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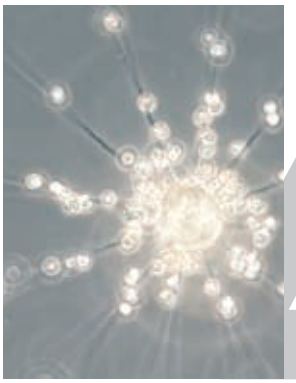

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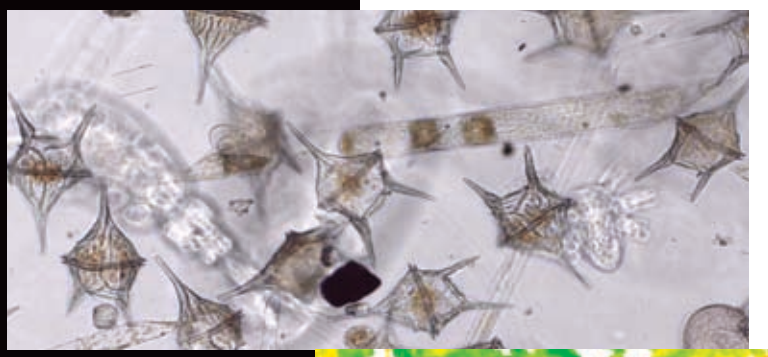
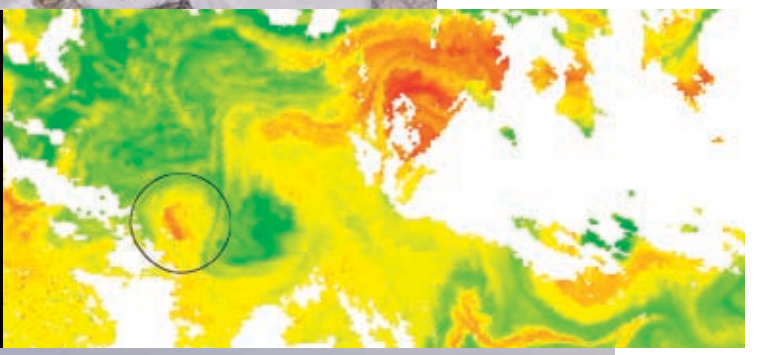
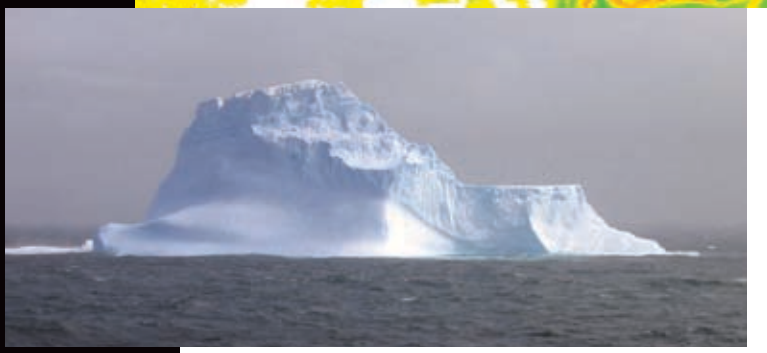
Scientific Synthesis of the Impacts of Ocean Fertilization on Marine Biodiversity







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Scientific Synthesis of the Impacts of Ocean Fertilization on Marine Biodiversity

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Front cover (top to bottom): (1) Phaeocystis cells freshly attached to the spines of a diatom (*Corethron pennatum*) in the process of colony formation (cells are 0.005 mm). b) Older colonies overgrowing a diatom cell (the largest colony is 0.05 mm across)—photo: Marina Montresor, SZN / Alfred Wegener Institute. (2) The phytoplankton species *Ceratium pentagonum* from the ice field with diatoms and juvenile copepods in the background—photo: M. Montresor, SZN / Alfred Wegener Institute. (3) Satellite image of sea-surface chlorophyll concentrations with LOHAFEX bloom encircled. Note much larger natural bloom on the upper right and the generally higher values in the southeast than elsewhere—graphic: NASA (http://oceancolor.gsfc.nasa.gov). (4) Iceberg—photo: Kevin Saw, NOCS / Alfred Wegener Institute.

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FOREWORD

As early as the 1930s, scientists had speculated that iron deficiency could account for areas of the world's oceans with scarce phytoplankton growth. In the 1980s, the studies of the oceanographer John Martin confirmed that the scarcity of iron micronutrients was indeed a major factor in limiting phytoplankton growth and overall productivity in "high-nutrient, low-chlorophyll" (HNLC) areas of the oceans. His research, supported by test experiments, suggested that adding iron to the surface waters of HNLC areas would intensify phytoplankton growth to such an extent that it could reduce atmospheric CO_2 concentrations and thereby mitigate climate change. In 1991, John Martin famously stated "*Give me a half a tanker of iron and I will give you another ice age,*" giving rise to the concept of "ocean fertilization." With the predicted increases in atmospheric CO_2 concentrations and the impact that this will have on humankind and life on Earth, all ideas and concepts to mitigate climate change have to be considered—controversial or not. Ocean fertilization is an intriguing concept: it utilizes the ocean (the largest carbon reservoir on Earth); is based on natural processes; and in theory, suggests that large amounts of CO_2 could be sequestered with relatively little cost.

In recent years, a number of companies have expressed interest in carrying out large-scale ocean fertilization on a commercial basis. This caused policy-makers and stakeholders, including countries, international organizations, and the scientific community, to assess the concept of ocean fertilization in more detail, which highlighted potential benefits but also a range of uncertainties and questions, such as: "*Is large-scale ocean fertilization a feasible and effective option to mitigate climate change? What are the impacts of the intended and unintended changes caused by ocean fertilization? How will the marine environment respond? Will marine biodiversity and ecosystems remain healthy, or will the addition of iron give no net benefit while causing other problems?*" In the ongoing debate about ocean fertilization, the Conference of the Parties to the Convention on Biological Diversity, at its ninth meeting, requested Parties and urged other Governments, in accordance with the precautionary approach, to ensure that ocean fertilization activities do not take place until there is an adequate scientific basis on which to justify such activities. Likewise, many other international organizations and experts have expressed their concerns about the possible adverse impacts of large-scale ocean fertilization activities.

This publication, prepared in direct response to a request by the ninth meeting of the Conference of Parties to the Convention, investigates the scientific basis of these concerns with a view to providing an objective synthesis and analysis of the impacts of ocean fertilization on marine biodiversity. Among other findings, this publication demonstrates that there are uncertainties surrounding the viability of large-scale ocean fertilization as a carbon sequestration tool and potential adverse consequences for marine species, habitats and ecosystem function. There is thus an urgent need to establish a global, transparent and effective control and regulatory mechanism as well as to set in place a thorough prior assessment of the potential impacts of the proposed projects involving ocean fertilization, in order to ensure that such activities do not jeopardize human health or breach the protection, conservation and sustainable management of the marine environment or living resources.

Dr. Ahmed Djoghlaf
Executive Secretary
Convention on Biological Diversity