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# A SCIENTIST AT THE CENTRE OF THE SPILL

Vernon Asper was one of the first researchers in the Gulf of Mexico to study the oil gushing out from the BP well. But it has not all been smooth sailing, reports **Mark Schrope**.

On 12 May, Vernon Asper was cruising through the Gulf of Mexico, just a few kilometres south of where the Macondo well was gushing tens of thousands of barrels of oil a day into the ocean. Asper, an oceanographer at the University of Southern Mississippi near Diamondhead, wasn't there to see the carnival of response ships and drilling rigs at the site, or to look for oil slicks on the surface. He and his colleagues were hunting for something more elusive — an answer to what might be happening to the unseen oil and natural gas billowing into the bottom of the Gulf.

As the first group of academic scientists on the scene, having arrived less than two weeks after the well blowout, Asper (pictured) and his team knew that valuable information about the spill was being lost and that they were the only ones in a position to capture the disappearing data. The researchers, funded by the US National Oceanic and Atmospheric Administration (NOAA), lowered a constellation of instruments into the Gulf that would beam up data in real time to their ship, the RV *Pelican*. A fluorometer scanned the water with a narrow beam of light that would cause any dissolved oil to fluoresce at a telltale wavelength. A transmissometer measured how particles or cloudiness in the water blocked the transmission of light. And another sensor gauged levels of dissolved oxygen.

For most of the day, the monitors showed little of interest. But towards the afternoon, when the instruments were passing through water about 1,000 metres deep, the fluorometer and transmissometer readings spiked. The team went on to track remnants of that signal for some 45 kilometres southwest of the wellhead, in a layer between about 1,000 metres and 1,400 metres deep. It took some time for researchers to make sense of the data, but all the signs suggested that a deep, hidden plume of oily water was spreading away from the gusher.

The news came as a shock, because oil is supposed to float on water. "That was a very, very disturbing and fascinating development," says Jeffrey Short, an environmental chemist based in Juneau, Alaska, who works with the conservation-advocacy group Oceana, and was a leader in the damage assessment of the 1989 *Exxon Valdez* oil spill before he retired from NOAA.

If oil was spreading in the deeper parts of the Gulf, there could be major consequences. That oil might harm a host of organisms, ranging from delicate deepwater corals to migrating plankton, that help support the Gulf's food web. It might expose BP, the company responsible for the leaking oil well, to a new area of liability for environmental damages. And it would raise a question about whether the use of oil dispersants at the wellhead had contributed to the deep plume — something that scientists would need to answer quickly.

Oil at the surface, said Asper, "could be contained or monitored or defended against". The deep plume was something entirely different. "It's far more complicated than I expected," he said on the boat.

Although he was talking about the oil, Asper might as well have been forecasting his life. Following the *Pelican* cruise, he would find himself in the middle of a political and scientific maelstrom that he could never have anticipated.

Several teams of researchers would later confirm the *Pelican*'s discovery. But throughout the agonizing three months that the well spouted, Asper was surprised to find his team's work alternately ignored and challenged by NOAA. The agency temporarily requested that Asper and his colleagues stop talking to the media. And BP is now trying to hire Asper and other scientists, in what some view as an attempt to silence them[1]. It has all been more than enough to probe the limits of his otherwise composed and good-natured disposition.

"The whole experience has been both exciting — to be involved in cutting-edge research into an incredibly important event — and frustrating," says Asper.

It was chance that brought Asper and his colleagues to the centre of the oil spill just days after it started. When the Deepwater Horizon rig, operated by a contractor for BP, suffered a catastrophic blowout on 20 April, Asper's team was making final

plans for a research cruise to study natural methane seeps and shipwrecks at the bottom of the Gulf of Mexico. His group, including the cruise's chief scientist, Arne Diercks from the University of Mississippi in Oxford, was part of the National Institute for Undersea Science and Technology (NIUST), a NOAA-funded multi-university cooperative effort to apply new technology to undersea research.

After the blowout, the researchers requested approval from NOAA to switch plans and investigate the spill instead. The NIUST team was still working out its research strategy when it departed from shore on 2 May, with a general mission to track where the oil was going and to collect samples of sediments in areas not yet affected by the spreading oil.

Two weeks into the voyage, the instruments picked up signs that were consistent with the presence of oily water at depth. The researchers started to wonder whether the oil was getting trapped in a relatively stable layer, rather than rising to the surface as expected. As they cruised southwest of the well site, they kept encountering hints of oil at depths below 1,000 metres (see map overleaf).

