# Photographic Evidence of the True Extent and Duration of Impacts to the Seafloor and Surrounding Seep-Related Benthic Community Shortly After the Deepwater Horizon Accident

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## ABSTRACT

Oil spills caused by shallow drilling hazards stir fears of catastrophic disturbance to ecosystems. In the case of the Deepwater Horizon accident, tragedy and understanding intersected when a massive spill created opportunity to examine relationships between seeps and spills. Hydrocarbon seeps, methane hydrates, and vent sites are known to support a diverse array of chemoautotrophic taxa. These rich faunal communities and deposits occur across many oceans and depths. It is well-known that the sulfide-oxidizing bacteria, Beggiatoa, typically form mats, often extensive in size, on sediments where strongly anoxic reducing conditions exist—such as natural hydrocarbon seeps, vents, and regions with intense sediment oxygen demand due to organic loading. Furthermore, Beggiatoa and other chemolithotrophic bacteria are major facilitators of the diets of polychaete worms and other benthic infauna. Three cruises looking at impacts to the benthic community were conducted around the Deepwater Horizon wellhead in 2011 and 2014 using a sediment profile (SPI) and plan-view (PV) imaging system. Stations were arranged in eight radial transects emanating from the wellhead to map near-field impacts (within 10 km of the wellhead) and far-field impacts (to 120 km away). Three replicate sets of images were analyzed from 809 stations, providing an extensive spatial and temporal dataset that would not be economically feasible using traditional sediment sampling techniques. The response of the benthic community to hydrocarbon input from the Deepwater Horizon accident was familiar to our researchers, as it mimicked the response and recovery pattern documented for similar large-pulse inputs of utilizable food sources (natural seeps, spreading seafloor ridges, whale carcasses) to what is normally an oligotrophic system. Unlike the predictions discussed in much of the popular media and scientific literature, we document that natural recovery in the deep-sea benthic ecosystem surrounding the wellhead is dramatic and occurring faster than expected. These results from the Deepwater Horizon spill revealed biological conditions and benthic community structure that resemble natural seep environments in proximity to the wellhead and suggest that chemoautotrophic communities can establish quickly after a spill. Our findings differed from the media and some scientific reporting, yet the SPI imagery provides photographic evidence to the true nature of impact to the benthos from this spill.