CLIMATE DEBATE OVERLOOKS OUR OCEANS

The oceans moderate global warming, which in turn has major effects on their ecosystems. Within the framework of the Oceans 2015 Initiative, some 20 researchers from across the world have analysed the risks of impact on marine and coastal ecosystems. They warn that safeguarding our oceans must be a priority of the United Nations Climate Change Conference (COP 21) in Paris

ADAGP PARIS 2015

RENÉ DUVILLIER – 'Spray blossom' (1955)

Global warming, actors and victims

BY JEAN-PIERRE GATTUSO AND ALEXANDRE MAGNAN

The ocean covering more than two-thirds of our planet functions as a "climate integrator", moderating climate change in two ways. It absorbs most of the heat that accumulates in the atmosphere: it has absorbed 93% of the excess heat from the increased greenhouse effect (1), at the cost of rises in ocean temperature and sea level, largely due to thermal expansion and the melting of the Greenland ice cap. It also captures much of the carbon emissions generated by human activity (28% since 1750), at the cost of acidification (see graphic, page IV).

This climate regulating function therefore comes at a cost, since the ocean deteriorates as it mitigates climate change. The changes in the ocean's fundamental physics and chemistry, though less spectacular than the rise in sea level, have a considerable impact on marine ecosystems, and consequently on humanity. Ocean warming and acidification impede the calcification process vital to some marine organisms (corals, shellfish); many coral reefs are being bleached by the destruction of their symbiosis with zooxanthellae (algae); phytoplankton is declining in warmer waters; the fish food chain is being disturbed; some species can migrate to cooler waters, but not all.

Despite the ocean's critical role in providing food security for hundreds of millions of people around the world, international climate negotiations under the United Nations Framework Convention on Climate Change (UNFCCC) have given it minimal attention. To fill this gap, a number of researchers (2) taking part in the Oceans 2015 Initiative (3) decided to provide the negotiators at the Paris climate conference (COP 21) with a synthesis of past changes and changes projected to occur by the end of the century, and of the consequences for marine ecosystems and the services they provide. Two contrasting greenhouse gas emissions scenarios were considered: a continuation of the present rising trend (business-as-usual) and, more optimistically, a fall that would keep the global temperature increase to less than 2°C in the 21st century.

Apart from strict limitation of carbon emissions, the international community needs to protect marine and coastal ecosystems, restore those that have already been damaged, and enable societies that depend on marine resources to adapt to change. A number of approaches are being tested at local level, but the further we move away from the 2°C target, and the warmer and more acidified the ocean becomes, the less room there is for manoeuvre. For example, the further coral reefs deteriorate, the more vulnerable they will become and the harder it will be to save them. Some approaches are antagonistic: solar radiation management aims to limit global warming by increasing the amount of heat reflected back into space. This could undermine efforts to reduce carbon emissions and would do nothing to remedy ocean acidification.

Four key messages emerge from the Oceans 2015 Initiative's analysis. First, the ocean strongly influences the climate system and provides important services to humans. Second, the deterioration of marine and coastal ecosystems is already detectable and is certain to worsen, even under the optimistic scenario where global carbon emissions fall – especially as, no matter what happens, the damage to the ocean will occur across all latitudes, making this a global concern. Third, an immediate and substantial reduction of emissions of greenhouse gases, especially carbon dioxide (CO_2), is vital to prevent irreversible impacts on ocean ecosystems; any treaty that did not make it possible to limit global warming to 2°C would have disastrous consequences. Finally, the higher atmospheric CO_2 rises, the fewer the options for protecting the ocean and restoring its ecosystems.

The Oceans 2015 Initiative, noting that the ocean has received minimal attention at previous climate conferences, pleads for a radical change of perspective: COP 21 must take the necessary action and propose a new, less destructive plan for civilisation. The future condition of the ocean depends on the amount of carbon emitted in the coming decades. The more stringent, optimistic scenario allows less than one-sixth of the emissions expected by the end of the 21st century under the pessimistic scenario, without regulation. In fact, carbon emissions will need to be even lower since the ocean's capacity to absorb will decline over time. The choices made at COP 21 will therefore have serious consequences for the ocean.

According to the Oceans 2015 Initiative scenarios, ocean acidity may have risen by 38-150% between the industrial revolution and the end of the 21st century, while average sea level may have risen by 60-86 centimetres between 1901 and 2100. The ocean's oxygen inventory is projected to decrease, slower or faster depending on the scenario, affecting all forms of marine life.