None of their data was conclusive. The researchers knew, for example, that natural seeps emit more than 400,000 litres of oil and gas into the Gulf each day[2]. And when the *Pelican* team pulled up water from the region where the instruments pointed to oil, the initial samples looked clear and had no oily scent. "I don't know what to think," Asper said at the time, "but that's why we're here."

Over the course of the cruise, the researchers collected enough evidence to build what they considered a strong circumstantial case for the existence of a deep plume of some form of oil. They also found unusually low concentrations of oxygen in the water, which they suspected could be caused by bacteria metabolizing oil and methane at depth. Many oil wells produce substantial amounts of methane and later measurements of samples collected by the *Pelican* team would find methane levels 100–100,000 times higher than normal in the plume.

Towards the end of the trip the group was asked by NOAA to take a detailed inventory of all the water samples it had collected, in case they ended up as evidence in legal proceedings. The agency needed the data to fulfil its challenging roles in responding to oil spills. NOAA must work closely with BP to guide response efforts, but it must also lead the environmental assessment that will ultimately determine BP's liability.

Assembling the inventory was a time-consuming task at a point when the group was frantically trying to finish its work. At first the scientists feared that they might have to halt their research early to get it done. "I'm a scientist," said Asper soon after the directive came through. "This legal crap is not what I got into the business for."

## A media storm

But Asper and his colleagues could not avoid the issue of liability. Shortly before the *Pelican* crew found the plume, BP had begun to apply dispersants at the wellhead — the first time these chemical brews designed to break up oil had ever been used underwater. Asper and his colleagues discussed from the outset the possibility that the dispersants might explain why they were seeing oil forming a plume 1,000 metres down, rather than rising to the surface.


NIUST/NOAA

**Evidence of deep oil plumes, gathered by the crew of the RV *Pelican*, has caused controversy.**

"The experience has been both exciting and frustrating."

"I really wonder if the plumes are a result of that or if they would have been there without it," Asper said at the time. The question had some urgency because the US Environmental Protection Agency would require BP to stop using the dispersants if they were shown to be creating a hazardous situation — for example by depressing oxygen concentrations enough to harm life. The team felt that it was important to get its findings out quickly so that scientists could mobilize to collect more information as fast as possible.

But once he was on shore, Asper found himself at the centre of a mess that would in some ways prove even more challenging than understanding the deep oil. He had agreed to be the *Pelican* team's media face, and he did interviews from just after dawn until the evening on the day they returned. "It was just a crazy, crazy, crazy day," says Asper. "It was a twilight zone."

During the interviews, he described the evidence for a hidden plume of deep oil that was spreading an untold amount of hydrocarbons into the Gulf. Asper believes he was careful to note that more analyses were needed before anything could be said for sure. Still, some media reports gave the impression that huge lakes of crude oil were hiding in the deep — a view not supported by the data.

"It was a surprise to us that we had been misinterpreted," says Asper, who admits that he entered the fray with little media experience. But he says that he did what he could to keep the record straight, and doesn't know how he could have better controlled the picture that the media painted.

Other researchers were also unprepared for the crush of attention, which might have caught even the most media-savvy scientists off guard. Samantha Joye, a biogeochemist at the University of Georgia in Athens who collaborated with the *Pelican* crew and has grant funding through NIUST, was quoted by *The New York Times* as saying "There's a shocking amount of oil in the deep water, relative to what you see in the surface water." Joye says that she now chooses her words more carefully and makes a concerted effort to be

"less excited" when giving interviews, but that she does not regret spreading the news about the plumes because the opportunity to study them might have been missed if the press had not learned about the *Pelican* data.

The deep-oil discovery was not good news for BP. At the time, efforts to contain the oil and study its effects were focused on the surface, where the battle against all previous oil spills had been fought. Executives and spokespersons at the oil company questioned the existence of any deep plume of oil or gas, arguing simply that oil floats. (When *Nature* contacted BP, the company provided information already publicly available but did not give specific responses to several questions.)

What baffled Asper and his colleagues, however, was NOAA's cool response to the *Pelican* data. The day after the ship returned to shore, NOAA asked the researchers to postpone talking to the press to allow time for regrouping. On the same day, the agency issued a statement about the plumes calling media reports on the team's work "misleading, premature and, in some cases, inaccurate".

The researchers were taken aback. "We took it personally," says Asper. "We thought it was talking about us." His team was proud of the work it had accomplished under difficult circumstances. "We expected NOAA to be as proud of it as we were," he says. "To instead have NOAA basically say that our results were invalid was quite a surprise."

