

Why is ocean acidification a major political issue?

By absorbing almost one-third of carbon dioxide emissions from human activities, oceans act as a vital buffer. This process modifies the chemistry of the seawater, thus reducing its pH. This is what is known as ocean acidification. These changes endanger marine ecosystems, especially calcifying organisms such as mollusks and corals. The effects extend far beyond marine life and threaten fisheries, food security, and coastal economies, especially in countries of the Global South. Yet public policies and financing still fall short of addressing this huge challenge. This article draws attention to the urgent need to take action at all levels and proposes courses of action for addressing this issue.

Ocean acidification – an invisible phenomenon with dramatic consequences

Greenhouse gas (GHG) emissions continue to increase each year. In 2023, they reached a record high of 57.1 gigatons of CO₂ equivalent (United Nations Environment Programme/UNEP, 2024). Approximately 25 % of CO₂ emissions are absorbed by oceans through physical processes (solubility pump, carbonate pump) and biological processes (primary productivity). When CO₂ dissolves in seawater, it alters the water's chemical composition, increasing the concentration of H⁺ ions and leading to a decrease in pH (Gattuso and Hansson, 2011). This process is known as "ocean acidification" (OA). Since the beginning of the industrial era, the average pH of the surface ocean has thus decreased from 8.2 to 8.1 units, a difference equivalent to a 30 % increase in seawater acidity.

While these changes are not visible, they have dramatic consequences for marine ecosystems, especially for calcifying organisms such as sea urchins, oysters, mussels, crabs, as well as corals. Indeed, OA results in a decrease of carbonate ions (CO₃²⁻), which are essential to the formation of their skeletons or their calcareous shells. Acidification makes them fragile, and they become more vulnerable to the other harmful pressures they face (storms and tsunamis, for example). Corals are particularly vulnerable, as their growth slows and their skeleton becomes weakened

(less dense), which potentially reduces their capacity for resilience (Canesi, 2022). These changes undermine their essential role as habitats for a large number of marine species, which threatens the balance of reefs. This ultimately raises serious environmental and socio-economic concerns, in particular in the fisheries, tourism and food sectors.

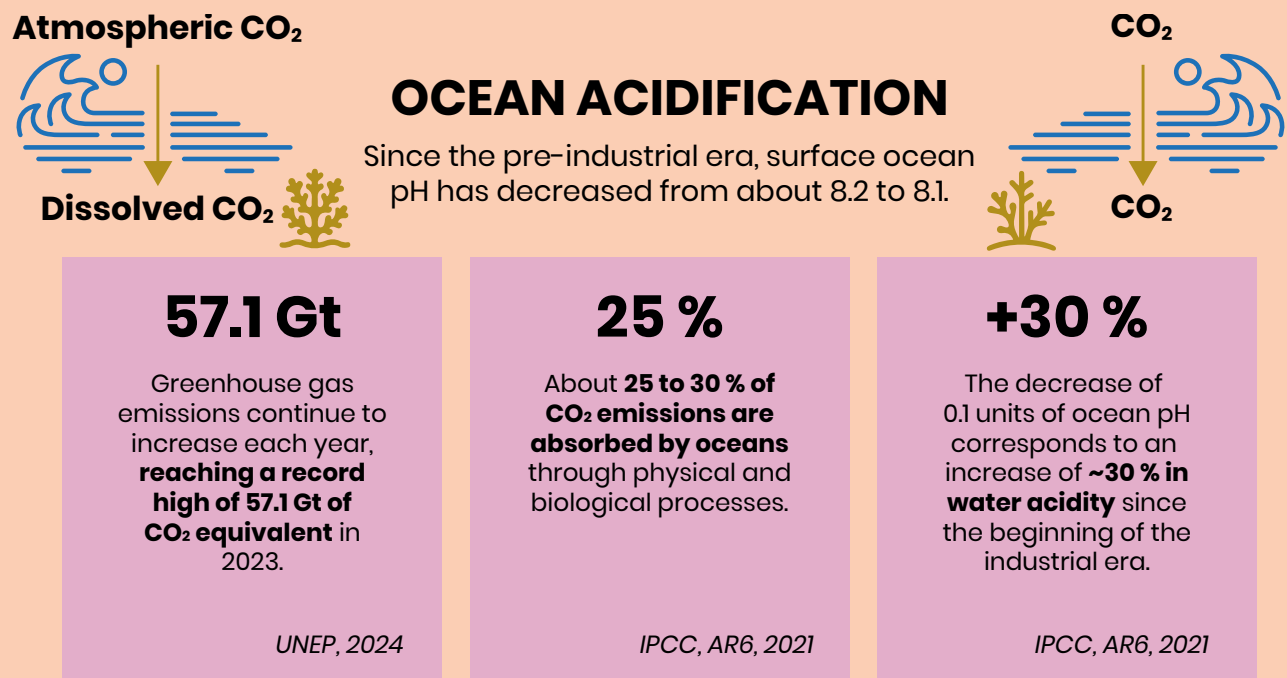
Ocean acidification is projected to increase in the coming decades under all emission scenarios. According to the most pessimistic scenarios (Intergovernmental Panel on Climate Change/IPCC, 2021), by 2100, the average pH of the surface ocean could fall below 7.7. More than three billion people directly depend on marine ecosystems for their livelihoods. Certain countries of the Global South, such as island States and tropical coastal nations, are on the frontlines: their food security and their local economies are directly threatened. Their vulnerability is exacerbated by the lack of infrastructure and means of adaptation, which increases their exposure to the collapse of marine ecosystems. In the longer term, the depletion of coastal areas and loss of livelihoods are likely to exacerbate regional and global socio-economic tensions.

