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ASSESSING SCIENTIFIC LEGITIMACY

THE CASE OF MARINE GEOENGINEERING

Lucas Dotto and Bryan Pelkey

Key Points

- There have been growing concerns within the international scientific and political communities about marine geoengineering occurring at untested scales and without appropriate oversight. In 2007, several private companies planned to introduce large quantities of iron into the ocean to stimulate the growth of phytoplankton, which would pull CO_2 from the atmosphere and help mitigate climate change impacts, a process known as ocean iron fertilization (OIF).
- The negative publicity that OIF garnered forced the parties of the London Convention and the London Protocol (LC-LP) to rethink governance of marine geoengineering, resulting in the Assessment Framework for Scientific Research Involving Ocean Fertilization.
- However, gaps in the governance still remain: the framework has not been integrated on a national level by the International Maritime Organization (IMO), there is a void of transparency mechanisms in place and there currently exist no independent assessments of the impacts of OIF.
- To remedy these issues, this brief recommends that the IMO and parties to the LC-LP develop memorandums of understanding (MoUs) to delineate framework implementation plans, adopt legally binding governance transparency mechanisms to ensure linkages between national and international governance institutions, and create independent assessment panels (IAPs).

Introduction

In 2007, there was growing concern within the international scientific and political communities about the prospect of marine geoengineering taking place at untested scales of deployment without appropriate regulatory controls or oversight. OIF (see Figure 1) was intended to mitigate climate change impacts through the sequestration of CO_2 and generate profits through the sale of carbon credits in international carbon markets (Buck 2014). These proposed projects would have been the first instance of intentional and coordinated geoengineering in the world.

The emergence of commercial interest in large-scale OIF projects caught the international community by surprise. Up to that time, there had been a growing scientific knowledge base stemming from 12 field trial programs involving small-scale OIF experiments conducted by the international oceanographic community over the previous 15 years (Buesseler et al. 2008). However, international governing bodies did not anticipate the commercialization of OIF projects and the negative publicity that followed. This publicity elevated the topic and generated widespread concern among international governance bodies, environmental groups and states regarding environmental risks, governance gaps and whether OIF is even an effective climate change mitigation option (IMO 2007).

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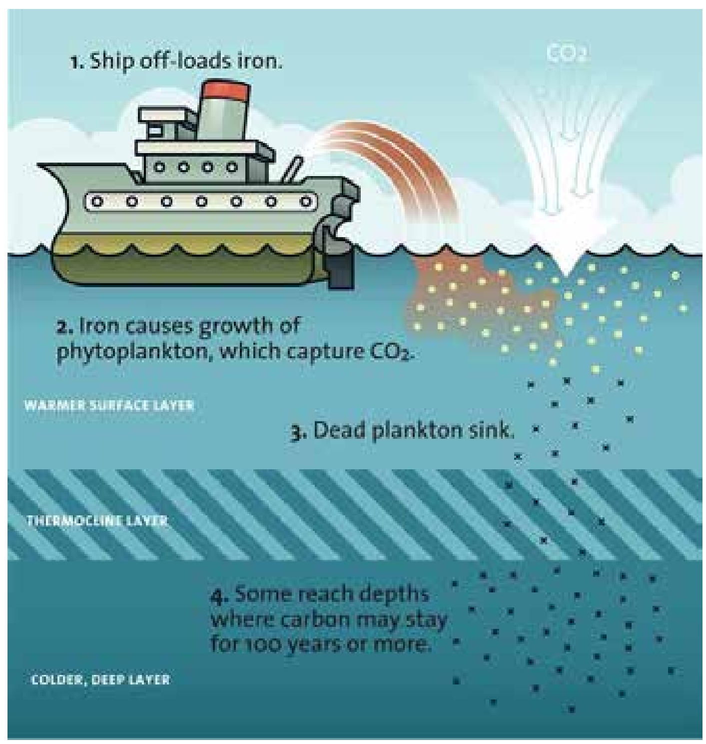
Parties to the LC-LP and the Convention on Biological Diversity (CBD) responded by agreeing to prohibit both commercial and large-scale OIF activities from taking place while providing an exception for small-scale projects constituting "legitimate scientific research" (IMO 2013). This decision highlighted the importance of gathering scientific knowledge of biogeochemical processes and carbon dynamics in ocean ecosystems; small-scale OIF experiments were important to understand not just the efficacy of OIF as a marine geoengineering technique, but to better understand the fundamental processes and relationship between oceans and climate systems.

