PESTICIDES

Pesticides are chemicals designed to kill pests.

- A pest is an organism that people consider to be disturbing or unwanted.

Today, pesticides can be grouped into four categories:

1. **Insecticide:**
   - These are used to kill insects.
   - They can stay in the environment for 1-12 weeks or up to 15 years.

2. **Herbicide:**
   - These are used to kill weeds.
   - They usually only stay in the environment for a few days or weeks.

3. **Fungicide:**
   - These are used to kill moulds and other fungi.
   - They usually only stay in the environment for a few days.

4. **Bactericides:**
   - These are used to kill bacteria.
   - The time they stay in the environment is mostly a few days.

Broad-spectrum Pesticides:

- Toxic to a wide range of species

Narrow-spectrum Pesticides:

- Toxic to a limited number of species

Possible Effects of Regular Pesticide Use:

1. Non-target species:
   - kill non-damaging or beneficial organisms
     ↳ Honeybees - essential for pollinating fruit crops
2. Bioamplification:
   - predatory birds: ospreys, bald eagles, peregrine falcons
3. Development of Pesticide Resistance:
   - requires higher concentration of pesticide to have the same effect

Alternatives to Pesticide Use

1. Organic farming – no synthetic pesticides or fertilizers
2. Biological control – predatory insects, mites, disease-causing micro-organisms prey on & infect pest species
   wasps, ladybugs
3. Altered timing – avoid peak pest populations
4. Crop rotation and mixed planting –
   no monocropping
   - monocultures in the same location year after year pest populations prosper

Bioaccumulation and Biomagnification

Bioaccumulation

- Organisms get rid of wastes and toxins from their body through urine or sweat.

- Some toxins, such as heavy metals (mercury) and pesticides (DDT) are not soluble in water but are fat soluble.

- Because these toxins are not water soluble they are not eliminated by the body. Instead these toxins accumulate or are stored in the fatty tissues of the body.

- As an individual continues to eat food contaminated with these toxins they accumulate high amounts of the toxin in their body. This process of accumulation is called **bioaccumulation**.

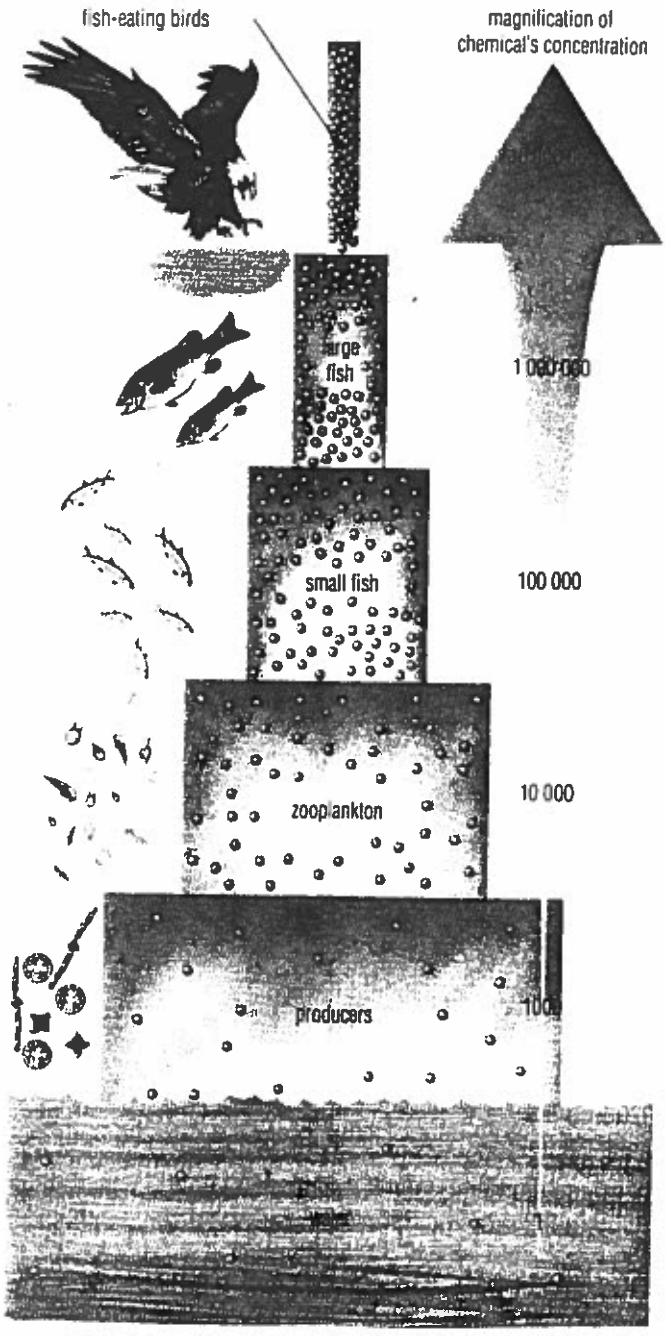
Bioamplification (also called Biomagnification)

- All organisms are part of a food chain, so toxins stored in the fatty tissue of one trophic level are passed on to the organisms of the next trophic level.

