

2.3 Effect of **Bioaccumulation** on Ecosystems

- Amphibians are valuable **indicators** of environmental health because they're sensitive to chemical changes.
- Since the 80s the world amphibian population has declined & birth deformities have increased.
- This may be due to: drought, increased UV rays, pollution, habitat loss, parasites & diseases.



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

Bioaccumulation

- **Bioaccumulation**: a slow build up of chemicals in the bodies of organisms.
 - If bioaccumulation occurs in a **keystone species**, it can affect every other organism in its far reaching **niches**.
- Eg. bioaccumulation of PCBs in the B.C. Orcas.
 - PCBs will affect the reproductive cycles of Orcas until at least 2030, even though they were banned in '77.

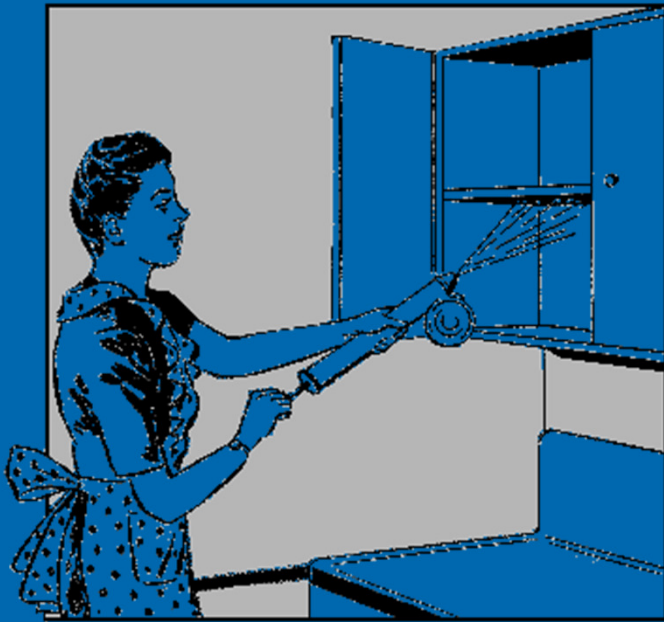


- Chemicals like **PCBs** and **DDT** & other insecticides are called **persistent organic pollutants (POPs)**.
 - **POPs** contain **carbon**, & remain in water & soil for many years (like all organic comp)
 - **DDT**, even at low levels (5 **ppm**) causes nervous, immune & reproductive system disorders in animals.
 - **ppm** = parts per million

