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RIO+20

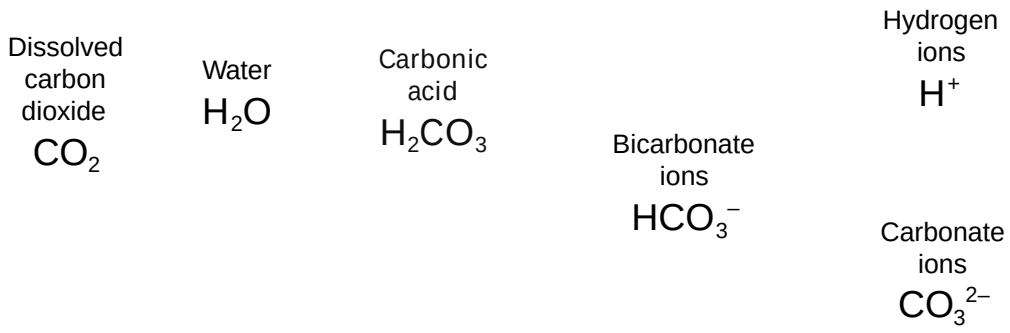
on Sustaina Conference lopment

It is amazing to think that just ten years ago hardly anyone had heard of ocean acidi cation.
It is now much more widely understood that the increasing amount of carbon dioxide (CO_2) we are emitting into the air by our activities is reacting with the ocean to alter its chemistry and push it along the scale towards acidity. One major effect is reducing the availability of carbonate ions needed by many marine animals and plants to build their shells and skeletons.

This brie ng paper from the International Ocean Acidi cation Reference User Group provides essential information and highlights the actions needed on ocean acidi cation by Governments at Rio+20

There is little doubt that the ocean is undergoing dramatic changes that will impact many human lives now and ever more so in the coming generations, unless we act quickly and decisively. Previous acidi cation events in the Earth's geological record were often associated with extinctions of many species. Whilst the causes of such extinction episodes are complex, it is notable that the biodiversity recovery took hundreds of thousands and, after mass extinctions, millions of years.

The burning of fossil fuels not only increases CO_2 in the atmosphere but also in the ocean. As a result, the concentration of hydrogen ions increases (increasing acidity) whilst the concentration of carbonate ions decreases.Source University of Maryland.



Who is taking action on ocean acidification?

In the last few years there has been a signi cant growth in scienti c studies to understand what is happening now and what may happen in the future as a result of ocean acidi cation.

Current scienti c studies focus on understanding the consequences and mechanisms of this global problem to identify the best strategies for addressing it. There is a need to ensure that the concerns of developing countries are adequately addressed, and also that new ndings are rapidly disseminated as they emerge in the research community.

In November 2010, the CSM and the IAEA (sponsored by the USA Peaceful Uses Initiative) jointly hosted an international workshop with the endorsement and support of the Principality of Monaco, the Oceanographic Museum, the Prince Albert II of Monaco Foundation and the French Ministry of Ecology, Energy, Sustainable Development and the Sea. This meeting on the *Economics of Ocean Acidi*f*cation: Bridging the Gap between Ocean Acidi*f*cation Impacts and Economic Valuation* produced a set of recommendations as a basis for policy decisions concerning ocean acidi cation (www.iaea.org/nael/page.php). Another workshop is planned for 2012 to further develop the natural and social scienti c collaborations.

A Paper on sh behavioural response to predators under high CO_2

B Oceans Day and other acidi cation activities during COP15

C Launch of the lm, *Acid Test*

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Major studies underway or in advanced stages of planning

European Union

In 2008 the European Commission funded the European

Finding out more about ocean acidification – useful sources of further information

Ocean acidi cation featured as new topic in the press release from the rst global meeting on the *Ocean in a High CO_2 World*, supported by the United Nations Educational, Scienti c and Cultural Organization (UNESCO). Since then, a rapid expansion in work and concern on this issue has occurred.

