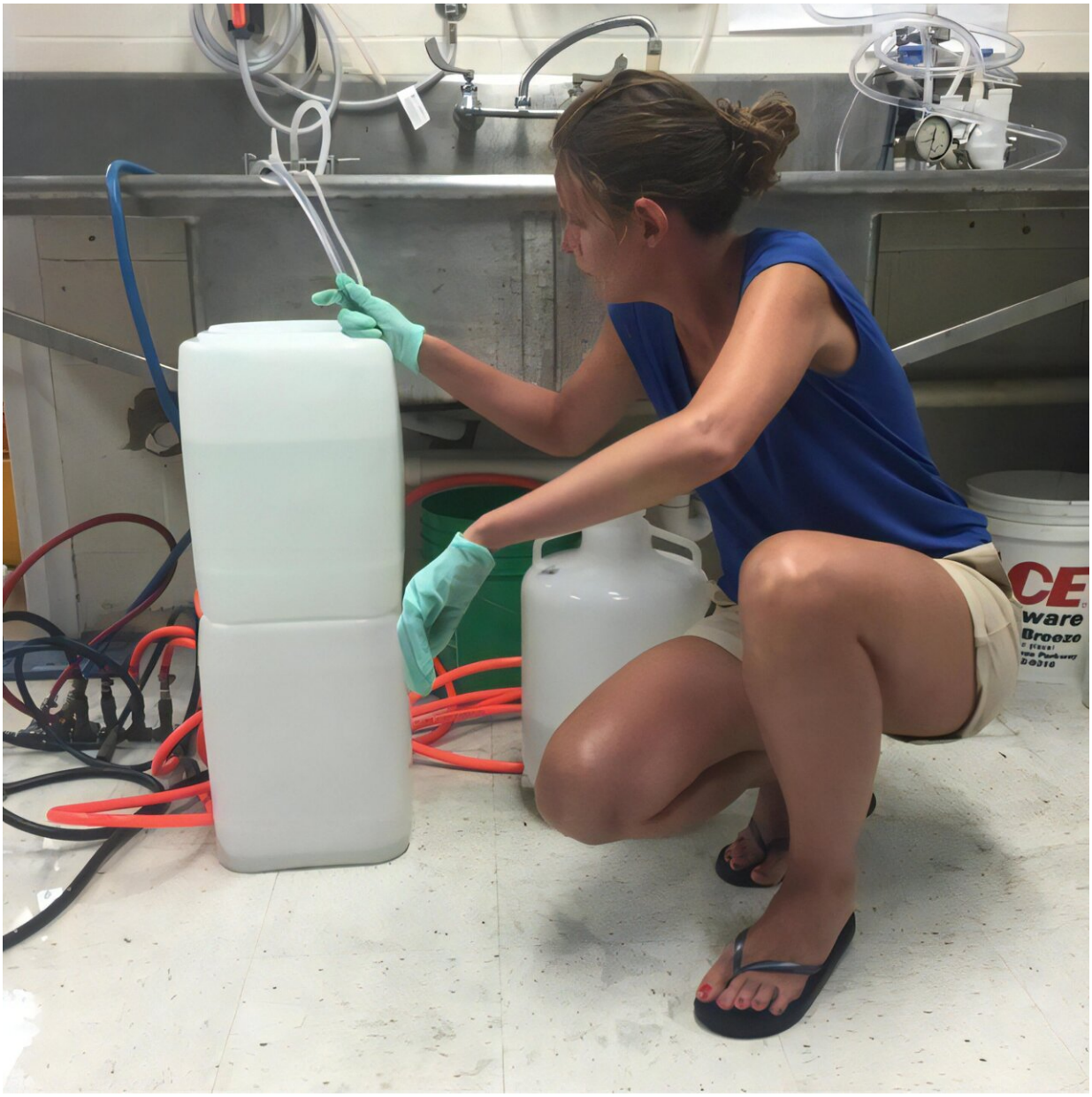
Deepwater Horizon oil spill study could lead to overhaul of cleanup processes worldwide

January 22 2024



Dr. Sabine Matallana-Surget, University of Stirling, carrying out seawater filtration to collect marine bacteria in Florida. Credit: University of Stirling

New research by the University of Stirling could lead to major improvements in marine oil spill cleanup processes.