Spraying DDT,
1958



DDT



DDT... FOR CONTROL OF HOUSEHOLD PESTS



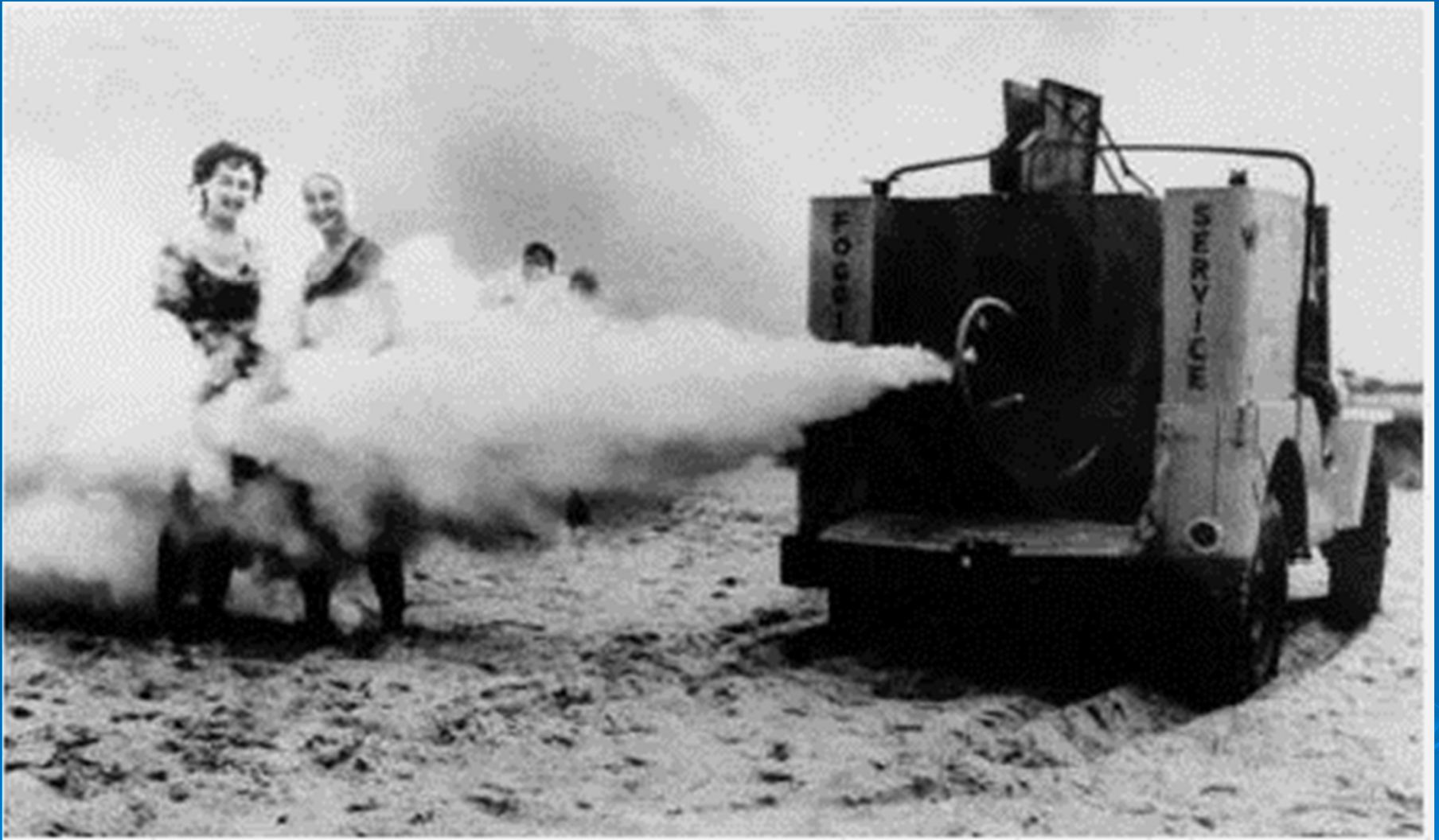
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DDT was first used in WWII to protect against diseases such as typhus and malaria.

It is cheap and effective as an insecticide - so it began to be manufactured for home use.

Before it was banned in 1972 by the EPA for use in agriculture, **1,350,000,000 pounds** of DDT had been made in North America.







➤ **Heavy metals also bioaccumulate.**

- Lead, cadmium & mercury are the most dangerous.
 - **Lead** is not considered safe at any level, it can cause anemia, nervous & reproductive system damage.
 - **Cadmium** is toxic to earthworms & causes many health problems in fish.
 - **Cadmium** causes lung diseases, cancer, nervous & immune system damage in humans (exposure to cigarette smoke).



