

# The Oceans and the UN Framework Convention on Climate Change

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Only a few months remain until delegates from 196 countries convene in Paris, France, to negotiate and sign a globally binding agreement on climate change mitigation and adaptation. The “Paris Summit” is a major milestone in a longterm international negotiations effort that has been moving at a very slow pace, lagging far behind the fast advance of geophysical changes in the earth system. Despite its high relevance to climate change mitigation and adaptation, the ocean has been widely left out of the UN climate policy negotiations, but new opportunities are arising to change this course. In this article, we discuss the relevance of the ocean as a major climate regulator to the UN climate discussions, and share a few lessons learned from early career ocean scientists involved in bridging this gap.

## The ocean in a changing climate: a major player

Because of its vast expanse and depth, its dynamic circulation and biogeochemistry, and water’s high heat capacity, the ocean exerts unparalleled dominance over the climate system. The ocean, for instance, has taken up approximately 93% of the excess heat trapped by anthropogenic greenhouse gas emissions since 1955 (Levitus et al. 2012), buffering the true cost of fossil fuel carbon emissions. Moreover, the ocean absorbs over a quarter of global carbon emissions every year, roughly the equivalent of China’s total annual carbon

emissions (Le Quéré et al. 2015). This uptake of carbon and heat, while expected to continue into the future, is sensitive to biogeochemical and physical interactions in the ocean-atmosphere-climate system (Ciais et al. 2013; Watanabe et al. 2013), and has important implications for future emissions reduction targets and strategies.

These invaluable mitigation services come at a high price, warming the ocean, decreasing its pH, and reducing its oxygen content, with potentially synchronous and irreversible impacts on marine ecosystems already under stress from overfishing and pollution (Keeling et al. 2010; Gruber 2011; Pörtner et al. 2014). Observing these longterm subsurface changes and their impacts requires “intergenerational” global observations networks that depend on timely and coherent implementation across institutions and governments (Cai et al. 2015), and which are hindered by uncertain and

short-term funding horizons (Wunsch et al. 2013). With its central role in buffering climate change and sustaining impacts from ocean warming, acidification, and deoxygenation, the ocean ought to be a major component of the UN discussions on mitigation and adaptation.

## The UNFCCC process: a (very) brief history

Climate change is a global problem that necessitates international cooperation. In 1992, the United Nations Framework Convention on Climate Change (UNFCCC) was created as an overarching legal framework to address this problem through annual meetings known as the Conference of the Parties (COP). Since COP 1, nearly every meeting has been dominated by the underlying “responsibility” argument, reaffirmed recently by UN Secre-

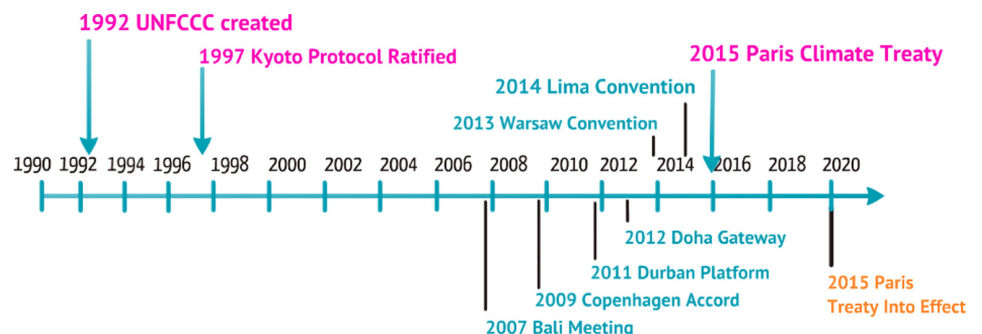
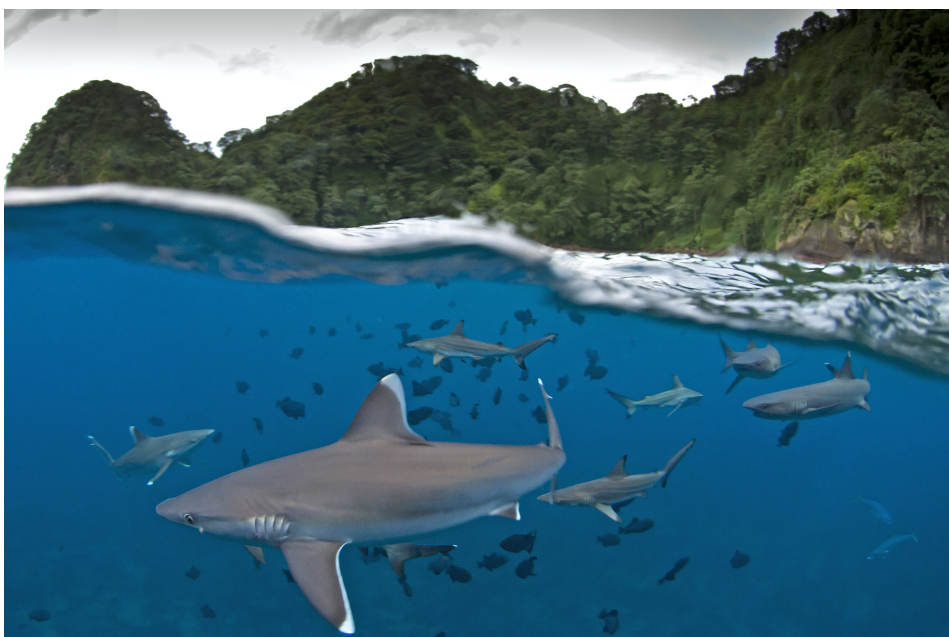