The innovative study led by researcher Dr. Sabine Matallana-Surget and Dr. Wade Jeffrey of the University of West Florida assessed the impact of the Deepwater Horizon oil spill on microscopic seawater bacteria that perform a significant role in ecosystem functioning.

Dr. Matallana-Surget, of the University of Stirling's Faculty of Natural Sciences, used a pioneering technique more commonly employed in medical science during field work in the Gulf of Mexico. The research is published in the journal *Frontiers in Marine Science*.

The findings show chemical oil dispersants used to mitigate the impact of the Deepwater Horizon disaster in 2010 worsened the stress response in bacteria and those harmful effects were then intensified by exposure to sunlight.

The Deepwater Horizon marine oil spill—the largest in history with 4.9 million barrels of crude oil released into the Gulf of Mexico—happened in the spring, a season characterized by extreme sunlight in the region.

Dr. Matallana-Surget said, "We have demonstrated that dispersants exert a more profound impact on the regulation of microbial communities than the oil spill itself. In just 24 hours, these chemicals induce acute stress responses.

"Additionally, sunlight played a crucial role in intensifying dispersant

toxicity. In the presence of sunlight and oil, the diversity of essential hydrocarbon-degrading bacteria significantly decreased.

"This suggests that sunlight can modify the chemical structure of oil, making it more toxic to specific bacterial species.

"Our study also revealed the impact of oil and dispersant on cyanobacterial photosynthesis, further emphasizing the intricate interactions between contaminants, sunlight, and microbial communities in the Gulf of Mexico."

The research has international significance for society and industry because it deepens understanding of the impact of oil spill responses.

Dr. Matallana-Surget added, "By understanding how dispersants impact microbial communities in the presence of natural hydrocarbon degraders, we contribute to more effective oil spill cleanup strategies. The benefits extend globally, as marine ecosystems worldwide face similar challenges.

"The findings have the potential to influence environmental policies and cleanup procedures on an international scale.

"The study's implications extend to environmental conservation, influencing future strategies for mitigating the impact of such incidents and safeguarding marine ecosystems."

Among the countries that could benefit from the findings is the United Kingdom. Dr. Matallana-Surget said, "The study primarily focuses on the impact of oil spills in the Gulf of Mexico, but its outcomes hold broader relevance for policymakers in regions facing similar challenges, such as Scotland, with crude oil seepages.

"The insights gained from our research could provide valuable guidance for crafting effective policies and response strategies in these comparable environments."

The study saw researchers simulate oil spills in waters collected off Pensacola Beach in Florida. Crude oil was added with and without dispersant under sunlight and dark conditions, with larger organisms filtered out.

The study's use of state-of-the-art molecular tools typically employed in medical science places it at the forefront of environmental science research.

Dr. Matallana-Surget, who has pioneered the technique, said, "This enables a more precise and comprehensive analysis of microbial communities' reactions to oil spills.

"These findings not only enhance our comprehension of environmental impacts but also underscore the capacity of employing state-of-the-art molecular tools to address crucial concerns in marine conservation.

"This innovative approach marks a transformative shift, elevating the precision and depth of oil spill investigations and guiding future endeavors to preserve the health of our oceans."

The research led by the University of Stirling was an international collaboration with scientists from the University of West Florida (U.S.), Sorbonne University (France), the University of Mons (Belgium) and the University of Tübingen (Germany).

"This project would have never been possible without the truly concerted effort of a team of long-term colleagues who have played a pivotal role in bringing together the outcomes of this ambitious study," added Dr.

Matallana-Surget.

More information: Sabine Matallana-Surget et al, Clarifying the murk: unveiling bacterial dynamics in response to crude oil pollution, Corexit-dispersant, and natural sunlight in the Gulf of Mexico, *Frontiers in Marine Science* (2024). DOI: 10.3389/fmars.2023.1337886

Provided by University of Stirling