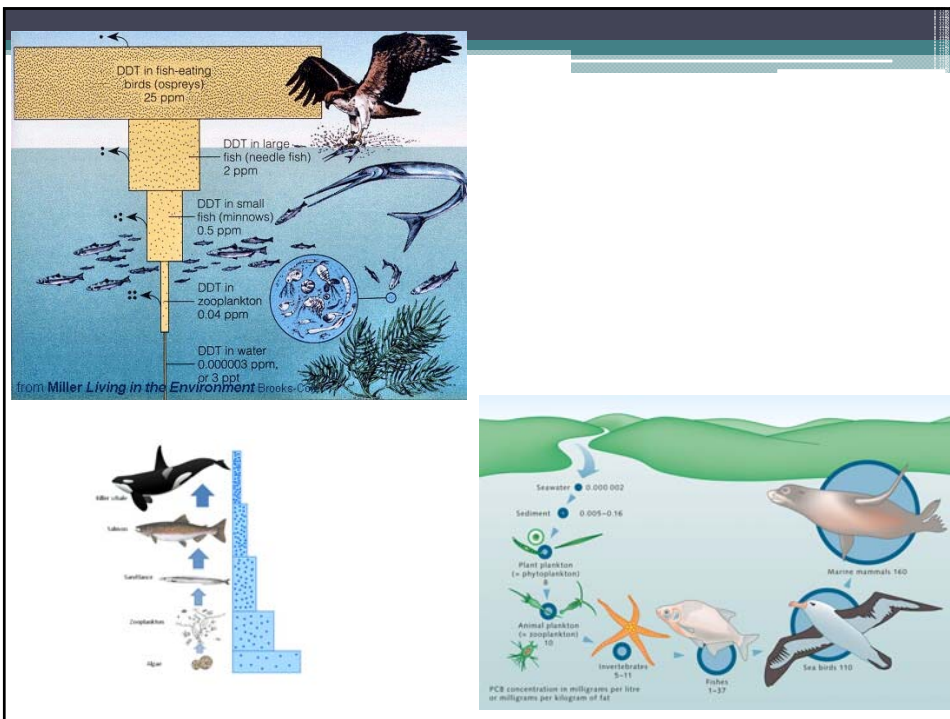
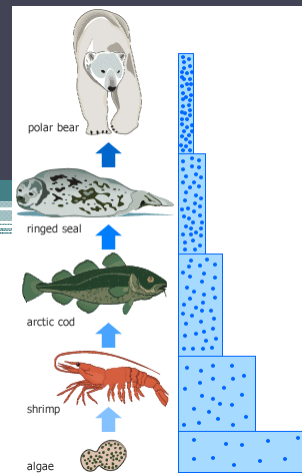


Effects of Bioaccumulation on Ecosystems

2.3



Key Ideas

- Synthetic chemicals enter the environment in air, water and soil
- Plants can take up these chemicals and the chemicals **bioaccumulate** in the fat tissue of herbivores and carnivores
- There are heavy metals – lead, cadmium, and mercury that negatively affect organisms
- Bioremediation help clean up chemical pollution

Amphibians indicate the health of an ecosystem

- because they live both in water and land
 - Frogs have been found to have some major malformations. Also seen in salamanders and toads



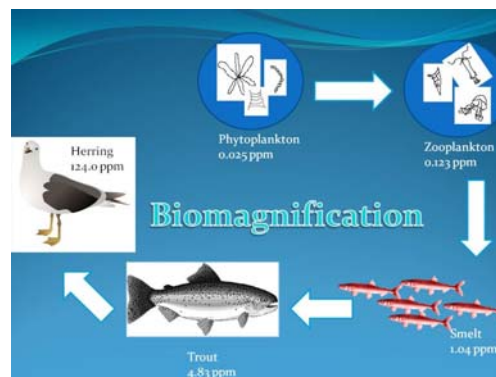
Amphibians

- Some of these malformations are due to drought, uv light, depletion of ozone layer
- Other reasons include:
 - Habitat loss
 - Pollution
 - Overhunting
 - Parasites
 - Disease
 - Fungi
 - Pesticides

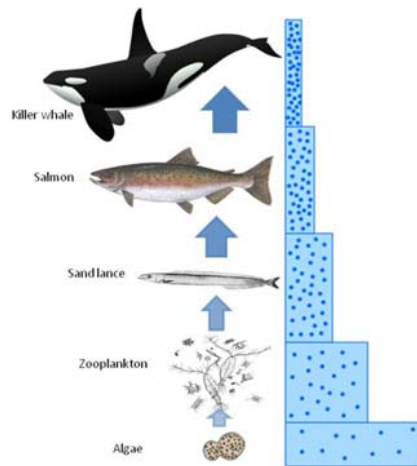


How Pollutants Climb the Food Chain

- Natural disturbances like forest fires and invasive species can disturb natural ecosystems.
- Human activities can make drastic changes to ecosystems but the most impactful are **synthetic (human-made) chemicals**.



