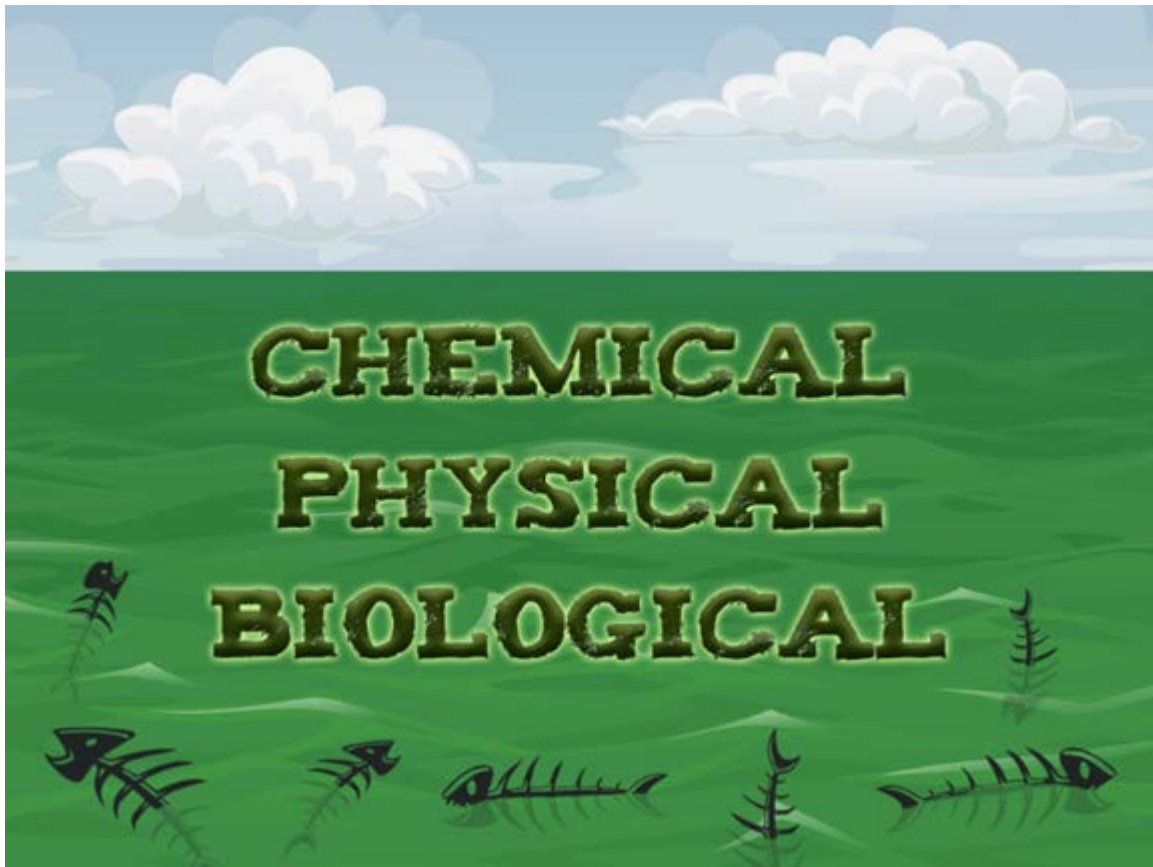


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Ocean Pollution

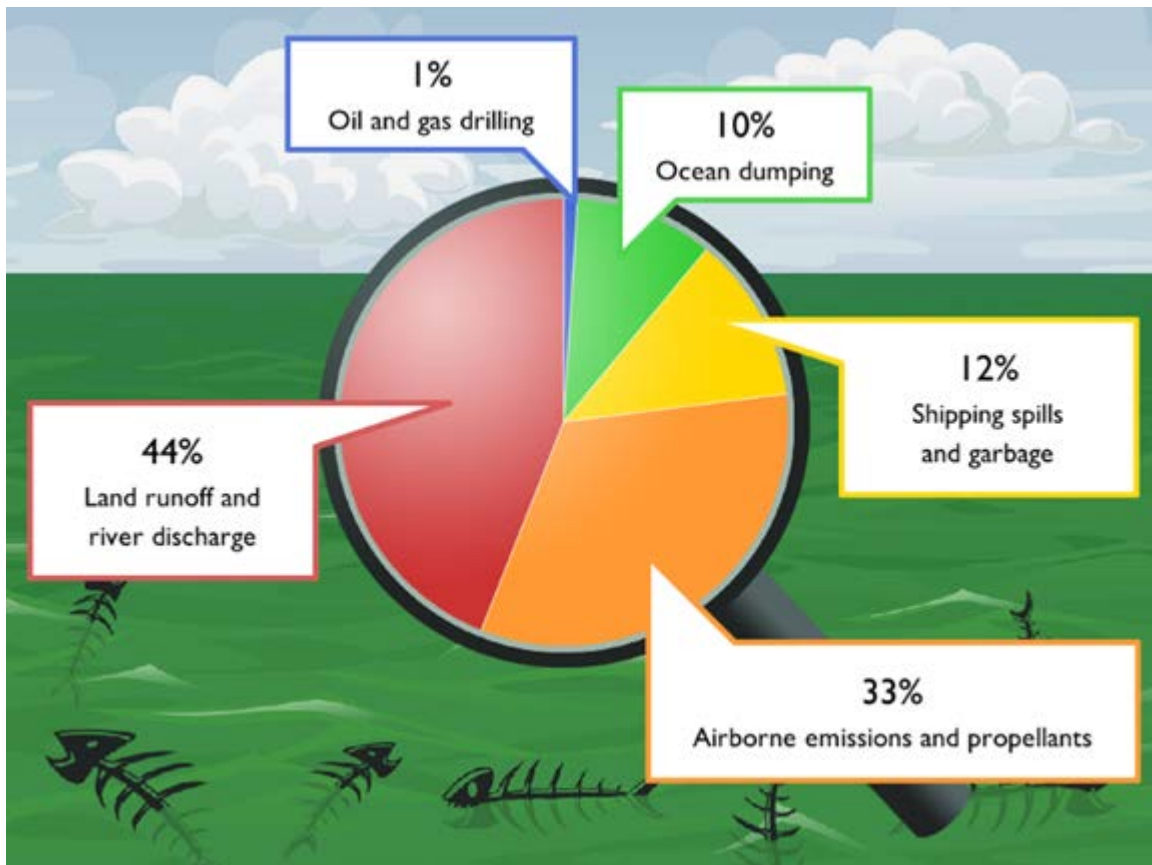
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Ocean pollution is an important modern-day environmental issue. Pollution occurs when chemical, physical, and/or biological agents are introduced into an environment and cause undesirable