The scientists were further surprised by the rest of NOAA's statement, which said that the scientists wished to clarify that they had not yet reached definitive conclusions. It also said that the team's findings showed that oxygen levels were not low enough to be of concern, and that any connection to subsea dispersant use was only speculative.

Asper says that they fully agreed with the statements attributed to them, but that the *Pelican* researchers had not seen the text before NOAA released it. "They were doing damage control and trying to make sure people didn't panic," says Asper. "I kind of understand that, but I do wish they would have communicated with us a little bit better."

Short saw the statement as a way to divert attention. "I think the agency probably felt like they should have been the ones to catch this and they weren't," he says.

Although NOAA never completely denied the possibility that the oil might spread far below the surface, it consistently backed away from confirming the *Pelican* findings, and pointed to a need for definitive confirmation. Weeks after the cruise, Jane Lubchenco, head of NOAA, still seemed uncertain about the evidence for a significant plume of oil at depth. "Obviously it would be highly unusual if we didn't find oil right close to the well; the question is what's happening farther afield," she said. "I think the bottom line is that there is a lot of potential out there for jumping to conclusions that may not be warranted and that we are all served best by proceeding in a careful, thoughtful and quantifiable manner."

NOAA

Jane Lubchenco urged caution in discussions about deep-sea oil.


Justin Kenney, NOAA's communications chief, told *Nature* last week: "Throughout this event, all researchers have been committed to providing scientifically accurate information as soon as possible. Specifically in the case of the *Pelican*, all of us agreed that laboratory analyses of water samples collected on site had to be completed before definitive statements could be made about the presence of oil."

In hindsight, the *Pelican* discovery should not have been much of a surprise. Ten years earlier, the US Minerals Management Service in collaboration with 23 oil companies, including BP, released some 120,000 litres of oil at a depth of 844 metres off the coast of Norway, as part of an experiment aimed at simulating a deepwater blowout. They found that a small but significant amount of the oil was confined to lower levels and did not rise quickly to the surface[3]. But few people seemed to recall the Norwegian experiment as NOAA set about coordinating the response to the blowout in the Gulf.

A few days after asking the *Pelican* scientists to stop speaking to the press, NOAA rescinded its request. Since then, Asper has been interviewed regularly. "It's extremely time consuming," he says. "There are so many phone calls and inquiries, but it's hard to say no. We're paid to collect data and obtain information, so you don't want to withhold anything when someone asks about your findings."

## Corroborating evidence

Within weeks of the *Pelican*'s return, other researchers were finding corroborating evidence for the deep oil plume. Researchers at the University of South Florida in Saint Petersburg went out to study the spill area on the *Weatherbird II* twice in May, and NOAA presented data collected by the Florida researchers on 8 June. Lubchenco announced that NOAA had confirmed the presence of low concentrations of oil from the Deepwater Horizon well in deep plumes: specifically hydrocarbons in the parts per million range, and polycyclic aromatic hydrocarbons — carcinogenic oil-breakdown products — in the parts per trillion range. "It was gratifying," says Asper, "I thought, 'Great, at last now we're vindicated'."

But the *Weatherbird II* team had its own challenges with NOAA. Representatives from the agency and from BP travelled with the scientists on their first boat trip, and much of the work was carried out as part of the government's Natural Resource Damage Assessment (NRDA) process for gathering evidence that might be used in future spill liability cases. The NRDA process is a foreign one to many scientists because there are restrictions on how samples and data are handled.

"Everything was kept under a very, very strict chain of custody," says Ernst Peebles, a biological oceanographer from the University of South Florida and one of the lead researchers on the vessel. His group relinquished its

samples to NOAA and has not been given the opportunity to analyse them or most of those collected during the second cruise. The Florida team is scheduled to head out on another research cruise this week, but university administrators arranged funding for the trip independent of NOAA and BP.

Despite the corroborating data collected by the *Weatherbird II* and other cruises that found multiple shifting plumes, NOAA continued to publicly criticize parts of the *Pelican* team's work. Speaking at a conference in Baton Rouge in early June, Lubchenco said: "Unfortunately, some data collected have not been usable because the protocols that have been well identified have not always been followed."

Lubchenco was referring to samples taken by the *Pelican* crew during its cruise. At the time, the scientists had followed established protocols by collecting water in glass containers for oil analysis and in plastic bottles for methane measurements. By a prior arrangement, the *Pelican* crew sent the glass containers off to researchers in Texas who were scheduled to do the oil tests.

