How Oil Harms Animals and Plants in Marine Environments

An oiled seabird was found dead on the beach following the Kuroshima oil spill near Dutch Harbor, Alaska, in November 1997. (NOAA)

In general, oil spills can affect animals and plants in two ways: from the oil itself and from the response or cleanup operations. Understanding both types of impacts can help spill responders minimize overall impacts to ecological communities and help them to recover much more quickly.

Spilled oil can harm living things because its chemical constituents are poisonous. This can affect organisms both from internal exposure to oil through ingestion or inhalation and from external exposure through skin and eye irritation. Oil can also smother some small species of fish or invertebrates and coat feathers and fur, reducing birds' and mammals' ability to maintain their body temperatures.

We have a series of guidance documents that describe the biology of and impacts of oil on sea turtles, mangroves, and coral reefs. Each one includes related planning and response considerations for oil spills which may affect these particularly sensitive organisms and habitats.

What Creatures Are Most Affected by Oil Spills?

Since most oils float, the creatures most affected by oil are animals like sea otters and seabirds that are found on the sea surface or on shorelines if the oil comes ashore. During most oil spills, seabirds are harmed and killed in greater numbers than other kinds of creatures. Sea otters can easily be harmed by oil, since their ability to stay warm depends on their fur remaining clean. If oil remains on a beach for a while, other creatures, such as

snails, clams, and terrestrial animals may suffer. To learn more details about this topic, check out the Oiled Wildlife Care Network from the University of California at Davis.

What Measures Are Taken When an Animal Comes in Contact with Oil?

Most states have regulations about the specific procedures to follow. Untrained people should not try to capture any oiled bird or animal. At most U.S. spills, a bird and/or mammal rehabilitation center is set up to care for oiled animals. You can read an overview of this topic at EPA's Rescuing Wildlife page and find more information at the Tri-State Bird Rescue and Research website and the Oiled Wildlife Care Network website.

What Type of Spilled Oil Causes the Most Harm?

The type of oil spilled matters because different types of oil behave differently in the environment, and animals and birds are affected differently by different types of oil. However, it's not so easy to say which kind is worst.

First, we should distinguish between "light" and "heavy" oils. Fuel oils, such as gasoline and diesel fuel, are very "light" oils. Light oils are very volatile (they evaporate relatively quickly), so they usually don't remain for long in the aquatic or marine environment (typically no longer than a few days). If they spread out on the water, as they do when they are accidentally spilled, they will evaporate relatively quickly.

However, while they are present, light oils present two significant hazards. First, some can ignite or explode. Second, many light oils, such as gasoline and diesel, are also considered to be toxic. They can kill animals or plants that they touch, and they also are dangerous to humans who breathe their fumes or get them on their skin.

In contrast, very "heavy" oils (like bunker oils, which are used to fuel ships) look black and may be sticky for a time until they weather sufficiently, but even then they can persist in the environment for months or even years if not removed. While these oils can be very persistent, they are generally significantly less acutely toxic than lighter oils. Instead, the short-term threat from heavy oils comes from their ability to smother organisms whereas over the long-term, some chronic health effects like tumors may result in some organisms.

Also, if heavy oils get onto the feathers of birds, the birds may die of hypothermia (they lose the ability to keep themselves warm). We observe this same effect if sea otters become oiled. After days or weeks, some heavy oils will harden, becoming very similar to an asphalt road surface. In this hardened state, heavy oils will probably not harm animals or plants that come in contact with them.

In between light and heavy oils are many different kinds of medium oils, which will last for some amount of time in the environment and will have different degrees of toxicity. Ultimately, the effects of any oil depend on where it is spilled, where it goes, and what animals and plants, or people, it affects.

Living in Space

What is life like on board a space shuttle? Different! Floating around is challenging, but it's also fun.

Effects of Microgravity

During their first hours in space, the astronauts' bodies go through a big change. On Earth, gravity pulls blood down into the veins of your legs. The muscles in your legs then help your heart by pumping the blood back up to your upper body.

