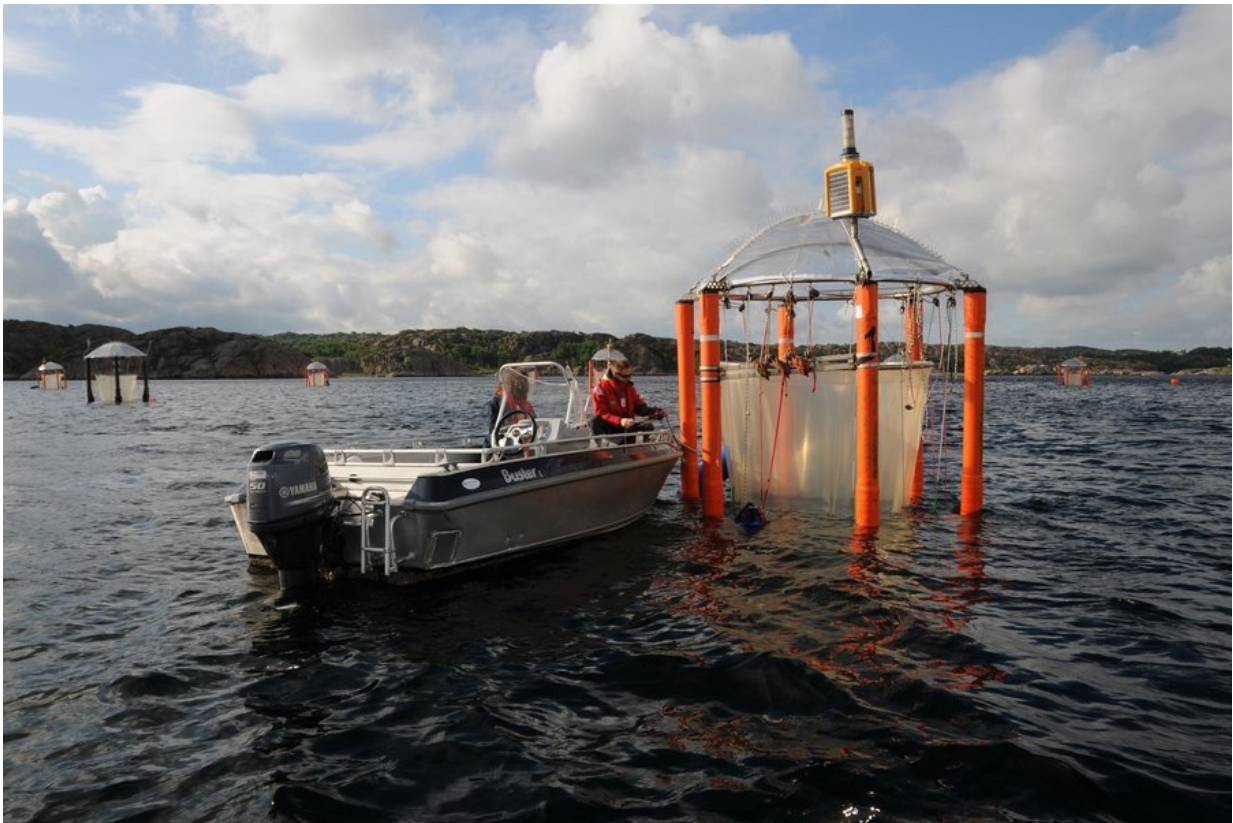


Ocean acidification research makes a strong case for limiting climate change

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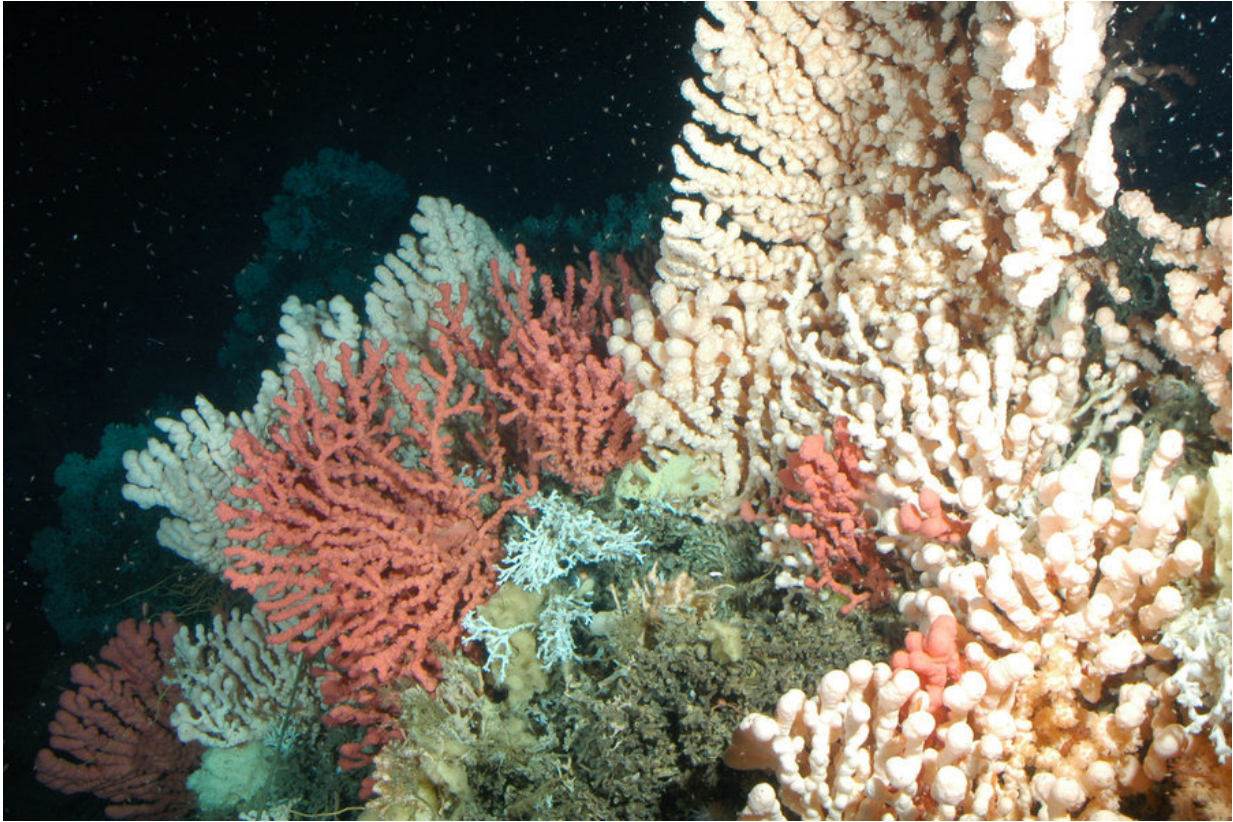
In several long-term experiments with the KOSMOS mesocosms, the BIOACID members have investigated the impact of ocean acidification on marine ecosystems. Credit: Maike Nicolai, GEOMAR (CC BY 4.0)

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. [A brochure summarises](#) major outcomes of the project for policymakers and the public. Members of the project Biological Impacts of Ocean Acidification (BIOACID) will also be present at the United Nations climate change conference COP23 in Bonn.

As a gigantic carbon sink, the [ocean](#) absorbs 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 benefits the ocean provides to humankind. This includes the regulation of the Earth's climate, food provision, recreation and biodiversity as a condition for intact and functioning ecosystems.

"Humans need to see themselves as part of a global system and understand the many ways 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?"



Cold water coral reefs also belong to the ecosystems that are affected by oceanic acidification. Credit: JAGO Team, GEOMAR (CC BY 4.0)

According to Hans-Otto Pörtner, co-coordinator of BIOACID, 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.



The Kiel research vessel ALKOR with the KOSMOS mesocosms in the Gullmar Fjord, Sweden. Credit: Maike Nicolai, GEOMAR (CC BY 4.0)



In 2015, an experiment with the KOSMOS mesocosms was conducted in the Raunefjord, Norway. Credit: Maike Nicolai, GEOMAR (CC BY 4.0)

More information: "Exploring Ocean Acidification. BIOACID – Biological Impacts of Ocean Acidification."

[www.oceanacidification.de/wp-c ... D brochure e web.pdf](http://www.oceanacidification.de/wp-content/uploads/2015/09/D_brochure_e_web.pdf)

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