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TRIBAL CARBON SOLUTIONS

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Plankton (algae) bloom (Energy Tracker Asia). "Ocean fertilisation is the process of adding macronutrients to stimulate algae growth in the ocean. Algae utilise carbon in the ocean to perform photosynthesis. This process increases the quantity of carbon dioxide the ocean absorbs from the atmosphere. However, the technology is still under research, and there are currently several associated environmental concerns, like harmful algal blooms." (Energy Tracker Asia)

Carbon Sequestration in Oceans Presents Dangers

By Mark Fogarty

The oceans represent a huge resource for sequestering carbon dioxide. But they also represent possibilities to compound threats like previous ones experienced in deep seas—overfishing, biodiversity loss, pollution, acidification and deoxygenation.

"The massive deposition or transfer of particles, organic matter, and CO2 into the deep ocean from OBCIs present new biogeochemical and ecosystem threats and governance challenges, particularly in international waters."

"Many of these (threats) stand to be compounded or exacerbated by OBCIs (ocean-based climate interventions). In addition, the massive deposition or transfer of particles, organic matter, and CO2 into the deep ocean from OBCIs present new biogeochemical and ecosystem threats and governance challenges, particularly in international waters," according to a paper recently published in Science by Lisa A. Levin of the Scripps Institution of Oceanography and several other authors.

Dr. Levin recently briefed the Intertribal Working Group of Global Ocean Health's Building Tribal Leadership in Carbon Removal on the paper, called "Deep-sea impacts of climate interventions."

"The ocean contains 50 times as much carbon as the atmosphere and acts as a biotic and abiotic thermostat, absorbing and releasing CO2 and heat," according to Levin et al.

Lisa A. Levin, Oceanographer.

"Strong connectivity between the surface and deep ocean will transfer impacts through the water column and to the seafloor," the writers say, with the potential to alter albedo and reflectance. Introducing carbonate or silicates would alter turbidity and light fields.

"Resulting changes in the distribution and productivity of plankton will affect ecosystem connectivity and food supply to other organisms. Smaller inorganic and organic particles are unlikely to reach the deep seafloor as detectable deposits but may be ingested or entrained in aggregations of sinking particles (marine snow) and transported to the deep ocean."

Other impacts, like ocean fertilization, artificial upwelling, and ocean thermal energy conversion, "are likely to enhance phytoplankton growth, which may increase local particulate organic carbon flux to the seabed. Extensive nitrogen and phosphorus uptake by macroalgal culture could exacerbate open-ocean nutrient limitation and lower rates of nitrogen and phosphorus recycling, which could affect nutrient stoichiometry and phytoplankton composition or productivity," according to the article.

Changes like these "would alter the supply, composition, and lability of organic matter to the deep sea, leading to changes in food webs, communities, biodiversity, and ultimately in carbon sequestration. Macroalgae and crop waste could release particulate or dissolved OM on descent, altering microbial production, oxygen consumption, and food supply in the mesopelagic realm and beyond. Algae and crop waste may create physical resuspension and disturbance upon reaching the seabed, introduce unnatural amounts of food into a typically oligotrophic system, and smother the sediment biota," according to Levin's paper.

Increased food supply "will attract large numbers of opportunist detritivores and predators and alter species interactions. These changes could harm commercially harvested fish and invertebrates."

