ELEMENTA
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Evidence of lasting impact of the Deepwater Horizon oil spill on a deep Gulf of Mexico coral community

Pen-Yuan Hsing[1] • Bo Fu[1] • Elizabeth A. Larcom[1] • Samantha P. Berlet[1] • Timothy M. Shank[2] • Annette F. Govindarajan[2] • Alexandra J. Lukasiewicz[1] • Philip M. Dixon[3] • Charles R. Fisher[1*]

[1]Department of Biology, The Pennsylvania State University, University Park, Pennsylvania, United States
[2]Biology Department, Woods Hole Oceanographic Institution, Woods Hole, Massachusetts, United States
[3]Department of Statistics, Iowa State University, Ames, Iowa, United States
*cfisher@psu.edu

Abstract

A coral community 11 km southwest of the site of the Deepwater Horizon blowout at 1,370 m water depth was discovered 3.5 months after the well was capped on 3 November 2010. Gorgonian corals at the site were partially covered by a brown flocculent material (floc) that contained hydrocarbons fingerprinted to the oil spill. Here we quantify the visible changes to the corals at this site during five visits over 17 months by digitizing images of individual branches of each colony and categorizing their condition. Most of the floc visible in November 2010 was absent from the corals by the third visit in March 2011, and there was a decrease in the median proportions of the colonies showing obvious signs of impact after the first visit. During our second visit in 2010, about six weeks after the first, we documented the onset of hydroid colonization (a sign of coral deterioration) on impacted coral branches that increased over the remainder of the study. Hydroid colonization of impacted portions of coral colonies by the last visit in March 2012 correlated positively with the proportion of the colony covered by floc during the first two visits in late 2010. Similarly, apparent recovery of impacted portions of the coral by March 2012 correlated negatively with the proportion of the coral covered with floc in late 2010. A notable feature of the impact was its patchy nature, both within and among colonies, suggesting that the impacting agent was not homogeneously dispersed during initial contact with the corals. While the median level of obvious visible impact decreased over time, the onset of hydroid colonization and the probability of impacts that were not visually obvious suggest that future visits may reveal additional deterioration in the condition of these normally long-lived corals.

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Introduction

Considered by many as the final frontier on the Earth, the deep sea has become increasingly affected by human activities. Accumulation of garbage in the deep sea is well documented (Spengler and Costa, 2008; Watters et al., 2010; Ramirez-Llodra et al., 2011), and there is growing international appreciation for the long-lasting detrimental effects of trawling on deep-water communities on continental shelves and seamounts (Hall–Spencer et al., 2002; Clark et al., 2010). Recently, there has been renewed interest in the extraction and recovery of deep-sea resources. The International Seabed Authority (ISA) has granted exploration permits in international waters for polymetallic nodules at over 4 km depth in the Clarion Clipperton fracture zone and for massive polymetallic sulfide deposits on mid-ocean ridges in the Indian and Atlantic oceans (http://www.isa.org.jm/). In addition, numerous permits have been granted for exploration and assessment of mineral resources in the territorial waters of developing countries in the western Pacific. Papua New Guinea granted a mining license to Nautilus Minerals for an active hydrothermal field in their territorial waters (van Dover, 2011) (though this license is currently in dispute). At the same time, energy companies