INTERNATIONAL MARITIME ORGANIZATION

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ANY OTHER BUSINESS

Regulation of CO_2 sequestration

Submitted by the World Conservation Union (IUCN)

SUMMARY

Executive summary: Fertilization of the oceans to stimulate phytoplankton growth using micro-nutrients such as iron in order to sequester CO_2 is the subject of increasing commercial interest, despite major outstanding questions about its effectiveness, its impact on marine ecosystems and potential feedback loops that could serve, *inter alia*, to exacerbate the effects of climate change. No international forum has yet considered rules to ensure that ocean fertilization activities to sequester CO_2, including in high seas areas, are effective and do not create hazards to human health, harm living resources and marine life, damage amenities or interfere with other legitimate uses of the sea. Such a forum and a process could be provided through appropriate guidance from the London Convention and Protocol, accompanied by regulations by States to control the activities of their citizens and nationals and of ships flying their flag and ships leaving their ports. First, however, extensive research and discussion at the global level are necessary to address many of the open scientific and legal questions regarding the effectiveness and potential environmental impact of open ocean fertilization activities for CO_2 sequestration purposes and responsibility for controlling related activities

Action to be taken: Paragraph 11

Related documents: None

Introduction

1 Increasing concern over the impacts of climate change is driving quests for new technologies to sequester greenhouse gases such as carbon dioxide in the ocean and seabed. The Parties to the London Protocol have recently amended Annex I of the London Protocol to enable sequestration of CO_2 in sub-seabed geological formations under carefully controlled and

regulated conditions. They have also agreed to foster further scientific research and monitoring to assess its long-term effectiveness as a sequestration mechanism and its environmental impacts.

2 Fertilization of the oceans to stimulate phytoplankton growth using trace nutrients such as iron is another proposed method to sequester CO_2 from the atmosphere into the oceans. Despite years of research, there are still many doubts about its potential effectiveness[1] and significant concerns regarding its potential impact on marine ecosystems and potential feedback loops that could serve, *inter alia*, to exacerbate the effects of climate change.[2] According to recent studies, it is questionable whether such fertilization could substantially contribute to fixing carbon in the ocean, and the effect might well be temporary, in particular in tropical areas.[3] According to the May 2007 summary report of the Intergovernmental Panel on Climate Change (IPCC) on potential mitigation measures: "Geo-engineering options, such as ocean fertilization to remove CO_2 directly from the atmosphere, or blocking sunlight by bringing material into the upper atmosphere, remain largely speculative and unproven, and with the risk of unknown side-effects."[4]

Increasing commercial activities

3 Yet there is increasing commercial interest in this process. There is now at least one commercially-operated pilot research project underway and growing interest by several other similar newly-formed small companies in using iron fertilization activities to sell carbon offset credits.[5]

4 As reported in the New York Times on 1 May, the first commercial project was to have started in early May 2007 when the WeatherBird II, a 115-foot research vessel operated by Planktos Corp., was to have left its dock in Florida to head out to the South Pacific near the

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1 Blain, S, B. Queguiner, L. Armand, S. Belviso, B. Bombled, L.Bopp,,A. Bowie, C. Brunet, C. Brussaard, F. Carlotti, U. Christaki, A. Corbie`re, I. Durand, F. Ebersbach, J-L. Fuda, N. Garcia, L. Gerringa, B. Griffiths, C. Guigue, C. Guillerm, S. Jacquet, C. Jeandel, P. Laan, D. Lefe`vre1, C.Lo Monaco, A. Malits, J. Mosseri, I.Obernosterer, Young-Hyang Park8, Marc Picheral15, P. Pondaven, T. Remenyi, V. Sandroni, G. Sarthou, N. Savoye, L. Scouarnec, M. Souhaut, D. Thuiller, K.Timmermans, T.Trull, J. Uitz, P.van Beek, M. Veldhuis, D.Vincent, E. Viollier, L.Vong, & T. Wagener,, 2007; Effect of natural iron fertilization on carbon sequestration in the Southern Ocean, *Nature 446,* 1070-1075; Boyd, P., T.Jickells, C.Law, S.Blain, E.Boyle, K.Buesseler, K.Coale, J.Cullen, H.deBaar, M.Follows, M.Harvey, C.Lancelot, M.Levasseur, R.Pollard, R.Rivkin, J.Sarmiento, V.Schoemann, V.Smetacek, S.Takeda, A.Tsuda, S.Turner, A.Watson (2007) Mesoscale iron-enrichment experiments 1993-2005: synthesis and future directions. Science,315,612-617; De Baar, H.J.W., P.W. Boyd, Kenneth H. Coale, Michael R. Landry, Atsuhsi Tsuda, Philip Assmy, D.C.E. Bakker, Y. Bozec, R.T. Barber, M.A. Brzezinski, K.O. Buesseler, M. Boyé, P. L. Croot, F. Gervais, M.Y. Gorbunov, P. J. Harrison, W.T. Hiscock, P. Laan, C. Lancelot, C. Law, M. Levasseur, A. Marchetti, F. J. Millero, J. Nishioka, Y. Nojiri, T. van Oijen, U. Riebesell, M.J.A. Rijkenberg, H. Saito, S. Takeda, K.R. Timmermans, M. J.W. Veldhuis, A. Waite and C.S. Wong (2005) Synthesis of Iron Fertilization Experiments: From the Iron Age in the Age of Enlightenment. In: Orr, J. C., S. Pantoja, and H.-O. Pörtner (eds.) The Oceans in High CO2 World, Special Issue of J. Geophys. Res. (Oceans), 110, C09S16, doi:10.1029/2004JC002601, pp 1-24; Buesseler, K.O., Andrews, J.E., Pike, S.M. & Charette, M.A., 2004. The Effects of Iron Fertilization on Carbon Sequestration in the Southern Ocean *Science 304*. no. 5669, pp. 414 – 417; Buesseler, K. O. & Boyd, P. W. 2003. Will ocean fertilization work*? Science 300*, 67–68.

