

Examining Bioaccumulation and Biomagnification

Key Question: How does matter such as a toxin become more concentrated in an ecosystem?

Learning Objective:

Describe the mechanisms of bioaccumulation and biomagnification.

Explain the process of biomagnification on the viability and diversity of consumers at all trophic levels.

Learning Event:

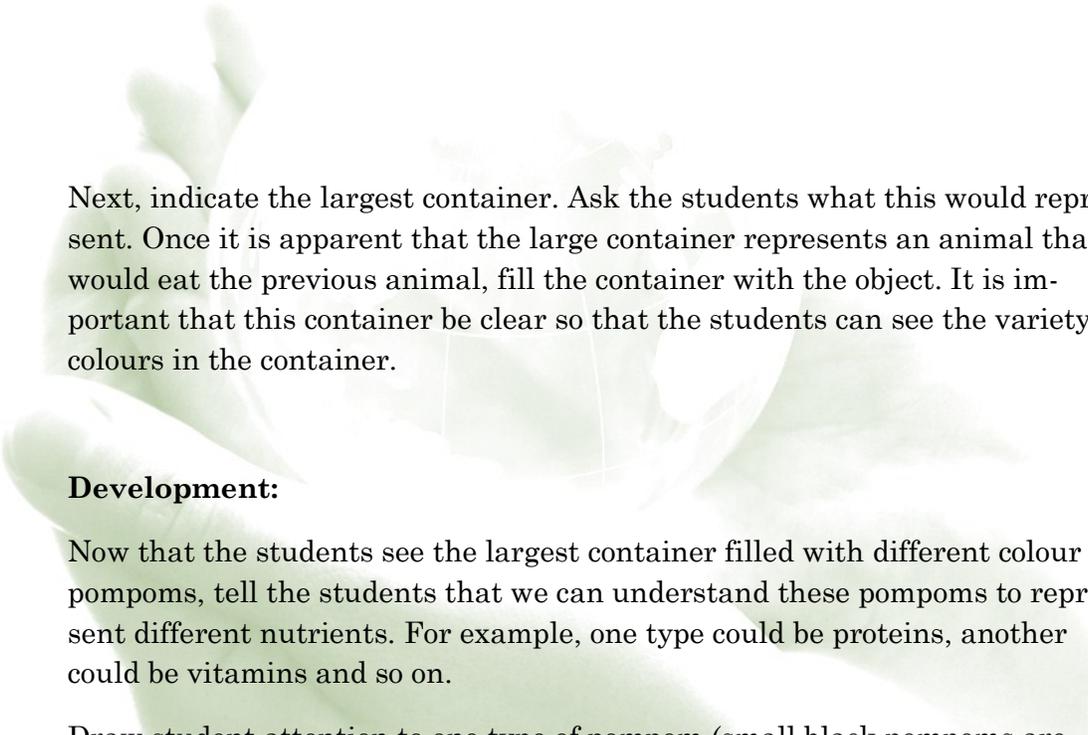
Students will learn about bioaccumulation through a demonstration activity that will show how a toxin can build up through a food chain. Also, issues concerning pesticide use and fertilizer use will be examined through discussion and journal reflection questions.

Set: You will need several small objects of different colours and sizes (Pompoms would work well) and clear containers (small, medium, and large).

Have a small but plentiful object to represent the producer level of the food chain. The more the better but about 50 pieces minimum.

Explain to the students that these objects represent the producers of an ecosystem. Ask students, as a review, what happens to these producers OR what consumes these producers. When the students volunteer the correct answer, label the smallest container Primary Consumers. Have a volunteer fill the smallest container with the pompoms to represent the animal consuming the producer.

Next, ask the students what happens to the primary consumer? Once it is established that the primary consumer gets eaten by the next level, label the medium sized container “Secondary Consumer”. Using the Primary Consumer container, fill the medium sized container. This should take several scoops. As you are doing this, review the previous lesson and explain to students why the next level needs more “food” or energy.



Next, indicate the largest container. Ask the students what this would represent. Once it is apparent that the large container represents an animal that would eat the previous animal, fill the container with the object. It is important that this container be clear so that the students can see the variety of colours in the container.

Development:

Now that the students see the largest container filled with different colour pompoms, tell the students that we can understand these pompoms to represent different nutrients. For example, one type could be proteins, another could be vitamins and so on.

