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- for students to copy in their own hand-writing
 - ◆ in order to complete their class notes
 - ◆ if student did not have enough time in class
 - ◆ if student was away and missed this section
- for assistants and tutors to follow progress of the concepts taught

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2.3 Effect of Bioaccumulation on Ecosystems



- **Amphibians (like frogs) live on both land and in the water.**
 - ◆ They are also sensitive to chemicals changes in the environment.
 - ◆ They are therefore valuable indicators of environmental health.
 - ◆ Since the 1980s, much of the world's amphibian species have suffered declines in population.
 - ◆ There has also been alarming increases in amphibian birth deformities in that time.
 - ◆ Many theories attempt to explain these changes, including drought, increased UV rays, pollution, habitat loss, parasites and diseases.



Amphibians, like this frog, have exhibited drastic changes since the 1980s.

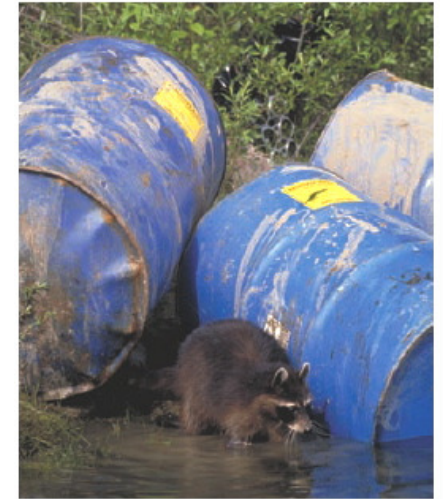
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Bioaccumulation



- **Bioaccumulation refers to an organism slowly building up the amount of chemicals in their bodies.**
 - ◆ Many harmful chemicals cannot be decomposed naturally.
 - ◆ These chemicals can be eaten or absorbed, and sometimes cannot be removed from the body of the organism effectively.
 - ◆ If a keystone species suffers a chemical bioaccumulation, it can affect every other organism in its far reaching niches.
 - A keystone species is a vital part of an ecosystem.
- **Biomagnification refers to the animals at the top of the food pyramid receiving huge doses of accumulated chemicals.**
 - ◆ At each level of the food pyramid, chemicals that do not get broken down build up in organisms.
 - ◆ When the consumer in the next trophic level eats organisms with a chemical accumulation, they receive a huge dose of the chemical(s).

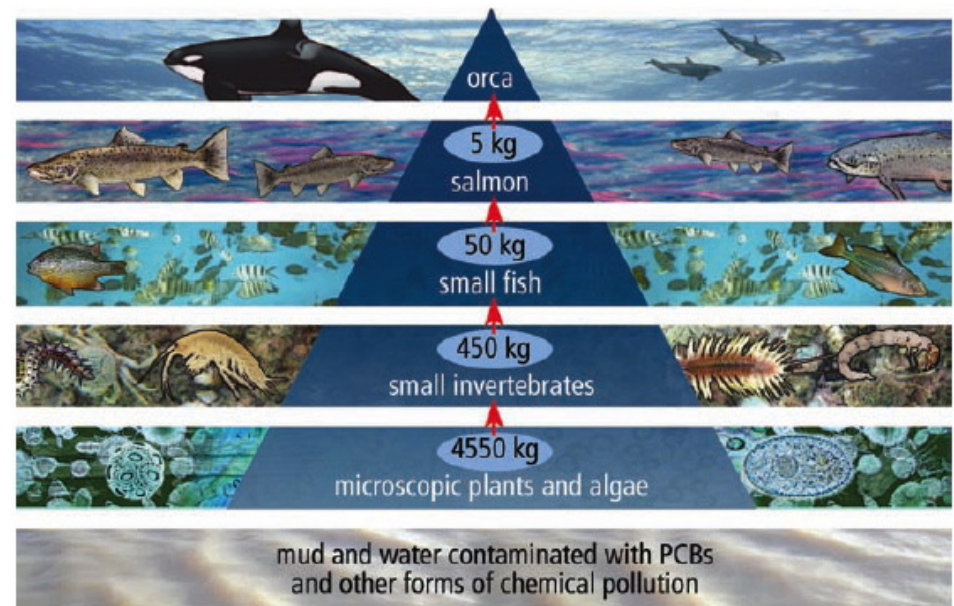


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Bioaccumulation (continued)



- An example of bioaccumulation in BC is the effect of PCBs on the Orca.
 - ◆ PCBs are a chemical that were used for many industrial and electrical applications in the mid 20th century.
 - ◆ PCBs were banned in 1977 because of fears of their environmental impact.
 - PCBs bioaccumulate, and also have a long-half life (they break down very slowly).
 - PCBs will affect the reproductive cycles of Orcas until at least 2030.



The bioaccumulation of PCBs begins with the absorption of the chemicals by microscopic plants and algae.

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Bioaccumulation (continued)



- **Chemicals like PCBs and DDT are called persistent organic pollutants (POPs)**
 - ◆ **POPs contain carbon, like all organic compounds, and remain in water and soil for many years.**
 - ◆ **Many POPs are insecticides, used to control pest populations.**
 - **DDT was introduced in 1941 to control mosquito populations, and is still used in some places in the world.**
 - **Like PCBs, DDT also bioaccumulates and has a long half life.**
 - **At even low levels (5 ppm), DDT in animals can cause nervous, immune and reproductive system disorders.**
 - **ppm = parts per million**



Spraying DDT, 1958

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Bioaccumulation (continued)



- **Heavy metals also bioaccumulate.**
 - ◆ **Lead, mercury and cadmium of the most polluting heavy metals.**
 - ◆ **Lead is found naturally at low levels, but levels have increased.**
 - **Lead is not considered safe at any level.**
 - **Many electronics contain lead, and must be recycled carefully.**
 - **Lead can cause anemia, nervous and reproductive system damage.**
 - ◆ **Cadmium is also found in low levels naturally.**
 - **Cadmium is used in the manufacture of plastics and nickel-cadmium batteries.**
 - **It is toxic to earthworms, and causes many health problems in fish.**
 - **In humans, the main source of cadmium exposure is cigarette smoke.**
 - **Cadmium causes lung diseases, cancer, nervous and immune system damage.**



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Bioaccumulation (continued)



- ◆ Mercury also is found naturally.
- ◆ Much more has entered ecosystems through the burning of fossil fuels, waste incineration, mining and the manufacture of items like batteries.
 - Coal burning adds 40% of of the mercury released into the atmosphere.
- ◆ Mercury bioaccumulates in the brain, heart and kidneys of many animals.
 - Fish bioaccumulate mercury compounds, adding risk for any organisms eating fish.
- Reducing the effects of chemical pollution
 - ◆ By trapping chemicals in the soil, they cannot enter the food chains as easily.
 - ◆ Bioremediation is also used, as micro-organisms or plants are used to help clean up, and are then removed from the ecosystem.
 - The oil industry will often use bacteria to “eat” oil spills.
 - ◆ Certain natural species are also excellent at bioremediation.

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[Take the Section 2.3 Quiz](#)

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