change or contamination. Pollution may adversely affect the organisms that depend on the resources in a polluted environment. In order to combat the challenge of ocean pollution, it is important to be educated about the types and origins of pollution.

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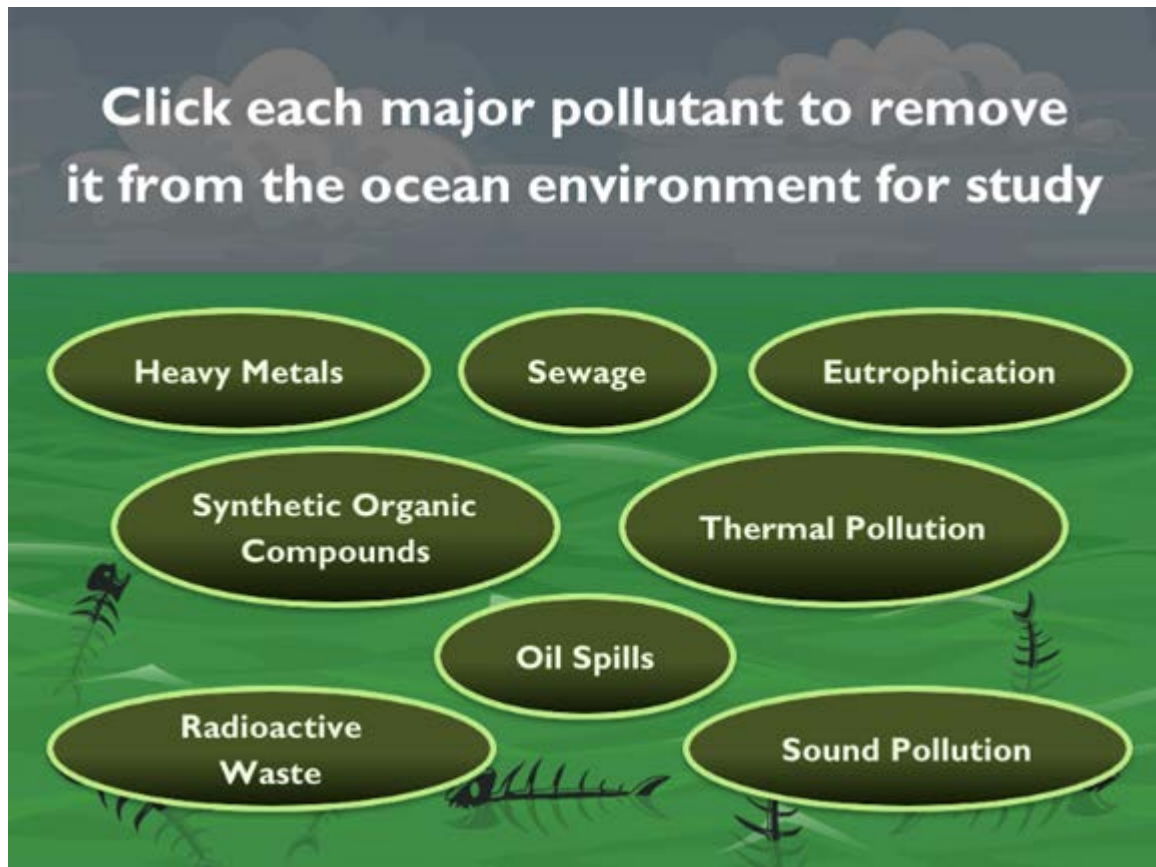
### Topic 1 Content: Ocean Pollution Notes