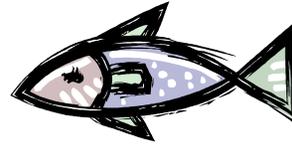
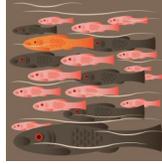
Draw student attention to one type of pompom (small black pompoms are good for this). Tell the students that this represents a toxin that has been introduced into the environment. Take a scoop of the pompoms with the smallest container. Show/count how much of the toxin exists at that level. Then take a scoop with the medium sized container. There should be more of the toxin in the medium sized container. And finally, count the toxins in the largest container. This container should contain the most amount of toxins.

Discuss that this represents the concept of *Bioaccumulations and Biomagnification*. As each level consumes it's food source, it is also consuming more of the toxin. Toxins aren't always something that can be removed or used by the animal so they will build up as the animal lives longer and needs food to survive. By the time the last consumer enters the food chain, it could be consuming a great deal of toxins with every meal.

Ask the students what consequences this could have on the environment?

Distribute the Student Handout "Bioaccumulation in an Ecosystem". Discuss the food chain with the students and have them answer the questions.

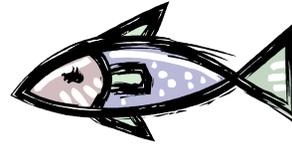
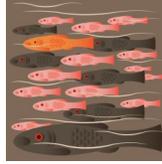
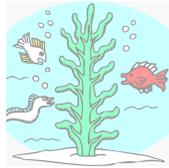
Bioaccumulation in an Ecosystem



1. The pictures above represent an aquatic food chain. Imagine that a toxin was introduced to the algae. Explain how Bioaccumulation would eventually effect the last level of the food chain.
2. Why should people be concerned about Bioaccumulation?
3. Saskatchewan uses pesticides and herbicides in many agricultural practices. Although this leads to bigger yields, how will this effect the food chain of the Saskatchewan population?
4. Do you think the use of toxins, such as pesticides or herbicides, is beneficial or harmful to our food production?
5. Read the article: <http://www.agriculture.gov.sk.ca/Default.aspx?DN=9856dcff-7298-4dd2-ab00-85653d447ede> which outlines the standards for the organic industry in Saskatchewan. Identify ways in which these practices will influence Bioaccumulation in our food production.
6. Read <http://www.pan-uk.org/pestnews/Actives/ddt.htm>

Prepare a report that identifies the species at risk because of the introduction of DDT to the environment. Please use diagrams and written language in your report.

Bioaccumulation in an Ecosystem



1. The pictures above represent an aquatic food chain. Imagine that a toxin was introduced to the algae. Explain how Bioaccumulation would eventually effect the last level of the food chain.

The algae would consume the toxin and the algae itself would become toxic. The smaller fish, and algae eater, would consume the algae and the toxin. Because the consumer has to eat more algae, the fish would have more toxins ingested. Larger fish would the consume the smaller fish with the same effect. Finally, the human consumer would eat the larger fish and consume the accumulated toxins getting the highest amount of toxin consumption.

2. Why should people be concerned about Bioaccumulation?

Because we are the top of the food chain, bioaccumulation is concerning as we will consume a large variety of toxins. Also, as the toxins accumulate through the food chain, they can increase their potency. The higher the potency the more health consequences for the animal.

3. Saskatchewan uses pesticides and herbicides in many agricultural practices. Although this leads to bigger yields, how will this effect the food chain of the Saskatchewan population?

Although the bigger yields are good for individual farmers and the economy, the effect that this may have on the population of Saskatchewan's wild life can be severely negative. The materials that are used to kill the plants and animals that interfere with crop production will leave some chemical toxins behind. This means that they will also be introduced to unintended species. The toxins will move through the food chain and continue to build up in each successive level. This may lead to a harmful amount of the toxin that will negatively impact the natural populations of Saskatchewan. "These toxins also remain in the end product thus impacting the health of consumers from Saskatchewan and the world."

4. Do you think the use of toxins, such as pesticides or herbicides, is beneficial or harmful to our food production?

The use of toxins to control unwanted plants and pests definitely boosts the yield of crops. It is dangerous to do so without very careful study because we do not know how the chemicals we introduce will effect all the plants, insects and animals, including humans, in the ecosystem. Other ways can be used to control pests that do not alter the chemical composition of the environment. Although it is reasonable to see the positive draw of pesticides and herbicides, there is a significant negative aspect as well.

5. Read the article: <http://www.agriculture.gov.sk.ca/Default.aspx?DN=9856dcff-7298-4dd2-ab00-85653d447ede> which outlines the standards for the organic industry in Saskatchewan. Identify ways in which these practices will influence Bioaccumulation in our food production. *Answers will vary.*

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