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On the Trail of Oil-Munching Organisms

By KATE YANDELL

Two years ago today, BP's Macondo well was in the midst of its 87-day spree of spewing oil into the Gulf of Mexico. Tar balls and oil slicks were showing up on beaches from Texas to Florida.

A significant amount of the 4.9 million barrels of oil spilled still lies on the ocean floor, lingers in salt marshes or is mixed into beach sand, scientists say. Yet some other oil has been degraded by oil-digesting organisms -- and a new paper in the journal PLoS suggests that fungi are among them.

Holly Bik, a biologist who was then at the University of New Hampshire, sampled sand from beside the water on beaches in Alabama a little over four months after the spill. Dr. Bik, who is now at the University of California at Davis, and her colleagues sequenced DNA extracted from the sand and then compared it with DNA in sand collected just weeks after the spill, before the beaches were heavily oiled.

Before the heavy oiling, fungi made up less than 5 percent of the microorganisms on each of the five beaches. Months later they had gained a majority on three beaches at the expense of microscopic marine worms and other tiny creatures.

Joel Kostka, a microbial ecologist at Georgia Tech who not involved in the study, said that since it was well known that fungi can degrade oil, "I think it's an intriguing idea that fungi predominate after contamination hits." Scientists have studied changes in bacterial populations on beaches and deep in the sea in response to contamination, but Dr. Bik is among the first to test how tiny nonbacterial organisms like fungi and worms responded.

Yet Dr. Bik and Dr. Kostka agree that the results are inconclusive. Because Dr. Bik did not have measurements of how contaminated each beach was before the spill, there is no way of definitively linking the fungi to the oil's presence. The fungi could be responding to seasonal variations or other changes in the environment rather than the oil, for example. "In order to understand the effects of oil, we have to first understand how the gulf works," Dr. Kostka said.

Dr. Kostka refers to the beaches as the "kidneys of the coast," natural filtration systems outfitted with millions of microbes that routinely digest nutrients in runoff as it flows from the land to the ocean. During the spill, he started collecting sand samples in July 2010 at the municipal beach in Pensacola, Fla. By the time he arrived, there was a stripe of oil buried a foot deep in the continually shifting sand. (The oil spill, which began with an explosion on April 20, 2010 that killed 11 workers, was not plugged until July 15 that year.)

Dr. Kostka dug a trench and took samples from oily and relatively clean sand. The oilier the sand, the more oil-eating bacteria he found. By September, the stripe of oil had noticeably diminished along with the oil-eating bacteria. His initial results were published last fall.

Of course, spills vary. Oil from the BP spill was light, digestible and local, like the oil that seeps naturally from the sea floor, so gulf microbes had already adapted to break it down.

Researchers hope is that research into the gulf's oil-digesting bacteria and fungi will help guide future responses to oil spills. For instance, scientists have noticed that oil takes longer to disappear from salt marshes than from beaches - possibly because oil-digesting bacteria thrive on oxygen, which is scarce in muddy still waters.

Dr. Kostka suggested that future spill responders might therefore choose to focus on the more sensitive salt marshes. Scientists also hope to use tests for oil-eating bacteria to detect the presence of contamination, avoiding the steeper cost of taking direct measurements of oil. Given the continued deepwater drilling in the gulf, he noted in his fall paper, the risk of another spill is high.

In the meantime, Dr. Bik continues to collect samples from beaches along the gulf, hoping to build a clearer picture of how nonbacterial microorganisms have fared in the two years since the spill and to possibly better understand their role in the cleanup.

While it may be too late to fully understand what happened to all the oil from the Deepwater Horizon disaster, it has clearly led to a surge in research on the gulf's diversity.

Patricia Sobecky, a biologist at the University of Alabama who studies oil-eating bacteria in salt marshes, calls the current research into gulf microorganisms unparalleled. She credits DNA sequencing technology, which has made surveying patches of sea or sand for life relatively quick and cheap.

"You can do things that you couldn't even imagine doing things 10 years ago," she said."I think this is going to help to give more predictive power in the future."