Finding the sources of pollution is not easy. Virtually all ocean water already contains pollution. This makes it tricky for scientists to identify new pollution, since samples are already contaminated by pollutants. The oceanic conveyor belt moves all ocean water, so pollution can be moved far from its original source. Environmental programs have still managed to estimate percentages on the sources of ocean pollution, and many scientists support the following:

- 1% comes from oil and gas drilling.
- 10% comes from ocean dumping.
- 12% comes from shipping spills and garbage.
- 33% comes from airborne emissions and propellants.
- 44% comes from land runoff and river discharge.

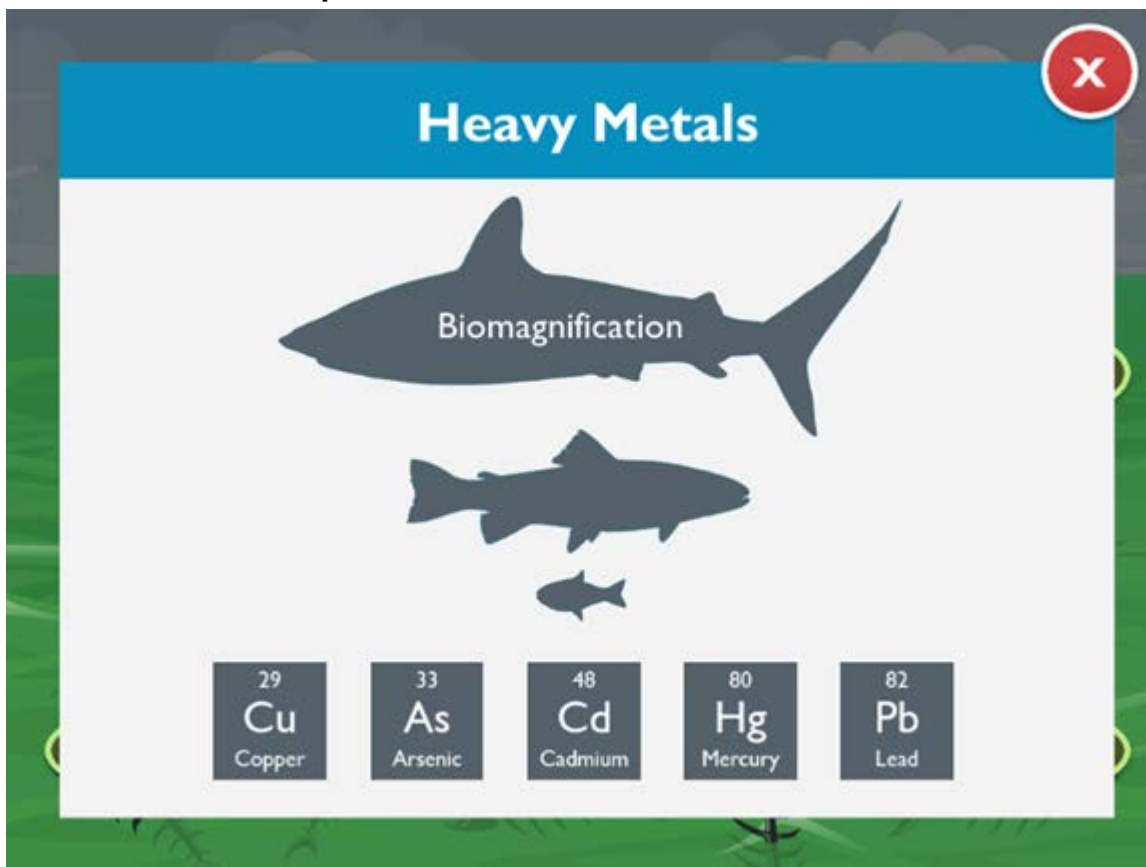
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Oceanographers have identified many sources of ocean pollution by humans. Click on each of the major types of ocean pollutants to learn how it affects the ocean environment.

