EXECUTIVE SUMMARY

Undisturbed

The deep ocean's vital role in safeguarding us from crisis

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Introduction

The deep ocean is the most inaccessible and mysterious ecosystem on our planet. But today even these vast, remote areas of the ocean are being impacted by human activities, climate change and ocean acidification, and these impacts are projected to intensify and accumulate in the coming decades. Unless urgent, precautionary action is taken to address the threats to the deep ocean posed by activities including deepwater oil and gas extraction, deep-sea trawling, unsustainable fishing, and deep-seabed mining, we risk disrupting the essential ecosystem services and resources provided by the deep ocean, including climate regulation. In the face of the interconnected climate and nature crises facing our planet, we must unite to safeguard the health of the deep.

This synthesis report by the Deep Sea Conservation Coalition (DSCC) explores the critical role of the deep ocean in the global climate cycle and highlights the risks confronting it, including the multiple threats driven by climate change and ocean acidification, and identifies key actions that could be taken to protect it at this pivotal global moment. It is crucial that the rare opportunity presented by the convergence of several key international processes – including climate change COP27, the new Global Biodiversity Framework to be agreed at COP15, and negotiations for a new UN High Seas (BBNJ) Agreement – is not missed. Meanwhile, it is possible that deep-sea mining regulations could be approved by the International Seabed Authority by July 2023.

Action to protect the deep is key to combating climate change. It is critical to look to the future and take steps now to fully integrate the deep ocean into climate policy and strategy, and vice versa, and stop activities that risk the disruption of irreplaceable ecosystem services and resources that we all depend on.

The deep ocean – climate connection

The bonds between the ocean and climate change run deep. The deep ocean – defined as all areas below 200 meters – helps to regulate Earth's climate by absorbing and storing over 90% of the excess heat and approximately 38% of the carbon dioxide generated by humanity. Marine animals, from fish to whales to microbes, play a major role in storing and transporting carbon from the surface to the seafloor. And the seafloor itself is also the world's largest pool of sediment/soil carbon stocks, with 75% of them stored in the sediments of the deep ocean. Without these deep-ocean carbon sinks and fluxes, global warming would have already rendered our planet unlivable.

As well as playing a critical role in regulating our climate, the deep ocean is also threatened by the impacts of climate change and ocean acidification. A growing body of research is revealing that these impacts are now occurring at unprecedented rates, leading to a warmer, more acidified, less oxygenated deep ocean, with potentially dire consequences for deep-sea life and the ecosystem services provided by the deep ocean, including – paradoxically – climate change mitigation.

Climate change induced temperature rises in the ocean are already affecting the distribution and ranges of marine species, including commercially important fish like tuna and billfishes, and have the potential to cause physico-chemical impacts, including disrupting the efficiency of the ocean's carbon biological pump on which all life on Earth depends. Low oxygen concentrations can also disrupt biogeochemical cycling by altering the sources, sinks and cycling of key biological elements, resulting in fundamental changes to the productivity of deep-ocean species. Increased warming of surface waters and continental margins will likely reduce the flux to the seafloor of particulate organic carbon (POC) that deep-ocean species rely on for food. As a result, biomass is projected to decline in the majority of deep-sea biodiversity hotspots, including cold-water coral reefs, seamounts and canyons where food is already scarce.

But despite the growing evidence of the climate impacts on deep-sea ecosystems, and their huge carbon absorption and storage potential, many of these deep-ocean—climate connections remain unrecognized and unquantified, and there are possibly many more connections yet to be discovered. That's why the current global push to reduce emissions and enhance carbon sequestration is an unmissable opportunity to highlight the climate contribution of the deep ocean and the urgent need to protect deep-ocean ecosystems and the vital services they provide.

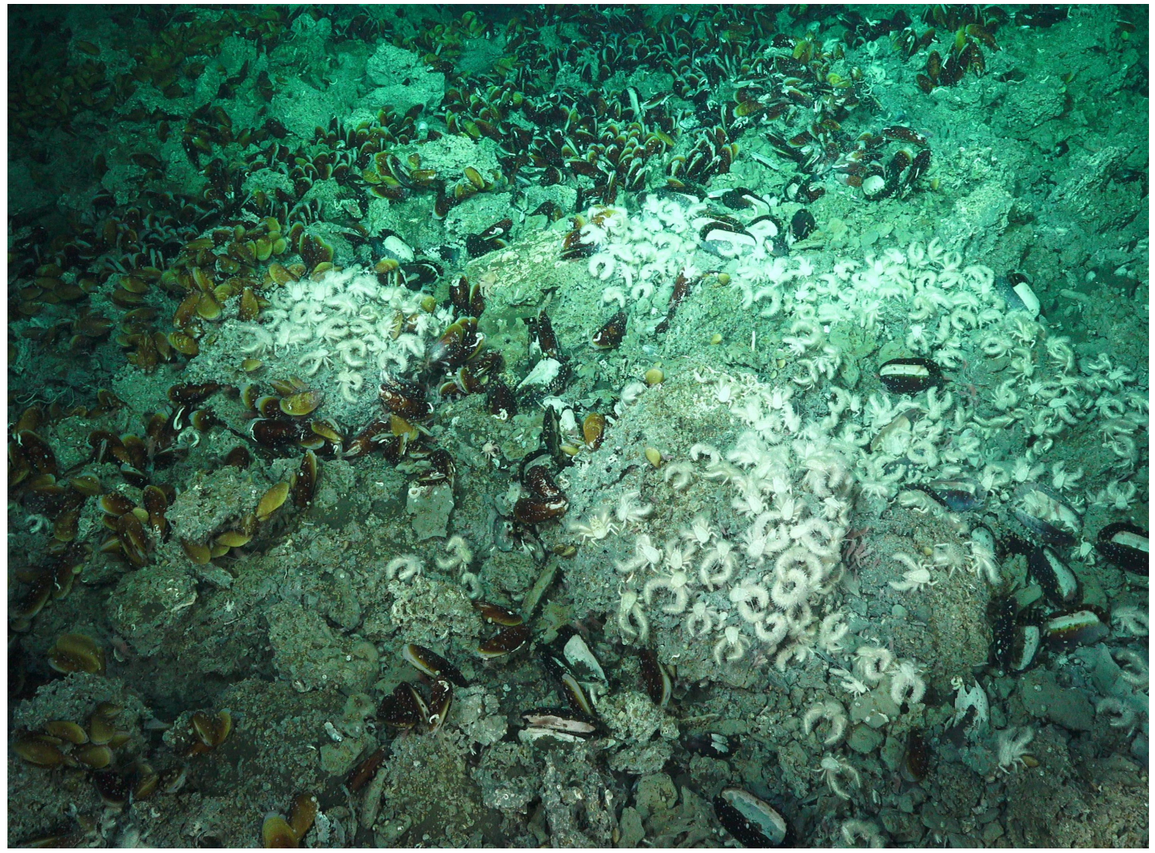
Deep water octopus at nearly 1200 meters depth, Ribbon Reef Canyons, 170km northeast of Cairns, Australia. © Schmidt Ocean Institute

