

The Science Behind Oil Spills and Seafood Safety

Advanced technology in oil spill research

In the 1970s and 1980s, the NWFSC developed state-of-the-art tools to detect toxic petroleum compounds in aquatic life, including a method to rapidly measure the compounds that are processed and eliminated from fish. Since then, scientists have applied these analytical tools to assess impacts on the ecosystems and seafood safety following major oil spills, from the 1989 *Exxon Valdez* spill to the 2010 *Deepwater Horizon* spill. Newer molecular tools are improving our ability to detect oil-induced biological injury following spills. Such tools helped scientists assess the damage to oiled Pacific herring following the 2007 *Cosco Busan* oil spill.

Oil spills and human health

Oil is made up of a complex mixture of hundreds of chemicals. Among these, the polycyclic aromatic hydrocarbons (PAHs) are recognized as the oil components of greatest health concern. Many PAHs are known to be toxic to humans and some can cause cancer. PAHs can also persist in the environment for long periods of time, increasing the possibility that people will be exposed. By sampling water, sediment and seafood after an oil spill, NWFSC scientists can look for and identify several known PAHs that serve as chemical indicators of human health risk. Oil dispersant chemicals that may be applied to oil spills can also be monitored, although they pose little human health risk in seafood consumption.

How much exposure to oil is acceptable for human seafood consumption?

One of the more challenging aspects of our work is helping managers set levels of concern for PAHs that present a negligible risk to seafood consumers. Federal and state risk managers aim to be conservative in establishing acceptable thresholds, and their methods for doing so incorporate the best peer-reviewed science available. Considerations include how much seafood people eat, the average body weight over a person's lifetime, and the higher risks of some populations such as children, and the elderly to the oil toxins.

Sensory and chemical analyses inform decisions to close and re-open fisheries

Scientists collect seafood samples to determine when fishing can resume in an oil-affected area. For an area to be reopened, seafood samples must meet strict criteria. First, samples must pass the sensory test—minimum of 5 of 7 expert assessors finding no detectable petroleum and dispersant odor or flavor. Even if one sample fails, the entire area could remain closed to fishing. Second, if samples from a closed area pass the sensory test and a follow up chemical analysis, an area could be re-opened. Scientists continue to collect samples in opened areas to ensure that the seafood remains safe.

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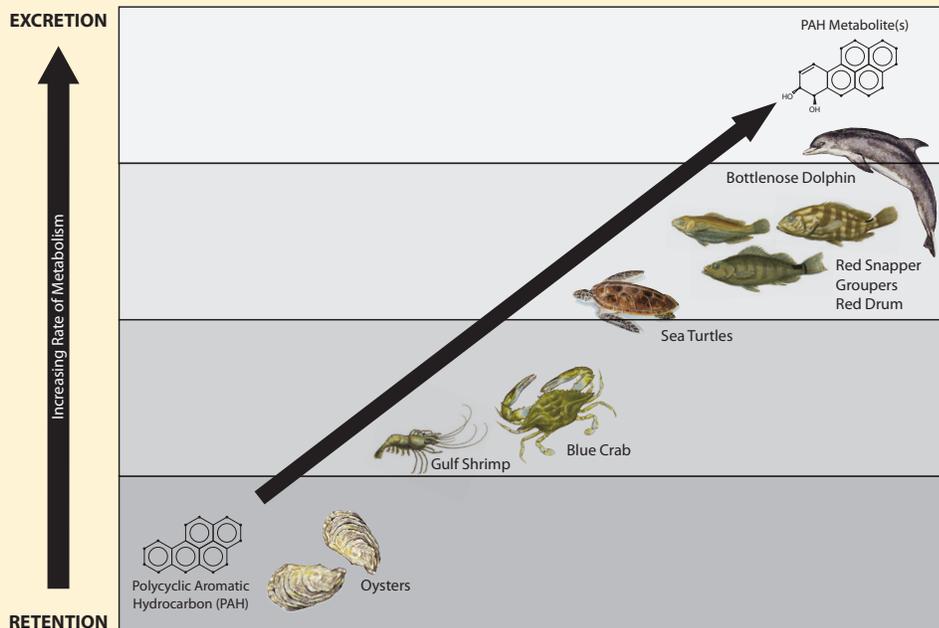
NOAA FISHERIES

NWFSC's research has improved our understanding of the impacts of oil spills on imperiled species, aquatic ecosystems, and human health.

Extent of Metabolism of PAHs

Oil affects marine life differently

One of the lessons learned from NWFSC's work following the *Exxon Valdez* oil spill is that marine fish such as tuna, grouper, and snapper, have a well-developed capacity to alter oil so that their systems can quickly eliminate it. Thanks to this capability, there is low potential for PAHs to accumulate in edible tissues and thus to transfer up the food chain to humans. Other marine species such as oysters and clams have a much lower capacity to process PAHs, while crustaceans, including shrimp and crabs, have a capability that lies somewhere in the middle. Studies in the laboratory have also shown that certain PAHs can affect the early life stages of fish, causing fish embryos to develop heart defects.



The ability of various animals to process and eliminate polycyclic aromatic hydrocarbons (PAHs). Fish and mammals metabolize PAHs more efficiently than mollusks (oysters and clams). Therefore, mollusks might retain more PAHs in their tissues than do fish.

Keeping seafood safe after *Deepwater Horizon* oil spill

In April 2010, the United States experienced the largest oil spill in history as a result of the explosion of the *Deepwater Horizon* oil well, which released 4.9 million barrels of oil into the Gulf of Mexico. A sophisticated Federal and state effort helped keep tainted seafood from reaching the market and our dinner plates. State and Federal fisheries scientists, trained sensory experts, risk assessors, toxicologists, analytical laboratories, and seafood experts around the country worked hundreds of thousands of hours to protect seafood consumers. Though fisheries were closed in some areas for more than a year, no contaminated product ever reached the market.

What were the overall results of the seafood testing?

A very low percentage—0.16%—of samples failed the sensory testing. This was expected as we know that fish quickly process and eliminate oil from edible tissues. For the chemical tests, all results were magnitudes below—at least 1/100th—the established level of concern.

How extensive was the sampling effort?

At its furthest extent, about 37% of federal waters in the Gulf Exclusive Economic Zone were closed to fishing, stretching in a wide arc of 88,522 square miles from the northeastern coast of Texas to the Florida Keys. More than 8,000 seafood samples, representing tens of thousands of individual animals, were collected and tested. The samples included commercially and recreationally important species such as shrimp, oysters, crabs, snapper, grouper, tuna, wahoo, jack, and swordfish.

How do we know that seafood wasn't contaminated by chemical dispersants?

Public concern about the use of oil and chemical dispersants led to a collaborative effort between the Food and Drug Administration and NOAA to quickly develop and approve a method to measure dispersants in many different types of seafood. Once the method and risk levels were in place, scientists tested the samples, including 50% of those collected before the test was approved; all samples passed and were below the set risk levels.

What was the public perception of the safety of seafood from the Gulf?

Multiple scientific studies have established that even low levels of PAHs are unlikely to be found in edible tissues of fish, but scientists and managers felt it necessary to continue to assure the public of the safety of Gulf seafood with these new data. The extensive, real-time sampling effort and strict protocols were designed to help ensure that Gulf seafood was truly safe to eat.

Learn more & come see us in action

Sharing our work with other scientists, with policymakers, and with the public is important to us. To learn more about what we do, please visit our website at www.nwfsc.noaa.gov, find us on Facebook at <https://www.facebook.com/noaafisheriesnw>, or follow us on Twitter at @NOAAFish_NWFSC.