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### Topic 1 Content: Ocean Pollution Notes

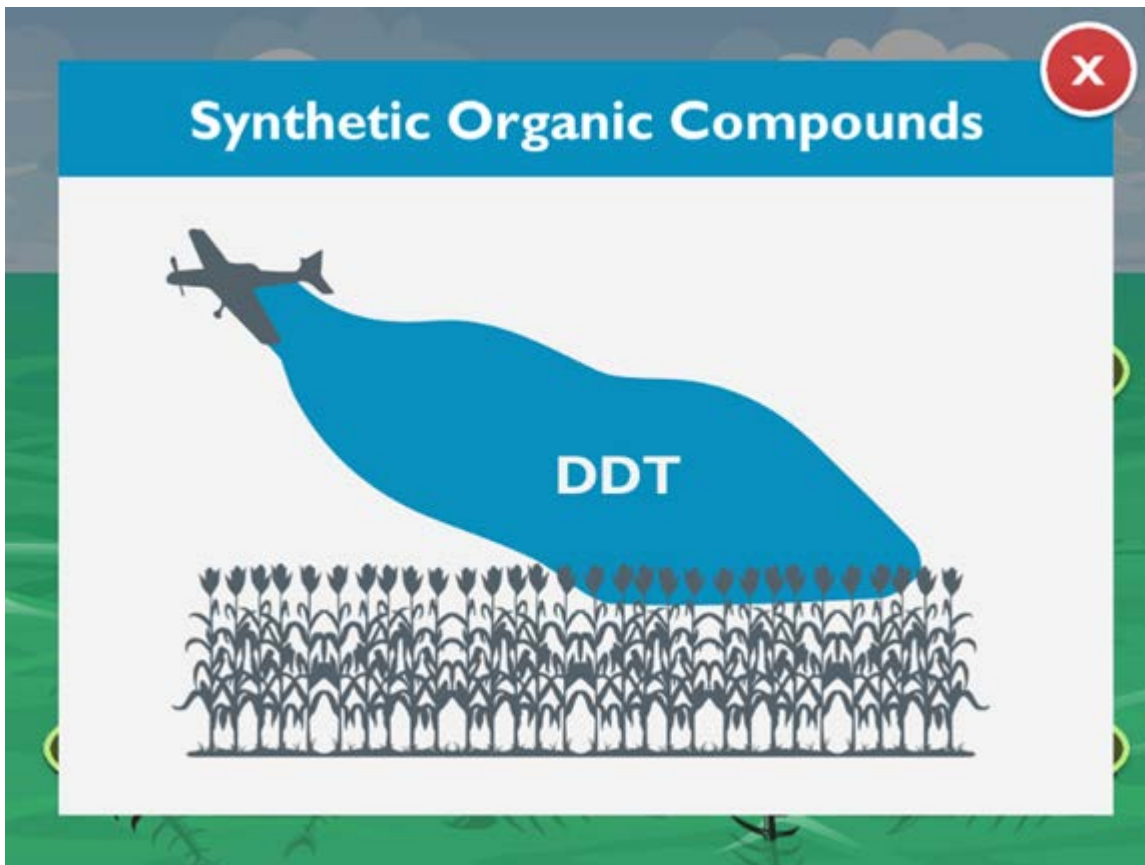


Heavy metals include lead, mercury, cadmium, arsenic, and copper. Sources of heavy metals include waste incineration, industrial work, runoff, coal combustion, oil refining, and gas fumes. Heavy metals interfere with an organism's metabolism, cause disorders, and have negative consequences for ocean life and humans. An example is mercury, which is very dangerous and can lead to neurological disorders, such as Minamata Disease.

Organisms store the pollutants in their tissues through bioaccumulation. The more an organism is exposed to the pollutant, the more metals are stored in the organism's tissue. Then, they pass these metals on to their predators when they are consumed. As the animal tissue is passed up the food chain, so are the dangerous metals. Since organisms higher in the food chain must consume more of animals lower in the food chain to maintain energy, those top consumers will have a greater concentration of dangerous metals in their body systems. This is called biomagnification.

