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TITLE: Environmental Impacts of the Deep-Water Oil and Gas Industry: A Review to Guide Management Strategies

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ABSTRACT:

The industrialization of the deep sea is expanding worldwide. Expanding oil and gas exploration activities in the absence of sufficient baseline data in these ecosystems has made environmental management challenging. Here, we review the types of activities that are associated with global offshore oil and gas development in water depths over 200 m, the typical impacts of these activities, some of the more extreme impacts of accidental oil and gas releases, and the current state of management in the major regions of offshore industrial activity including 18 exclusive economic zones. Direct impacts of infrastructure installation, including sediment resuspension and burial by seafloor anchors and pipelines, are typically restricted to a radius of approximately 100 m on from the installation on the seafloor. Discharges of water-based and low-toxicity oil-based drilling muds and produced water can extend over 2 km, while the ecological impacts at the population and community levels on the seafloor are most commonly on the order of 200-300 m from their source. These impacts may persist in the deep sea for many years and likely longer for its more fragile ecosystems, such as cold-water corals. This synthesis of information provides the basis for a series of recommendations for the management of offshore oil and gas development. An effective management strategy, aimed at minimizing risk of significant environmental harm, will typically encompass regulations of the activity itself (e.g. discharge practices, materials used), combined with spatial (e.g. avoidance rules and marine protected areas) and temporal measures (e.g. restricted activities during peak reproductive periods). Spatial management measures that encompass representatives of all of the regional deep-sea community types is important in this context. Implementation of these management strategies should consider minimum buffer zones to displace industrial activity beyond the range of typical impacts: at least 2 km from any discharge points and surface infrastructure and 200 m from seafloor infrastructure with no expected discharges. Although managing natural resources is, arguably, more challenging in deep-water environments, inclusion of these proven conservation tools contributes to robust environmental management strategies for oil and gas extraction in the deep sea.

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