



POLICY FORUM

OCEAN GOVERNANCE

An ecosystem-based deep-ocean strategy

Monitoring and assessment must underpin development of a new international agreement

By R. Danovaro,^{1,2*} J. Aguzzi,^{3*} E. Fanelli,^{4*} D. Billett,⁵ K. Gjerde,^{6,7} A. Jamieson,⁸ E. Ramirez-Llodra,⁹ C. R. Smith,¹⁰ P. V. R. Snelgrove,¹¹ L. Thomsen,¹² C. L. Van Dover¹³

Increasing exploration and industrial exploitation of the vast and fragile deep-ocean environment for a wide range of resources (e.g., oil, gas, fisheries, new molecules, and soon, minerals) raises global concerns about potential ecologi-

cal impacts (1–3). Multiple impacts on deep-sea ecosystems (>200 m below sea level; ~65% of the Earth's surface is covered by deep ocean) caused by human activities may act synergistically and span extensive areas. Cumulative impacts could eventually cause regime shifts and alter deep-ocean life-support services, such as the biological pump or nutrient recycling (2, 4, 5). Although international law and national legislation largely ignore the deep sea's critical role in

the functioning and buffering of planetary systems, there are promising developments in support of deep-sea protection at the United Nations and the International Seabed Authority (ISA). We propose a strategy that builds from existing infrastructures to address research and monitoring needs to inform governments and regulators.

Growing demands for ocean space and seabed resources have generated a need for international laws and policies (6) to enable