LESSON 1.2

Hungry, hungry bats

Overview

Students will learn the importance of food chains and looking after entire ecosystems.

Students will be presented with a series of mathematical problems related to micro-bat consumption and population patterns.

Background information

An ecosystem is a term used to describe how a range of elements in the environment work together as a functioning system. These elements include biotic (plants and animals) and abiotic (air, water, soil) features. The ecosystem can be large or it can be small depending on the elements involved. For example a pond is an ecosystem and a rainforest is an ecosystem.

Within ecosystems there is a complex flow of energy from organism to organism. This is called a food web. A food web is made up of a series of food chains. Each organism in the chain obtains energy from the one before it. Micro-bats play an important role in many food chains as they eat an abundant amount of food and are in-turn food for other animals.

Insectivorous (insect eating) micro-bats will eat around 50-75% of their body weight each night – sometimes this can be as much as 1200 mosquitoes every hour! This makes micro-bats extremely important for keeping insect populations under control.

Resources

Calculator

Activity descriptions

Activity 1: Food chains

Draw an example of a food chain on the board (see Activity Sheet 1.2A). Discuss with the class what would happen if you were to take the bats out of the food chain. What would happen to the other links in the chain?

Introduce students to the terms **Food Chain, Producer, Consumer, Decomposer, Herbivore, Carnivore** and **Omnivore**. Using these terms, students create food chains of three different species of micro-bats using the stories on the Activity Sheet 1.2B as a guide.

Time requirement: 30 mins (approx)

Activity 2: Micro-bat maths

Introduce students to how many insects micro-bats can consume every night. Discuss why this is important for healthy ecosystems.

Using the activity sheets, ask students to solve the mathematical problems using whole numbers, decimals, percentages and fractions to determine and present statistical analysis.

Population Percentages Answers

1. (a) 25% (b) 40% (c) 75% (d) 80% (e) 30%
2. (a) 0.25 (b) 0.4 (c) 0.75 (d) 0.8 (e) 0.3
3. (a) 25/100 = 1/4 (b) 40/100 = 4/10 = 2/5
   (c) 75/100 = 3/4 (d) 80/100 = 8/10 = 4/5
   (e) 30/100 = 3/10

Consumption Calculations Answers

1. 10 hours 2. 2000 bugs 3. 10 hours 4. 2010
5. 201 6. 12:00am - 1:00am 7. 4:00am - 5:00am
8. 4 hours 9. 6 hours

Ecosystem Equations Answers

1. (a) 100,000 g (b) 100 kg (c) 15,000 kg
2. (a) 10% (b) 120 g (c) 250 (d) 5/20 or 1/4

Time requirement: 30 mins (approx)