Through the LC-LP, the IMO agreed to create a legal framework for the regulation of legitimate small-scale research in this field by creating the Assessment Framework for Scientific Research Involving Ocean Fertilization. The framework was designed to provide contracting parties to the LC-LP a template to evaluate proposed OIF activities on a case-by-case basis, and to determine whether a proposed activity constitutes legitimate scientific research. However, the framework does not provide a definition of scientific legitimacy.

This brief provides a clear definition of what constitutes scientific legitimacy in the field of marine geoengineering and gives recommendations to improve legitimacy in this field.

Figure 1: The OIF Process



Source: Haiken (2008).

Background

Geoengineering, "the deliberate large-scale intervention in the Earth's climate system," is an emerging consideration in geopolitics, particularly in the fields of biodiversity and climate change (Royal Society 2009). Marine geoengineering is one subfield of geoengineering, and is defined as "the deliberate intervention in the marine environment to manipulate natural processes, including to counteract anthropogenic climate change and/or its impacts" (IMO 2013). OIF, among all proposed marine geoengineering techniques, has received the most attention as a means to achieve carbon sequestration in ocean ecosystems. Unlike other geoengineering subfields, OIF experiments have already taken place and governance mechanisms have already been developed.

Initial concerns about OIF were associated with the uncertainty of potential environmental impacts on biological processes and marine biodiversity if large-scale deployment of the practice went unchecked (IMO 2010b). These concerns were effectively addressed by actions on the part of international governing bodies and member states to create a legal framework governing marine geoengineering and restricting OIF activities to legitimate scientific research.

The actions taken since 2007 were the result of deliberations within the governing bodies of the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, known as the London Convention and its successor, the London Protocol. Acting in response to concerns raised by member states, environmental groups and the science groups of the LC-LP regarding several planned OIF projects in international waters, the parties of the LC-LP endorsed the "Statement of Concern Regarding Iron Fertilization of the Oceans to Sequester CO_2" in November 2007, which took the view that "knowledge about the effectiveness and potential environmental impacts of ocean iron fertilization currently was insufficient to justify large-scale operations" (IMO 2007).

Further decisions under the LC-LP and CBD reinforced the view that OIF activities should not take place until risks were assessed and effective control, and regulatory and governance mechanisms were in place (UNEP 2008). Parties of the LC-LP took steps to assess these risks and create governance mechanisms for OIF by adopting Resolution LC-LP.1 (IMO 2008), a non-binding agreement stipulating parties would not allow ocean fertilization activities "other than legitimate scientific research"; and Resolution LC-LP.2 (IMO 2010a), containing the assessment framework. In October 2013, contracting parties to the LP passed Resolution LP.4(8), which codified that compliance with the assessment framework would determine whether a proposed OIF activity represented legitimate scientific research (IMO 2013).

The steps highlighted above provided a legal framework to regulate marine geoengineering. However, criticisms about the effectiveness of OIF and the feasibility of ever scientifically proving its ability to sequester worthwhile amounts of CO_2 without causing significant impacts to ocean ecosystems remain problematic for defining and governing legitimate scientific research, leading some scientists to call for an end to OIF experimentation in the field of marine geoengineering (Strong et al. 2009). OIF modelling shows that even under the most optimistic assumptions, it would only reduce atmospheric CO_2 by 10 percent and that it could acidify the deep ocean or even increase net greenhouse gases released in the process (Caldeira, Bala and Cao 2013). Additionally, concerns regarding accountability and transparency in the governance of marine geoengineering activities, and OIF especially, generate debate and are symptoms of broader "social, ethical, legal, and political issues" at the core of geoengineering governance (Royal Society 2009). Previously, OIF had only taken place on relatively small scales and these experiments did not generate the same degree of contention; with greater attention being afforded to OIF experimentation in the field of marine geoengineering, the issue of scientific legitimacy and integrity has become central, in particular as it relates to the risks of commercialization and politicization of scientific research.