Key reports that together provide a comprehensive source of knowledge are as follows:

The rst time many policy advisers became aware of ocean acidi cation was through the 2005 international conference on *Avoiding Dangerous Climate Change: A Scienti c Symposium on Stabilisation of Greenhouse Gases*. This took place under the United Kingdom's presidency of the G8, with the participation of around 200 internationally renowned scientists from 30 countries. It examined the link between atmospheric greenhouse gas concentration, and the 2°C (3.6°F) ceiling on global warming thought necessary to avoid the most serious effects of global warming. Previously this had generally been accepted as being the concentration of 550 ppm CO_2 rather than being linked to a temperature ceiling.

The rst major publication on ocean acidi cation rapidly followed. The Royal Society 2005 policy document *Ocean acidi cation due to increasing atmospheric carbon dioxide* recognized ocean acidi cation is a signi cant threat to many calcifying organisms with the potential to alter food chains and other ecosystem processes and lead to a reduction of biodiversity in the oceans. The appointed working group made speci c policy recommendations, including limiting the accumulation of CO_2

In 2008 the European Geosciences Union, Asia Oceania Geosciences Society and the Japan Geosciences Union produced a joint *Position Statement on Ocean Acidi*f*cation*. This concluded that the impacts of ocean acidi cation may be just as dramatic as those of global warming (resulting from anthropogenic activities on top of natural variability) and the combination of both are likely to exacerbate consequences, resulting in potentially profound changes throughout marine ecosystems and in the services that they provide to humankind.

In 2009 a further milestone report was produced. The*Monaco Declaration* is supported by H.S.H. Prince Albert II of Monaco who, whilst taking part in the working sessions of the second international symposium *The Ocean in a High-CO_2 World*, expressed his earnest wishes for the *Monaco Declaration* to be drafted. The resultant declaration is approved by 155 scientists from 26 countries, all leaders of research into ocean acidi cation and its impacts. It callr.1817 Tm [(are likely to exacerb /Span <<519.4we Tm519BDC BT /T1_2 1 9 0 0 9 1>>

half minute animation starring characters from King Poseidon's Kingdom beneath the sea and laments the fact that Doctorpus, Britney Star, Michelle Mussel, Derek the Diatom and other subsea creatures are suffering as the ocean becomes more acidic as a result of human activities; the lm ends with Poseidon demanding that we terrestrials sort the problem out and stop pumping more and more CO_2 into the atmosphere to be absorbed by the sea, with potentially disastrous consequences. The children and their animation won the Royal Society of Chemistry's Bill Bryson Prize for Science Communication.

The movie *Tipping Point* released in 2011 mostly describes research performed in the framework of the European Project on Ocean Acidi cation. It just received the Prince Rainier III Special Prize at the 51st Monte-Carlo Television Festival. Nicolas Koutsikas, the producer, received the award from Prince Albert II of Monaco on 10 June 2011. This is the third award received by *Tipping Point* after the 'Best 2011 science documentary award' at the 15th International Festival of Scienti c Documentary and Movie and the "Best Scienti c Movie" award at the Mediterranean lm festival.

A powerful short lm on Ocean acidi cation: *Connecting science, industry, policy and public*, released in 2011 by Plymouth Marine Laboratory as part of the UK Ocean Acidi cation Research Programme's outreach. As scienti c research reveals more about how the ocean and the life it contains might be affected, there is a need for scientists to engage with a wider community including policy makers, industry, environmental managers and the general public to understand what is happening, how we might be affected and what actions could be taken to reduce any risks. The lm brings together a wide range of stakeholders including, HSH Prince Albert II of Monaco, school children, a Plymouth shmonger, a UK government Chief Scienti c Adviser, representatives from industry and policy making departments, as well as a group of internationally recognized expert scientists.

Science to Policy

Following the successes of the rst and second symposia on *The Ocean in a High-CO_2 World*, the latest scienti c

Further details and contacts

Further details on the work of the International Ocean Acidi cation Reference User Group and its membership, and EPOCA can be found at:
www.epoca-project.eu/index.php/Outreach/RUG/
and the UK Programme at