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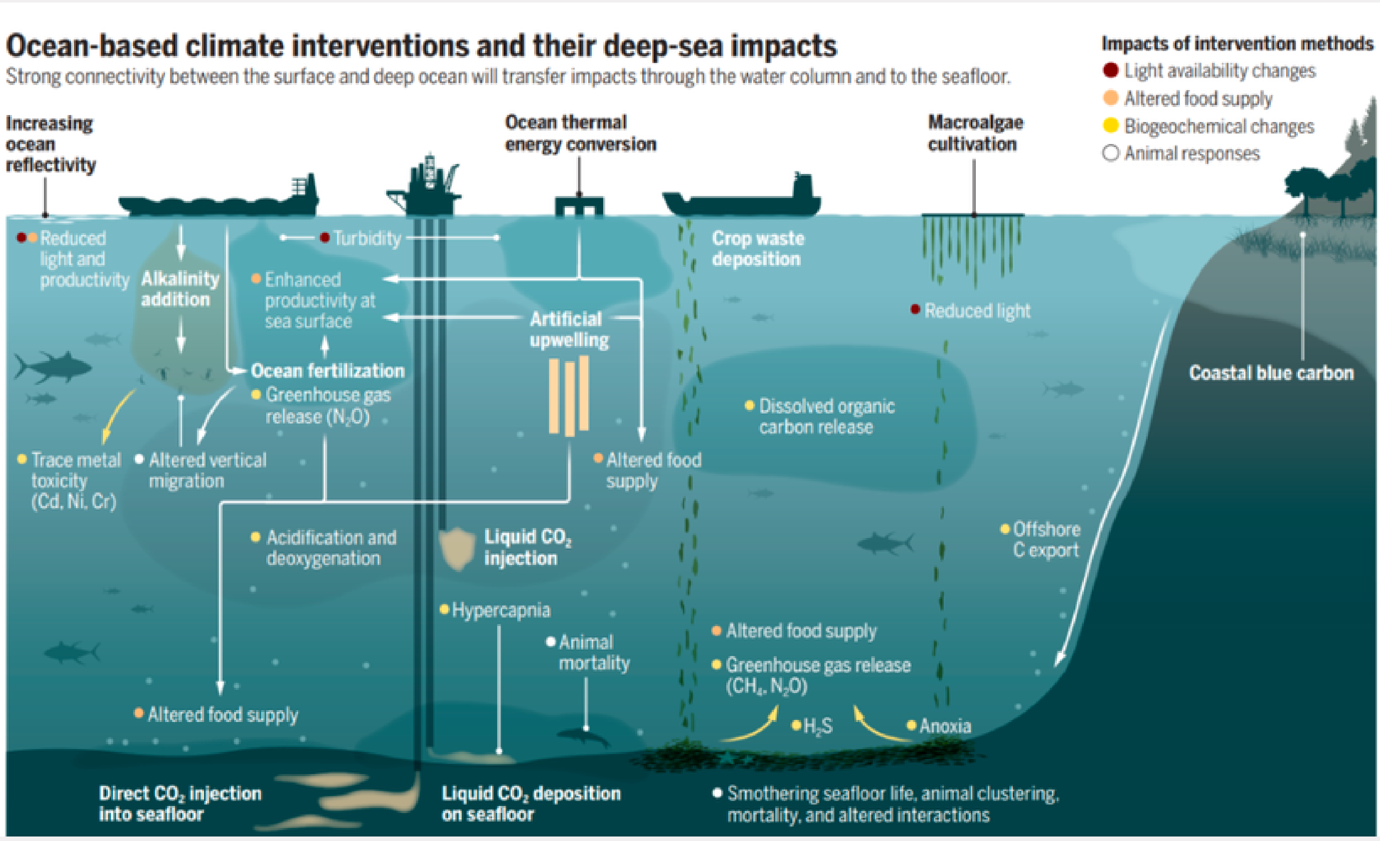
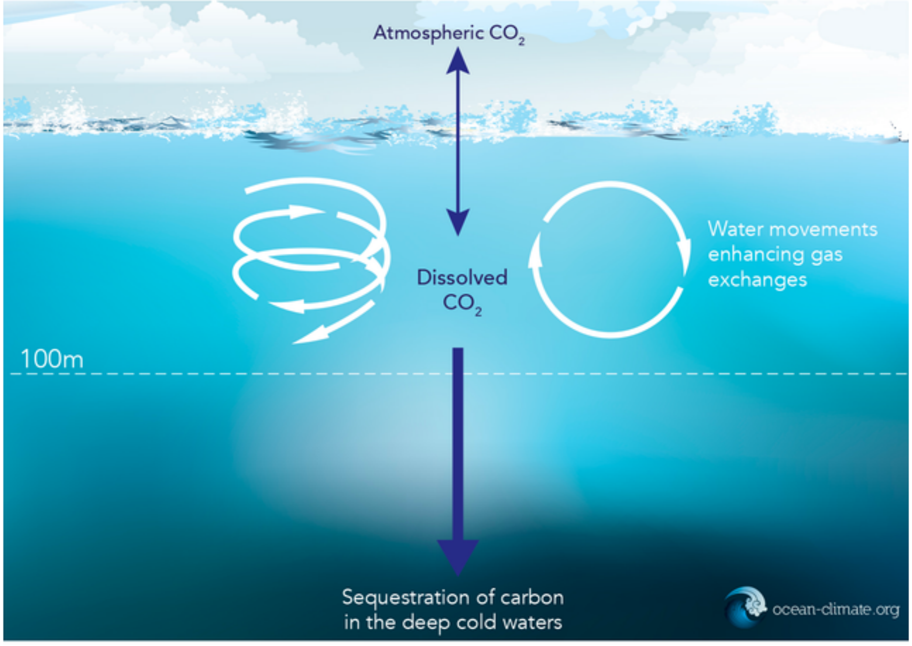
The graphic below highlights the potential impacts of OBCIs on deep-ocean environments. Levin et al., *Science* 379: 6636 (2023)

