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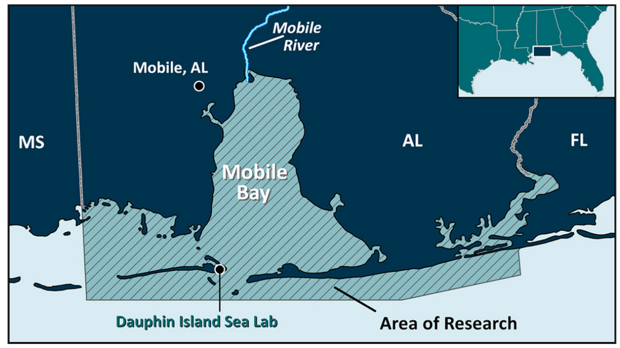
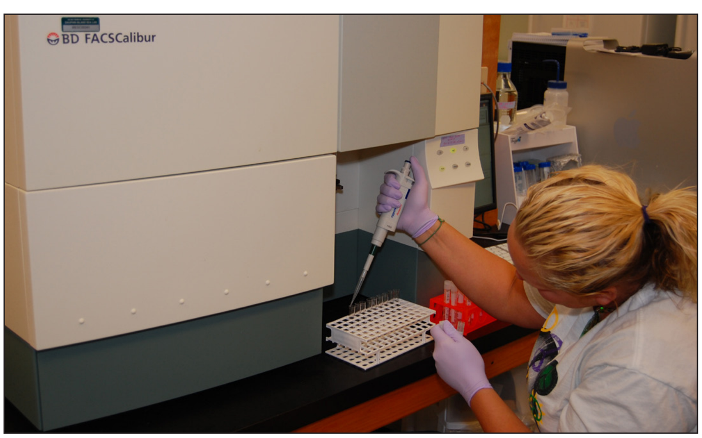
# Microbes and the marine food web

**Scientists across the Gulf of Mexico, with support from NGI, are evaluating the impacts of the Deepwater Horizon oil spill on the health of the marine ecosystem. To understand the effects on key elements of the marine food web, one Dauphin Island Sea Lab scientist is comparing microbial samples taken before the oil spill to samples that were exposed to Deepwater Horizon oil.**




The release of oil and application of chemical dispersant associated with the Deepwater Horizon disaster may have altered portions of the ***pelagic*** (open ocean) ecosystem in the northern Gulf of Mexico. The changes, although most likely to occur at the surface where much of the oil accumulated and where most marine organisms live, could happen at any depth. Additionally, the effects on the deep water ecosystems may have been increased by the application of dispersants to the oil at the source, ~1200 meters deep. For these reasons, Dr. Alice Ortmann and other NGI scientists are studying oil spill effects on the smallest and most widespread inhabitants of the Gulf of Mexico: phytoplankton (microscopic, drifting plants) and other ***microbes*** (bacteria, archaea and viruses).

Phytoplankton, like land plants, produce organic material from carbon dioxide (CO2) and sunlight to form the base of the marine ***food web***. Single-celled micro-organisms, like bacteria and archaea, are able to convert organic matter, including the organic compounds found in oil and dispersants, into energy and CO2, which can then be used by organisms such as phytoplankton. Both the oil and the dispersants may have toxic effects, but may also alter the microbial community by stimulating growth in the portion of the community capable of metabolizing (breaking down) this carbon rich material. However, the growth of these microbes may be controlled by the availability of oxygen and nutrients such as nitrogen and phosphorous. The introduction of carbon-rich, but nutrient poor, organic matter from the Deepwater Horizon oil spill could result in a shift in the diversity of the pelagic microbial community. This change could then translate into a shift in the functioning of the ***microbial loop*** (essential to the marine food web) and therefore interrupt the transfer of carbon to consumers in the food web.



*A flow cytometer is used to analyze bacteria, archaea and viruses collected after the oil spill. Photo credit: DISL*

Researchers are working to determine if oil and dispersants act as toxins, killing off microbes; if the hydrocarbons in oil are converted into a usable food source for phytoplankton; or, if both scenarios are occurring. The research team will continue to study microbial communities in the Gulf of Mexico and investigate the flow of energy in the food web in the presence and absence of oil. Results from this study will help Dr. Ortmann and others understand how the Gulf of Mexico has changed in response to the Deepwater Horizon oil spill and help to determine if and when the environment has "recovered."

## *Education Extension*

**Key Terms:** *food chain, food web, community, producer, consumer, decomposer, plankton, microbes, pelagic*

**Classroom Activity: Food Web Wipeout**

Food webs demonstrate complex feeding relationships among species in an ecosystem by combining several food chains. Scientists use food webs to demonstrate the fragile and interconnected nature of an ecosystem. This activity demonstrated the complexity of a food web and what can happen when one component of a food web is altered.

***Ocean Literacy Principles***: 5. The ocean supports a great diversity of life and ecosystems 6. The ocean and humans are inextricably interconnected
***National Science Standards***: A. Science as Inquiry: Understandings about scientific inquiry; C. Life Science: Populations and ecosystems; G. History and Nature of Science: Science as a human endeavor.

**Supplies:** *photo i.d. of marine organisms, yarn*

**Directions:** 1) Ask each student to pick a pelagic marine organism to represent and discuss who are the producers, consumers and decomposers (microbes). 2) Form a large circle around the sun and instruct the sun to toss the yarn to an organism that gets its energy from the sun. 3) That organism then tosses the yarn to an organism that eats it and so on. Continue until you reach the top consumer for that chain and cut the yarn. 4) Return the yarn to the sun and continue. The students will form a large complex web. 5) Ask the students what would happen if an organism was eliminated from the food web. Eliminate an organism by pulling out all of the yarn they were holding. Anyone that had yarn removed from their hands knows they have been affected by the loss of that organism. What effect could this change in the food web have on humans?

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...

***Pelagic*** refers to the open ocean, neither close to the sea floor nor to the sea shore.

***Microbes*** are present in virtually all environments and are typically the first organisms to react to chemical and physical environmental changes. Because they are at the base of the food chain, changes in microbial communities are often a precursor to, or indicator of, changes in the health and viability of the environment as a whole.

The ***microbial loop*** is an integral process in the marine environment by which dissolved organic matter is returned to the food web via bacteria and other microbes.

***Food webs*** are models comprised of several food chains and the linkages between them.

***Hydrocarbons*** (components of oil) provide microbes with a burst of energy for growth and development in a manner similar to the way oil provides a combustible engine with energy needed to do work.

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