Ocean Acidification & Food Security

Ellycia Harrould-Kolieb et al
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Key insights

Policymakers and researchers can better understand, mitigate, and adapt to the impact of ocean acidification on food security, ensuring a more sustainable future for blue foods and the communities that depend on them if they:

1. Ensure baseline measurements of acidification are taken across different ocean basins.
2. Research the impact of ocean acidification on fisheries, shellfish, coral and plankton and priortize seafood species of local importance.
3. Explore knowledge gaps in ocean acidification science and research through a food security lens.
4. Align and integrate ocean acidification and food security research with regional and national policy objectives.
5. Leverage international frameworks to direct research, policy and financing support to more adequately assist nations in prolonged responses to the impacts of ocean acidification on food security.

POLICY BRIEF
OCEAN ACIDIFICATION & FOOD SECURITY

Prepared by:

- Dr. Ellycia Harrould-Kolieb and Rachel Carey, School of Agriculture, Food and Ecosystem Sciences, Faculty of Science, University of Melbourne, Australia
- Iris Kostas, Alluvium Consulting, Melbourne, Australia
- Dr. Annika Frosch, Bartlett School of Environment, Energy, and Resources, University College London, United Kingdom
- Inken Dressler and Jessie Turner, the International Alliance to Combat Ocean Acidification Alliance, UN Foundation, Washington DC, USA
- Professor Aaron L. Strong, Environmental Studies Program, Hamilton College, New York, USA
- Dr. Mitchell Lennan, School of Law, University of Aberdeen, United Kingdom

Key takeaways:

By implementing these recommendations, policymakers and researchers can better understand, mitigate, and adapt to the impact of ocean acidification on food security, ensuring a more sustainable future for blue foods and the communities that depend on them:

- **Ensure baseline measurements** of acidification are taken across different ocean basins.
- **Research the impact of ocean acidification** on fisheries, shellfish, coral and plankton and prioritize seafood species of local importance.
- **Explore knowledge gaps** in ocean acidification science and research through a food security lens.
- **Align and integrate ocean acidification and food security research with regional and national policy objectives.**
- **Leverage international frameworks to direct research, policy and financing support** to more adequately assist nations in prolonged responses to the impacts of ocean acidification on food security.

The Importance of Blue Foods

Blue foods from the sea (BFFS) are crucial for nutrition, livelihoods, and culture worldwide. They include fish, invertebrates, algae, mammals, and aquatic plants. BFFS currently make up **17 percent** of all edible animal protein produced worldwide.[1] Globally, more than 3.3 billion people depend on fish for at least **20 percent** of their animal protein intake, which exceeds **50 percent** in many developing countries.[2] Approximately **40 percent** of the 90 million tonnes of BFFS caught each year come from small-scale fisheries (SSF).[3]

Climate Change Impact on Blue Foods

Climate change is already changing marine ecosystems, causing large declines in the availability and abundance of many fish stocks, especially in the tropics. Climate change has already negatively impacted food production from shellfish aquaculture and fisheries in some ocean regions, leading to declines in net primary production and catch potential.[4] These effects are often compounded by other threats, including overfishing, habitat destruction, and pollution (including plastics), resulting in reduced availability of fish.[5] This is particularly concerning given the rising global demand for aquatic food.

[1] FAO. 2020. The State of World Fisheries and Aquaculture 2020. Sustainability in action. Rome. https://doi.org/10.4060/ca9229en, p. 5

[2] FAO. (2022) The State of World Fisheries and Aquaculture 2022: Towards Blue Transformation. FAO. https://doi.org/10.4060/cc0461en

[3] FAO, Duke University & WorldFish. 2023. Illuminating Hidden Harvests: The contributions of small-scale fisheries to sustainable development – Executive summary. Rome. https://doi.org/10.4060/cc6062en, p. 2

[4] IPCC, 2022: Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama (eds.)]. Cambridge University Press. Cambridge University Press, Cambridge, UK and New York, NY, USA, 3056 pp., doi:10.1017/9781009325844.

[5] Impacts of Climate Change: Impacts of Climate Change on Marine Organisms and Ecosystems (https://doi.org/10.1016/j.cub.2009.05.046)

Ocean Acidification: An Understudied Threat To Food Security

While emerging publications examine the required policy responses to the impacts of climate change on both large scale and small-scale fisheries (**see resources available by partners**), (OA) remains under-examined in relation to food security.

OA occurs when increased carbon dioxide (CO_2) levels alter marine carbonate chemistry, primarily affecting organisms that build skeletons and shells (e.g., corals, shellfish, phytoplankton), but with documented effects on a wider range of species, including fish (see **Figure 1** below).

OA is already causing changes in ocean, coastal, and marine species and ecosystems that millions of people rely on for food.

Food security is defined as a situation where "all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life."[6]

Food security has six interconnected dimensions: stability, sustainability availability, access, utilization, and agency. The first three dimensions (stability, sustainability, availability) are largely shaped by environmental factors, while the latter three (access, utilization, agency) are particularly influenced by social factors. Ocean acidification undermines the ability to meet all six dimensions of food security (as outlined in **Figure 2** below).