- The higher the organism is in the food chain, the more concentrated the toxin becomes. This process is called bioamplification.

- As the toxin bioamplifies in a food chain, it may reach toxic concentrations.

- Many species of predatory birds including bald eagles declined in numbers because the pesticide DDT bioamplified in their bodies and interfered with the birds ability to produce strong egg shells.



Case Study: DDT in a Food Chain

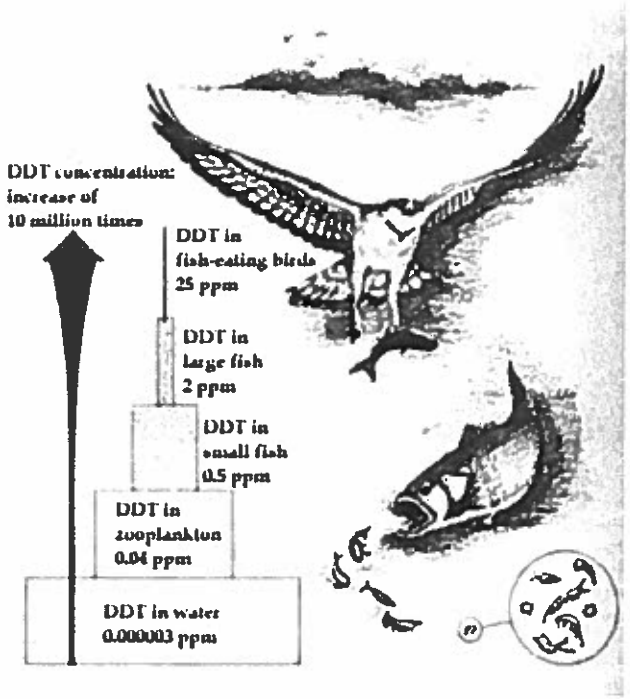
The risks of using powerful pesticides in ecosystems first became widely known during the 1950s and 1960s, when the toxic effects of the insecticide DDT were recorded. DDT was one of the first and most powerful pesticides developed. During World War II, it was used to control populations of insects (such as body lice and mosquitoes) that can transmit deadly diseases to people. As a result, the rate of death from malaria, bubonic plague, typhus, and yellow fever fell dramatically. DDT was also used widely on crops to control damage caused by insect pests.

About ten years after the first use of DDT, signs of trouble appeared. Dead birds, fish, frogs, and other animals were found in areas that had been heavily sprayed with DDT. The fat in their bodies contained high levels of the pesticide. Harmless or beneficial insects, such as butterflies and honeybees, also started to disappear from areas that had been sprayed.

Tests of soil and water showed that DDT remained in the environment for many years. For example, DDT was still found in the soil of some heavily sprayed orchards ten years after the spraying was stopped. DDT was also found in the bodies of many different organisms around the world where the insecticide had never been used. It also began showing up in the tissues of people.

An unexpected outcome of using DDT was its effect on populations of birds of prey. Numbers of hawks, eagles, and ospreys on farmlands across North America and Europe fell sharply during the 1950s and 1960s. Scientists discovered that DDT reduced the ability of these birds to produce normal eggshells. Affected birds laid eggs with thin shells that broke in the nest, so they were unable to produce the usual number of young. The adult birds accumulated DDT in their bodies from the fish they ate. The amount of DDT had accumulated in the bodies of organisms, moving from producers to primary consumers, to secondary consumers, and so on in a process called biomagnification. This process is illustrated in the diagram on the next page. The concentration of DDT in each organism is given in parts per million (ppm). One ppm is equivalent to 1mg/L.

DDT has not been banned worldwide, because in some cases, its societal benefits outweigh its environmental risks. DDT is used responsibly in mosquito-infested parts of Africa in homes and on mosquito nets. This saves millions of lives by combating an often lethal disease called malaria, which is carried by mosquitoes.



Questions: Use the diagram and the text to answer these questions!

1. Why was DDT used in the early 1900s?
2. How does DDT enter a food web? At what trophic level does DDT enter a food web?
3. What is the relationship between the trophic level of an organism and the concentration of DDT in its body?
4. How many times greater is the concentration of DDT in the large fish than in the seawater?
5. How could an animal living hundreds of kilometers from an area sprayed with DDT get DDT into its body?
6. DDT is stored in body fat and remains toxic for many years. Explain why these characteristics are undesirable in a pesticide. What characteristics would you want in a pesticide to make it less harmful to non-pest organisms?
7. Explain why animals at the top of a food chain are particularly at risk from poisons in the environment.
8. Why is DDT still used in some parts of the world today, even though its risks are well known?