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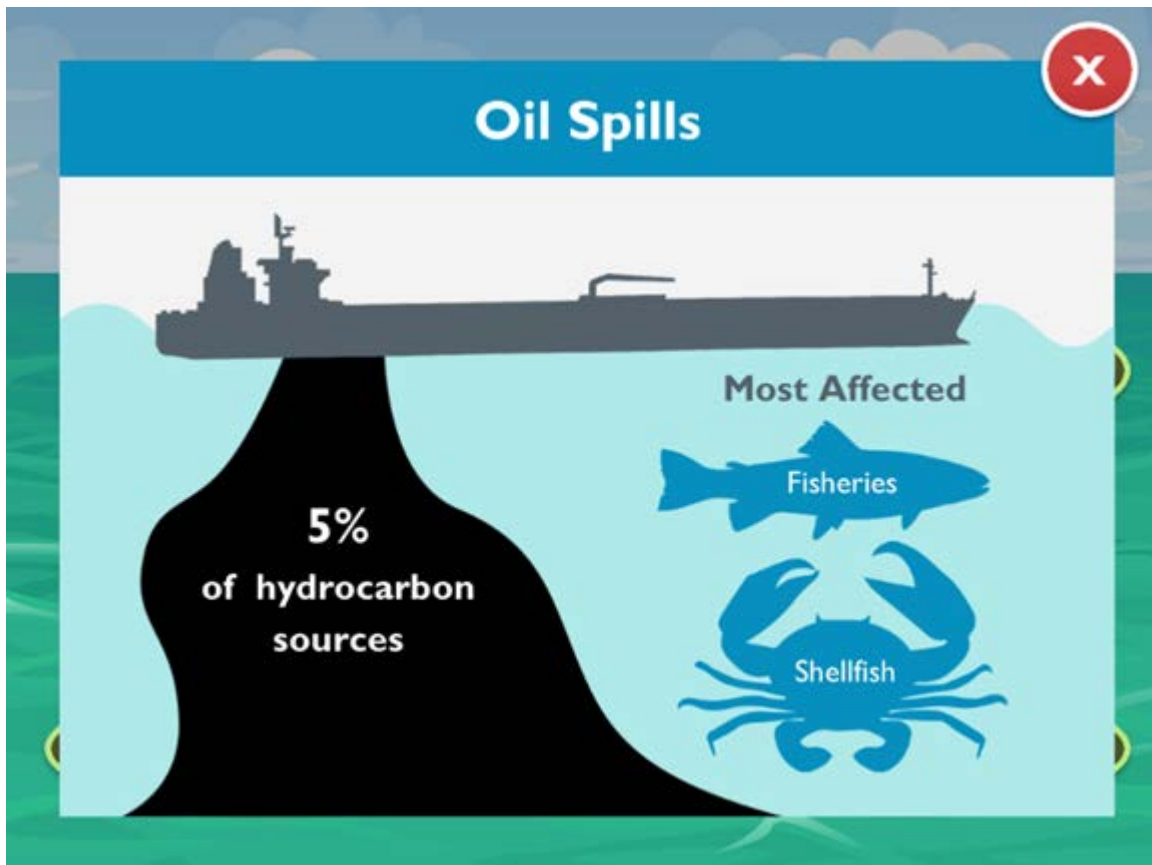


Synthetic organic compounds are manmade chemicals based on an organic molecular structure. In small amounts, their toxicity can cause major problems through bioaccumulation and biomagnification. An example of this occurred with a heavily-used pesticide dichlorodiphenyltrichloroethane, or DDT. This pesticide was not detectable in ocean water; however, it biomagnified ten million times in just five trophic levels.

Other synthetic organic compounds include Aldicarb, Benzene, Carbon Tetrachloride, Chloroform, Dioxin, Ethylene Dibromide, Trichloroethylene, Vinyl Chloride, and Polychlorinated Biphenyls or PCBs. Beluga whales accumulate so much polychlorinated biphenyls or PCBs, that when they die, their carcasses are considered hazardous waste.

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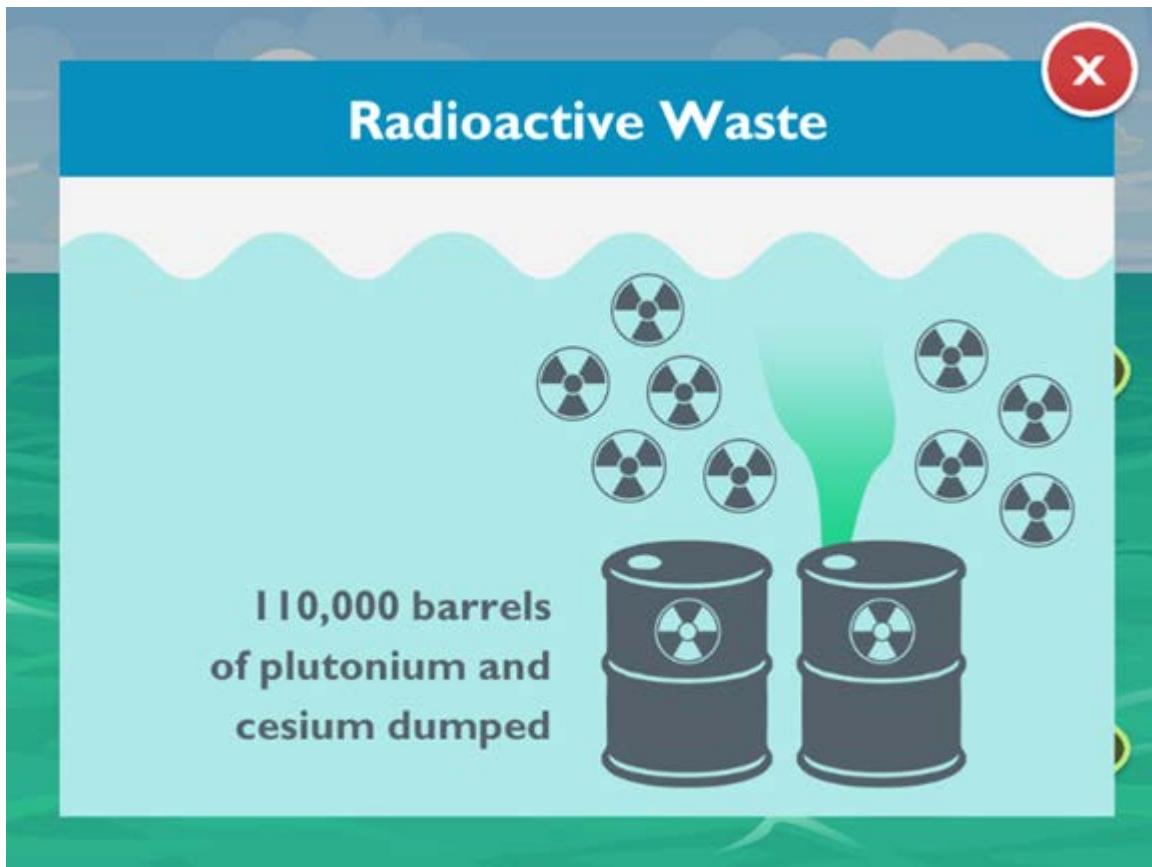
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Although oil spills are damaging to the ocean environment, they do not pose the largest threat to the ocean in context to other pollutants. The spilling of oil is actually less of an environmental concern than other factors; however, six million hydrocarbons enter the oceans per year. Oil tanker accidents equal five percent of the hydrocarbon sources, but runoff dumps two hundred forty million gallons per year. Oil spills affect fisheries and shellfish the most.

