Bacteria supplemented their diet to clean up after Deep Water Horizon oil spill

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Bacteria living in the Gulf of Mexico beaches were able to 'eat up' the contamination from the Deep Water Horizon oil spill by supplementing their diet with nitrogen, delegates at the Goldschmidt conference will be told today, Friday 30th August.

Professor Joel Kostka will tell geochemists gathered in Florence for the conference that detailed genetic analysis showed some of the bacteria thrived on a diet of oil because they were able to fix nitrogen from the air. The research—the first to use next generation sequencing technologies to dig into the detail of how the native beach microbes are metabolising the oil over time—could open the door to much more sophisticated clean up techniques.

"Oil is a natural product, made of decayed plants and animals, and so is similar to the normal food sources for these bacteria." explains Professor Kostka, a microbiologist from Georgia Institute of Technology in Atlanta. "But because oil is low in nutrients such as nitrogen, this can limit how fast the bacteria grow and how quickly they are able to break down the oil. Our analysis showed that some bacteria are able to solve this problem themselves—by getting their own nitrogen from the air."

Professor Kostka worked with Professor Markus Huettel, a biogeochemist from Florida State University, to take more than 500 samples over two years from Pensacola beach in the Gulf of Mexico, starting when the Deep Water Horizon oil slick first came ashore in June 2010. By analysing every gene of every bacteria in the sample, they were able to see which bacteria were present and how they responded as the conditions on the beach changed.

The researchers looked at the prevalence of genes which encode for different types of activity—such as nitrogen fixing or phosphorus uptake—to identify exactly how the bacteria were degrading the oil.

"By understanding how the oil is degraded by microbes, which microbes do the work, and the impact of the surrounding environmental conditions , we can develop ways to intervene to support the natural clean-up process," says Professor Kostka. "However, we need to do this in a very measured and targeted way, to avoid long-term, unintended damage to the ecosystem. For example, in the past, nitrogen fertiliser has been sprayed onto contaminated beaches to speed up the work of the bacteria. Our analysis shows that, where bacteria can get this nitrogen naturally, such drastic intervention may not be necessary."

The genetic analysis carried out by Professor Kostka and his colleague Konstantinos Konstantinidis at Georgia Tech can show exactly how the oil-degrading bacteria are working at each part of an affected coastline, making it possible to identify which beaches are most effective at self-cleaning and target mitigation efforts—such as offshore booms—at the most vulnerable areas.

But not all the bacteria thrived on a diet of oil. Professor Kostka's research showed that some bacteria which play an important role in the ecosystem of the beaches experienced a sharp decline following the contamination in June 2010.

"There's a tendency to focus on the short-term, visible effects of an oil spill on the beach and assume that once the beach looks 'clean' then all is back to normal," he says. "Our analysis shows some of the invisible impact in the loss of these important microbes. We need to be aware of the long-term chronic damage both a spill—and in some cases our attempts to deal with it—can cause."

More information: goldschmidt.info/2013/

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