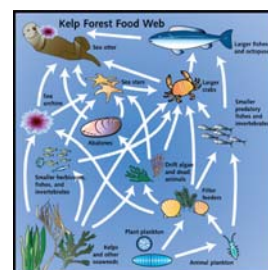
Bioaccumulation



- **Is the gradual buildup of chemicals in living organisms**
 - Enters through food, skin or respiration
- High concentrations of chemicals can be dangerous
 - Storage in fat tissue and harmful when fat is burned
 - Can also be harmful if not metabolized (taken in and stored faster than it is broken down).

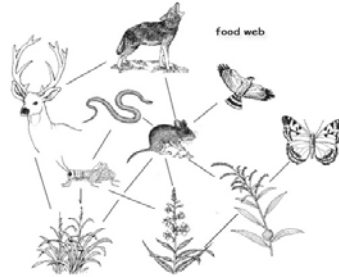
Bioaccumulation

- Bioaccumulation can affect nervous, immune and reproductive systems
- May be a small problem to individual organisms but may affect entire ecosystems when **keystone species** are affected.



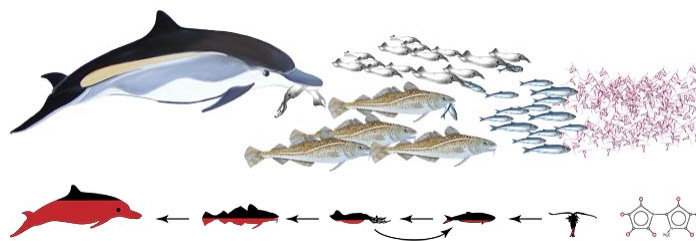
Keystone Species

- A keystone species is a species that can greatly affect population numbers and the health of an ecosystem
 - Salmon is a keystone species because it provides nutrients for bears, wolves, eagles, otters in the fall.
 - Also their decaying bodies, after spawning, provide important nutrients – like nitrogen for trees
 - Transfer chemicals



Biomagnification

- When chemicals become more concentrated as you move up each trophic level
- Herbivores eat lots of plants, much more so than their body weight
- For this reason, even small concentrations of chemicals in producers can build up and cause problems



PCBs and Orca

- PCBs (polychlorinated biphenyls) are synthetic chemicals that were used in paints, plastics, heat exchanges, and lubricants
- They have a very long **half life** and stay in the ecosystem a very long time



PCB's are POPs!

- PCB's belong to a class or Persistent organic pollutants
- They remain in soil and water for many years, usually through insecticide sprays
- DDT (Dichloro-diphenyl trichlorethane) controlled disease-carrying mosquitoes



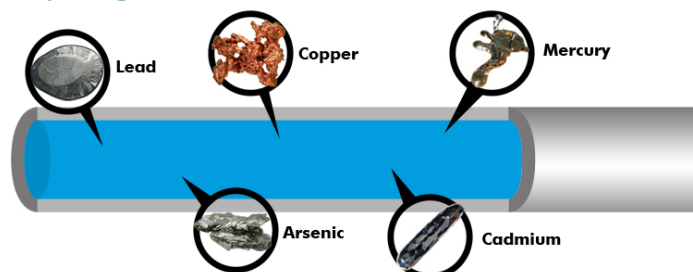
DDT

- Binds strongly with soil and persists for as long as 15 years
- Bioaccumulates in fish, bird, and animals that eat plants
- Initially accumulates in plankton
- ppm – parts per million (Hot water tank 150L and eyedropper)
- DDT is harmful for at 5ppm



Heavy Metals

- Metallic elements with high density that are toxic to organisms at low concentrations
- Three most polluting heavy metals are
 - Lead (Pb)
 - Cadmium (Cd)
 - Mercury (Hg)



Heavy Metals

- **Lead**
 - 0.0012ppm is not considered safe
 - Can cause anemia, nervous system damage, sterility in men, infertility in women, kidney failure
- **Cadmium**
 - Enters environment through weathering, volcanoes, and forest fires
- **Mercury**
 - Burning coal – 40% of Hg in atmosphere
 - Burning fossil fuels (waleye)



Reducing Effects of Chemical Pollution

- Scientists constantly working to solve the problem. A few methods have been tried.
- 1. **Trapping contaminant in soil**
 - Ex. Add phosphate to lead-contaminated soil. A chemical reaction occurs, the resulting pyromorphite can not be easily spread by water → less harmful.

Reducing Effects of Chemical Pollution

2. Bioremediation

- Uses living organisms to clean-up pollutants naturally.
- Micro-organisms that naturally feed on chemicals and turn into non-toxic compounds.
- Plants can also act as natural traps to biodegrade hazardous wastes in soil, taking in and concentrating heavy metals in their tissues.

Reducing Effects of Chemical Pollution

2. Bioremediation

- Most often used in resource industries (forestry, mining, energy production).
- Oil industry often uses bacteria to clean up spill and underground leaks.