2 E.g. Chisholm, S. W., Falkowski, P. G., Cullen, J. J., 2001. Dis-Crediting Ocean Fertilization. *Science, 294,* 309-310; Lawrence, M. G, 2002. Side Effects of Oceanic Iron Fertilization *Science*, *297*, 1993.

3 See also: Zeebe, R. and D. Archer, 2005. Feasibility of ocean fertilization and its impact on future atmospheric CO2 levels. Geophys. Res. Letters, doi:10.1029/2005GL022449; Archer, D. 2007. Thin soup and a thin story, RealClimate, climate science from climate scientists. www.realclimate.org; Schiermeyer, Q, 2007. Only mother nature knows how to fertilize the ocean. Natural input of nutrients works ten times better than manmade injections. www.nature.com/news/2007.

4 IPCC, 2007. Summary for Policymakers IPCC Fourth Assessment Report, Working Group III, p. 20, para. 17.

5 Richtel, M. 2007. "The Plankton Defense: Companies Try New Ways to Counter Global Warming". The New York Times, 1 May 2007; Planktos Corp website: www.planktos.org.

Galapagos Islands. According to the New York Times and the company website, the ship plans to dissolve tonnes of iron over a 10,000-square-kilometer patch (2,912 square nautical miles) in the high seas of the Eastern Pacific. Over the next two years, the company plans to conduct six discrete pilot studies of moderately large-scale pelagic iron fertilization. In addition to the Eastern Pacific off the Galapagos Islands, other candidate sites include locations off Moorea and Hawaii. Each of this project's six studies will be, in the company's own words, *at least one to two orders of magnitude larger and last four to six times longer than any of the 10 previous international research efforts in this field*[6] (emphasis added).

5 The company Planktos is already offering carbon credits generated through iron-stimulated plankton blooms in the oceans and afforestation projects in Europe (www.planktos.com). According to their website, they sell offsets from these projects to individuals and businesses that are looking to reduce their carbon footprint. Other companies such as Climos (www.climos.com) are also involved in iron fertilization commercialization efforts.

6 IUCN recognizes the importance of scientific research to find methods to reduce the impacts of climate change. Nevertheless, it also believes that commercial activities, including those conducted at the research and pilot levels, involving the intentional deposit of substances to change the marine environment should be guided by provisions no less stringent than those under the London Convention and Protocol to enable a balanced consideration of the potential benefits as well as the potential impacts.

Lack of international rules and guidelines

7 No international forum has yet considered rules to ensure that ocean fertilization activities to sequester CO_2 are effective and do not create hazards to human health, harm living resources and marine life, damage amenities or interfere with other legitimate uses of the sea. As noted in the preamble to the London Convention, all States have the responsibility under international law to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction.

8 Such a forum and a process could be provided through appropriate guidance from the London Convention and Protocol, accompanied by regulation at the State level of the activities of their citizens and nationals and of ships flying their flag and ships leaving their ports. This is particularly appropriate bearing in mind that Contracting Parties to the London Convention are to individually and collectively "promote the effective control of all sources of pollution of the marine environment" (article 1) and under the London Protocol, shall "protect and preserve the marine environment from all sources of pollution" (article 2).

