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TITLE: Ecosystem function and services provided by the deep sea

AUTHOR: ['Andrew R. Thurber', 'Andrew K. Sweetman', 'Bhavani E. Narayanaswamy', 'Daniel O. B. Jones', 'Jeroen Ingels', 'Roberta L. Hansman']

ABSTRACT:

Abstract. The deep sea is often viewed as a vast, dark, remote, and inhospitable environment, yet the deep ocean and seafloor are crucial to our lives through the services that they provide. Our understanding of how the deep sea functions remains limited, but when treated synoptically, a diversity of supporting, provisioning, regulating and cultural services becomes apparent. The biological pump transports carbon from the atmosphere into deep-ocean water masses that are separated over prolonged periods, reducing the impact of anthropogenic carbon release. Microbial oxidation of methane keeps another potent greenhouse gas out of the atmosphere while trapping carbon in authigenic carbonates. Nutrient regeneration by all faunal size classes provides the elements necessary for fueling surface productivity and fisheries, and microbial processes detoxify a diversity of compounds. Each of these processes occur on a very small scale, yet considering the vast area over which they occur they become important for the global functioning of the ocean. The deep sea also provides a wealth of resources, including fish stocks, enormous bioprospecting potential, and elements and energy reserves that are currently being extracted and will be increasingly important in the near future. Society benefits from the intrigue and mystery, the strange life forms, and the great unknown that has acted as a muse for inspiration and imagination since near the beginning of civilization. While many functions occur on the scale of microns to meters and timescales up to years, the derived services that result are only useful after centuries of integrated activity. This vast dark habitat, which covers the majority of the globe, harbors processes that directly impact humans in a variety of ways; however, the same traits that differentiate it from terrestrial or shallow marine systems also result in a greater need for integrated spatial and temporal understanding as it experiences increased use by society. In this manuscript we aim to provide a foundation for informed conservation and management of the deep sea by summarizing the important role of the deep sea in society.

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