Ocean warming and acidification is already seriously affecting warm-water corals, mid-latitude seagrass, high-latitude pteropods and krill (planktonic crustaceans), mid-latitude bivalves and finfishes. Even under the optimistic scenario, projections of the impact on warm-water corals and mid-latitude bivalves are cause for serious concern. But

Continued on page IV

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Five thousand protected areas

BY FERDINAND MOECK

A marine or coastal protected area (MCPA), as defined by the Convention on Biological Diversity (CBD) adopted at the Earth Summit in Rio de Janeiro in 1992 and signed by 168 states, is "any defined area within or adjacent to the marine environment, together with its overlying water and associated flora, fauna, historical and cultural features, which has been reserved by legislation or other effective means, including custom, with the effect that its marine and/or coastal biodiversity enjoys a higher level of protection than its surroundings" (1). In response to extreme weather events and the consequences of the exploitation of natural resources, the creation of MCPAs seeks to limit exploitation (of fish stocks, oil and gas) so as to preserve "the sustainable use of [the] components [of biodiversity], and the fair and equitable sharing of benefits arising out of the utilisation of genetic resources."

Recognised by international organisations such as the United Nations, the International Union for the Conservation of Nature (IUCN) (2) has established a classification system that is increasingly used by national governments for the definition and registration of protected areas. Its categories range from I – "strictly controlled and limited [human visitation, use and impacts]" – to VI – "sustainable use of natural resources" – according to the objectives of the MCPA in question. The aim is to reconcile diverse interests – ecological (biodiversity, fish stocks) and socioeconomic (tourism, fishing, cultural traditions, social resilience of communities dependent on local resources) – and manage MCPAs as sustainable and profitable investments for all stakeholders. There are currently more than 5,000 MCPAs around the world.

The CBD establishes rules that are largely non-binding on states; most of them continue to define MCPAs according to their own legislation. This explains the difficulty of protecting international waters, in terms of establishing the legal authority and implementing the necessary international regulation. The CBD does, however, respond to the need for shared norms that will make it possible to standardise the concept of MCPAs at global level for the first time. If national governments legislate on the basis of the CBD, transnational norms could emerge and help define effective action for protecting all oceans.

The latest report of the UN Environment Programme (UNEP) in partnership with the IUCN estimates that MCPAs cover 3.4% of the global ocean area, and only 0.25% of the ocean area outside national jurisdiction (3). This means just 2% of the world's oceans are effectively protected. The CBD's strategic plan for 2011-20 calls for "at least 10% of marine and coastal areas" to be covered by MCPAs by 2020 (4).

TRANSLATED BY CHARLES GOULDEN

(1) www.cbd.int
(2) Founded in 1948, the IUCN is the world's oldest environmental organisation with more than 1,200 member organisations in 140 countries, including 200 governments or governmental organisations, and 800 NGOs; www.iucn.org
(3) UNEP, "Protected Planet Report 2014: tracking progress towards global targets for protected areas", Cambridge, 2014.
(4) CBD, "Aichi Biodiversity Targets"; www.cbd.int/sp/targets

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Easter Island's marine reserve

Last September the US established a huge marine reserve in the Pacific Ocean, covering nearly 1.3m sq km. The Chilean government and the inhabitants of Easter Island are debating the creation of a 'marine park'

BY SÉBASTIEN DESLANDES

Brightly coloured fishing boats came and went, bobbing on the ebb tide at Hanga Piko, a small port on Easter Island in the South Pacific. Fishermen waved as one boat set out to sea while others landed last night's catch – tuna, barracuda, lobsters – and tourists looked on in delight. For Sara Roe, president of the Hanga Piko Fishing Association, one of the island's largest with 60 members, it was a familiar sight: "Illegal fishing isn't a recent problem. When I was a girl, my father used to tell us about the lights of the big ships he saw out at sea. We realised how serious the problem was in 2004 when there was a sharp fall in our catches. It lasted nine years, and some fishermen had to find other work. Families can no longer pay for their children to go to school in Chile [to which the island belongs]. We are fighting to stop other people from taking our resources, now and in the future. That's why we support the proposal for a marine protected area, though I don't like the word 'park' – I'd prefer *rehui*, which means 'total protection' in Rapa Nui [the local language]."