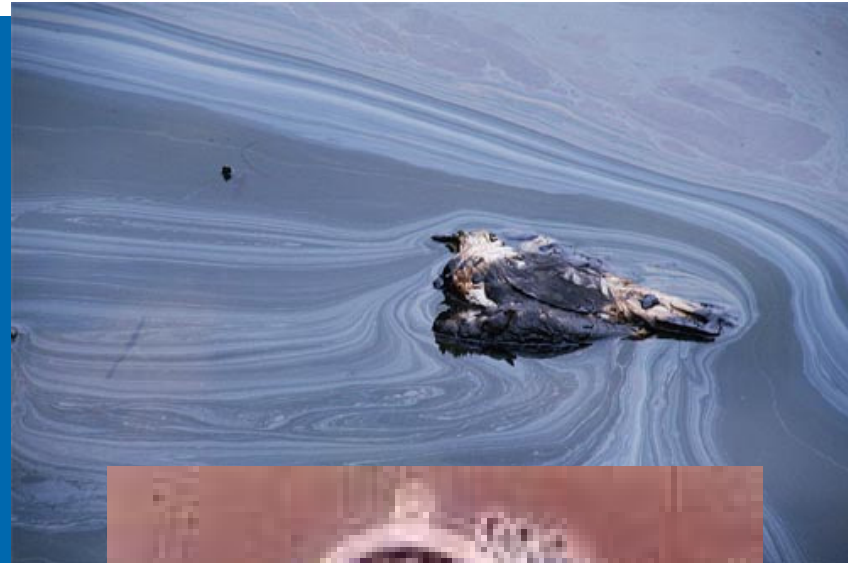
- **Mercury** enters ecosystems through burning of fossil fuels, waste incineration, mining & the manufacture of batteries.
 - Coal burning adds 40% of the mercury released.
 - Mercury **bioaccumulates** in the brain, heart & kidneys of many animals (Fish **bioaccumulate** mercury, adding risk for any organisms eating fish).

- Reducing the effects of chemical pollution
 - If chemicals are trapped in the soil, they cannot enter the **food chains** as easily.
 - **Bioremediation**: micro-organisms or plants are used to help clean up, and are then removed from the ecosystem. Eg. The oil industry will often use bacteria to “eat” oil spills.

Bioremediation

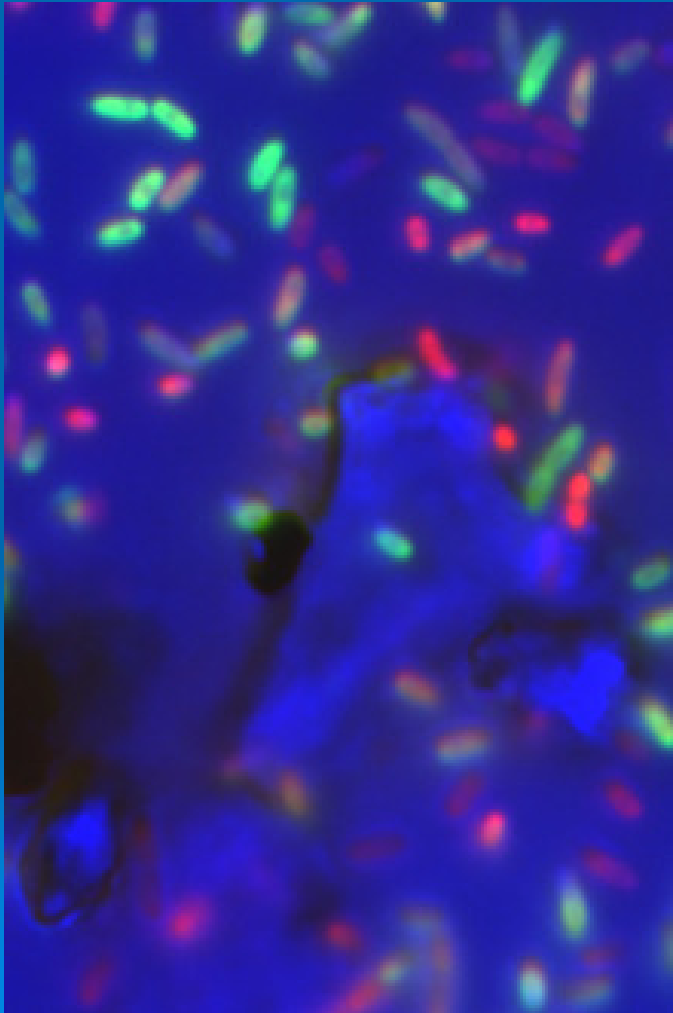


Rhodococcus bacteria can biodegrade PCBs



Bacteria can be used to clean up oil spills and underground leaks

A Bright Idea!

