

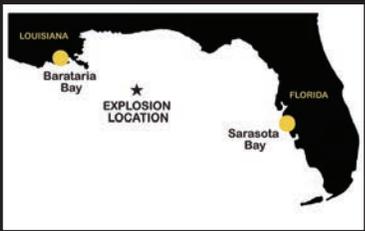
CTSG's De Guise helped lead research into long-term effects of Deepwater Horizon oil spill on dolphins

By Judy Benson

Above, a pod of striped dolphins, which share the Gulf of Mexico with the bottlenose dolphins in the study, swims through oil on April 29, 2010, in this photo taken from a helicopter survey nine days after the Deepwater Horizon drilling rig explosion. Photo: NOAA Fisheries

Center, the research team measures one of the Barataria Bay dolphins. Right, Sylvain De Guise holds a dolphin's tail up for sampling blood from the veins on the underside of the tail. Photos: Todd Speakman / National Marine Mammal Foundation





A Coast Guard MH-65C rescue helicopter and crew document the fire aboard the mobile offshore drilling unit Deepwater Horizon, while searching for survivors on April 21, 2010. Multiple Coast Guard helicopters, planes and cutters responded to rescue the Deepwater Horizon's 126-person crew. Photo: U.S. Coast Guard



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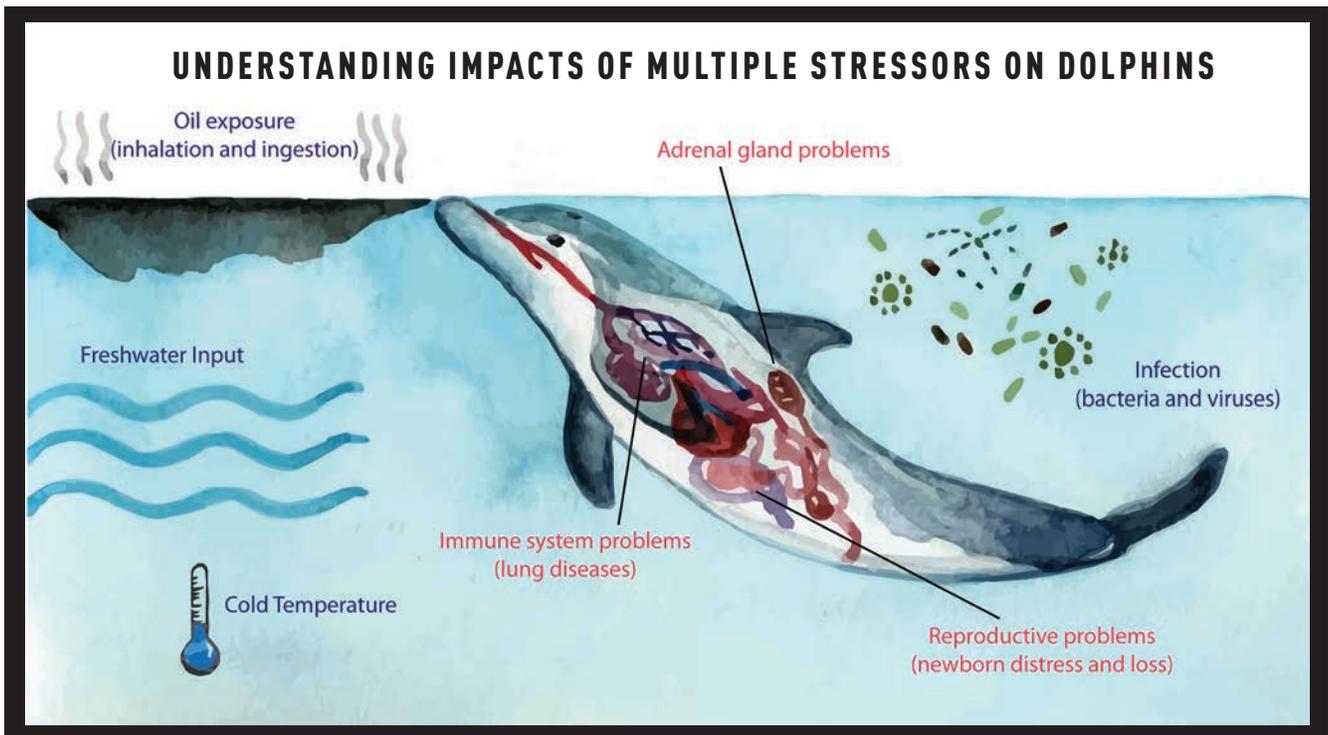


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Above: The inset map shows Barataria Bay, where the bottlenose dolphin research took place; Sarasota Bay, where the control population was located; and the approximate site of the explosion. Map: Maxine A. Marcy

Left, Rob Yordi, zoological director of SeaWorld, holds one of the dolphins with Sylvain De Guise, CT Sea Grant director, as they check vital signs. Center, a suction cup is attached to a dolphin's jaw to play back sound as part of a hearing test. Photos: Todd Speakman, National Marine Mammal Foundation

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Above Graphic: Anna Hinkeldey / Oil Spill Science Outreach Team-Mississippi-Alabama Sea Grant Consortium

Oil that gushed from the explosion of the Deepwater Horizon drilling platform 11 years ago opened a large wound in the Gulf of Mexico that remains unhealed.