Investing in action against ocean acidification

The 2030 Agenda adopted by the United Nations General Assembly in 2015, with its 17 Sustainable Development Goals (SDGs), clearly identifies ocean acidification as a priority issue. SDG 14, dedicated to the conservation and sustainable use of marine and coastal ecosystems, includes target 14.3, which aims to “*minimize and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels*”.

In this perspective, the United Nations Decade of Ocean Science for Sustainable Development (2021-2030), supported by UNESCO (United Nations Educational, Scientific and Cultural Organization), has stepped up global efforts to address these challenges. France is actively involved, in particular through the Priority Research Program (PRP) “Ocean & Climate: An Ocean of Solutions” (2021-2027), with € 40 million of financing. This program aims to mobilize the scientific community, local stakeholders and civil society to propose science-based solutions for the sustainable management of marine resources (SDG 14.a).

Figure 1 – Ocean acidification – key figures, simplified mechanisms and consequences.



Examples of the consequences

- Ecological** – Alteration in calcifying organisms, disruption of the food web
- Social** – Food insecurity, potential loss of cultural identity
- Economic** – Threat to coastal tourism, increase in adaptation costs

OARS – An international program to observe, understand and take action

At the international level, the "Ocean Acidification Research for Sustainability" (OARS) program, launched in 2021, is recognized under the United Nations Decade of Ocean Science for Sustainable Development (IOC-UNESCO, 2024). This program provides an action plan to improve global surveillance of acidification, assess its impacts on marine life, and strengthen regional capabilities. The ultimate objective is to elaborate a coherent scientific and political response by 2030. Coordinated by the Global Ocean Acidification Observing Network (GOA-ON), OARS seeks to address critical gaps in the surveillance, understanding and management of the effects of acidification, in particular in the most vulnerable regions.

This program hosts more than ten projects, organized around seven strategic objectives: (1) increase global capacity for observation, with harmonized methods; (2) assess the biological and socio-economic impacts, in particular on fisheries resources and coastal communities; (3) develop predictive models to anticipate future scenarios; (4) provide data readily available to policymakers; (5) incorporate acidification in climate adaptation and marine management policies; (6) train new experts, in particular in countries of the Global South; (7) engage local actors and the general public.

OARS functions through a decentralized governance based on regional hubs (for example, in Africa, the Pacific and Latin America). The objective is to adapt the responses to the local ecological, economic and institutional situations. By combining knowledge production, international cooperation and support for public policies, this program is a key tool for the incorporation of ocean acidification into climate, marine and sustainable development agendas.

While these initiatives contribute to generating knowledge, means of implementation, and mitigation solutions, they will not be sufficient to eliminate ocean acidification on a long-term basis. To keep global warming to 2 °C, which is now a more realistic target than 1.5 °C, it would be necessary to reduce global CO₂ emissions by about 25 % by 2030 compared to 2010 and reach net zero CO₂ emissions by 2070 (IPCC, 2021). Yet the policies in place at the end of 2020 would lead to a temperature increase of between 2.4 and 3.5 °C by the end of the century, an irreversible tipping point for marine ecosystems. At 2 °C, it is estimated that up to 99 % of coral reefs could disappear, due to the combined effect of ocean warming and acidification. To address this emergency, courses of action need to be taken without delay: appropriate financing, local mobilization, innovation, awareness-raising and, especially, strong political decisions.

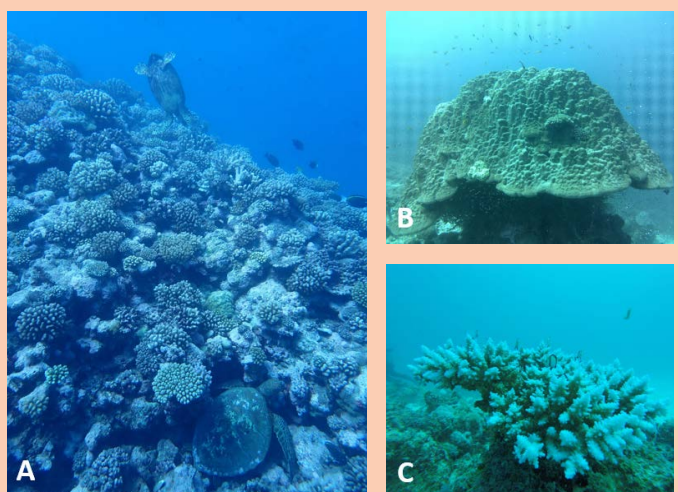
Urgent need for international political commitments

Ocean acidification is a global threat. It exacerbates existing inequalities, as it has a stronger impact on countries of the Global South, especially for those whose livelihoods, economy or culture are highly dependent on marine resources and which have a limited capacity for adaptation. The resilience of Small Island Developing States (SIDS) and coastal countries in Africa, Southeast Asia and Latin America will largely depend on international solidarity and ambitious policy choices. To address the magnitude of the issue, a coordinated response at several levels is essential.