There have already been changes: even the fishing has improved a little. "The government has agreed to send planes to monitor our fishing zones eight times a year. It's encouraging," said Roe. Simon, 43, who fishes around the island every day, said: "For several years, boats used come back without catching anything, which never happened before. Now, when I go out, I may come back with four or five tuna." But years of illegal over-fishing have left their mark. Petero Avaka, 67, head of a small fishermen's association based in the port of Hanga Roa, looked at the huge pile of rubbish at the bottom of his garden (plastic waste, crates, fishing net floats) and said bitterly: "It's all from illegal fishing boats. And I picked it all up in just four hours!"

RENÉ DUVILLIER – 'Javelins and sea' (1962)

ADAGP, PARIS 2015

Far from the huge moai statues, Easter Island's marine protected area project has just reached a major milestone: the second Our Ocean conference, held 3,680km away in Valparaíso on 5-6 October, has made it official. Chile, as host nation, welcomed 400 politicians and scientists from 90 countries around the world, presenting itself as a champion of marine conservation.

The "marine park" is a showcase for the Chilean government's policies: measuring 720,000 sq km, it will be one of the world's biggest. But under the UN Convention Concerning Indigenous and Tribal Peoples in Independent Countries (no 169), which requires its signatories to promote self-determination, the last word will go to the island's original inhabitants – the Rapa Nui people, some 3,000 in number, who make up a large part of the population.

It was in fact the Rapa Nui who first proposed the park. The instigators were members of the Mesa del Mar (Ocean Round Table), an informal body that, according to its president Maria Atan, brings together representatives of "fishermen's associations, tourist industry organisations and environmental associations". The project calls for a first protected zone extending 80km from the island's coast, where only subsistence fishing will be permitted (1). This reserve would be surrounded by a marine park, extending 320km from the coast and encompassing the existing 150,000-sq km park around the neighbouring island of Salas y Gómez (see map). Within this marine park there would be a ban on all fishing. National governments determine the exact form that marine protected areas take, but on Easter Island and elsewhere the aim is to restrict or prohibit human activities to prevent the decline or disappearance of animal species.

The Rapa Nui hope the project will counter the threat that illegal fishing presents to the local economy and environment. Rodolfo Pérez, adviser to Easter Island's mayor Pedro Edmunds Paoa in charge of development projects, explained: "These are highly desirable fishing zones because some species, including tuna, breed here. The park is vital, not only for the island's 150 permanent fishermen but also for its 7,000 inhabitants, and for our traditions." The Chilean navy reports industrial fishing vessels operating around Easter Island under a wide variety of flags, including Russian, Chinese, Korean and Spanish. Some of these ships are hundreds of metres long, and Rapa Nui fishermen's associations claim they are responsible for the decline of Easter Island's fish stocks, a view corroborated by UN Food and Agriculture Organisation (FAO) studies which indicate that 90% of the world's fishing resources are overexploited or fully exploited (2).

Compared to these industrial fishing giants, Easter Island's traditional "stone" fishing technique seems trifling. It is so called because the fisherman starts by looking for stones to weight his lines (80 metres long); he must then catch some flying fish to use as bait.

It is hard to enforce fishing bans. It's not just a matter of distance – Chilean navy vessels take at least six days to reach Easter Island – but of resources. The small monitoring vessel I saw moored in one of the island's ports is not enough to ensure strict observance. The Chilean government seems to be aware of the scale of the challenge. The foreign ministry says illegal fishing is costing the country "tens of millions of dollars", and the maritime services are striving to eradicate it.

Captain Mario Montejo, deputy director of the Maritime Operations Centre in Valparaíso, explained: "The area to be monitored is huge – from the South Pacific to Antarctica. The Chilean government is responsible for monitoring the fourth largest area. We have been working for a long time to determine who is doing what, and we now have a database of vessels that we have identified." The *Lafayette*, 299 metres long, was stopped and inspected last year. "We can track its movements, even though its has changed names and is sailing under a different flag." Montejo is counting on the resources provided by Catapult, a project launched in January, based on new monitoring technology developed by The Pew Charitable Trusts, a US-based NGO, and a British company, The Satellite Applications Catapult, which is able to analyse "multiple sources of live satellite tracking data [and link] it to information about a ship's ownership, history and country of registration, providing a dossier of up-to-the-minute data that can alert officials to suspicious vessel movements."