[6] HLPE Report #15 - Food security and nutrition: Building a global narrative towards 2030. A report by the High-Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security. United Nations System Standing Committee on Nutrition. http://www.fao.org/3/ca9731en/ca9731en.pdf

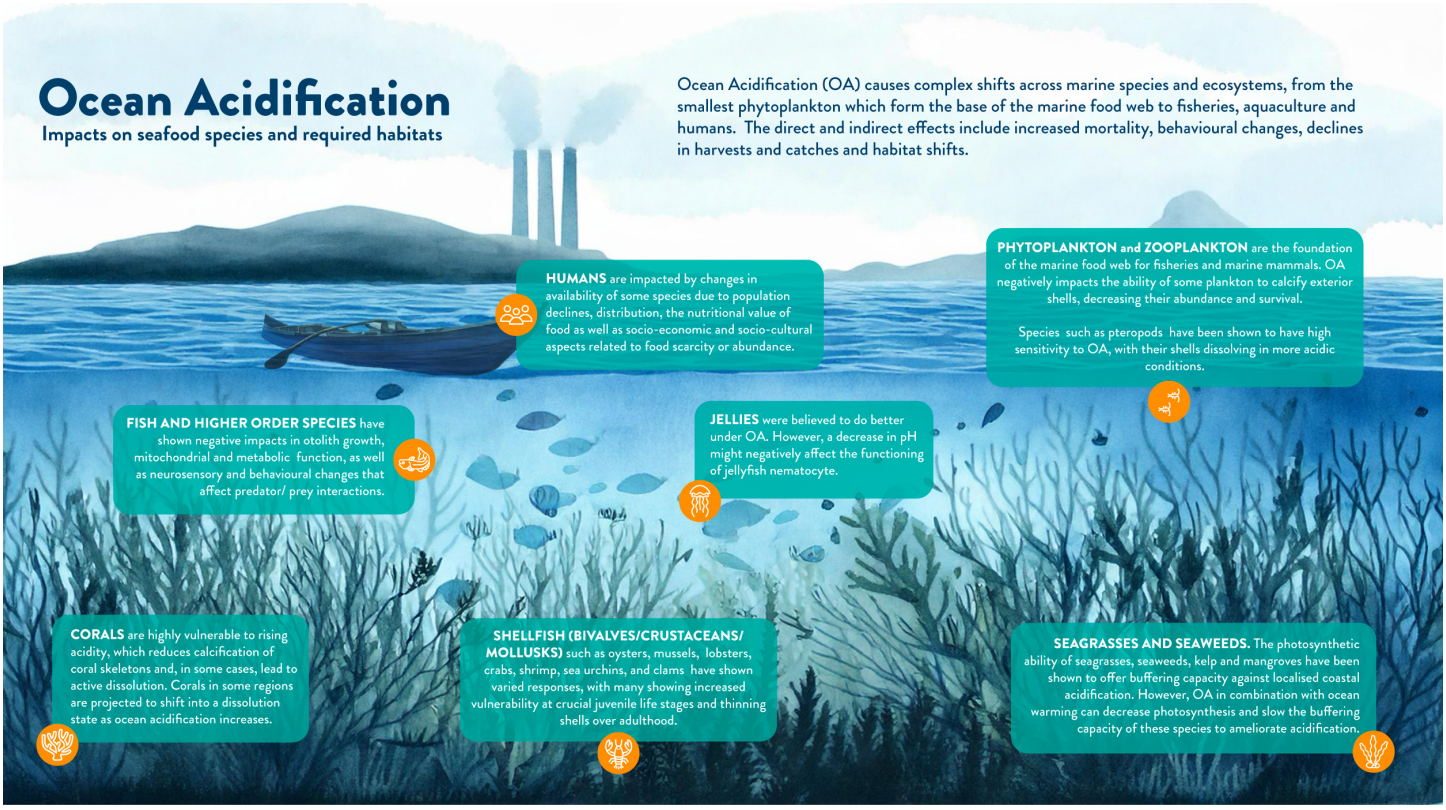

Figure 1: Ocean Acidification Impacts on seafood species and required habitats.

