 IMO, 'Marine geoengineering techniques – potential impacts' available at https://www.imo.org/en/MediaCentre/PressBriefings/pages/Marine-geoengineering.aspx; accessed 22 February 2024.

23 IMO, 'Marine geoengineering – statement' (2023) available at https://www.imo.org/en/MediaCentre/MeetingSummaries/Pages/LC-45-LP-18.aspx; accessed 23 February 2024.

geoengineering, the LC/LP is often perceived as a primary means of further regulating other SRM and CDR methods. The LC/LP regime allows for an interdisciplinary approach where ethical and technological discussions, among others, can take place, and which require expertise and exchanges from and among different stakeholders and experts in order to provide a comprehensive governance approach. This includes, for example, the consideration and acknowledgement of GESAMP WG 41 advice by the LP Parties.