The Legal Framework

The restriction on large-scale OIF activities and the creation of the assessment framework for evaluating scientific research involving OIF is the first example of global governance in geoengineering. The significance of these efforts is underscored by the acknowledgment within the CBD that this framework represents the singular exception from the view that current regulatory mechanisms for climate-related geoengineering do not meet the criteria for a "science-based, global, transparent and effective" regulatory framework (UNEP 2014).

The fundamental problem that OIF presented, in the context of an international legal framework for its regulation under the LC-LP, was that it constituted something other than "dumping," which the LC-LP is structured to regulate. Rather, OIF was considered to be "placement of matter other than mere disposal thereof," which did not fall under the existing rules of the LC-LP (IMO 2010a). Parties agreed that marine geoengineering and OIF were within the scope of the LC-LP, and that the legal framework was able to provide regulatory control based on their objective under Article I of the LC and Article 2 of the LP to "protect and preserve the marine environment from all sources" (IMO 2007).

Amendments to the LP to expand its regulatory scope to include "placement" activities did not come until the adoption of Resolution LP.4(8) in 2013, which has yet to come into force, but will institute the definitions of marine geoengineering and ocean fertilization under the new "Annex 4," which will list permissible placement activities having specific assessment frameworks developed in accordance with the "Assessment Framework for Matter that may be Considered for Placement under Annex 4," referred to as the generic assessment framework or Annex 5 (IMO 2013). Marine geoengineering activities other than OIF may be considered in the future under the legal framework established with Resolution LP.4(8). Ocean fertilization would be defined as "any activity undertaken by humans with the principal intention of stimulating primary productivity in the oceans [and that] does not include conventional aquaculture, or mariculture, or the creation of artificial reefs" (IMO 2012b). The amendment also obligates parties to adopt administrative and legislative measures in compliance with the new provisions for permitting marine geoengineering activities.

Although the amendments will be successful in establishing a legal framework for regulating marine geoengineering activities, in that states will soon have an international set of rules that can be applied at the national level to guide permitting processes, it remains unclear whether the legal framework, along with the assessment framework, ensures that all the elements of a "science-based, global, transparent and effective control and regulatory mechanism" will emerge (UNEP 2014).

Several issues remain and must be addressed as states begin to develop national frameworks to assess OIF projects and the regulatory mechanisms that would apply to them — specifically, the issue of how consistency and transparency will be addressed at the national level in order to ensure national authorities implement measures consistent with the assessment framework. As well, lack of clarity around roles and responsibilities between project proponents, state-permitting authorities and international governing bodies could result in issues of disclosure of important information regarding environmental impacts and research results. Disclosure-based governance would help address environmental and social concerns for OIF research and would also serve to improve legitimacy of the process, which would be important in addressing broader ethical and governance issues (Craik and Moore 2014).

Defining Scientific Legitimacy

The assessment framework presumably regulates marine geoengineering activities by codifying what constitutes legitimate scientific research in this field. However, Resolution LP.4(8) defines scientific legitimacy simply as compliance with the assessment framework; this definition is hollow and lacks substantive prescriptions. A more prescriptive definition of scientific legitimacy as it relates to marine geoengineering is needed.

Therefore, scientific legitimacy, in the field of marine geoengineering, is a characteristic of scientific research that fulfills two requirements: the science must be legitimately justified and have a legitimate methodology. The assessment framework fulfills the latter requirement, but not the former; it provides the methodology, but does not make a normative determination on the value of the science being conducted.

Scientific research is justified if it is science worth doing and if it ought to be conducted. OIF activities are premised on the assumption that it is an effective means for sequestering carbon and mitigating climate change; therefore, marine geoengineering research is worth doing and ought to be conducted if its effectiveness as a carbon sequestration technique is proven true. If OIF is proven to be an ineffective means to that end, then the research cannot be justified. However, the assessment framework cannot yet make this normative determination and is therefore unable to fulfill this first requirement.

The requirement that a legitimate methodology be applied to scientific research in the field of marine geoengineering is not as open to interpretation as the justification of scientific research, and the existing assessment framework does constitute a legitimate methodology as it is robust, comprehensive and requires a wealth of baseline data to be provided. The framework fulfills this second requirement, but the methodology could be strengthened.