Remnants of the more than 200 million gallons of spilled oil linger in the sediments. The disaster left diminished populations of sea turtles, pelicans and sheepshead minnows, among other animals, and chronic stressors on one of the most iconic species of this marine environment, bottlenose dolphins.

Though the largest oil spill in U.S. waters, media and public attention faded quickly after the immediate disaster, which killed 11 people and thousands of animals, including an estimated 1,300 dolphins.

But the team of researchers that included Connecticut Sea Grant Director Sylvain De Guise didn't forget. Instead, they spent much of the last decade on research that documented the damage to the approximately 1,700 surviving dolphins that live in Barataria Bay, off the southeastern Louisiana coast some 125 miles from the explosion site. While their conclusions are troubling, they can give added urgency to efforts to build an energy economy based on renewable resources.

"As long as we are dependent on fossil fuels, there are going to be spills, even with the best technology," said De Guise. "The dolphins of Barataria Bay are kind of the poster child for how there are long-term consequences for what we do."

Separate from his duties running CT Sea Grant, De Guise has built a distinguished career as a veterinary pathologist. He specializes in toxicology—figuring out how chemical exposures impact marine animal health, with an active research lab at UConn's main campus in Storrs. While he has studied lobsters, shellfish and fish, his expertise is with dolphins and whales.

Beluga whales, particularly, are the species that set the course for his career.

Now 55, he grew up in a small town in Quebec on the St. Lawrence River, where swimming, boating and fishing were instinctive. Over time he saw troubling changes in the local environment. He couldn't drink the water from the river like his father and grandparents used to. Increasing pollutants made swimming and eating fish from the river hazardous.

"It was a slow awareness that drew me to asking questions," he said. "How come we can't do the things my grandparents and parents used to be able to do?"

After completing veterinary school, he continued studies in veterinary pathology and ultimately earned a doctorate in immunotoxicology. Along the way, he got the chance to work with a researcher doing a necropsy on a beluga whale. De Guise was fascinated. Relatively small among whales, these 3,000-pound, all-white cetaceans are found in the St. Lawrence, often in polluted environments where they suffer from a variety of diseases, and in the relatively pristine Arctic. His curiosity took him to harsh, remote places, chasing after whales amid icebergs.

“Seeing belugas in their natural environment was just incredible,” he said.

As his career progressed, he moved through several academic and research appointments until landing at UConn in 1998 and Connecticut Sea Grant in 2005. Six years later he and the dolphin research team began their work in Barataria Bay. The work was funded initially by the National Oceanic and Atmospheric Administration and then through multi-million-dollar grants from a program originally set up with funds from BP, owner of the Deepwater Horizon rig. It required trips to the Gulf each summer to capture, examine, X-ray and sample blood and tissue of three-to-four-year-old calves to adult dolphins.

“In some ways, it was like going back to camp each summer,” De Guise said. “There was a lot of professional camaraderie in the group. But it was also very sobering, because of the gravity of what we were finding.”

The first of the projects found reproductive impacts, with miscarriage and stillbirth rates 46 percent higher among female dolphins that survived the oil spill compared to a control population. The second phase looked at immune system effects, finding Barataria Bay dolphins had three times more of the type of white blood cells that cause dysfunction in the body’s response to infections compared to the control group. This in turn was associated with persistent inflammation in the lungs of many of the dolphins studied. Even more worrisome, these effects were found across generations, both in dolphins alive at the time of the spill and in their offspring.

“Their health has not improved over time, but gotten worse,” said Lori Schwacke, chief scientist for conservation medicine at the National Marine Mammal Foundation.

A statistician and epidemiologist on the research team, Schwacke was one of the authors of a paper published last December in the journal *Environmental Toxicology and Chemistry*. De Guise was the lead author.

“The dolphins are still showing chronic lung disease that seems to be getting progressively

worse,” Schwacke said. “It’s like their immune systems are on overdrive. This research has given us an opportunity to understand the impacts of the oil spill and look at why these animals aren’t recovering. But it’s absolutely heartbreaking to see the impacts.

“There is no antidote to the oil,” she added.