At the local level, communities face real challenges, but they often lack financial resources. It is thus necessary to develop appropriate financing mechanisms, mobilizing both Public Development Banks and private actors. These resources could support innovative solutions, for example, for marine biotechnologies (such as microalgae cultivation to capture CO₂), or Nature-based Solutions (NbS). Among the NbS, seagrass beds have demonstrated their capacity to increase the local pH by more than 0.07 units through photosynthesis, which sustainably reduces water acidity (Ricart *et al.*, 2021). This type of nature-based intervention for ecological restoration provides a concrete response that can be replicated in other parts of the world.

At the international level, closer North-South cooperation would make it possible to support local capacities for research, adaptation and governance, while including OA in climate negotiations, in particular through targeted financing. This requires strong political commitment to make the protection of oceans a pillar of sustainable development agendas.

Photo 1 – Examples of coral reefs throughout the world
(A) Moorea, French Polynesia, 2023 ; (B) Indonesia, 2018 ;
(C) Glorioso Islands, France, 2019.



Credits: Marine Canesi.

Initiatives are already underway, in particular to encourage the new generation to take up the issue and make it a driver for action. For example, *Agence Française de Développement* (AFD), in partnership with the French Ministry of Education, has provided teachers with an educational booklet to raise awareness among young people of the ocean challenges of tomorrow, including OA (AFD Educational Booklet, 2025).

However, these actions need to be part of a global, ambitious and structuring process. The United Nations Ocean Conference (UNOC3), which will be held in Nice in June 2025, represents a major opportunity to place ocean acidification at the center stage of political negotiations, and put it on the international political agenda, to ensure that there is an immediate and quantifiable collective commitment (reliable and accurate indicators). Combating ocean acidification, and therefore reducing anthropogenic CO₂ emissions, is an essential prerequisite for limiting global warming to +2 °C and maintaining ocean pH above the critical threshold of 7.7 during the century (UNEP, 2024), thereby ensuring global climate stability.

References

Agence Française de Développement and French Ministry of Education (2025), *Educational Booklet* « *Oceans – comprendre et agir* », Éditions AFD, Paris.

Canesi, M. (2022), *Impacts of Global Change on Massive Porites and Diploastrea Corals Across the Pacific Ocean*, University of Paris-Saclay, Paris.

Gattuso, J.P. and L. Hansson (2011), *Ocean Acidification*, Oxford University Press, Oxford, <https://books.google.fr/books?id=8yjNFxkALjIC>

Intergovernmental Panel on Climate Change/IPCC (2021), *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*, Cambridge University Press, Cambridge. <https://doi.org/10.1017/9781009157896>

IOC-UNESCO (2024), “Ocean Acidification Research for Sustainability – A Community Vision for the Ocean Decade”, *IOC Technical Series*, 185, Paris, IOC-UNESCO, <https://doi.org/10.25607/YPE3-0H04>

Ricart A.M., M. Ward, T.M. Hill, E. Sanford, K.J. Kroeker, Y. Takeshita, S. Merolla, P. Shukla, A.T. Ninokawa, K. Elsmore and B. Gaylord (2021), “Coast-wide Evidence of Low pH Amelioration by Seagrass Ecosystems”, *Global Change Biology*, 27(11), pp. 2580–2591, <https://doi.org/10.1111/gcb.15594>

United Nations Environment Programme/UNEP (2024), *Emissions Gap Report 2024: No More Hot Air... Please! With a Massive Gap Between Rhetoric and Reality, Countries Draft New Climate Commitments*, UNEP, Nairobi, <https://wedocs.unep.org/20.500.11822/46404>

Agence française de développement (AFD)
5, rue Roland Barthes | 75012 Paris | France
Publishing director Rémy Rioux
Editor-in-chief Thomas Mélonio
Graphic design MeMo, Juliegilles, D. Cazeils
Layout eDeo-design.com
Translation Cadenza Academic

Legal deposit 2nd quarter 2025 | **ISSN** 2428-8926
Credits and authorizations
License Creative Commons CC-BY-NC-ND
<https://creativecommons.org/licenses/by-nc-nd/4.0/>
Printed by the AFD reprographics department

The analyses and conclusions of this document are entirely those of their authors. They do not necessarily reflect the official views of the AFD or its partners institutions.

To consult other publications: <https://www.afd.fr/collection/question-de-developpement>