Pew, an independent non-profit organisation supported by foundations, specialises in the conservation of the marine environment, and works in partnership with the Bertarelli Foundation. Like Pew, the Bertarelli Foundation has supported the Easter Island project for many years; it also supports marine protected area projects around Belize and in the Chagos Archipelago in the Indian Ocean. "We have allocated just under $5m to the Easter Island project," said Bertarelli's Damian Jensen. "We also want to establish an education centre, to raise awareness of the issues surrounding the reserve and allow the development of tourism based on these activities."

Matt Rand is director of Pew's Global Ocean Legacy project and "works with local communities, governments and scientists around the world to protect and conserve some of the Earth's most important and unspoiled marine environments." He explained that the global objective is to create 15 [marine] parks by 2020, increasing the number of protected areas. "We currently have six major reserves, with 2% of the world's oceans under protection." (The target set in 2010 by COP 10, the 10th conference of the parties to the Convention on Biological Diversity in Nagoya, Japan, was to create a network of protected areas covering 10% of the world's oceans.) Rand emphasised how much preparation has gone into the Easter Island project. "We've been working with the Rapa Nui people for three years. We began sending scientists to Easter Island to study fish stocks in 2012." Pew also helped the Rapa Nui present their marine park initiative to the Chilean government, as Sara Roe confirmed: "It started when I met someone from Pew, by chance, at a market on the island. We decided to work together. Pew enabled us to meet the government and talk things over with them."

Setting aside the hypothetical role of climate change and the phenomena of El Niño and La Niña in the decline of fish stocks, Rand focused on his organisation's struggle: "We are concentrating on fighting illegal fishing in waters that are known for their exceptional biodiversity. Scientists have counted 142 species, some of them not found anywhere else on Earth. And it's not just about the ocean, but culture too. Everything is linked."

"We're all fishermen here!" Alberto, 41, a tourist guide by day, is the proud owner of a small fishing boat. On a warm evening, sitting in one of Easter Island's few bars with some friends, he talked of the Rapa Nui's close relationship with the sea: "We belong to the blue continent. We owe everything to the sea; we are tied to it – it's our mother, our way of life."

The success of the marine park project depends on the extent to which local people can be made aware of the issues, and the involvement of the Rapa Nui population in its implementation. Professor of marine ecology Carlos Castilla has been working with Rapa Nui fishermen and Pew since 2011. He is studying "ways of achieving sustainable management, maintenance and renewal of resources through local community involvement" and believes it is "important to involve the islanders in [the park's] management and take into consideration the fact that [the sea] is part of their culture."

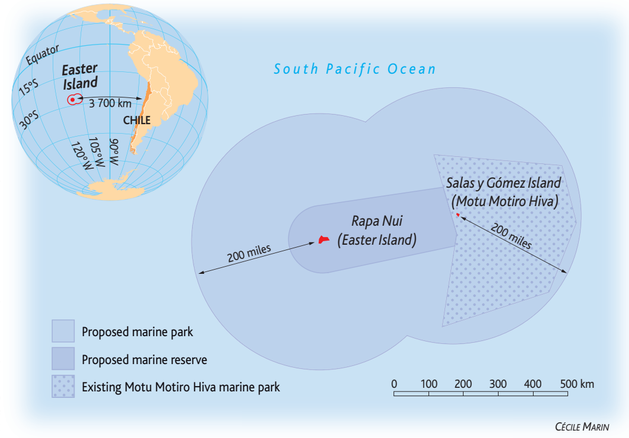
This could be a problem, since a small but significant number of fishermen are opposed to the project. They include a group known as the Tapu, who have left the negotiating table, and Petero Hito, president of another association, who is concerned that the area his members are allowed to fish will be gradually reduced. But the key factor is the ongoing management of the project, given the historically tense relations between the Chilean government and the islanders, who last summer blockaded the national park where the moai statues stand. The park is run by Chile's National Forest Corporation, which reports directly to the agriculture ministry, and was created in the 1950s without consulting the Rapa Nui people. Some, including Mario Tuki, a member of the unofficial Rapa Nui parliament, are protesting that the Chilean government takes too large a share – about half – of the entrance fees: "Once I was arrested, along with four other people, for opening a rival ticket office at the airport."

These incidents are a clear indication that the issues at stake are not limited to the marine park. "The moai are part of our history," said Alberto. "It's our island, but we are still in a position of weakness. You have to remember that the [moai] park covers 47% of the island, and the government owns another large section of it. So most of the Rapa Nui live in town: 90% of the population occupies 8% of the territory. And Chile is a mining superpower, so I'd be surprised if it was prepared to hold back from mining here indefinitely."