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Radioactive waste comes from nuclear-waste dumping, which started in the 1940s. The United States dumped 110,000 barrels of plutonium and cesium in several areas off of the Eastern Coast, and some of these barrels still leak. Oceanographers have said that they can track the leaking and actually map deep ocean circulation.

While the ocean may be vast enough to disperse some of the radioactive material, experts believe that some radioactive elements deposit on the seafloor or are suspended in the water and carried by the currents. Organisms at the bottom of the food chain can absorb the radioactive elements and eventually be consumed by fish, marine mammals, and humans. It is difficult to quantify the effects of radioactive material on marine life because those effects may not present themselves for decades, or even centuries.



## Module 10: Environmental Oceanography

### Topic 1 Content: Ocean Pollution Notes

The infographic is titled "Eutrophication" in a blue header. Below the title, a light blue box labeled "Sources" contains a bulleted list: Fertilizer and agriculture runoff, Septic systems, Factory effluent, and Soil erosion. At the bottom, there are two clusters of green, spherical algae. Between them are two dark grey boxes: the first contains the number "7", the letter "N", and the word "Nitrogen"; the second contains the number "15", the letter "P", and the word "Phosphorus". A red circular button with a white "X" is in the top right corner of the infographic.

## Eutrophication

### Sources

- Fertilizer and agriculture runoff
- Septic systems
- Factory effluent
- Soil erosion