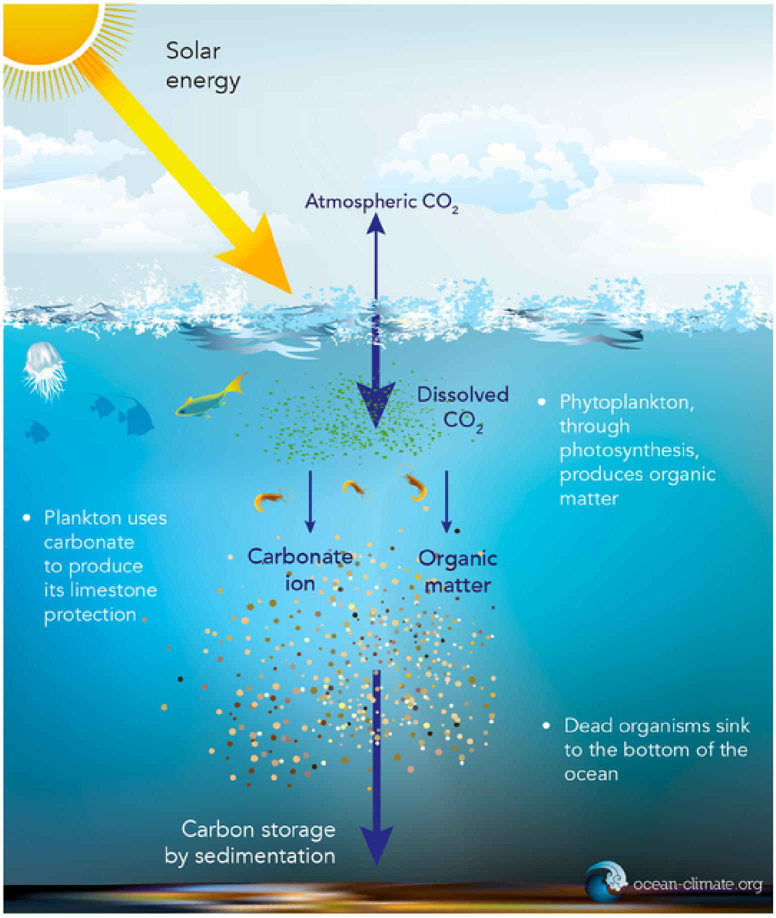


The Ocean Carbon Pump

The ocean carbon pump, also known as the biological pump or marine biological pump, refers to a series of processes by which carbon dioxide (CO2) is removed from the atmosphere and stored in the deep ocean. It plays a crucial role in regulating Earth's climate and the carbon cycle. The ocean carbon pump is composed of two compartments: the physical pump (on the right) and the biological pump (below).



Physical carbon pump



Biological carbon pump

The physical pump refers to the role of ocean circulation in transporting carbon from the surface to the deep sea. It involves the sinking of carbon-rich particles and the movement of dense water masses, particularly in the Polar Regions. This component primarily deals with physical processes such as water movement and the sinking of organic matter.

On the other hand, the biological pump focuses on the role of marine organisms, particularly phytoplankton and zooplankton, in the transfer and storage of carbon. It involves photosynthesis by phytoplankton, the consumption of organic matter by zooplankton, and the subsequent sinking of organic particles to the seabed. The biological pump encompasses the biological processes and interactions within the marine food web. (Ocean & Climate Platform)

For more information visit Ocean & Climate Platform at https://ocean-climate.org/en/awareness/the-ocean-a-carbon-sink/.