The Rapa Nui people have not forgotten the lessons of their history, especially those related by Jared Diamond in his controversial book *Collapse: How Societies Choose to Fail or Succeed* (Penguin, 2006), which claims the civilisation that produced the moai statues declined because of the degradation it had caused to its own environment. Mayor Pedro Edmunds says: "On an island, the consequences of any decision, or failure to make a decision, are immediate. I've often wondered what the islanders were thinking as they cut down their last tree."

TRANSLATED BY CHARLES GOULDEN

(1) The FAO defines subsistence fishing as the catching of fish for direct consumption by the families of fishermen, in contrast to commercial fishing, where the catch is bought up by middlemen for sale on a wider market.
(2) See FAO, "The State of World Fisheries and Aquaculture 2010"; www.fao.org



CÉCILE MARIN

Towards a 'blue economy'

By protecting our marine resources we can help local economies, especially through ecotourism

BY DAN LAFFOLEY

Marine protected areas are one of our best tools to secure the health and resilience of the ocean – over 70% of our planet. A marine protected area (MPA) is an area where measures to protect, manage and sometimes restore ocean health are applied. The aim is to preserve the quality and diversity of ecosystems, habitats and species, the essential services they provide, or simply the beauty of the marine world. MPAs became widespread after 1992 when the UN Convention on Biological Diversity (CBD) was signed in Rio de Janeiro (see *Five thousand protected areas*, page I). The reason so many countries place their trust in MPAs – as of 2015 there are more than 5,000 around the world – is that, when properly managed, they help ecosystem balance. MPAs where extractive activities are suspended give the ocean a breathing space, sometimes with excellent results in the amount and diversity of marine life. They also provide valuable information on what does and doesn't work in terms of marine protection.

Many scientific studies have shown the effectiveness of marine protected areas. In 2011 a US research team collated the results of more than 150 studies published in specialist journals from 61 countries, showing a 446% increase in biomass (1) on average in protected areas (2). Both the number of species and the size of individuals within species increased. MPAs also have considerable benefits for local economies. On the Great Barrier Reef in Australia, where zoning helps manage different uses, industries dependent on the reef such as tourism and fishing contribute over $3.5bn annually to the Australian economy and support nearly 70,000 jobs. A 2015 study shows that the cost of extending MPA coverage to 10-30% of the world ocean would be clearly justified by the end results. The estimated net benefits of increasing protection to 30% by 2050 range from a conservative $490bn (150,000 jobs) to an optimistic $920bn (over 180,000 jobs) (3). It is clear that MPAs are a pathway to a sustainable "blue economy".

We learn at school how to assess consequences through experiments. So it's surprising to see nations that have yet to establish proper MPAs claim "sustainable development" or "sustainable use" with no benchmarks to measure them by. This lack of monitoring and analysis is the more regrettable since the ocean, in terms of its quantifiable resources, amounts to the seventh largest economy in the world (4).

It is clear from even this brief account that the situation is worsening. The first and most serious problem is that the measures taken to date – MPAs or other mechanisms – are not enough to compensate for human impact on the ocean. We may save a few species of fish from over-exploitation but isolated actions won't restore the diversity of ecosystems. A recent report by the World Wide Fund for Nature (WWF) shows a worrying decline in marine life: monitored populations of marine animals (5,829 populations of 1,234 species) have halved since 1970 (5). Fish stocks are falling rapidly and "if current rates of global temperature rise continue, the ocean will become too warm for coral reefs by 2050."

How much progress has been made towards the 2020 target of the Convention on Biological Diversity? So far just 3.4% of the ocean is officially protected, and even then the level of protection is not adequate. The target was set decades ago before people were concerned about major changes to the ocean; these are now happening, with climate disruption, and ocean deoxygenation and acidification (see *Global warming, actors and victims*, page I). If we reassess the level of protection required in light of the new problems on top of the familiar ones of overfishing and pollution – as was done at the World Parks Congress in Sydney last year – the target will have to be raised to at least 30% of the ocean (6).

We also need to ensure effective management of existing marine protected areas. MPA designation is just the start of the process. The real challenge is in delivering management that ensures the targets are met, particularly by establishing shared standards, cooperation between countries and a system for evaluating progress. This is the purpose of the Green List of Protected Areas, adopted by the International Union for Conservation of Nature (IUCN) at the Sydney congress (7). These structures will form the basis for a global community to help the concerned countries and environmental agencies.