Fig. 1. Timeline of major international climate agreements and meetings under the UNFCCC.



**Fig. 2.** Co-author Lauren Linsmayer addresses delegates, NGO representatives, and observers on the effects of ocean acidification on marine organisms at COP 18 Warsaw, Poland. Used with permission © OSIP.



**Fig. 3.** Ocean imagery served as a powerful tool to engage policymakers. Here, an example of underwater photography of a marine ecosystem was used in postcards handed out at the ocean booth accompanied by brief ocean-climate related messages on the back. Photograph used with permission © Octavio Aburto ([www.octavioaburto.com](http://www.octavioaburto.com)).

tary General Ban Ki-Moon at COP18 Doha, Qatar, stating: “The climate change phenomenon has been caused by the industrialization of the developed world, it’s only fair and reasonable that the developed world should bear most of the responsibility” (The Guardian 2013).

The Kyoto Protocol, signed in 1997, began to address this issue by requiring emissions reduction targets of about 5% below 1990 levels solely from industrialized countries over its first commitment period from 2008 thru 2012, and set up a Clean Development Mechanism to allow for emissions reduction across borders

(Antonich et al. 2015). With no requirements for developing countries and no US ratification, however, the world’s largest two emitters remained unregulated under this protocol, with atmospheric CO<sub>2</sub> currently building up past the daunting 400 parts per million mark.

Acknowledging Kyoto’s limited scope, world leaders convened in Bali, Indonesia in 2007 to adopt the Bali Action Plan, establishing a roadmap to a globally binding treaty with substantial emissions reduction requirements for developing and developed nations (Antonich et al. 2015). Consequent meetings debated

the details and nature of such a treaty, with the 2009 Copenhagen Accord and the subsequent COP 16 in Cancun, Mexico setting a limit on future warming to 2°C by 2100, generating some emissions reduction pledges, and establishing a Green Climate Fund to raise \$100 billion per year by 2020 (Antonich et al. 2015).

At COP 17 Durban, South Africa, delegates continued down this roadmap by creating the Ad Hoc Working Group on the Durban Platform for Enhanced Action (ADP) to “develop a protocol ... with legal force under the Convention applicable to all Parties” by 2015, with emissions reduction requirements going into effects by 2020 (Antonich et al. 2015). The following COPs in Doha, Warsaw and Lima, delegates further extended Kyoto into a second phase, established a mechanism on Loss and Damage, and rushed to close concluding negotiations to focus on the ADP, the regulatory blueprint for the upcoming Paris treaty. Throughout most of these highly intensive discussions and policy documents, the ocean was a very rare topic of discussion.

### The oceans in the UNFCCC forum: challenges and opportunities

While ocean topics have been discussed within some expert group meetings, such as the Structured Expert Dialogue (SBSTA 2015), they rarely move to the UNFCCC general negotiations, where several other topics compete for attention, including finance, energy, deforestation, equity, gender, and capacity building. The word “ocean,” for instance, is nonexistent within the Kyoto Protocol in all of its 28 articles. Leaving the oceans outside of international climate policy decisions raises several key questions, including:

1. How will future emissions reduction targets account for potential changes in ocean carbon and heat uptake?
2. Does the Copenhagen 2°C goal appropriately reflect ocean changes and their impacts?
3. How will ocean impacts be assessed without robust global observing systems in place?

The uncertain future of the strength of the oceanic carbon sink calls for flexibility to reassess mitigation goals and strategies in the future. Furthermore, Copenhagen’s 2°C goal, though simple, is a clear example of how ocean



impacts, such as acidification which depends on atmospheric CO<sub>2</sub> concentrations rather than surface temperature, are not taken into consideration in climate policy decisions. Victor and Kennel (2014) argue that, in addition to global mean surface temperatures, several planetary indicators, or “vital signs,” are needed to appropriately reflect changes in the climate system. Most of these indicators are oceanic in nature, such as the ocean heat content, pH, dissolved oxygen concentrations, sea ice cover, and sea level, which continue to change despite a flattening in global mean surface temperatures over the last 15 yr (Stocker et al. 2013). By neglecting the ocean as a major mitigation force and a highly vulnerable and voiceless entity, the UN climate negotiations risk creating poorly designed, land-biased mitigation and adaptation strategies, placing ocean-dependent nations at greater risk.

