NEW HOT PAPERS - 2009

November 2009

PDF

Ove Hoegh-Guldberg talks with *ScienceWatch.com* and answers a few questions about this month's New Hot Paper in the field of Multidisciplinary.

Article Title: Coral reefs under rapid climate change and ocean acidification
Authors: Hoegh-Guldberg, O, et al.
Journal: SCIENCE
Volume: 318
Issue: 5857
Page: 1737-1742
Year: DEC 14 2007
* Univ Queensland, Ctr Marine Studies, St Lucia, Qld 4072, Australia.
* Univ Queensland, Ctr Marine Studies, St Lucia, Qld 4072, Australia.
* Univ Exeter, Sch Biosci, Marine Spatial Ecol Lab, Exeter EX4 4PS, Devon, England.
(addresses have been truncated)

SW: Why do you think your paper is highly cited?

The paper focuses on the issue of coral reefs and climate change, synthesizing our current understanding of past, present, and future trajectories for these biologically diverse marine ecosystems. I believe that this paper has attracted a lot of attention given the importance of coral reefs to over 100 million people worldwide, and given that the paper summarizes the latest science on how these ecosystems are and will be impacted by climate change.

The paper has also had policy significance, in that it has contributed to the debate on the stabilization targets for atmospheric carbon dioxide. In the latter case, it makes the point very plainly that exceeding atmospheric carbon dioxide levels of more than 450 parts per million (ppm) will trigger the loss of coral reefs (and a lot more).

SW: Does it describe a new discovery, methodology, or synthesis of knowledge?

Primarily, it is a synthesis of the science gained over the past decade, which has been marred by the increasing destruction of reefs by rapid anthropogenic climate change. In addition to the loss of Arctic sea ice, coral reefs represent an early example of the scale and intensity with which climate is likely to affect natural ecosystems and processes everywhere.

One of the major outcomes of the paper is the conclusion—convincingly, we would argue—that increasing carbon dioxide levels above 450 ppm will cause coral-dominated reef ecosystems to disappear. Synthesizing the available science and coming to this conclusion (i.e., 450 ppm is the absolute upper limit for stabilization) has not been done in a single place before.

SW: Would you summarize the significance of your paper in layman's terms?

This paper summarizes the last 10 years of science on how coral reefs are being affected by climate change. In doing so, it reveals the enormous risk that we take with the world's most biologically diverse marine ecosystem, and in doing so, highlights the extreme danger that we face with respect to all human and natural systems if we push carbon dioxide well beyond where it has a been during the past 20 million years.

The identification of the critical stabilization point of 450 ppm has attracted a lot of interest from policymakers, who are looking to scientists for advice on where these targets for atmospheric CO_2 must lie. In this respect, the implications of this paper have now been fed into national and international negotiations on several occasions already.

"In addition to the problems of reducing emissions, there will almost certainly be major changes to natural ecosystems, such as coral reefs..."

SW: How did you become involved in this research, and were there any problems along the way?

Many of the authors on this paper have been involved in research associated with the biology of coral for many decades. Most of them have come to this area of research at the same time, as there has been increasing evidence that local concerns—pollution, fishing—and global issues—rising sea levels, temperatures, and acidities—are seriously impacting coral reef ecosystems.

The paper also discusses the link between local stresses arising from human activities such as coastal development, urbanization, and over-fishing, and global climate change. The interrelationship between the two stresses has highlighted the importance of dealing with both, and the opportunity that exists to buy important time for coral reefs while we struggle to get global emissions under control. For example, time can be bought for reefs by maintaining healthy populations of herbivorous fish, which in turn control seaweeds and give corals a better chance of bouncing back from impacts like mass coral bleaching and mortality. And so on.

SW: Where do you see your research leading in the future?

The next big sets of questions are those associated with the solutions that we need to apply to the challenges of rapid anthropogenic climate change. In some ways, this is going to be a more difficult area than that associated with the initial identification of the problems. For example, we recently formed an expert group to explore whether or not current ecosystem management tools were adequate enough to match the enormous challenges that climate change imposes on natural ecosystems such as coral reefs and other ecosystems.

Our conclusion (O Hoegh-Guldberg, *et. al.*, "Assisted Colonization and Rapid Climate Change" *Science* 321:345–46, July 2008) was that many of the so-called traditional tools were now ineffective under rapid climate change. The questions such as whether or not we should move species and ecosystems critically endangered by a rapidly moving climate are currently unanswered and form an important frontier for future research. Trying to understand more about the interaction and synergies associated with climate factors will also be increasingly important as we tried to pre-empt the "surprises" and non-linear changes that are almost certain to occur over the coming decades and century of stress.

SW: Do you foresee any social or political implications for your research?

As discussed above, there are many social and political implications of our research. In identifying the problems associated with exceeding atmospheric carbon dioxide concentrations of 450 ppm, research such as ours has essentially thrown out an enormous challenge to policymakers and other specialists such as the economists.

Stabilization at 450 ppm will require deep and immediate cuts in carbon dioxide emissions, such that emissions need to be in decline globally within 10 years time. As has been seen from recent discussions, this will be far from easy. In addition to the problems of reducing emissions, there will almost certainly be major changes to natural ecosystems, such as coral reefs, as climate change that is in the pipeline (so to speak) rolls through the system. In this respect, there will be continued deterioration of coral reefs by thermal stress (bleaching) and ocean acidification, with implications for the estimated hundred million people that depend on them daily, and the billion-dollar tourist and fishery industries associated with coral reefs.

Ove Hoegh-Guldberg
Professor and Director
Centre for Marine Studies

The University of Queensland
St. Lucia, Australia

Related links:

Smart State Premier's Fellow (2008-2013)
Blog
Coral Reef Targeted Research Project
ARC Centre for Excellence
Fluorescence Images by Ove Hoegh-Guldberg

Keywords: coral reefs, coral-dominated reef ecosystems, rapid anthropogenic climate change, global climate change, biologically diverse marine ecosystem, global CO2 emissions, atmospheric carbon dioxide levels, 450 parts per million, pollution, fishing, rising sea levels, temperatures, acidities, coastal development, urbanization, over-fishing, healthy populations of herbivorous fish, mass coral bleaching.

PDF

back to top

2009 : January 2009 - Hew Hot Papers : Ove Hoegh-Guldberg

Scientific Home | About Scientific | Site Search | Site Map