

What is Pollution?

Pollution is the addition of undesirable substances to an ecosystem.

Where Does It Come From?

There are two ways in which pollution can get into the water: directly or indirectly. Direct pollution can be dumped, poured or spewed directly into the water. An oil tanker spilling oil into the middle of the ocean would be an example of direct pollution.

Indirect pollution comes from another source (land or air) before it reaches the ocean. Eighty percent of water pollution comes from activities on land. From the land it is washed into rivers and streams and eventually into the ocean. A common type of indirect pollution is **runoff**. For example, when fertilizer is added to your lawn, some of that fertilizer will likely be washed down the nearest storm drain next time it rains or you water the lawn. The water from the storm drain, and the pollutants in it, will eventually end up in the ocean. For example, as the Wasatch Front here in Utah has become more populated, suburbs and industry have crept to the edge of the lake's wetland fringe, spilling millions of pounds of pollutants into the water every year.

Effects on Animals

Birds, mammals, amphibians, reptiles, fish and invertebrates are all affected by water pollution, but in different ways. Habitats can be ruined by pollution, leaving animals without a healthy place to live. Breeding and nursery grounds are especially susceptible to the effects of water pollution.

Amphibians, like frogs and salamanders, breathe through their skin and because water and air so easily flows into and out of their skin, amphibians are much more vulnerable to pollution in water and air than other animals. In fact, today amphibian numbers are declining all over the world. Acid rain is thought to be responsible for amphibians disappearing from streams, lakes and ponds where they were common only a few years ago.

Ingesting pollutants can also be harmful, affecting the behavior, breeding and health of many animals. These effects can be seen directly or further along the food chain. In one study the levels of pollutants in harbor seals found in the North Sea were so high that the seals were declared toxic waste!

Another example involves Utah's Great Salt Lake. Here, selenium, a naturally-occurring mineral, has been measured in large quantities. The lake is a critical habitat for and home to hundreds of thousands of birds each year. It is an important migratory stop between North and South America. Birds that feed in the open waters of the Great Salt Lake ingest selenium through their diet, by consuming brine shrimp and brine flies that have consumed it as part of their development.

Selenium exposure can cause reproductive deformities and present problems with the hatching of bird eggs. Selenium is a necessary element in bird diets and can also be toxic to birds, with only a fine line between levels that are safe or toxic. To help protect the lake and those that depend on it, the Great Salt Lake Science Panel is developing a water quality criterion for selenium that protects the birds that feed in the open waters of the Great Salt Lake.

Some pollutants, such as oil, affect marine life from the outside in, rather than the inside out. Birds and otters are especially sensitive because they rely on their feathers or fur to survive. Once its feathers are soaked in oil, a bird can no longer keep itself warm and becomes too heavy to fly. Sea otters, who have no blubber and depend on their thick fur to keep them warm, are also in danger of hypothermia once their fur is covered in oil.

Effects on Humans

It may make you sad just thinking about pollution, but did you know water pollution could really make you sick? Other animals are not the only ones who can get sick from swimming in polluted waters; humans are at risk too. Even without going near the ocean, pollution can be dangerous to humans who eat fish or other seafood from polluted waters.

What Can We Do?

Many of the products that we use in our households (oven cleaner laundry detergent, gas and fertilizers) contain some type of chemicals. These chemicals may be harmful to animals even in small amounts.

There are safer alternatives for many household cleaners. For example, instead of using scouring powder to clean a sink stain, try a damp cloth dipped in baking soda. For tougher jobs, try using steel wool. Three tablespoons of baking soda mixed with one quart of warm water can be used to clean your oven. A soft cloth and mayonnaise or one part lemon juice and two parts vegetable oil makes an effective furniture polish substitute. In the yard, replace chemical fertilizers with compost from the kitchen and yard wastes such as grass clippings and leaves.

You can also try to reduce your use of harmful chemicals, properly dispose of the chemicals that you do use and don't pour anything toxic down storm drains. Get involved and educate others by stenciling (identifying) your local storm drains so that people will be less likely use them as dump sites.

Bioaccumulation and Biomagnification

Bioaccumulation is a natural and essential process that organisms use to accumulate vitamins, minerals and essential amino acids necessary for growth. However, bioaccumulation can be harmful when pollutants find their way into the ocean. **Bioaccumulation** is the increase in the concentration of the pollutant

over time in an organism relative to the concentration of the pollutant in the environment. **Biomagnification** is the increase in concentration from one link of a food chain to the next. Bioaccumulation refers to how pollutants enter the food chain, while biomagnification refers to the tendency of the pollutant to become concentrated as it moves up the food chain.

How Does it Happen?

When pollutants enter the ocean they can be absorbed by phytoplankton and/or zooplankton. These drifting plants and animals create the base of the food chain, and the pollution continues to move up from there.

The following is an example of how bioaccumulation might affect a food chain found in the ocean. Believe it or not, this story actually begins on the land. One day Charlie decides to wash the car and then rinse the soap and water down the driveway and into a storm drain. The toxic chemicals in these products are now on their way to the ocean, where they will be absorbed by zooplankton. A herring swims by and begins feeding, unknowingly swallowing a mouthful of contaminated plankton, ingesting the toxins along with it. The herring has already begun to increase the concentration of pollutants compared to its surrounding environment, but let's see where it goes from there. Next, a larger fish called a lingcod eats several herring and the toxins are passed on and concentrated again. Finally, the toxic lingcod are eaten by a killer whale where the toxins are now concentrated enough to affect behavior, cause birth defects, and lower resistance to disease.

Effects on Animals

The accumulation of pollutants can affect marine animals in different ways. There are both lethal and sub-lethal effects. Sub-lethal effects may affect the behavior of the animal, its reproductive success or its ability to escape from predators or fight off disease. These effects can also be passed on to the animal's offspring, which can be seen in shell thinning in birds. Birds that consume contaminated fish or invertebrates lay eggs with thin shells that lower the survival rate of their chicks. In mammals, pollutants can also be passed from mother to a newborn through the mother's milk. Large, long-lived animals with abundant fatty tissue and low metabolic rates are the most susceptible to the effects of bioaccumulation, putting marine mammals at high risk.

Effects on Humans

As members of the food chain, humans are also affected by bioaccumulation and biomagnification. People can become sick from eating fish that have accumulated toxins. These processes can also affect the fishing industry by polluting their catch.

What Can We Do?

Stop pollution before it starts!