After the ship returned, NOAA requested water samples so that the agency could conduct its own oil analyses. The *Pelican* researchers provided some of the remaining samples, which had been collected in plastic and were less ideal for oil analysis because of potential interactions with the plastic. But Lubchenco blamed the *Pelican* crew for failing to follow protocol.

"Did you hear what she was saying up there?" asked an incensed Asper, after hearing Lubchenco's accusations in Baton Rouge.

He felt better when he spoke directly to Lubchenco afterwards. "I got the impression that she really did not understand what our situation had been and that the information she had been provided was very incomplete," says Asper. "I don't blame her personally."

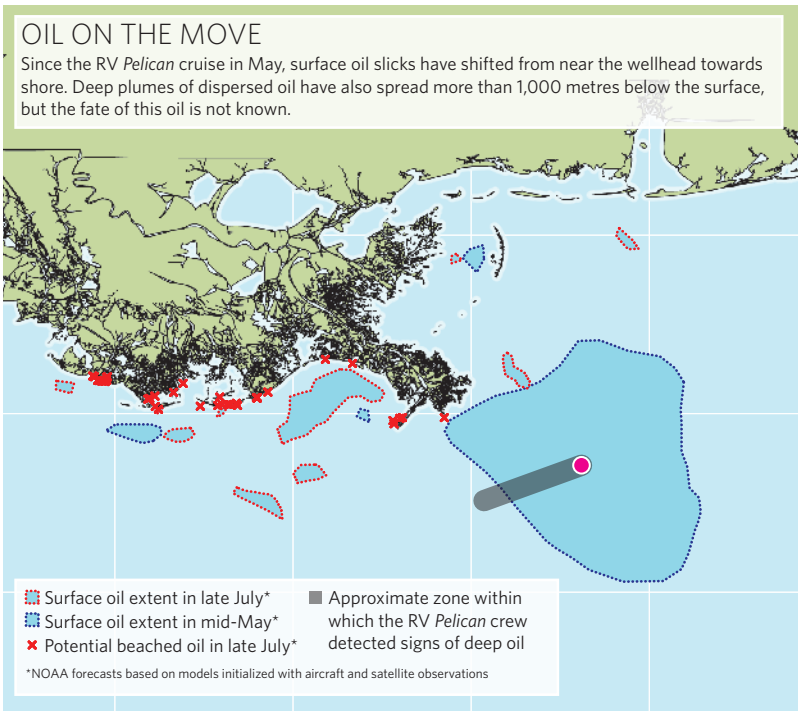
But Asper and his colleagues were again dismayed when NOAA issued a research update on 13 June that criticized the sample collection on the *Pelican*. "It's like they were saying, 'Shame on you for not being psychic and reading our minds and knowing what we wanted'," says Joye, who maintains that the samples were collected properly for their intended use.

## Offending words

Steve Murawski, director of scientific programmes and chief science adviser for NOAA Fisheries, says that no criticism was intended and he considers the sample issue a mix-up. "Those guys jumped into the breach," he says. "I think they did the nation an incredible service and they should be congratulated." However, NOAA has not yet acted on the team's request to take down the press statement.

"That whole issue to my nose had a bad odour," says Short, who feels that the protocol issue was part of an overall tendency by NOAA to be overcautious in its response to the spill. "I don't feel it's responsible to hide behind excuses like, 'Oh, you used the wrong sample bottle.' That's the kind of behaviour you expect out of an oil company trying to minimize liability. It's not what you expect out of a government that is supposed to be telling us what is happening."

It is not yet certain whether oil and gas in the plumes are harming life in midwaters, or the delicate deepwater corals and other bottom dwellers found in fertile areas on the ocean floor throughout the Gulf. Scientifically, it is all new territory. "I suspect that the concentrations found may pose threats to plankton and larvae of many species," says Tom Shirley, a marine biologist at Texas A&M University in Corpus Christi. Murawski has similar fears. "Personally, I'm concerned about that much oil in a community that is long lived and slow growing, although we don't have any indications of mortalities."




In addition to toxicity, a key concern is the oxygen depletion caused by microbes consuming oil and methane in deep plumes. On their cruises, Asper and his colleagues found that oxygen concentrations had dropped by 30–55% within the plumes. In June, a team led by John Kessler, an oceanographer at Texas A&M University in College Station, found reductions of up to 30%, in patterns similar to those seen by the *Pelican* team. Neither group detected oxygen levels that would be considered hypoxic — too low to support aerobic organisms — which is the level set by the Environmental Protection Agency to cease use of dispersants.