Establishing standards raises the issue of applying them. New technologies will soon invalidate excuses – an MPA is too large, too remote, has insufficient staff. It will no longer be possible to hide behind a shortage of patrol boats or complain that fishermen (who often receive indirect pubic subsidies) are concealing their location data. The availability of remote monitoring technology with which to ensure laws are enforced means that illicit activities cannot be hidden forever, however vast the ocean. The Pew Charitable Trusts' Virtual Watch Room, provided in conjunction with a UK company, The Satellite Applications Catapult, gives countries with MPAs the evidence they need to arrest illegal fishermen.

New developments such as Google's SkyBox satellite system will by 2018 provide a new source of high-resolution visual coverage around the world, including the ocean. The agreement between The Pew Charitable Trusts and the startup OneWeb, signed in June, covers the use of a complementary cuboid satellite system to connect the 50% of the world population not yet connected to the web, by the same date. There are no more excuses: the time has come to put MPAs in place as agreed under the CBD. In a few years' time, governments and extractive industries will be held far more accountable than they have been up to now.

Signatory countries to the CBD have agreed a target of protecting 10% of the world ocean by 2020 through MPAs. But further measures will be needed to meet this target, including monitoring ocean areas outside national jurisdictions – the high seas – and restricting deep-sea mining. Such measures will increase the ocean's resistance to future pressures, whether from the consequences of population growth, climate change or acidification.

Closely associated with MPAs are a range of local measures that contribute to ocean conservation, though that is not their primary aim. Grouped under the term Indigenous Peoples' and Community Conserved Territories and Areas, these benefit ecosystems as well as fish stocks. As the mechanisms of marine spatial planning show, conservation activities must be integrated and coordinated, and conflicting uses of the seabed reconciled, if we are to achieve a sustainable process.

We also need greater exchange between experts on climate change and MPAs, both at the level of international negotiations and in the field. Climatologists have recently discovered that MPAs help mitigate carbon emissions by limiting the release of carbon held in coastal ecosystems such as mangroves and tidal marshes. But more needs to be done to ensure that ocean management and the measures put in place factor in high seas resources such as krill (planktonic crustaceans) and fish. It is astonishing that, in 2015, the discourse of carbon management extends to coastal ecosystems and the role of MPAs, yet makes so little mention of the high seas.

As we assess the challenges ahead, we need to factor newly acquired knowledge of marine climate change into the design of the MPA network. Unless we take account of the trends of ocean warming and acidification at regional level, there's a danger that we won't configure the MPAs and wider measures correctly. We will increasingly hear words like "sources" and "sinks" – locations that favour marine life – and "marine corridors" – vast strips of ocean running north-south alongside continents, whose protection needs to be more closely coordinated with the establishment of MPAs, as ocean warming drives species and ecosystems towards higher latitudes.

In some ways, there has never been a more exciting time for marine conservation as the changes and collaborations we bring about now will be fundamental to the wellbeing of future generations. There is still time to adopt new thinking and take the necessary measures. But we need to act now.

ORIGINAL TEXT IN ENGLISH

(1) The total mass of organisms in a given area or volume.
(2) Science of Marine Reserves team, "What can science tell us about marine reserves?", Partnership for Interdisciplinary Studies of Coastal Oceans; www.piscoweb.org
(3) Luke Brander, Corinne Baulcomb et al, "The benefits to people of expanding marine protected areas", Institute for Environmental Studies, VU University Amsterdam, May 2015; and WWF, "Reviving the Ocean Economy: the case for action – 2015", April 2015.
(4) WWF, "Marine protected areas: smart investments in ocean health", May 2015.
(5) WWF and Zoological Society of London, "Living Blue Planet Report: species, habitats and human well-being", September 2015.
(6) International Union for Conservation of Nature World Parks Congress, Sydney, Australia, 12-19 November 2014.
(7) www.iucn.org

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Time for international rules

Climate talks too often neglect the world's oceans. One of the key aims of the Paris climate conference (COP 21) is to define precise rules to protect oceans and manage them sustainably

BY TERESA RIBERA, JULIEN ROCHETTE AND ALEXANDRE MAGNAN

Humanity has great responsibility towards the planet. We must develop greater awareness of the changes taking place, and what action is needed to limit the causes and effects of the disruption of the balance of the world's oceans, caused by over-fishing, pollution from land-based activities (agriculture, industry), destruction of ecosystems (clearing of mangroves, mining of coral reefs, oil spills) and global warming.

