Ocean Acidification

Seas turning sour

Ocean acidification is a direct consequence of increased human induced carbon dioxide (CO_2) concentrations in the atmosphere. The ocean absorbs 25% of the total human emissions to the atmosphere each year. While ocean acidification is only a recently discovered and researched phenomenon, the changes in ocean chemistry caused by increasing atmospheric CO_2 are well understood. CO_2 dissolves in sea water and forms carbonic acid, thus decreasing the ocean's pH and leading to a suite of chemical changes collectively known as ocean acidification.

Reduced capacity of the ocean to buffer climate change

The ocean is Earth's biggest carbon sink. Uptake of CO_2 by the ocean currently moderates or partially buffers the rate of climate change. By absorbing CO_2 from the atmosphere, the ocean slows the anthropogenic greenhouse effect. However, ocean acidification harms various forms of marine life and therefore puts at risk ocean-related benefits to society.

Recent studies show that the ocean's ability to absorb and thus buffer anthropogenic CO_2 will decrease in upcoming decades. Ocean warming reduces CO_2 solubility and leads to increased ocean stratification, thus reducing the ocean's ability to absorb carbon. The ocean will continue to be a carbon sink as long as atmospheric CO_2 concentrations continue to rise. But as the ocean's capacity to act as a carbon sink diminishes, atmospheric CO_2 may over centuries stabilize at higher levels than would otherwise have been the case.

Changes at unprecedented rate and magnitude

Present ocean acidity change is unprecedented in magnitude, the rate of change exceeding any known to have occurred for at least the past 25 million years. This is jeopardizing ocean systems' ability to adapt to changes in CO_2 that would naturally occur over the millennia. Changes in ocean pH levels will persist as long as concentrations of atmospheric CO_2 continue to rise.

Impacts on marine ecosystems and consequences for humans

A growing body of scientific evidence on the biological impacts of ocean acidification emerged since the IPCC 4th Assessment Report. Ocean acidification has the potential to change marine ecosystems and impact many ocean-related benefits to society. Although more knowledge on the impacts of ocean acidification on marine life is needed, changes in many ecosystems and the services they provide to society can be extrapolated from current understandings.

Some of the strongest evidence of the potential effects of ocean acidification on marine ecosystems stems from experiments on calcifying organisms. Increased seawater acidity has been demonstrated to affect the formation and dissolution of calcium carbonate shells and skeletons in a range of marine species, including corals, mollusks such as oysters and mussels, and many phytoplankton and zooplankton species that form the base of marine food webs. Changes in species growth and reproduction as well as structural and functional alterations in ecosystems will threaten food security, harm fishing industries, and decrease natural shoreline protection while increasing the risk of inundation and erosion in low-lying areas.

What needs to be done?

The long time-lags inherent in the marine carbon cycle put a penalty on delaying limits on carbon dioxide emissions, and a premium on early action if the worst damages associated with ocean acidification are to be avoided. While climate change is the consequence of a range of greenhouse gas emissions, ocean acidification is solely caused by increased concentrations of atmospheric CO_2 dissolved in sea water. To combat the worst effects of ocean acidification, carbon dioxide emissions must be significantly and immediately cut at the source. While some geo-engineering methods may affect climate change, some techniques will not reduce CO_2 concentrations in the atmosphere. These climate change mitigation strategies will hence have little direct effect on ocean chemistry and will not help to alleviate the threats posed by ocean acidification.

What is IUCN doing?

IUCN supports the European Project on Ocean Acidification (EPOCA), a collaboration between top European research groups aimed at filling gaps in our understanding of the effects and implications of ocean acidification. The project aims to document changes in ocean chemistry and biogeography across space and time and to determine the sensitivity of marine organisms, communities and ecosystems to ocean acidification. Laboratory and field-based experiments will be used to quantify biological responses to ocean acidification, assess the potential for adaptation, and determine the consequences for biogeochemical cycling. IUCN participates in the EPOCA Reference User Group, and plays an important role in communicating results from this cutting edge research across the globe. In 2009 EPOCA released 'Ocean Acidification: The Facts. A special introductory guide for policy advisers and decision makers'[1].

IUCN is also working towards addressing ocean acidification permanently into national and international policy frameworks such as the United Nation Framework Convention on Climate Change (UNFCCC). Ocean acidification must be recognized as a serious global challenge of unprecedented scale and importance that requires immediate action.

More information

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IUCN Global Marine Programme – www.iucn.org/marine

[1] http://www.iucn.org/about/work/programmes/marine/marine_resources/marine_publications/?4338/oceanacidificationenglish