These two requirements are inextricably linked together in a loop: the methodology is an iterative process that provides reliable empirical knowledge that is used to determine the efficacy and legitimacy, and, therefore, justifiability of the science (Douglas 2014; Feynman 1955). The methodology must come first in order to provide the data required to make a normative determination of the legitimacy of the science.

The assessment framework is a governance document delineating the methodologies, processes and structures for gathering this hard data; however, it is not infallible. It is important to identify gaps in its governance to ensure the fidelity of the process and the virtue of the data needed to determine whether OIF activities constitute legitimate scientific research in this field.

Assessing Scientific Legitimacy

To identify potential governance gaps intrinsic to the assessment framework, it is juxtaposed here with the Oxford Principles (OP), as these guiding principles for geoengineering governance currently represent the best practices in the field (see Table 1). The OP are intended to help guide the development of geoengineering technologies from research to eventual deployment and are widely endorsed by the scientific community (National Research Council 2015).

Table 1: Assessing Framework Adherence to the OP

OP	Assessment Framework	Adherence
1. Geoengineering should be regulated as a public good.	No commercial interests or financial gain. Strong focus on common good.	Yes
2. Public participation is required in geoengineering decision making.	Consent is sought, not required. "Public" is never defined.	Uncertain
3. Disclosure of geoengineering research and open publication of results.	Non-binding, secretariat role undefined, mechanism not provided.	Uncertain
4. Independent assessment of impacts of geoengineering research.	No assessment independent of those submitting proposals.	No
5. Governance before deployment.	Relatively successful.	Yes

Source: Authors.

Principle 1 of the OP states that geoengineering should be regulated as a public good (Rayner et al. 2013). Importantly, the OP does not define public goods in economic terms, but rather in the common interest. The assessment framework successfully incorporates this principle by ensuring that no financial benefit can be realized and no commercial interest can be present in OIF activities, and that all activities must contribute to the general body of common scientific knowledge (IMO 2010b).

Principle 2 states that public participation is required in geoengineering decision making (Rayner et al. 2013). The "all affected principle" requires all parties affected by a decision to be notified, consulted and have their consent obtained before a research activity can commence (ibid.). The framework does not require consent of affected stakeholders, however, and does not define whether stakeholders are part of the process at all. Consequently, it is unclear whether the framework successfully incorporates Principle 2, as it does not define who the "public" is and does not explain how the public is incorporated into the consultation process.

Principle 3 requires the disclosure of geoengineering research and open publication of the results (ibid.). The framework does require some disclosure, in particular of the environmental assessment; however, the secretariat is charged with this responsibility, and both the secretariat's role in disclosing the research as well as which disclosure mechanism facilitates publication is not provided. Without knowing how the results are to be disclosed, it is unclear whether the framework successfully incorporates Principle 3.

Principle 4 requires an independent assessment of the impacts of geoengineering research (ibid.). The framework does not require an independent authority to verify the impact assessment provided and there exists no safeguard preventing the information from being falsified. The validity of the impact assessments thus depends on the implementing rules of each state. The framework fails to incorporate Principle 4 by not having a binding independent assessment requirement of implementing states.

Principle 5 requires geoengineering governance to exist before deployment can take place (ibid.). The framework itself acts as a governing document, which ensures that certain governance provisions are required before OIF activities can be undertaken. Additionally, there still exists an IMO moratorium on large-scale geoengineering deployment and it permits only small-scale research conducted within certain parameters of governance. The framework therefore successfully adheres to Principle 5.

By juxtaposing the assessment framework against the OP it is clear that gaps in governance exist. The framework lacks clear definitions of key terms and needs to delineate some of the roles, responsibilities and processes more clearly. If scientific legitimacy is derived from scientific research, which is legitimately justified with a legitimate methodology, then the assessment framework needs strengthening to meet the latter requirement.

