

## Shoreline Oiling Deepwater Horizon Oil Spill

**Figure 1. Representative photographs of shoreline oiling conditions.** Sand beaches: A. Small surface residue balls in the supratidal zone (scale is 15 cm); B. Tunnel oil pattern; C. Surface residue balls in the intertidal zone that are angular, indicating that they were eroded from adjacent oil residue mats; D. Intertidal oil residue mats at the top of the beach; Beaches: E. Heavily oiled wetland at the high-water line and oiled mat of low-cover vegetation; F. Thick (>1 cm) emulsified oil under the laid-over vegetation mats; G. Oiled incipient asphalt pavement on the marsh platform; H. Oiled Phragmites along the Mississippi River delta.

## Shoreline Cleanup Completion Plan (SCCP) [10]

The final stage of the shoreline response (November 2011) and forward defined the process whereby removal actions would be deemed complete and shoreline segments could be crossed out of the response. For the first time, shoreline oiling conditions documented by SCAT teams were compared against shoreline cleanup "endpoints," meaning that once a segment met these final criteria, shoreline treatment was completed. As with the NFI guidelines, the SCCC endpoints were developed through consensus by representatives from the Responsible Party and Federal and State jurisdictions. The Plan included surveys of selected shoreline segments after the 2011 Atlantic hurricane season, and multiple surveys of segments post-treatment to assure that oiling conditions continued to meet "endpoints." Segments that did not meet endpoints were returned to Operations for further treatment, and the inspection process was repeated.

SCAT data on oiling characteristics were used routinely to generate maps and tabular data on degree of oiling by habitat, over-

lapment, Haven spill response area for beaches and marshes. Tables S1, S2, and S3 in File S1 provide more detailed breakdowns by state and habitat for the three periods. For the maximum oiling table and map, "no oil observed" means that, based on the SCAT survey, the shoreline was never oiled. For the Year 1 and Year 2 tables and maps, "no oil observed" means that, as of the last survey date within the period 1 Mar 2011 and 1 Mar 2012, the shoreline was not oiled. For these later periods, the shoreline might have been previously oiled, but that oil had been removed by cleanup actions and/or natural processes.

It is important to note that the most recent survey could have been conducted months prior to these reporting dates; however, all segments that had been documented as oiled were surveyed at least twice. The final survey for any given segment considered as operationally completed means that "no oil was observed" or that the oiling conditions met the appropriate guidelines or endpoints and did not require further cleanup treatment. There was one important exception to this statement for the Chandeleur Islands in

38.8% or 687 km remained with some oil. In addition, heavy to moderately oiled shorelines had declined by 87% in one year and 96% in two years, compared to maximum oiling conditions.

oiling than a section with rem of surface Heavy oiling where oil stretched adjacent to another section with Light oiling. The combination of surface oil categories and lengths of oiled shoreline provide a general level of understanding of the extent and magnitude of a spill, however, these descriptions are not adequate by themselves to develop cleanup strategies and goals for each habitat type or shoreline segment. The selection of appropriate cleanup strategies is dependent upon site-specific information regarding oiling thickness, width, distribution, and character, as well as numerous other factors including habitat condition and sensitivity, public use, wildlife use (e.g., nesting bird colonies, sea turtle nesting), and access and safety concerns.

## Results

Lengths of shoreline by oiling category and State for three periods are summarized in Table 1 and Figure 3A–C. Maximum oiling (highest degree of oiling ever observed on a shoreline): 2) Year 1 Post-Spill, degree of oiling as of the most recent survey in the database on 1 May 2011; and 3) Year 2 Post-Spill, oiling category as of the most recent survey in the database on 1 May 2012. Spatial extents of shoreline oiling categories for these same periods were also tracked (Figure 3). Figure 4 shows time-series plots of the lengths of shoreline by oiling category for the entire

change in the region, and potential differences in methods, criteria, or characteristics considered in studies of shoreline oiling for other purposes.

Of the 2,058 km of shoreline surveyed (Table 1), 1,273 km were documented as ever having been oiled (Heavy to Trace) across the entire affected area. The majority of these shorelines with documented oiling occurred in Louisiana (60%), followed by Florida (16.1%), Mississippi (16.6%), and Alabama (3.2%). For maximum oiling across all states, 20.3% of the shoreline oiling was classified as Heavy, 12.3% as Moderate, 33.9% as Light, 18.2% as Very Light, and 13.1% as Trace. Of the 1,273 km of shoreline that was ever observed as having been oiled, after one year (7.8% or 107 km) remained with some oil. In addition, heavy to moderately oiled shorelines had declined by 87% in one year and 96% in two years, compared to maximum oiling conditions.

Maximum shoreline oiling among maps: Shoreline habitats (Figure 2B) was broadly 50.0% of the total, mostly sand beach (but includes shell and mixed sand and shell beaches), marsh (14.9%, mostly coastal herbaceous marsh, but includes mangroves and shell terms fringing marsh areas), and other (14.2%, mostly man-made shoreline types). Most of the marsh oiling (94.0%) occurred in Louisiana. Beach oiling was distributed throughout the four states