More and more people are stressing the importance of the oceans to our survival, from coastal areas to the high seas. This is not just because the oceans are a source of food, which both developing and developed countries need to protect at all costs, but because they regulate global climate mechanisms, too. This has serious consequences for the marine environment, from ecosystems to human activities (see *Global warming, actors and victims*, page I). These consequences affect all countries, regardless of their level of development: processes like climate change do not recognise national borders or economic inequalities.

If the aim is to minimise disruption to the oceans, the first priority should be to reduce greenhouse gas emissions. We can only do this through coordinated international action: that is the whole purpose of the Paris climate conference (COP 21). In the run-up to the conference, the task of the "ocean community" – scientists, decision-makers, representatives of the private sector and civil society – was to draw the negotiators' attention to the major changes – some irreversible – that the marine environment will undergo if global warming exceeds the 2°C threshold (1). It also needed to convince them of the viability of ocean-based solutions. Solutions based on nature – preserving the ecosystems of coral reefs or mangroves – can help reduce the consequences of climate change and enhance the resilience and adaptability of coast-dwelling societies. The ocean community has extensive experience in "multi-scale" management. It has the expertise to steer climate negotiations away from the exclusively top-down approach taken up to now, by setting out the different scales of required action and decision-making – international, regional, national and local.

COP 21 should be the starting point for a new movement, an "ocean and climate club" that would bring together stakeholders keen to promote the benefits of a common programme, expand certain initiatives, encourage the development of coastal policies that respond flexibly to climate change, or work together to improve regional management of the oceans. The UN Framework Convention on Climate Change (UNFCCC) would become a forum where everyone could put forward proposals.

This ocean and climate club could be made up of a coalition of states, local authorities, enterprises and representatives of civil society. Members of the club could make a public commitment to extend their network of marine protected areas (see *Towards a 'blue economy'*, pages II-III), to promote a decarbonated marine economy, and finance projects relating to adaptation to climate change, and other initiatives aimed at more accurate prediction of the effects of climate change and building a future without greenhouse gas emissions. There are many possibilities, and we must encourage outstanding initiatives that bring together stakeholders from across the whole of society, not just national governments. Such a club could also help implement sustainable development in other areas.

Other forums besides the UNFCC will play a part in deciding the future of climate and oceans. Since preserving global climate depends on the health of our oceans, the international community must go on acting within different organisations – including those that manage the marine environment (regional fisheries and ocean management organisations, the International Maritime Organisation and the International Seabed Authority) – so as to establish and implement rules for the conservation and sustainable use of marine resources, protecting the ability of the oceans to capture CO2. So the creation of marine protected areas, sustainable management of fisheries and the fight against pollution *also* help to minimise the scale and impact of climate change.

This calls for closer links between organisations responsible for climate, environmental and economic issues: these interrelated challenges are too often addressed in isolation. COP 21 and the UN's recent adoption of a new set of Sustainable Development Goals are opportunities we must not miss.

TRANSLATED BY CHARLES GOULDEN

ADAGP, PARIS 2015

RENÉ DUVILLIER – 'Returns from sea' (1977)

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(1) See Alexandre Magnan, Raphaël Billé, Sara R Cooley, Ryan Kelly, Hans-Otto Pörtner, Carol Turley and Jean-Pierre Gattuso, "Intertwined ocean and climate: implications for the international negotiations", *Iddri Policy Briefs,* no 4, Paris, 2015; www.iddri.org

Global warming, actors and victims

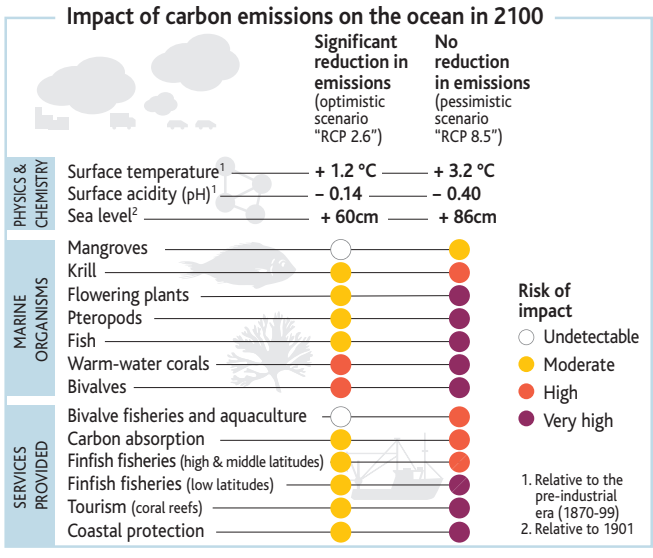
Continued from page I

if carbon emissions continue at their present rate, ocean warming will have a disastrous impact on all these organisms, leading to mass displacement and a decline in marine biodiversity in the tropics. These results – derived from experiments, field observations and modelling – are consistent with evidence from other periods in the geological record when atmospheric CO2 was high, owing in particular to volcanic activity.

