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Distribution and valuation of the biological carbon pump and its carbon sequestration: Implications for international area-based management and climate finance

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Marine organisms, from plankton to fish, provide a wealth of ecosystem services, including carbon sequestration in a process known as the ocean's biological carbon pump (BCP). The BCP brings carbon from the atmosphere to the ocean depths where it is stored for decades to centuries. Although parts of the ocean's BCP are under threat from human activities, BCP carbon sequestration rarely features as an objective in efforts to protect ocean spaces. Moreover, although BCP carbon sequestration services could support discussions of conservation and climate finance, its economic value has yet to be estimated in space and time.

Biogeochemical modeling and mapping efforts have grown in recent years, and emerging results could potentially help to fill in important spatially explicit and economic knowledge gaps that could inform the protection of the BCP. We developed a new metric to map and quantify the global ocean's BCP long-term carbon sequestration and computed its value on a potential carbon market. We show the global spatial patterns and valuation in relation to geopolitical and management boundaries, and highlight options for governance and management. Our results highlight potential opportunities for preserving the climate services of the BCP both nationally and in areas beyond national jurisdiction, and can be used to inform discussions about marine protected areas, environmental impact assessment, and conservation finance.