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A strong case for limiting climate change BIOACID concludes after eight years of extensive research on ocean acidification

25 October 2017/Kiel. In November 2017, the German research network on ocean acidification BIOACID (Biological Impacts of Ocean Acidification) reaches its conclusion after eight years of extensive interdisciplinary scientific activity. Experiments and analyses carried out by more than 250 scientists from 20 German institutions clearly indicate that ocean acidification and warming, along with other environmental stressors, impair life in the ocean and compromise important ecosystem services it provides to humankind. A brochure summarises major outcomes of the project for policymakers and the public. BIOACID members will also be present at the United Nations climate change conference COP23 in Bonn.

As a gigantic carbon sink, the ocean has taken up about a third of the carbon dioxide (CO₂) released into the atmosphere by human activities. But when absorbed by seawater, the greenhouse gas triggers chemical reactions, causing the ocean to acidify. Ocean acidification affects ecosystems and important services the ocean provides to humankind. This includes the regulation of the Earth's climate, food provision, recreation as well as biodiversity as a condition for intact and functioning ecosystems.

“We need to see ourselves as part of a global system and understand the many ways in which we depend on the ocean and its services. Because everyone in this global community will be affected by climate change, it will be for our own benefit if we manage to reduce carbon dioxide emissions in such a way that global warming is limited to less than 2 degrees Celsius”, says Prof. Ulf Riebesell, marine biologist at GEOMAR Helmholtz Centre for Ocean Research Kiel and coordinator of BIOACID. “The future of this planet depends on us. Wouldn't it be a great achievement if the anthropocene, the age of human dominance on Earth, goes down in history as an era of rethinking and changing behaviour?”

According to Hans-Otto Pörtner, co-coordinator of BIOACID, marine ecophysiologicalist at Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research and Co-Chair of the Intergovernmental Panel on Climate Change (IPCC) Working Group II, all countries would need to reduce their carbon dioxide emissions drastically by the middle of this century if they wish to reach the Paris climate targets. “The current world climate report indicates clearly that net-zero emissions are a precondition for limiting global warming to well below 2 degrees Celsius. However, reducing CO₂ emissions alone may not be sufficient. Net removal of CO₂ from the atmosphere would have to contribute. This is already technically possible, but the challenge is to develop and implement the respective technologies at a larger scale. The later the emission reductions start and the longer this process takes, the more difficult and costly it becomes to stay in line with the Paris agreement.”

Important BIOACID results

- Changes in the ocean carbonate system impact the acid-base balance in marine organisms. This can negatively affect key processes such as calcification.

- Many organisms are able to withstand ocean acidification, but may lose this ability if also exposed to other stressors such as warming, excess nutrients, loss of oxygen, reduced salinity or pollution.
- A reduction of regional stress such as nutrient runoff or the loss of oxygen can mitigate the impact of global stressors like ocean acidification and warming.
- In a natural community, the impact of stressors on a species can be amplified or diminished by associated shifts in biotic interactions such as competition, predation or parasitism.
- Even small alterations at the base of the food web can have knock-on effects for higher trophic levels.
- Marine life is able to adapt to ocean change through evolution and can partly compensate for negative effects. However, since ocean acidification happens extremely fast compared to natural processes, only organisms with short generation times, such as microorganisms, are able to keep up.
- About half the tropical coral reefs can be preserved if carbon dioxide emissions are limited to concentrations that keep global warming below 1.2 degrees Celsius. However, additional risks posed by ocean acidification are not included in this forecast.
- Ocean acidification reduces the ocean's ability to store carbon.
- Climate change alters the availability of prey for fish and as a consequence may affect their growth and reproduction.
- Ocean acidification and warming reduce the survival rates of early life stages of some fish species. This will likely reduce recruitment of fish stocks and ultimately fisheries yields.
- The distribution and abundance of fish species will change. This will have a significant impact on economic activities such as small-scale coastal fisheries and tourism.
- It is crucial to consider ocean acidification and warming in the management of fish stocks and marine areas.
- Following the precautionary principle is the best way to act when considering potential risks to the environment and humankind, including future generations. Even if the extent of possible risks is not fully understood, precautionary measures need to be taken in order to avoid or reduce the harm.
- A more sustainable lifestyle and economy require an interaction between society, businesses and politics. Political frameworks should regulate the phase-out of fossil fuels. It is crucial for every one of us to reconsider concepts of normality and adjust behaviour in everyday life.

About BIOACID:

Since 2009, more than 250 BIOACID scientists from 20 German research institutes have investigated how different marine organisms respond to ocean acidification and increasing carbon dioxide concentrations in seawater, how their performance is affected during their various life stages, how these reactions impact marine food webs and elemental cycles and whether they can be mitigated by evolutionary adaptation. Well-controlled laboratory as well as large-scale field experiments were conducted with keystone species and natural communities in a wide range of habitats in the North and Baltic Sea, the Atlantic and Arctic Ocean, and off Papua New Guinea, among other places. In addition to ocean acidification, other stressors such as ocean warming, deoxygenation, eutrophication and overfishing were considered in many BIOACID studies.

BIOACID contributed to the scientific discourse on ocean acidification in more than 580 peer-reviewed publications. The project has been coordinated by Prof. Ulf Riebesell, marine biologist at GEOMAR Helmholtz Centre for Ocean Research Kiel, and Prof. Hans-Otto Pörtner, marine ecophysiologicalist at Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research and Co-Chair of the Intergovernmental Panel on Climate Change (IPCC) Working Group II. Throughout the three funding phases, the German Ministry of Education and Research has supported BIOACID with a total of 22 million Euros.

The BIOACID Brochure:

“Exploring Ocean Acidification. BIOACID – Biological Impacts of Ocean Acidification”

www.oceanacidification.de/wp-content/uploads/2017/10/BIOACID_brochure_e_web.pdf

BIOACID at COP23

6 - 17. November 2017: information stand in the Bonn Zone

6 November 2017, 2:30-3:30 pm, German Pavilion: „Linking the ocean with climate protection - ocean acidification as a conjunctive matter“

11 November 2017, 12:30-1:30 pm, German Pavilion: German Science Hour: Our ocean future: marine ecosystems under climate change. Panel discussion Wilfried Kraus (BMBF), Prof. Hans-Otto Pörtner (IPCC, AWI – tbc), Prof. Ulf Riebesell (GEOMAR) and Dr. Sebastian Ferse (ZMT).

Links:

www.oceanacidification.de BIOACID – Biological Impacts of Ocean Acidification

www.geomar.de GEOMAR Helmholtz Centre for Ocean Research Kiel

Images:

Images are available for download at www.geomar.de/n5503-e. Video footage on request.

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