Important scientific and legal questions

9 First, however, IUCN suggests that extensive research and discussion at the global level are necessary to address many of the open legal and scientific questions. Unanswered scientific questions regarding the effectiveness and potential impact of open ocean commercial fertilization activities include, for example:

- Will artificial iron enrichment actually result in a flux of organic carbon to the deep ocean?

[6] Planktos Corp. Request For Science Collaboration Proposals 2007-2008, as distributed by Planktos.

- If it does, would it stay there and if so, how long will it stay in the ocean before it is returned to the atmosphere?

- Will additional organic material flux to the deep ocean cause a significant reduction in the dissolved oxygen concentrations as this organic material decays? What would be the significance for deep-sea marine life of a decline in deep ocean oxygen levels?

- What are the other potential impacts on the benthic communities living on or in the sediments?

- What would be the impacts of iron fertilization on natural (seasonal) planktonic bloom patterns and dynamics? Will any increased phytoplankton growth occur at the cost of planktonic blooms in other areas?

- What would be the impacts of iron fertilization on higher levels of the food chain? Could this improve the production of fish, change fish species composition, or decrease fisheries in general, both in the short- and long-term?

- Will iron fertilization dramatically alter the nature and function of the ocean marine food chains, especially if iron fertilization was done on a semi-continuous basis?

- Will the increased phytoplankton, if any, resulting from iron fertilization cause regional weather and climate modifications by increasing cloud reflectivities through the enhanced emission of sulphur-containing gases, which result in production of sulphate aerosols?

- Will the increased phytoplankton, if any, result in an increase in the greenhouse effect through, e.g., the release of methane and nitrous oxide, and will the increased production of halogen-containing gases also possibly result in reduced ozone?

- Will the absorption by plankton of solar radiation, which drives photosynthesis, have a substantial warming effect on the ocean surface, and if so what will be the effects, e.g., on mixing, oxygen concentration, and the viability of the organisms living in this warmer surface layer?

- Will the addition of iron cause any other long- or short-term changes in ocean chemistry in the project area or other areas?

10 Important legal questions that will need to be addressed include:

- Does the placement of iron in any form for the purposes of inducing phytoplankton blooms qualify as dumping under the London Convention and Protocol? Article III (1)(b)(ii) (London Convention) and Article I (4)(.2)(.2) (London Protocol) states that "placement of matter for a purpose other than the mere disposal thereof does not qualify as "dumping" under the Convention/Protocol, "provided that such placement is not contrary to the aims of this Convention"/Protocol.

- Who is to make the judgment, required under Article III (1)(b)(ii) (LC) and Article I (4)(.2)(.2) (LP), that ocean fertilization is or is not contrary to the aims of the Convention/Protocol, i.e., "is liable to create hazards to human health, to harm living

resources and marine life, to damage amenities or to interfere with other legitimate uses of the sea" (Article 1 London Convention), and "harm to living resources and marine ecosystems, hazards to human health, hindrance to marine activities, including fishing and other legitimate uses of the sea, impairment of quality for use of sea water and reduction of amenities" (London Protocol Article 1(10) and Article 2). The operator, the flag state, the port state, the State party, the Scientific Group, the Consultative Meeting of the Convention and/or the Meeting of Contracting Parties of the Protocol?

– What is the role of civil society, parties and non-parties to the London Convention and/or Protocol with respect to activities that may affect the high seas global commons?

– Who is responsible for damage to the marine environment from, e.g., oxygen deprivation, suffocation, nutrient depletion, acidification, etc., should such damage occur?

– Who is responsible to the global community and coastal states should the process in fact exacerbate warming of the oceans and atmosphere, or provoke other modifications of regional weather through, e.g., effects on clouds, and hence worsen the impacts of climate change?

Action requested of the Scientific Groups

11 The Scientific Groups are invited to:

.1 initiate, on a priority basis, scientific studies to determine what further action is necessary to bring commercial open ocean fertilization projects under appropriate scrutiny and control;

.2 bring to the attention of the Parties to the London Convention and to the Protocol the urgent need to ensure that ongoing and future commercial fertilization activities, including in high seas areas, are swiftly brought under international and domestic regulation and that related commercial research and pilot projects are subject to appropriate scrutiny and control in line with the aims, duties and provisions of the London Convention and Protocol; and

.3 bring to the attention of the Parties to the London Convention and to the Protocol the urgent need for legal studies to determine what further action, if any, is necessary to bring ocean fertilization projects under appropriate scrutiny and control and to ensure that commercial ocean fertilization projects are subject to assessment, permitting, control and monitoring procedures as are activities considered to be dumping under the Convention and the Protocol.