Schwacke noted that another of the seven authors on the recent paper was Jean Herrman, a veterinary dentist who is married to De Guise. Using her unique expertise, Herrman developed a way to age the dolphins using radiographs created from X-rays of dolphin teeth. This was a significant improvement both for the dolphins and the researchers, Schwacke said.

“We used to have to extract their teeth,” she said.

A third co-author, Randy Wells, brought his special skills doing long-term research with dolphins in Sarasota Bay off the Florida coast. The Sarasota Dolphin Research Program animals served as the reference population for comparison with their Barataria Bay cousins.

De Guise, Wells said, is a “top-notch scientist” who helped expand the immunological understanding not just of the Barataria Bay dolphins, but also those in Sarasota Bay.

“He’s one of my favorite colleagues, because he really cares about the people and the animals he’s working with,” said Wells, who is director of the Sarasota research program.

Ultimately, he said, he hopes the findings will inform future recovery programs, as well as possible development of a vaccine to help the dolphins with compromised immunity due to chronic exposure to oil.

While every research project is unique, the work with the Barataria Bay dolphins had some singular characteristics, De Guise said. The level of complexity was multiplied by the involvement of the federal government, which invoked the Natural Resources Damage Assessment process to commission the research. The federal lawsuit against BP and subsequent settlement meant that all the science became “a very legally



Sylvain De Guise holds X-ray film in a plate holder to make dental radiographs used to assess dental pathology and determine the age of one of the dolphins in the control population at the Sarasota Dolphin Research Program. In the foreground is De Guise’ wife Jean Herrman, a veterinary dentist who is taking the radiographs. Photo by the Chicago Zoological Society’s Sarasota Dolphin Research Program, taken under NMFS Scientific Research Permit No. 15543

...an opportunity to understand the impacts of the oil spill...But it's absolutely heartbreaking to see the impacts.

bound process,” from the research protocols to the content of published articles.

“Lawyers were involved every step of the way,” he said.

And then, of course, there were the dolphins.

“They’re in their own environment, where they’re more agile and more knowledgeable than we are,” De Guise said. “They’re pretty powerful animals. One part of it is restraining them, the other part is treating them like a patient, and the other part is that they are scientific subjects.”

Weighing up to 600 pounds each, the dolphins are surrounded by nets that are gradually closed around them. Over about an hour, the researchers monitor their heart rate, blood gas and other vital signs while they extract samples for lab analysis. They can feel the dolphin’s heart beating. Sometimes a captive calf will start calling for its mother.

“We try to keep them face-to-face, to be understanding and respectful of their social behaviors,” De Guise said. “It’s a very humbling part of it.”

The prognosis for the future of the Barataria Bay dolphins is far from certain. Current estimates, De Guise said, show the population will take 30 years to recover to pre-oil spill levels—barring any new stressors. But that appears unlikely, with climate change impacts affecting marine environments worldwide. In addition, a current plan to restore Barataria Bay may not be good for the dolphins.

The plan calls for diverting sediment from the Mississippi River to make up for land being lost to sea level rise around Barataria Bay. It could benefit birds and some other wildlife populations, Schwacke said, but she and others on the research team are concerned about how dolphins would be affected because it would bring in more fresh water, reducing the salinity of the bay.



A dolphin pushes a dead calf through the waters of Barataria Bay in March 2013. This behavior is sometimes observed in female dolphins when their newborn calf does not survive. Barataria Bay dolphins have seen a disturbingly low rate of reproductive success in the wake of the Deepwater Horizon oil spill. Photo: Louisiana Department of Wildlife and Fisheries

Dolphins develop skin lesions and other serious conditions when exposed to too much fresh water, De Guise said. It would be another stressor on an already over-stressed population. But in the end, the research, findings and any actions taken as a result aren’t just about the Barataria Bay dolphins.

In the broader view, the project highlights the need for better understanding of how all the pieces of nature and

human civilization are interconnected to yield better decisions for the future.

“If there are effects on one species,” De Guise said, “it’s also on the rest of the ecosystem, and people, too, because we’re part of the ecosystem.”

MORE INFORMATION:

- “Oil spill has long-term immunological effects in dolphins,” from the Feb. 2021 issue of *Environmental Toxicology and Chemistry*: <https://setac.onlinelibrary.wiley.com/doi/10.1002/etc.4980>
- “Exposure of cetaceans to petroleum products following the Deepwater Horizon oil spill in the Gulf of Mexico,” from National Oceanic and Atmospheric Administration: <https://repository.library.noaa.gov/view/noaa/20380>
- Oil spill science fact sheets from the Oil Spill Science Outreach Team-Mississippi-Alabama Sea Grant Consortium: <https://gulfoilspilloutreach.org/publications/>



Oil residues are visible in the marshes near the town of Grand Isle, LA, in early June 2010, six weeks after the Deepwater Horizon disaster. Photo courtesy of Louisiana Sea Grant