



UK Ocean Acidification
Research Programme

The Invisible Storm – Ocean Acidification

It will last at least 10,000 years and impact us all.



We cannot see or hear it but its impacts are already being felt, from oysters and the multi-million dollar aquaculture business on the west coast of North America, to the sea butterfly (marine shelled snails called pteropods) in Antarctic waters, a key link in the ocean food web.

The cause is global carbon dioxide (CO₂) production; the solution is substantial global reduction of CO₂ emissions.

Ocean acidification is directly caused by the increase of CO₂ levels in the atmosphere. When CO₂ enters the ocean it rapidly undergoes a series of chemical reactions, which increase the acidity of the surface seawater, lowering its pH. The ocean has already removed about 30% of anthropogenic CO₂ over the last 250 years, decreasing pH at a rate not seen for around 60 million years.

The continuation of such a fundamental and rapid change to ocean chemistry is bad news for life in the sea; it will not only cause problems for many organisms with calcium carbonate skeletons or shells (such as oysters, mussels, corals and some planktonic species) but could also impact many other organisms, ecosystems and processes, with potentially serious implications for society.

The highly productive upwelling along the coast of Peru, the rest of the West coast of Latin America and North America are particularly vulnerable to ocean acidification due to upwelling of CO₂ rich and low pH waters. The location of COP 20 alongside this upwelling is a real opportunity for the climate change negotiations to take account of the impacts of CO₂ and other greenhouse gases on ocean ecosystems and the food and livelihoods that depend on this natural provider.

“The health of the ocean is of vital importance to each and every one of us, making it crucial that its value and benefits are recognised in international climate change discussions. With the ocean facing a multitude of stressors, we, as a global society, need to ensure that the marine environment is protected for the benefit of future generations.”

Dr Carol Turley OBE, Plymouth Marine Laboratory, UK Ocean Acidification research programme.

Ocean acidification can also make species more susceptible to the impacts of warming waters, which have decreased oxygen levels, further stressing marine organisms.

Acting together these three stressors; increased acidity, an altered ocean chemistry and warmer waters with less oxygen, could rapidly threaten biodiversity, biogeochemical cycles, ecosystems and the goods and services the ocean provides to society.

It is imperative that society and international decision-makers, in particular, understand the enormous role the ocean plays in sustaining life on Earth and the consequences of high CO₂ emissions for the ocean and society.



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Knowledge Exchange Office

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The UK Ocean Acidification research programme is a 5 year programme, funded by the UK Natural Environment Research Council (NERC), the Department for Environment, Food and Rural Affairs (Defra) and the Department of Energy & Climate Change (DECC).

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Experts available for Interview in Lima:

Dr Carol Turley OBE – Plymouth Marine Laboratory (ct@pml.ac.uk)



Dr Carol Turley's research has been centred on the ocean's biogeochemical cycles looking at habitats from shallow and deep-sea sediments, estuaries, frontal systems to large enclosed waters. She has researched pelagic-benthic coupling and the role of sediment dwelling microorganisms on mediating sediment processes and the effect of sediment bound contaminants on biodiversity and biogeochemical processes.

In the last 10 years Carol became interested in ocean acidification leading the UK Government (Defra) review on impact of pH change on the marine environment, she was an author on the OSPAR report on the topic, a member of The Royal Society Working Group on ocean acidification and was a lead author on the 2007 Intergovernmental Panel on Climate Change (IPCC) 4th Assessment Report on Climate Change and Review Editor for the 5th Assessment Report. She is Knowledge Exchange Coordinator for the UK Ocean Acidification research programme and is chair of the Advisory Board for the Ocean Acidification – International Coordination Centre and member of other ocean acidification scientific steering committees.

She briefs a wide range of interested global stakeholders including the UK Government departments of DECC, Defra, FCO and GO Science, as well as the UK Government Chief Scientists, on the latest science of ocean acidification and has presented in the Houses of Parliament, the European Parliament, the U.S State Department and a number of U.N meetings. She has published and presented on a wide range of topics within the field of ocean acidification, ranging from its cause, chemistry, impacts and the potential social, economic and political consequences.

Dr Phil Williamson – UK Natural Environment Research Council and University of East Anglia (p.williamson@uea.ac.uk)



Phil Williamson has worked on the management and coordination of ocean acidification research for the past five years, with his current roles including:

- Science Coordinator for the UK Ocean Acidification research programme and the UK Shelf Sea Biogeochemistry research programme, both co-funded by the UK Natural Environment Research Council (NERC) and UK government departments.
- Co-chair of the Global Ocean Acidification Observing Network (GOA-ON), with sponsors including IOC-UNESCO and IAEA



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- Member of the Ocean Acidification International Reference User Group (OAIRUG), the main global interface body linking the research community with research users and policy-makers
- Member of the OSPAR-ICES Ocean Acidification Study Group, developing policy advice for ocean acidification monitoring in the North East Atlantic.