The impact of these changes on marine ecosystems also varies according to the scenario. If greenhouse gas emissions continue at their present rate, fishing will be severely affected, especially in tropical waters where it is a key source of protein and income for millions of people. There will also be a very high impact on services provided by coastal ecosystems – coastal protection (coral reefs, mangroves, seagrass beds), aquaculture or tourism.

The damage caused by ocean acidification and rising sea levels to marine organisms and ecosystems, and the resources they contain, is already detectable and could become severe, even under the optimistic scenario. It comes on top of other human impacts such as overexploitation of living resources, habitat destruction and pollution. Given the scale of the expected changes, it is time we realised that no country is safe: this is a worldwide problem and we cannot afford to let the North/South divide prevent us from taking action.

JEAN-PIERRE GATTUSO AND ALEXANDRE MAGNAN
ORIGINAL TEXT IN ENGLISH



(1) Thomas Stocker et al, "Observations: ocean" in "Climate Change 2013: the Physical Science Basis", Working Group I contribution to the fifth assessment report of the Intergovernmental Panel on Climate Change (IPCC), Cambridge University Press, 2013.
(2) Jean-Pierre Gattuso et al, "Contrasting futures for ocean and society from different anthropogenic CO2 emissions scenarios", *Science*, vol 349, no 6423, Washington DC, July 2015.
(3) The Oceans 2015 Initiative is led by France's Centre National de la Recherche Scientifique (CNRS), Pierre and Marie Curie University-Paris VI, and Institut du Développement Durable et des Relations Internationales (Iddri), and is supported by the Prince Albert II of Monaco Foundation, the Ocean Acidification International Coordination Centre of the International Atomic Energy Agency, the BNP Paribas Foundation and the Monégasque Association for Ocean Acidification; bit.ly/1M6YiS6

Ocean solutions

In June 2015 the UN General Assembly approved a resolution to negotiate a new legally binding instrument to implement the UN Convention on the Law of the Sea. We may hope this will pave the way for the creation of areas where marine biodiversity is rigorously protected by law, as well as more equitable access to the high seas and fairer sharing of their benefits, within a framework of shared governance.

This is just the start of what promises to be a lengthy process, but it represents a major shift in the international community's attitude to the protection of the oceans. It also signals the start of an era of real hope for a swift and effective end to the exploitation and degradation of the ocean that has characterised the last hundred years. It is encouraging that private organisations are driving a vision for bigger ideas, new thinking and broader partnerships.

Private philanthropic initiatives can provide decisive support in the design and implementation of marine protected areas. They offer a management framework that, by engaging local communities as well as scientists in the process should make it easier to overcome challenges and stay on course in the longer term.

Large, remote high seas ecosystems such as the Sargasso Sea are now recognised as key areas for protection, but by virtue of their size will require new forms of monitoring such as satellites, drones and unmanned marine vehicles. These will deliver scientific research benefits as well as operational efficiencies.

Studies have shown the value of large no-take marine protected areas as carbon sinks (helping to prevent global warming) but also as breeding grounds for whales and dolphins. The preservation of marine mammals is vital for the fishing and whale-watching sectors, and for global biodiversity.

It's clear we need to think differently. The ecological, scientific and legal arguments for ocean conservation are numerous and irrefutable, but they are not enough. To be effective, they must be combined with new ideas, technologies and sources of finance suited to the task.

The creation of an "ocean bank for sustainability and development", funded through a one-time equity investment by governments and private partners, could offer viable financing options for initiatives to promote the survival and regeneration of the oceans.

We also need to broaden our partnerships. The Paris climate conference (COP 21) this month offers an opportunity to form alliances between professionals from different sectors united by their awareness of the importance of protecting marine biodiversity. It's high time we recognised that the oceans are not just a source of food and minerals for exploitation, but are also vital for the future of our planet and the survival of humanity.

TORSTEN THIELE
ORIGINAL TEXT IN ENGLISH

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