However, unlike activities on land (e.g., deforestation), ocean issues can seem vague, lacking direct relevance to the immediate concerns of policymakers and their constituents. Furthermore, the UNFCCC has grown so complex that many question its efficacy as a platform for international cooperation (Victor 2011). Ocean issues, which abound in complexity and uncertainty, may render the UNFCCC process more complex and even less efficient. These challenges, however, do not justify leaving the oceans behind in the climate negotiations, but rather highlight the need to address ocean issues at the UNFCCC in a clear, simple, and relevant manner. Conversely, the ocean can serve as a unifying front to find common solutions, helping form new alliances within a fairly polar UNFCCC atmosphere. Finally, as new ocean issues emerge (e.g., changes in the Arctic Ocean and associated geopolitical issues), having an ocean regulatory mechanism in place within the UNFCCC can serve as a legal framework to proactively resolve future climate-ocean issues.

### Young scientists at the UNFCCC conferences: lessons learned

While participating at side events and observing the general negotiations at COP18 Doha, COP19 Warsaw, and COP20 Lima, we were surprised that the oceans occupied a very small niche compared to their significance to on-going discussion on mitigation and adaptation, highlighting the importance of communicating ocean science and impacts



**Fig. 4.** Delegates discuss regulatory text at a climate policy meeting held in June 2015, in Bonn, Germany, before reconvening at the Paris Summit in December of 2015. Used with permission © OSIP.



**Fig. 5.** Co-authors Yassir Edebbbar, Natalya Gallo, and Lauren Linsmayer (first, second and fourth from left), with UNFCCC Executive Secretary Christiana Figueres (third from left) at COP18 in Warsaw, Poland. Used with permission © OSIP.

to decision makers. Engaging policymakers on these complex issues, however, requires fluency both in science and policy, a skill that we think should be developed at a young academic age. As young scientists in training, we benefited greatly from programs such as the NSF Interdisciplinary Graduate Education and Research Training (IGERT) fellowship and the COMPASS Ocean Acidification Communication and Advanced Policy training workshops ([www.compassonline.org](http://www.compassonline.org)). Interdisciplinary research and education centers such as the Center for Marine Biodiversity and Conservation ([cmbc.ucsd.edu](http://cmbc.ucsd.edu)) at the Scripps Institution of Oceanography provided ideal platforms to acquire and develop specific tools and skills in science communication.

Bridging science and policy can be challenging and time-demanding. As young scientists, we felt especially cautious about the fine line between informing policy and advocacy. Clarity, honesty, and enthusiasm served as effective guidelines while directly engaging policymakers from different countries. Being familiar with the geopolitical and cultural background of delegates’ origins was essential in tailoring specific and relevant messages. Social and visual media facilitated by a structured web presence ([www.oceanscientists.org](http://www.oceanscientists.org)) helped reach a wider audience at these meetings. Finally, working at this fascinating intersection of science and policy was a highly rewarding experience, as we gained deeper insights on the value of basic and applied research. Inheriting an increasingly complex

problem, young scientists have an important role in the solution process, as they view climate change as a challenge to be met with optimism, creativity, and persistence.

## Lima, Paris and beyond: a turning tide?

At the 2014 COP20 in Lima, Peru, the oceans received increased attention through official side events as well as public exhibits outside of the conference venue, such as the Ocean Pavilion in the Voices for the Climate Center. A special event at COP20 on the Intergovernmental Panel for Climate Change (IPCC) 5th Assessment Report also focused in greater detail on ocean impacts (Pörtner et al. 2014). A greater focus on the ocean at COP20 was further facilitated by increased involvement of ocean scientists from multiple countries, the venue's proximity to the sea, the dependence of the host country on marine resources, as well as Peru's familiarity with the large impacts of ocean-related climate events such as El Niño Southern Oscillations on fisheries and rainfall.

Building on this momentum, an alliance of research institutions, NGOs, business entities, and the UNESCO Intergovernmental Oceanographic Commission formed the Ocean and Climate Platform, with the ultimate goal to "bring the ocean to the forefront in climate discussions" through promoting scientific understanding of policymakers and the public on climate-related ocean issues in preparation for COP21 in Paris ([www.ocean-climate.org](http://www.ocean-climate.org)). The ocean is intimately linked to climate, and, thus, both require "global, credible, measurable, actionable plans" to prevent dangerous anthropogenic interference (Figueres and Figueres 2015). There are many ways to take the ocean into consideration in climate policy (Galland et al. 2012), and an active conversation on the ocean's role in the upcoming climate negotiations is currently unfolding. COP21 in Paris, France later this year is the ideal time and venue to elevate this conversation to the UNFCCC level, and ocean scientists have a central role to play in informing this conversation.

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