His main activities have been the coordination of interdisciplinary programmes in marine biogeochemistry and climate change. In 2012, he was lead author for a review of climate geoengineering for the Convention on Biological Diversity, and has recently co-edited a CBD review on the impacts of ocean acidification on biodiversity. Phil has given presentations on ocean acidification at very many international meetings, including the Our Ocean conference hosted by the US. State Department (Washington DC, June 2014) and the 2nd International Ocean Research Conference, 'One planet, one ocean' (Barcelona, November 2014).

Resources

The Other CO₂ Problem - https://www.youtube.com/watch?v=F5w_FgpZkVY

Ocean Acidification: Connecting science, industry, policy and public - https://www.youtube.com/watch?v=_BPS8ctVW2s&feature=plcp

Ocean in Peril - <https://www.youtube.com/watch?v=bJOY50wbixQ>

Digital Explorer Ocean Acidification educational resource - <http://oceans.digitalexplorer.com/resources/?collection=ocean-acidification>

International Geosphere-Biosphere Programme (IGBP) ocean acidification online resource - <http://ocean-acidification.net/>

Massive Open Online Course (MOOC) video on ocean acidification - <https://www.youtube.com/watch?v=Dr4jhgxDQSI&list=PLk8mh9aWmPaRzVoQTI-mjuBHOJ0x4y113&index=5>

News Articles

<http://www.huffingtonpost.com/news/ocean-acidification/>

<http://www.bbc.co.uk/news/science-environment-29746880>

<http://www.bbc.co.uk/news/magazine-26746039>

<http://www.theguardian.com/vital-signs/2014/oct/29/diet-climate-maple-syrup-coffee-global-warming>

<http://www.newscientist.com/article/dn26344-acid-damage-to-coral-reefs-could-cost-1-trillion.html#.VHcWFJ1FDcs>

<http://www.newscientist.com/article/dn22531-animals-are-already-dissolving-in-southern-ocean.html>

<http://www.newscientist.com/article/dn24098-acidifying-oceans-will-heat-the-planet-more.html#.VHcWI51FDcs>



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<http://news-oceanacidification-icc.org/>

Reports

Updated synthesis of the impact of ocean acidification - <http://www.cbd.int/doc/publications/cbd-ts-75-en.pdf>

Ocean Acidification Summary for Policymakers -

<http://www.igbp.net/news/news/news/oceanacidificationsummaryforpolicymakersreleased.5.30566fc6142425d6c911265.html>

20 Facts about Ocean Acidification - <http://www.oceanacidification.org.uk/pdf/OA20Facts11-18final.pdf>

Public Perceptions of Ocean Acidification -

http://psych.cf.ac.uk/understandingrisk/reports/cardiff_ocean_acidification.pdf

Papers

Beyond ocean acidification - <http://www.nature.com/ngeo/journal/v4/n5/full/ngeo1150.html>

Field investigation of ocean acidification effects in northwest European seas - http://www.biogeosciences-discuss.net/special_issue129.html

Theme Issue 'Ocean acidification and climate change: advances in ecology and evolution' -

<http://rstb.royalsocietypublishing.org/content/368/1627.toc>

Useful links

- UK Ocean Acidification Research Programme (UKOA) - www.oceanacidification.org.uk
- Ocean Acidification - International Coordination Centre (OA-ICC) - www.iaea.org/ocean-acidification/page.php?page=2181
- Biological Impacts of Ocean Acidifications (BioACID) - www.bioacid.de
- Mediterranean Sea Acidification in a changing climate (MedSeA) – www.medsea-project.eu
- European Project on Ocean Acidification (EPOCA) - www.epoca-project.eu
- Global Ocean Acidification Observing Network (GOA-ON) - www.goa-on.org
- U.S. Ocean Carbon & Biogeochemistry Programme (OCB) - www.us-ocb.org
- Pacific Marine Environmental Laboratory (PMEL) Carbon Program - <http://pmel.noaa.gov/co2/>
- Hot , Sour & Breathless – www.oceanunderstress.com
- Ocean Acidification Summary for Policymakers - <http://www.igbp.net/publications/summariesforpolicymakers/summariesforpolicymakers/oceanacidificationsummaryforpolicymakers2013.5.30566fc6142425d6c9111f4.html>



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