How human activities are impacting the deep ocean

Deep-sea habitats are not only under threat from climate change stressors but are also at risk from increasing human activities. While some extractive activities, like deep-sea fishing and oil and gas extraction, have been going full steam ahead for decades, a new threat is now presenting itself in the form of the nascent deep-sea mining industry that could be targeting minerals from biodiversity hotspots including hydrothermal vents, abyssal plains and seamounts as soon as 2023. Meanwhile, as the quest to find solutions to the climate crisis intensifies, ocean-based climate interventions that affect the deep sea are being proposed with greater frequency.

The disturbance caused to the deep sea by these activities will interact with climate change stressors, further reducing the resilience of deep-sea organisms and ecosystems, and exacerbating impacts. For example, increasing deep-sea oil and gas extraction will not only cause direct impacts to deep-sea biodiversity and ecosystems from the extraction process itself, including from spills and blowout, but the subsequent burning of more oil and gas from the deep will exacerbate climate change and reduce deep-sea resilience. Likewise, deep-sea trawling is extremely damaging from both biodiversity and climate perspectives. Disturbance of the vast carbon stores on the seafloor by trawling could potentially lead to a positive feedback mechanism that reduces the ocean's role in buffering global climate change, while industrial trawling itself is responsible for carbon emissions equal to those generated by the global aviation industry – though far less frequently talked about.

As the threats facing the deep ocean mount, concerns surrounding the prospect of the launch of a new extractive deep-sea industry have grown across a range of stakeholders. If it is permitted to go ahead, deep-sea mining would lead to biodiversity loss and disruption of ecosystem services on an enormous spatial and temporal scale. The damage would stem from the direct removal and destruction of seafloor habitats and their unique fauna, the resulting sediment plumes that would extend the impacts for hundreds to thousands of kilometers, contaminant releases, changes to water properties, and increases in noise and light in the deep ocean. Deep-sea mining would also cause impacts above the sea surface due to the carbon emissions and other air pollutants from vessel fuel combustion over hundreds of nautical miles. Given the disturbance to the seabed, it is also clear that there is potential for significant, long-term mining impacts on carbon cycling and storage in the deep.



Carbon is captured in carbonate rocks and by microbes associated with mussels and yeti crabs at a Costa Rican methane seep. © Schmidt Ocean Institute/Eric Cordes Chief Scientist

Looking to the future – what can we do to protect the deep?

Although human activities are encroaching, the deep ocean remains relatively pristine. We need to act together to keep it that way, protect its vital role in mitigating and building resilience to climate change, and ensure that the irreplaceable benefits it bestows on humanity are available for future generations. This report outlines seven steps that can be taken now to protect the deep:

1. Take a precautionary approach and pause all human activities that disturb the deep seafloor, lead to biodiversity loss, and risk disruption of irreplaceable ecosystem services, including deepwater oil and gas extraction, deep-sea trawling, and deep-seabed mining.
2. Increase our ability to preserve deep-sea ecosystems and reduce uncertainties about the impacts of our activities by promoting robust deep-sea research that is independent of extractive agendas.
3. Expand climate-smart Marine Protected Areas that are designed to boost climate resilience by retaining species moving at different speeds at different depths due to climate change, while also managing non-climate threats, such as fishing and mining.
4. Introduce policies and strategies that support the protection of deep-ocean ecosystem services and take precautionary approaches to avoid irreversible losses of those services, by incorporating evidence-based strategic environmental assessments and risk analysis into all stages of management.
5. Develop ocean-based climate interventions and strategies that conserve carbon and avoid significant or irreversible damage to the deep sea.
6. Manage fisheries for climate, and vice versa, by paying attention to the role of fish in carbon storage, with management of stocks incorporating climate-induced changes in habitat and distributions, and recognizing that climate action is necessary for healthy future fish stocks.
7. Develop and implement international agreements and regulations that jointly address biodiversity and climate change, including UNFCCC climate agreements, BBNJ negotiations, and Regional Fisheries Management Organizations (RFMO) impact assessments of deep-sea fisheries.

Sea cucumber *Amperima* sp. on the seabed in the eastern Clarion-Clipperton Fracture Zone. © Craig Smith and Diva Amon, ABYSSLINE Project, NOAA Office of Ocean Exploration and Research