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Discovery Porthole

Sharing Research with Educators and the Public

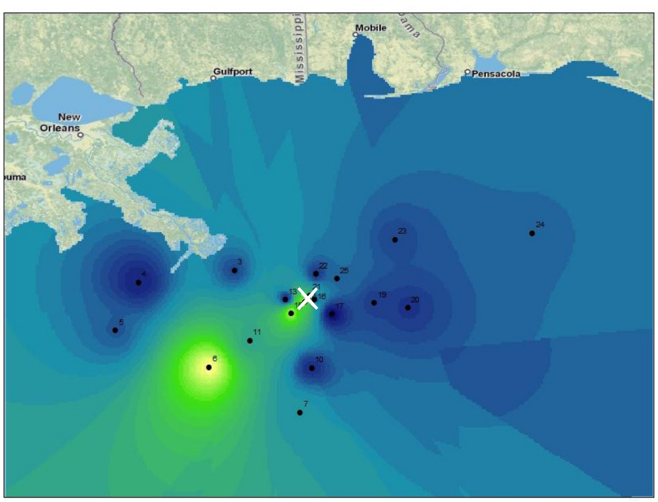
Florida to Louisiana: tracing the oil

The effects of the Deepwater Horizon oil spill on the ecology of the Gulf of Mexico are, for the most part, still unknown. Florida State University has developed an integrated study of the impact of oil on the coastal and ocean marine ecosystem of the Gulf of Mexico, including the northern West Florida Shelf, extending from the Big Bend Region west to Louisiana. They are investigating the effects of the spill on coastal ecosystems with a particular emphasis on changes in the food webs that support major commercial and recreational fisheries in the Gulf and in locating oil on the seafloor.

When the Deepwater Horizon oil rig exploded it sent 4.9 million barrels of not just crude oil but also traceable carbon atoms out into the Gulf of Mexico. The large pulse of carbon, with its unique chemical signature, is now becoming incorporated into the marine environment. Florida State University scientist Dr. Jeff Chanton is using ***radiocarbon*** and ***stable isotope*** technologies to trace the oil and dispersant through the coastal and offshore food web to determine the magnitude of its impact. An isotope is a unique form of a chemical element, like carbon or nitrogen. Radioactive isotopes decay over time while stable isotopes, as their name implies, do not. Plants and animals retain the isotopic signature of the compounds they consume enabling scientists to trace certain isotopes through the food web.

Samples were collected along the Gulf Coast, from oiled marshes in Barataria Bay (pictured above) to pristine Apalachicola Bay. Photo credit: Chanton FSU

Hydrocarbon residues, like those resulting from the oil spill, may become incorporated into marine food webs through multiple routes, from both sediments and the water. Some microscopic organisms living on the sea floor consume hydrocarbons in the sediment. When these organisms are eaten by others, like crabs, shrimp and fish, the hydrocarbons are incorporated into higher ***trophic levels*** of the food web. Some of the carbon accumulates in animal tissues like oysters as they filter water to feed. Radiocarbon in the oysters' shell, which builds up over long periods of time as the oyster grows, can serve as a reference for radiocarbon in the muscle tissue, which is more closely related to recent carbon uptake. Measuring radiocarbon over two different time scales within the same organism allows scientists to isolate the effects of the spill from other potential hydrocarbon exposure. Using the methods described, Dr. Chanton and his team will be able to describe the radiocarbon signature of coastal food webs prior to, during, and after oil impact in areas of varying oil exposure from Louisiana to Florida. This will allow them to trace the isotopic signatures of compounds from the oil spill through the food web and monitor the impact on fisheries.



This map shows the radiocarbon content of sediments on the seafloor of the Gulf. The more bright colors represent less radiocarbon; indicative of oil input. You can clearly see the trace of the oil plume to the southwest of the spill site (marked with an x). Image credit: Jeff Chanton, FSU

Education Extension

Key Terms: *food chain, trophic level, stable isotope*

Classroom Activity: You Are What You Eat

Students will investigate a food chain and explore how what an animal eats and where it lives leaves permanent chemical marks on them. The chemical marks can be analyzed by scientists and allow them to learn about the animals life history.

Ocean Literacy Principles: 5. The ocean supports a great diversity of life and ecosystems

National Science Standards: A. Science as Inquiry: Abilities necessary to do scientific inquiry; C. Life Science: Organisms and environments; E. Science and Technology: Understandings about science and technology

Supplies: *labels, colored stickers, stopwatch*

Directions: 1) Discuss the basics of chemical isotopes and stable isotope analysis 2) Divide class into trophic levels by assigning roles and different colored stickers: plankton, oysters, and cownose rays (or other food chain). 3) Assign half the plankton as "bay" and the other "ocean" using different colored stickers to illustrate stable isotope concept, as they would be distinguishable from one another analyzing stable isotope ratios. 4) Allow the plankton to flow through the oyster reef for 30 seconds. The oysters should tap any plankton it can reach and collect the stickers of any plankton it eats. 5) Allow the cownose rays to come in and feed on the oysters for 30 seconds. The rays should collect all of the stickers from each oyster it eats. 6) Analyze the results (stickers) to determine what the cownose rays ate and where their food came from. 7) Discuss other stable isotope applications in ecology as well as in archaeology, geology and forensics. How would this apply in tracing toxins?

Visit **http://dhp.disl.org/resources.html** for lesson plans and additional marine-related activities.

****Use the key terms above to search for additional lesson plans on the web!***

Did You Know...

Radiocarbon, also known as Carbon 14, is a radioactive isotope of carbon produced naturally in the upper atmosphere by radiation from the sun. C14 decays over time and is only found in items less than 100,000 years old. The carbon released in the oil spill is millions of years old and therefore does not contain C14.

Isotopes are different versions of a chemical element. Isotopes of a given element have the same number of protons but different numbers of neutrons.

Stable isotopes of the elements oxygen, carbon, nitrogen, hydrogen and sulfur, are resistant to decay and are commonly used in scientific analysis due to their abundance in nature.

A ***hydrocarbon*** is an organic compound made entirely of hydrogen and carbon atoms. Most naturally occurring hydrocarbon is found in crude oil.

A ***trophic level*** refers to the position an organisms occupies in a food chain such as producer, consumer or decomposer.

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Funding

This project is funded through a grant from the BP Gulf of Mexico Research Initiative. NGI received a grant from BP's Independent University Research funds to address regional impacts from the Deepwater Horizon oil spill.

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The Northern Gulf Institute (NGI) is a National Oceanic and Atmospheric Administration (NOAA) Cooperative Institute addressing the research needs of the northern Gulf of Mexico. Mississippi State University leads this collaboration of the University of Southern Mississippi, Louisiana State University, Florida State University, Alabama's Dauphin Island Sea Lab, and NOAA scientists at laboratories and operational centers.

This document was prepared under award NA06OAR4320264 06111039 to the Northern Gulf Institute by the NOAA Office of Ocean and Atmospheric Research, U.S. Department of Commerce. The Northern Gulf Institute and its academic members do not discriminate on the basis of race, color, religion, national origin, sex, sexual orientation or group affiliation, age, handicap/disability, or veteran status.