NOAA has been slow to compile and assess the oxygen data. Although several scientific groups found signs of oxygen depletion, an initial report in late June by NOAA and various federal agencies and BP did not describe any concerns[4]. "We don't see significant oxygen depletion," said Murawski soon after the report's release.

A report on 23 July by the same group acknowledged that oxygen depletion has been observed but suggested that available data are inconclusive[5]. The report did not include data from Kessler's group or from the *Pelican*, even though later work could have been compared with the first glimpse of the plumes to help assess their evolution. "It's still a mystery to us why NOAA is not recognizing our data set," says Asper.

The recent report is hesitant about the oxygen-depletion data, suggesting that backup measurements are needed because oil could potentially cause problems with the


NIUST/NOAA

The oil on the surface of the Gulf of Mexico is obvious — but what lurks at lower depths?

standard oxygen sensor used in most of the studies. But Kessler's team and others performed further analyses and found no such problems[6]. Kessler has tried several times to make his data available to NOAA and is working with the agency so it can incorporate his results into the ongoing analysis of the plumes. "They seem as eager to understand this as we are," he says, although he is not sure why it is taking NOAA so long to receive the team's data.

Short says that NOAA may be reluctant to acknowledge the oxygen impacts because it will make it harder for the agency to carry out its damage assessment. The effects of a diffuse oil plume are not clear, but there are more studies of how lowered oxygen concentrations can harm marine ecosystems. The news of oxygen depletion, he says, "complicates NOAA's relationship with BP because these assessment studies would also create the potential for liability on BP's part".

Kessler thinks the answer may be simpler. Although he is not privy to the inner workings of NOAA, he surmises that the agency is simply overwhelmed. "I know these guys are unbelievably busy. They've got to be running 12 different directions at once."

Some scientists suggest there are broad problems in the way the US government has handled research into the oil spill. "One critical shortfall is that there is no overall coordination of the many types of research that are being undertaken, so that important issues are not missed," says Nancy Rabalais, executive director of the Louisiana Universities Marine Consortium in Cododrie.

"It is still a mystery to us why NOAA is not recognizing our data set."

## Scientists for hire

Given the scale of the environmental problem, many researchers worry that the government and BP are not doing enough to understand the gusher and its consequences. Ira Leifer, an oil-spill specialist at the University of California, Santa Barbara, and about a dozen collaborators including Asper, have been pushing BP to fund a comprehensive series of studies examining how the gas, oil and dispersants behave as they enter the water at the wellhead and spread up the water column.

"What no one really knows is why the oil is going where people are finding it," says Leifer. "And because the underlying science is unknown we have no predictive capability." Researchers can't answer basic questions such as whether deep oil and gas will be exported from the Gulf into the Atlantic, and what is the most effective ratio of dispersant to oil. Leifer's funding requests have been rebuffed for several weeks, despite being championed by Congressman Ed Markey (Democrat, Massachusetts). Early on, BP said that it was very close to reducing the flow, so the study would be moot. Although the oil flowed for several more weeks, the capping of the well in July prevented the studies that Leifer has in mind.

For now, Asper is planning his group's next cruise to the spill zone and trying to keep up with interview requests. Previously, he was pondering whether to accept an offer to work as a consultant for BP to help guide its response to the spill. When first contacted by a BP lawyer about the possibility of working on retainer, Asper was sceptical. "I think he wants to make sure I don't testify against BP," he said.

More than a dozen scientists have already signed contracts with BP, according to the company[1]. Some academics found the offers by BP appealing because they said it would provide a way to bring strong science into efforts to respond to the spill. After he learned more about what would be involved, Asper found the offer more tempting, both scientifically and financially. But he recognized that there was a potential conflict of interest and eventually decided not to accept the offer.

Despite his frustrations with certain aspects of the oil-spill experience, Asper says that it is by far the most interesting scientific problem of his career. He recognizes the benefits of scientific stardom, which have helped to focus international attention on the needs of the Gulf Coast. "I'm also pleased that people are interested in the things we've been interested in for so long," he says. "It is flattering to have people call up and ask what you do. I say, 'Well, I've been doing this for 25 years and nobody ever asked before but I'm happy to tell you about it.'"

On a recent weekday afternoon the wind was blowing the oil stench from the Gulf to Asper's office building at the university. He had spent the morning with the journalist Dan Rather, doing an interview for a cable show. After work, Asper decided to take some time off to fly an experimental plane that he had finished building after 24 years of effort.

He flew up through the clouds and above trucks loaded with dispersants under military guard. "It is gorgeous up there," says Asper. "It's nice to get above it all." ■

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