Global Ocean Acidification Observations – connecting climate and SDG indicators

Isensee, K. and Schoo, K.[1]

[1] Intergovernmental Oceanographic Commission (IOC) of UNESCO, k.isensee@unesco.org

The **ocean absorbs around 23% of the annual emissions of anthropogenic CO_2** to the atmosphere, thereby helping to alleviate the effects of climate change on the planet. The related costs to the ocean are high, as the CO_2 reacts with seawater and changes the acidity of the ocean ; this process is referred to as ocean acidification. The current global rate of ocean acidification exceeds, by at least an order of magnitude, the rates inferred for the Paleocene - Eocene Thermal Maximum (PETM), which occurred approximately 56 Million years ago. **Ocean acidification threatens organisms and ecosystem services**, including food security, by endangering fisheries and aquaculture. It also impacts coastal protection (by weakening coral reefs, which shield the coastline) and tourism. Coastal areas in particular are subject to a range of factors affecting carbon dioxide levels in seawater, such as freshwater influx, ice-melting, nutrient input, biological activity, temperature change and large ocean oscillations. **Local and regional specific ocean acidification**, its spatial and temporal scale, is of great relevance to marine organisms and biological processes which are exposed to variations in the carbonate system over time. As the acidity of the ocean increases, its capacity to absorb CO_2 from the atmosphere decreases, lowering its buffering capacity and impeding the ocean's role in mitigating climate change.

Ocean Acidification - Global Trends and Natural Local Variability

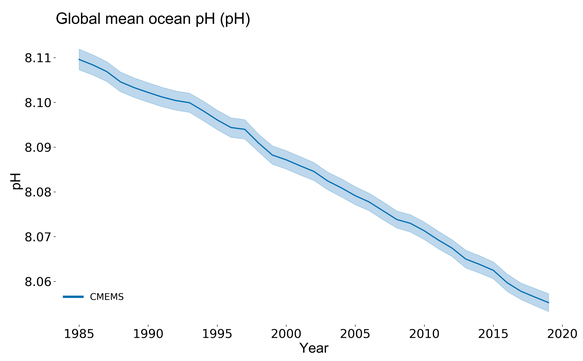


Figure 1 Global mean surface pH from E.U. Copernicus Marine Service Information (blue). The shaded areaindicates the estimated uncertainty in each estimate.

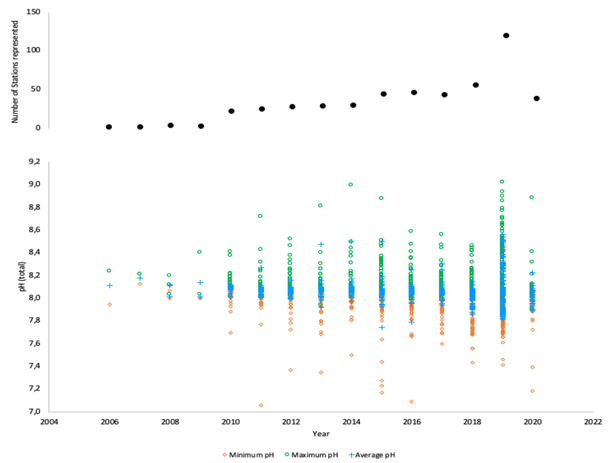


Figure 2 Calculated surface pH values based on ocean acidification data submitted to the 14.3.1 data portal (http://oa.iode.org). Top panel: Black dots – number of stations represented per year. Bottom panel: Blue crosses – average annual pH; orange diamonds – annual minimum pH for each station; green circles – annual maximum pH for each station.

Global trends of **ocean acidification** as presented in **the IPCC** and annual **Statement of the State of the Global Climate** show the global downward trend of ocean pH (Figure 1). However, national datasets of ocean acidification observations submitted towards the **Sustainable Development Goal (SDG) 14.3** and the associated **SDG Indicator 14.3.1** ("Average marine acidity (pH) measured at agreed suite of representative sampling stations") highlight the need for sustained, repeated observation and measurement of ocean acidification along the coastlines and in the open ocean to improve understanding of its consequences, enable modelling and predictions of change and variability (Figure 2). With improved site-specific information available, suitable mitigation and adaptation strategies addressing local conditions can be developed.

Ocean Acidification Observation and Research over the next Decade

Globally conducted **capacity development** increase the capability of many nations to measure, manage and report ocean acidification data, confirmed by the growing number of countries participating in the data collection towards the SDG Indicator 14.3.1 (Figure 3).

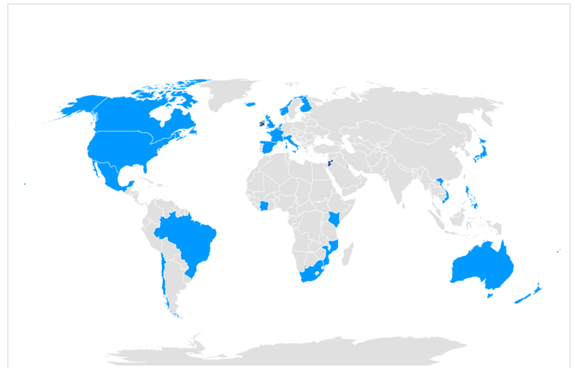
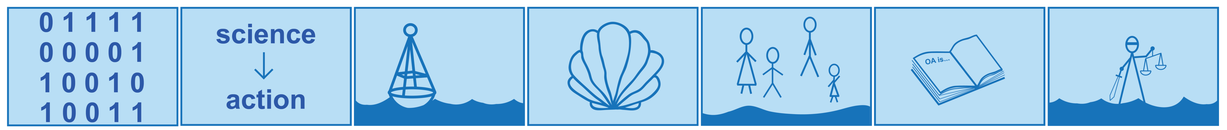


Figure 3. Map illustration of surface ocean carbonate chemistry measurement locations received for the reporting on SDG Indicator 14.3.1 on ocean acidification. Blue – countries whose data was reported in accordance with the SDG 14.3.1 Indicator Methodology; dark grey – countries reporting ocean acidification observation data not collected in accordance with the SDG 14.3.1 Indicator Methodology.

GOA-ON's programme "Ocean Acidification Research for Sustainability" (OARS), endorsed as an Ocean Decade Action for the UN Decade of Ocean Science for Sustainable Development (2021-2030), will address Sustainable Development Goal indicator 14.3.1 and will further develop the science of OA by (i) enhancing OA capacity, increasing observations of ocean chemistry changes; (ii) identifying the impacts on marine ecosystems on local and global scales and (iii) providing society and decision makers with the information needed to mitigate and adapt to OA. The **seven expected outcomes**, spanning from data management, communication, observation, the biological impacts to societally relevant projections, ocean acidification literacy to ocean acidification policy advice.



For more information, please visit:
https://ioc.unesco.org/our-work/ocean-acidification
https://oa.iode.org/
http://goa-on.org

2021 2030 United Nations Decade of Ocean Science for Sustainable Development

OARS Ocean Acidification Research for Sustainability

GOA-ON Global Ocean Acidification Observing Network