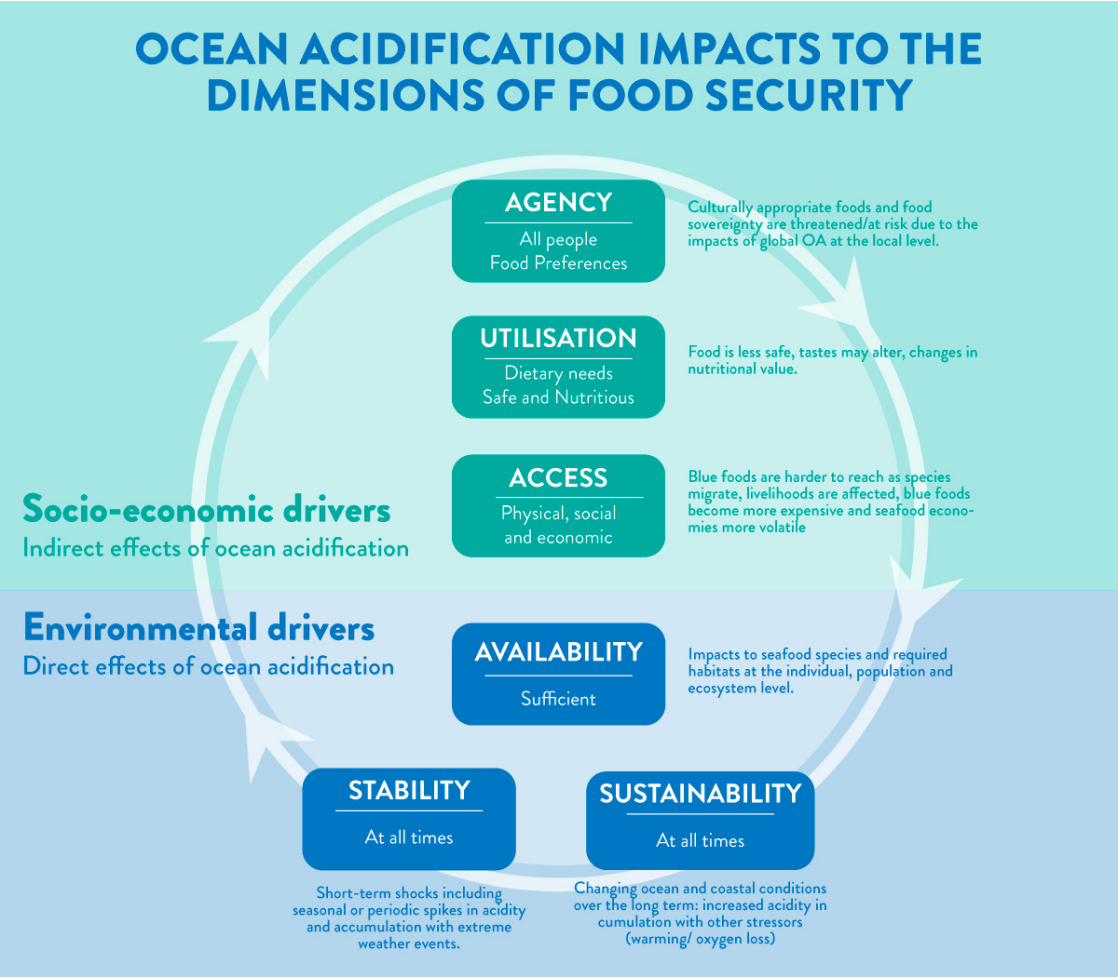

Figure 2: Ocean Acidification Impacts to the Dimensions of Food Security: depiction of the impacts ocean acidification poses to the environmental and socio-economic drivers of the six dimensions of food security, as conceptualised by the High-Level Panel of Experts on Food Security and Nutrition. Dimensions are interlinked and contingent upon each other. All need to be met in order to fulfill food security.

Research, Policy, and Global Responsibilities

Examining the links between ocean acidification and the six dimensions of food security can shed light on their complex interactions and further enhance research, policy, and responses to both.

To address the impact of ocean acidification on food security, policymakers should:

1. Increase **regional knowledge** about OA trends and impacts on local seafood species and habitats
2. Integrate OA across **climate, ocean, and food security agendas**
3. Utilize existing climate, ocean, food security, and sustainable development **financing and technological assistance.**

Improved coordination between entities working at the international level is crucial, especially at the science-policy interface where climate change and food security issues converge.

Recommendations

Targeted research and policy assessments are needed to explore ocean acidification impacts on blue foods from the sea and leverage appropriate responses. By implementing these recommendations, policymakers and researchers can better understand, mitigate, and adapt to the impact of ocean acidification on food security, ensuring a more sustainable future for blue foods and the communities that depend on them.

- **Ensure baseline measurements of acidification are taken across different ocean basins**

- **Research the impact of ocean acidification** on fisheries, shellfish, coral and plankton and prioritize seafood species that are most important to local communities.

- **Explore knowledge gaps in ocean acidification science and research through a food security lens.** For example, **governments, research institutions or bodies like FAO can support regional vulnerability assessments that help prioritize keystone species** and ecosystems of socioeconomic importance that should be studied under ocean acidification.

- **Align and integrate ocean acidification and food security research with regional and national policy objectives** that address ocean and fisheries management, climate change adaptation, sustainable development and food systems. These include policies like Sustainable Ocean Plans, Marine Protected Areas, Nationally Determined Contributions (NDCs), National Climate Adaptation Plans (NAPs), climate risk assessments, national development and blue economy plans.

- **Leverage international frameworks to direct research, policy and financing support to more adequately assist nations in prolonged responses** to the impacts of ocean acidification on food security. These include the UN Framework Convention on Climate Change, initiatives of the Food and Agriculture Organization of the United Nations, and 2030 Sustainable Development Goal Agenda to name a few. International frameworks with responsibilities for mitigating and addressing the impact of climate change, ensuring food security and supporting equitable and sustainable development are being underutilized when it comes to responding to the threat ocean acidification poses to food security worldwide.