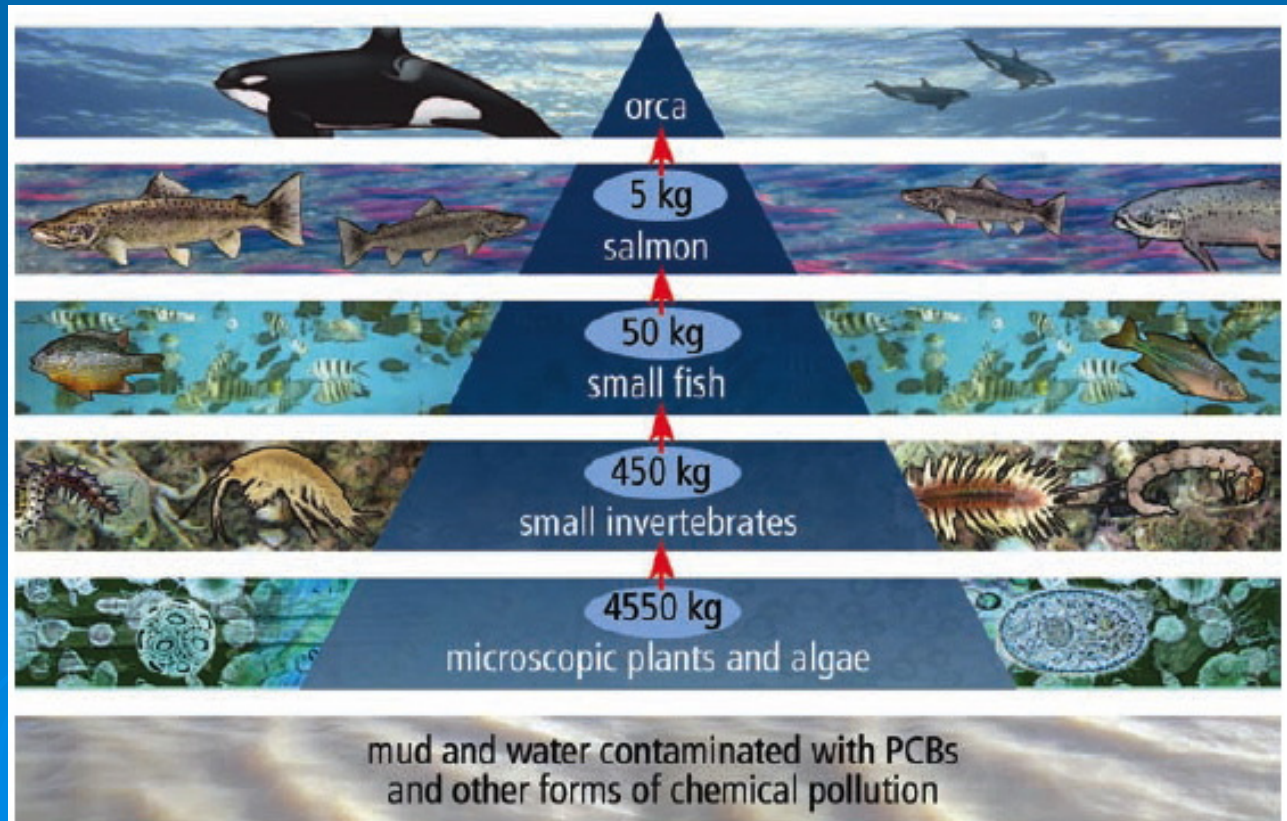


Recently, scientists were able to change a gene in these chemical-eating bacteria allowing them to **fluoresce** (glow) when they are in contact with oil or other chemical pollutants!

Biomagnification

Biomagnification: the consumers in each trophic level receive larger doses of accumulated chemicals than the one before it.

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



Food Chain

Top Predators

Seals, sharks, eagles, loons

Secondary Consumers

Crabs, lobster, mackerel

Primary Consumers

Blue mussels, snails, clams

Primary Producers

Algae, seagrasses

Water and Sediment



Contaminant Concentrations