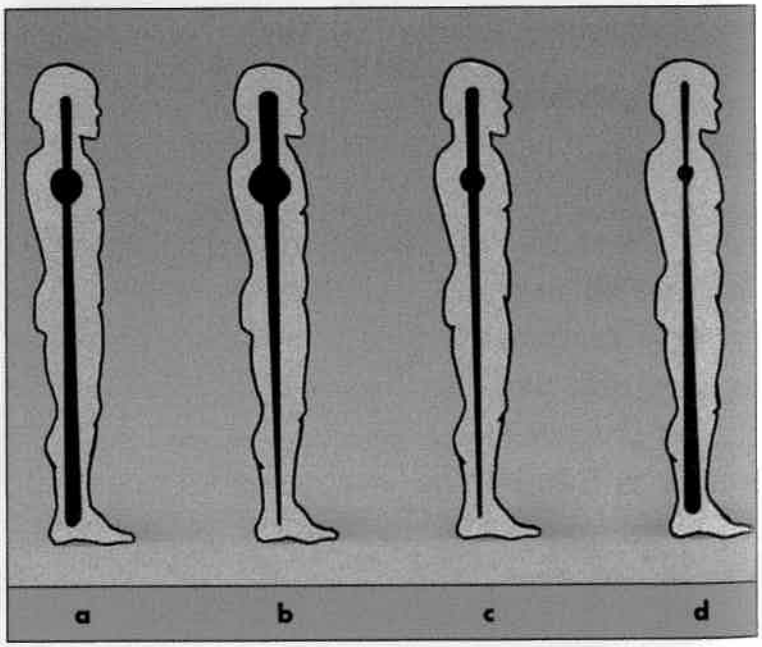
In the shuttle, there is not enough gravity to pull the blood down. But the natural muscle action in the astronauts' legs still pumps blood to their upper bodies. As a result, their upper bodies get more blood than they need.

By six to 10 hours into the flight, the astronauts' faces become puffy from the extra fluid. Any wrinkles they have disappear. Their waistlines shrink by 2 to 5 cm. Since there is less blood to be pumped, even their heart muscles shrink. Their shoes feel so loose that they have to tighten their laces!

Later, much of the excess fluid is removed through the kidneys. This cuts down on the total fluid in their bodies.

Body Changes

Figure (a) shows how blood spreads itself in a human body on Earth. In microgravity, more blood in the upper body causes the heart to get larger at first (b). When the amount of blood is less, the heart shrinks (c). Back on Earth (d), it takes a while for the blood volume to get back to its normal level. So the heart shrinks again, and little blood gets to the upper body and brain.



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Zebra Mussels

Wikipedia, http://en.wikipedia.org/wiki/Zebra_mussel

The **Zebra mussel**, *Dreissena polymorpha*, is a bivalve mussel native to freshwater lakes of southeast Russia. Zebra mussels are filter feeders. When in the water, they open their shells to admit food. Zebra mussels get their name from the striped pattern on their shells, though not all shells bear this pattern. They are usually about the size of a fingernail, but can grow to a maximum length of nearly two inches. Its native distribution is the Black Sea and Caspian Sea. Zebra mussels are considered an invasive species in North America, Great Britain, Ireland, Italy, Spain, and Sweden.

Scientific Classification	
Kingdom:	Animalia
Phylum:	Mollusca
Class:	Bivalvia
Subclass:	Heterodonta
Order:	Veneroida
Superfamily:	Dreissenoidea
Family:	Dreissenidae
Genus:	Dreissena
Species:	D. polymorpha

Effects: Zebra mussels are a great nuisance to people. Since colonizing the Great Lakes, they have covered the undersides of docks, boats, and anchors. They can grow so densely that they block pipelines, clogging water intakes of municipal water supplies and hydroelectric companies.

They also cleanse the waters of inland lakes, resulting in increased sunlight penetration and growth of native algae at greater depths. This proves beneficial for fish most of the time, helping the fish live in better conditions. They may also decrease the recreational value of inland lakes because once the mussels have devoured all the microorganisms in the water, weeds proliferate.

Reproduction: An adult female zebra mussel is one of the most reproductive organisms in the world. It may produce between 30,000 and 1 million eggs per year.

Spread: In the U.S., they were first detected in the Great Lakes in 1988. It is believed they were inadvertently introduced into the lakes in the ballast water of ocean-going ships traversing the St. Lawrence Seaway. Since adult zebra mussels can survive out of water for several days or weeks if the temperature is low and humidity is high, boats provide temporary refuge for clusters of adult mussels that could easily be released when transoceanic ships drop anchor in freshwater ports.

From their first appearance in American waters in 1988 zebra mussels have spread to a large number of waterways, disrupting the ecosystems, killing any local mussels (primarily by outcompeting native species for food, and damaging harbors, boats, and power plants). The cost of fighting the pests at power plants and other water-consuming facilities is $500 million a year in the U.S., according to the Center for Invasive Species Research at the University of California, Riverside.

A common inference made by scientists predicts that the zebra mussel will continue spreading passively, by ship and by pleasure craft, to more rivers in North America. Since no predator or combination of predators has been shown to significantly reduce zebra mussel numbers, such spread would most likely result in permanent establishment of zebra mussels in many North American waterways.

Daniels, H. & Steineke, N. (2011). *Texts and lessons for content-area reading.* Portsmouth, NH: Heinemann.