Unauthorized Incident of OIF off the West Coast of Canada

In July 2012, the Haida Salmon Restoration Corporation (HSRC) conducted an OIF experiment involving the placement of 120 tons of iron sulphate over an area of about one square km and 400 km west of Haida Gwaii in international waters. The HSRC claimed the experiment's primary purpose was to study the potential for enhancing productivity of salmon stocks with the possibility of generating revenues from carbon credits to fund salmon restoration (Buck 2014). The legality of this activity was debated, and an investigation by Environment Canada was launched in August 2012. Canada informed the governing bodies to the LC-LP of the incident in November 2012, stating that it was not authorized by Canadian authorities, and that the HSRC gave no prior notice of intent to conduct OIF activities (IMO 2012a). The experiment is widely criticized as lacking scientific legitimacy, integrity and rigour for being motivated by commercial interests rather than contributing to broad empirical scientific knowledge (Buck 2014). Although a formal assessment process would have given opportunity for authorities to question the intended outcomes and expected impacts before allowing it to proceed, it would have conceivably been, at least with some degree of improvement in the scientific methods employed, permissible under the legal framework of the LC-LP for ocean fertilization.

Recommendations

Contracting parties to the LC-LP should develop MoUs with the IMO delineating clear implementation plans of the assessment framework. There is currently no agreement between the IMO and contracting parties as to what each state's plan is for integrating the framework into national-level policies. The framework only succeeds in its mandate to the extent that states adopt and adhere to it consistently. MoUs should therefore be signed between each state and the IMO outlining the responsibilities of the state in implementing the framework. Information provided should include harmonization plans with existing national policies, which accountability and transparency mechanisms will be utilized, and a timeline for implementation. This process would allow for the development of best practices regarding implementation within the international community.

Parties to the LC-LP should adopt a legally binding transparency mechanism to ensure that relevant information passes from the national level to appropriate international governance institutions. The lack of clear and legally binding obligations for states — under the rules of the LC-LP and contained within Resolution LP.4(8) to disclose details of assessments of marine geoengineering projects — leaves potential for discretionary application of the assessment framework, determination of scientific legitimacy and permitting of marine geoengineering activities. A binding obligation for states to disclose this information would ensure that rules were applied consistent with the LC-LP.

The IMO should create IAPs to ensure the fidelity of the assessment framework. There is currently no mechanism for independent assessment of impacts and effects within the framework; this means there is no way to ensure the information and data on impacts and effects being provided by activity proponents is accurate. The goodwill of the proponent is entirely relied upon. The LC-LP have proposed an Independent International Expert Group, but only the composition of the group has been discussed — no proposal on the responsibilities of the group members has been put forward. The IMO should convene IAPs on a case-by-case basis upon being notified by a contracting party of a received OIF proposal. The IAPs will consist of scientists from contracting party states within the region of impact, but must not include scientists from the contracting party state which received the proposal. This ensures the panel members are independent of the activity being proposed.

The IAP will be tasked with verifying and cross-referencing the information and data on impacts and effects in the activity proposal received by the contracting party state. In this sense, the IAPs act as auditors in ensuring the fidelity and accuracy of the information and data being provided by the proponents. The IAP can then notify the IMO of any concerns that arise through their investigation, and the IMO can broach these concerns with the contracting party ensuring transparency and accountability.

Conclusion

Marine geoengineering is an emerging area of consideration in the international political and scientific community. Governance of marine geoengineering has been relatively successful when compared to its sister subfields of carbon geoengineering and solar geoengineering. Much of this success is due to the development of a legal framework which produced a robust and comprehensive assessment framework for marine geoengineering activities. The assessment framework has come to represent a framework not just for OIF experiments, but possibly a template for governance of other geoengineering research, particularly in how to govern the early stages of scientific research and experimentation.

However, there are gaps. The IMO has not yet provided a plan for national-level integration of the framework, there remains a troubling void of transparency mechanisms, and independent assessment of impacts does not yet exist. Therefore, the scientific legitimacy of the framework can be called into question; if OIF activities are to be considered scientifically legitimate in the future then the methodology provided by the framework must first be strengthened. Given that the assessment framework has yet to be applied to a marine geoengineering activity, the future of marine geoengineering governance and legitimate scientific research in this field will be typified by how successfully the international community rectifies these discrepancies.

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About the Authors

Lucas Dotto and **Bryan Pelkey** are candidates for the Master of International Public Policy at Wilfrid Laurier University, and CIGI Graduate Fellows at the Balsillie School of International Affairs.

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67 Erb Street West
Waterloo, Ontario N2L 6C2, Canada
tel +1 519 885 2444 fax +1 519 885 5450
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