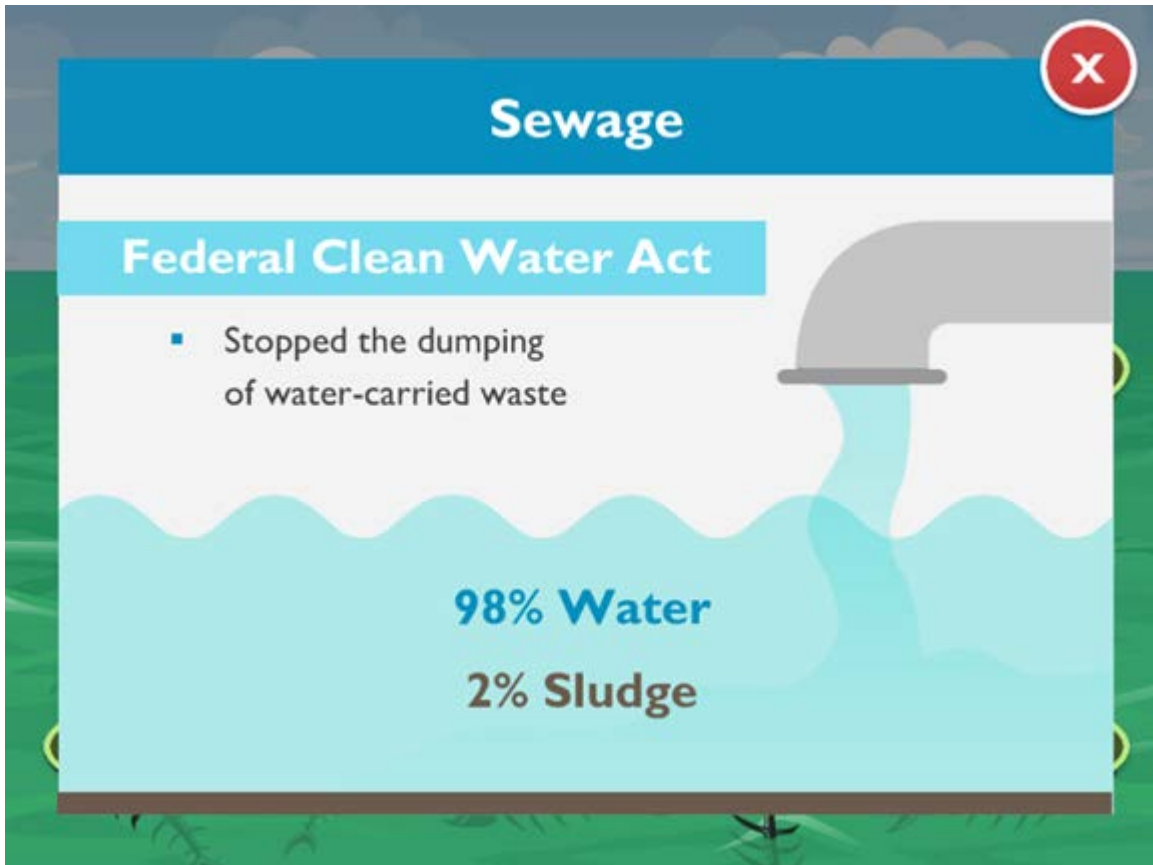
7  
N  
Nitrogen

15  
P  
Phosphorus

Eutrophication occurs when excess nutrients such as nitrogen and phosphorus run off the land and enter the ocean, where they can cause algae or phytoplankton to bloom in harmful levels. Sources of this runoff include fertilizer and agriculture run-off, septic systems, factory effluent, and soil erosion.

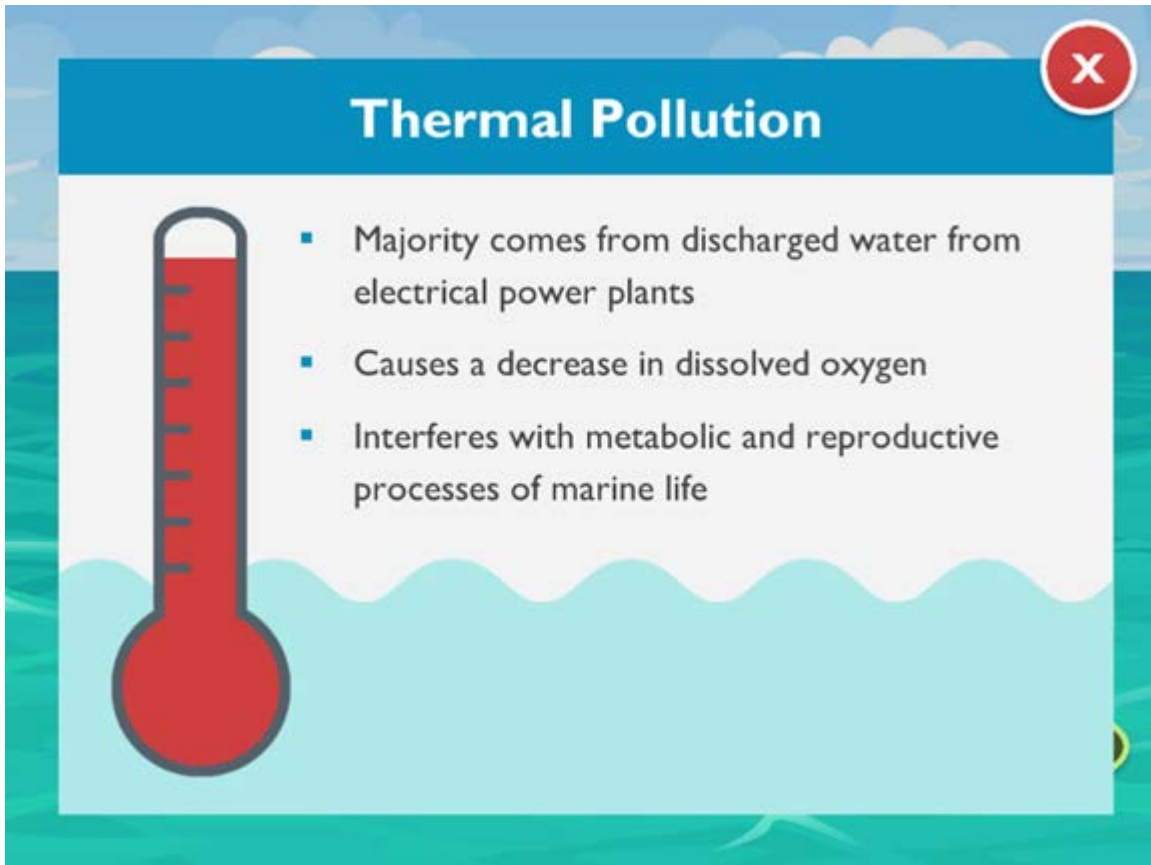
## Module 10: Environmental Oceanography

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Sewage dumping in the water was allowed until 1972, when the Federal Clean Water Act stopped the dumping of sewage, or water-carried waste. Now, water is cleaned in sewage treatment plants and then dumped into the ocean. Nearly 98% of this treated sewage is water, and the other two percent is concentrated solids in the form of sludge. The sludge sinks to the bottom and creates an oxygen-depleted environment. About ten million tons of sludge are dumped near the continental shelf.

