Thousands of marine animals still in danger from hidden oil in Gulf

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Scientists affiliated with the Woods Hole Oceanographic Institution (WHOI) have detected a plume of hydrocarbons at least 22 miles long and more than 3,000 feet below the surface of the Gulf of Mexico, a residue of the BP Deepwater Horizon oil spill. Learn more in the Sept. 2010 issue of NSF Current. Credit: Rich Camilli, WHOI

University of Georgia oceanographer Samantha Joye, like most scientists, always has a plan. Especially when it involves complex, expensive research cruises.

But the Deepwater Horizon oil well blowout, and the enormous environmental destruction it is causing, forced her to change the way she works.

"As an oceanographer, you are trained to make these detailed cruise

plans," notes Joye. "Everything is just so, 'I'm going to be here on day one and here on day ten'."

Days after the BP oil rig explosion in the Gulf of Mexico that killed 11 people, Joye got the wheels in motion to submit a proposal for a "Grant for Rapid Response Research" from the National Science Foundation (NSF). Her goal was to investigate underwater oil and gas plumes, and determine how this disaster was impacting deepwater organisms.

Within a week, NSF approved the grant. Joye and her team from the University of Georgia, along with researchers from several other universities, spent May 24 through June 6, 2010 aboard the University of Miami research vessel, Walton Smith, departing from Gulfport, Miss.

"I don't think I've ever flown by the seat of my pants the way we were flying there. But these are dynamic features, changing every single day," says Joye.

One complication of this trip: the smells of the huge amount of hydrocarbons that started spewing on April 20th. It could sometimes be overpowering.

"It was nauseating," says Joye. She described the intense smell as something like a cross between diesel fuel, creosote, and gasoline.

"Just wretched, wretched, dense air and it's hot, it's humid, and the air is just saturated with these very uncomfortable smells," she explains.

The scientists and the ship's crew had to wear respirators and protective suits at times, especially near "ground zero" where the blowout occurred.

Joye is a biogeochemist, who studies the natural seepage of oil and gas from the floor of the Gulf. At the time, the natural seepage rate in the

Gulf of Mexico was on the order of 1,000 barrels a day, over the entire Gulf. But in a 20-mile-long, 3-mile-wide oil and gas plume Joye tracked, the amount of oil and gas was off the charts.

"The gas concentrations are outrageously high. We have measured concentrations up to 100,000 times what we typically see in the Gulf of Mexico," says Joye.

Some deepwater creatures in the Gulf process tiny amounts of oil and gas that occur normally in the water.

Jack Barth of Oregon State University and his colleagues are studying the dead zones that appear each summer off the Oregon and Washington coasts. They have used impressive new tools to monitor unusual ocean conditions, including robotic undersea gliders, also known as autonomous underwater vehicles. See more in this Science Nation video. Credit: Science Nation, NSF

"There is a whole slew of organisms that depend on these natural seeps, and in these ecosystems, the one thing that these organisms need that can be taken away by this oil spill is oxygen," explains Joye. "That's because they eat oil and gas but the bacteria that sustain them are oxygen-requiring bacteria. So without oxygen, they can't survive."

Joye says that methane gas could create more zones of low oxygen in the Gulf, possibly choking off these deep water ecosystems.

To give a human equivalent, Joye says, "It would be like having your Thanksgiving dinner, but suddenly the living room is filled with argon or CO2 instead of oxygen. There's all this food around you, but you can't eat it because you are suffocating."

Joye says this prolonged environmental tragedy has had a profound impact on those who study life in the Gulf.

"I would characterize it as a transformative event because it changed the way I approached what I was doing. It was a disaster response instead of just a research cruise. There was this sense of urgency that I can't describe in words," says Joye.

Two of her students also were motivated to work as hard, and for as long as they possibly could, each day on the ship.

Microbiologist Melitza Crespo-Medina is a University of Georgia postdoctoral student.

"We started working at 9 a.m. until 1 or 2 in the morning. It was really intensive," says Crespo-Medina. "And I really remember this water looked clear, absolutely clear, but I remember the smell of it, I can't believe this water that looks clear smells so much like gas, like diesel. And that sticks in my mind."

The research cruise was the first-ever for undergraduate ecology student Chassidy Mann.

"So the experience wasn't just collecting the data, the experience wasn't just being amidst other people, it was science exploration, and for me, it

was unparalleled to anything I have ever experienced," says Chassidy.

One night, the rescue of a single, oil-soaked bird had an impact on everyone on the ship.

"He was exhausted. His wings were covered in oil, his eyes, [and] his mouth. It was just gut-wrenching and everyone was in tears, myself included. You see this innocent animal, doing the same thing that it had done for all of its life. And instantly, he is coated in this stuff that weighs down his wings. And there's just this look of desperation and fear in his eyes," says Joye. "Animals like that bird, whales, and sea turtles, and fish, and every organism that inhabits the Gulf of Mexico are being exposed to an atrocity."

What has frustrated Joye and many other scientists since this disaster began is the lack of information about the precise amount of oil and gas that has spewed from the well site.

"It took two months to nail down the magnitude of this spill. I'm still not convinced that it's an accurate number; 35,000 to 60,000 barrels of oil per day, that doesn't even include gas flux. The gas flux is probably another 30 percent on top of that," she says.

Shortly after she returned from this research cruise, Joye testified before Congress about some of her initial findings, and the very long road ahead for the recovery of the Gulf.

"In my congressional testimony, one of the biggest things I hammered again and again was the need to document the size of this spill," she says. "You can't even begin to fathom the environmental implications if you don't know how much gas and oil have come out of this wellhead."

Since this NSF cruise, the Deepwater Horizon well has been capped. But

Joye wants to make sure the public knows that just because the oil is no longer gushing out, the problems are far from over. She is especially concerned about the dispersants used to break up the oil and gas, to try to keep it from reaching shore.

The dispersant has not been widely tested on marine organisms, according to Joye. And it makes locating plumes of oil and gas much more difficult, even impossible, with satellite imagery.

"The volume, the sheer magnitude of dispersant application is mind-boggling. The fact is that we have no idea what this could do to the system. The dispersant is a complex chemical milieu of who knows what," explains Joye. "It [the use of dispersants] does one thing really well. It masks the magnitude of the spill, and it potentially does many, many things badly."

Joye wants a closer look at safety issues in offshore drilling. She also sees this horrible incident as a wakeup call for everyone when it comes to energy use.

"The impact of this is big, and it's wide, and it's bad, and it's ugly. The global appetite for oil and gas is driven by each one of us," says Joye. "And until each one of us changes our attitude, it's not going to get any better."

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