mesocosm

THE MESOCOSM

Since NOAA's Environmental Sensitivity Index maps list salt marshes as the most vulnerable habitat in the Gulf of Mexico, researchers undertook a mesocosm study to assess potential impacts of crude oil and dispersants in a simulated salt marsh community.

Dr. Fulton, a researcher who specializes in aquatic toxicology and physiology of marine organisms at the Center for Coastal Environmental Health & Biomolecular Research, said the mesocosm offers a unique way to do testing, particularly given the *Deepwater Horizon (DWH)* oil spill in the Gulf of Mexico involved about 2.1 million gallons of dispersant being applied. About 1.4 million gallons were applied on surface slicks and 771 thousand gallons were pumped into the water column at the wellhead.

"We submitted a proposal to evaluate the impacts of oil with and without chemical dispersants on a salt marsh ecosystem. Our work was not really designed to mimic what happened with *DWH*, but to have information that would be useful in future spills for understanding what kind of damage you might get in a salt marsh if you had incoming oil and dispersants together and whether there's a difference between the oil alone, the dispersants alone or both together."

The use of chemical dispersants to mitigate oil spills has been a controversial issue for many years since dispersants do not reduce the amount of oil in the environment, but rather alter the chemical and physical properties of oil, which affects transport and possible bioeffects, he said.

A major objective of the study was to improve NOAA's capacity to respond to major spills by increasing the information on crude oil impacts with and without dispersants. Researchers used the salt marsh mesocosm to track the movement of oil and the dispersant over time, taking various measurements. Results indicated that various animals, plants and microbiota were sensitive to the oil and dispersant alone as well as to the combination of both.

As opposed to looking at individual species in a laboratory, the mesocosm approach simulates a coastal ecosystem. The systems, consisting of two tanks stacked on top of each other, allow researchers to control water levels creating incoming and outgoing tides just as a coastal tidal creek system would have. Researchers introduced the oil and dispersant – alone and in various types of combinations as might be seen in regions with these types of spills – and tested the effects on the coastal environment, including plants, animals and water quality.

"We saw impacts associated with the oil on the growth of marsh grass. We also saw effects on the water quality, specifically a sag in dissolved oxygen associated with the oil and the oil plus dispersant," Fulton said. "We saw that the oil plus dispersant caused more of an effect and was quicker to affect the water quality than the oil alone. Reduced dissolved oxygen can lead to a negative impact on the health of a variety of species in the ecosystem."

Fulton said they want to expand to look at other types of dispersants and oils. Different oils have different chemical characteristics that would make them more or less toxic – a relationship they want to understand better.

Though working in the greenhouse setting can be a little too realistic with the humidity and "bug" factor, Fulton said the beauty of the mesocosm from an experimental standpoint is that the system allows researchers to see interactions in the ecosystem. "It allows us to look at community level effects of oil, rather than just trying to figure out what happens as a result of individual species testing. It also points out that there is an interaction between the oil and the dispersants, and there are effects associated with them, both individually and in combination."

Michael Fulton, Ph.D.

This mesocosm facility was used to test the effects of crude oil and chemical dispersants on a simulated saltmarsh ecosystem.