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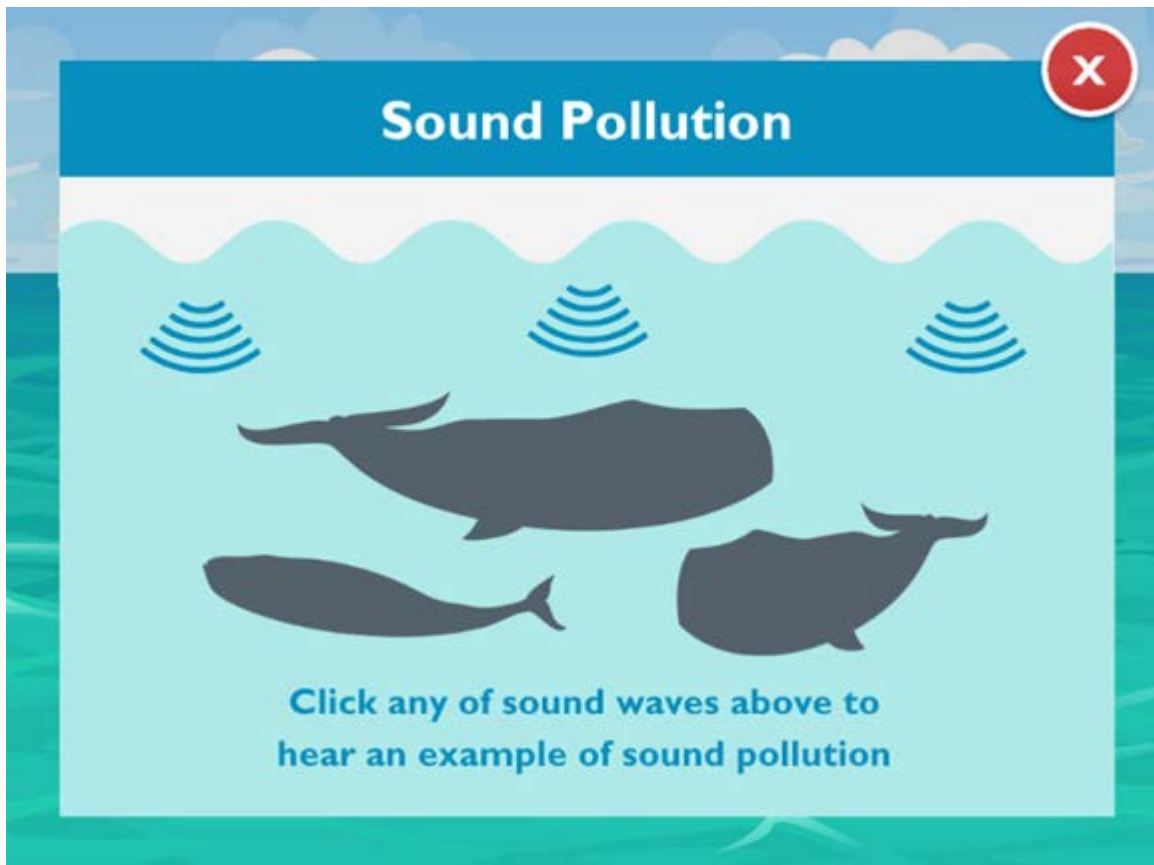
The infographic features a blue header with the title "Thermal Pollution" in white. To the right of the title is a red circular button with a white "X". Below the header is a white rectangular area containing a red thermometer on the left and a bulleted list on the right. The background of the infographic is a stylized ocean with blue waves and a light blue sky.

## Thermal Pollution

- Majority comes from discharged water from electrical power plants
- Causes a decrease in dissolved oxygen
- Interferes with metabolic and reproductive processes of marine life

Thermal pollution is the human-induced increase in the temperature of a body of water. Most thermal pollution comes from electrical power plants that discharge heated water into the oceans. Higher water temperatures can cause a decrease in dissolved oxygen. Higher water temperatures can also interfere with the metabolic and reproductive processes of marine life.

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Sound pollution is the introduction of environmental-degrading sound that can adversely affect organisms. Scientists think ship and SONAR noise could interfere with animal life. This area of marine pollution needs more study.