ACTIVITY SHEET 1.2A

Food chains

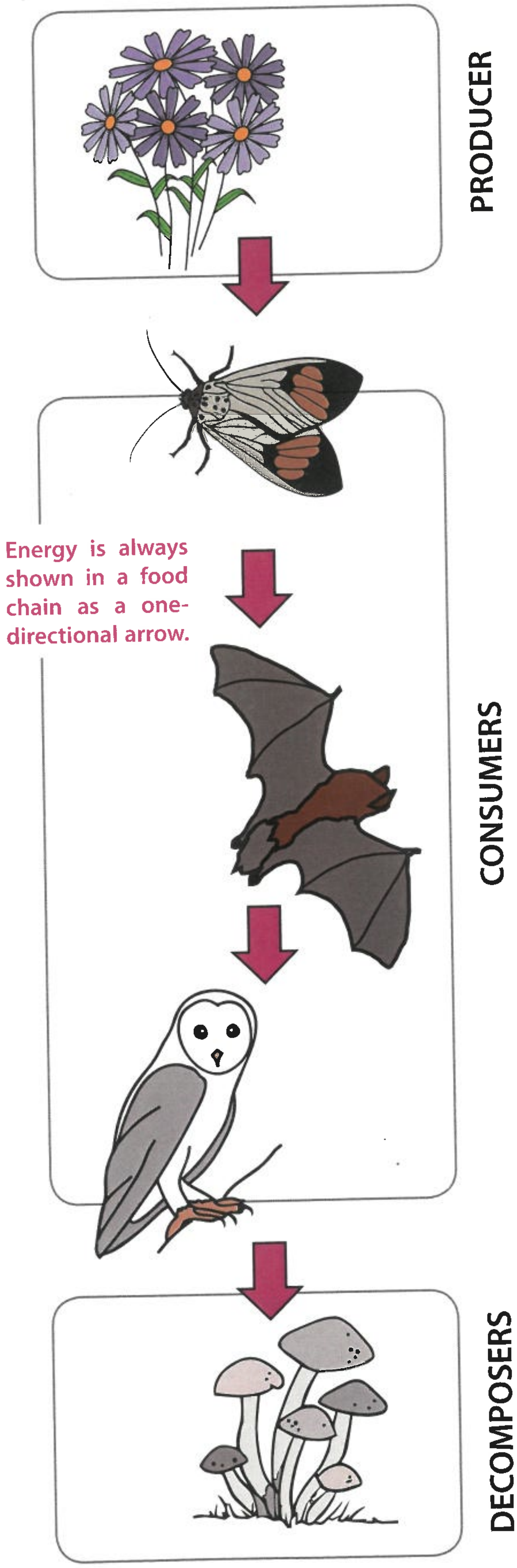
A **FOOD CHAIN** is a 'chain' of organisms, through which energy is transferred. Each organism in the chain feeds on and obtains energy from the one before it. We can combine multiple chains to create a **FOOD WEB.**

A food chain always starts with a **PRODUCER.** They produce the first level of energy in the chain. These are usually always plants, but can include microscopic organisms.

PRIMARY CONSUMERS are generally the vegetarians (*herbivores*) of the animal world. These animals eat the producers and get energy from them. Just like when we eat an apple or banana; it gives us energy. Animals that can be both primary and secondary consumers are called *omnivores*.

The next level is the **SECONDARY CONSUMERS.** These are generally the *carnivores* as they eat other animals. They get lots of energy from eating the primary consumers. There can be higher levels of consumers and this depends on how complicated your food chain is.

Lastly, we have **DECOMPOSERS.** These are the bacteria, fungi and insects that break down dead organic material (plants or animals) and return that energy back to the soil for producers to use.



What happens if a link in the chain is broken?

ACTIVITY SHEET 1.2B

Food chains

Read the following stories about three different types of micro-bat. Pay close attention to who the PRODUCERS and CONSUMERS are. Create a food chain for each story.

2. Bobby the eastern bent-wing bat

High in the forest the eucalypt flowers are blossoming. They provide a strong perfume that is attracting flying-foxes, possums and a variety of insects. As they feed on the abundant nectar, the insects are unaware of the bats that are quickly darting around them.

A flying-fox drops onto a branch and a plume of insects fly into the air - this is Bobby's chance to feast on an easy meal.

Using echolocation, Bobby the eastern bent-wing bat locates the moths and other insects that got disturbed by the flying-fox. Bobby swoops in and uses his quick movements to snatch up and eat insects while still flying about. With so much food available, Bobby will eat half his body weight in insects before finding a tree to roost in for the day.

1. Gilda the ghost bat

One day, an active little grasshopper was munching on some grass along the banks of a river. He got so full that he had to stop and rest for a while. Unfortunately, a hungry tree frog was watching and waiting for the grasshopper to finish his meal. When he saw that the grasshopper could move no more, he leaped over and ate the grasshopper up.

As night fell, Terry tree frog started looking out for more food in the tree tops. He was completely oblivious to the silent predator that was stalking him. Out of nowhere, Gilda the ghost bat flew in and captured Terry in her feet. Terry tried to get away but couldn't. Gilda took Terry back to her cave where she felt safe to focus on her tree frog meal.

The night was still early and Gilda was still hungry, this time for some moths she new flew above the river. As she started to head out of her cave she was struck by a python who was hiding in a crack on the side of the wall. The python moved so quick that Gilda had no chance of escape.

3. Milo the large-footed myotis

One dark night, with no moon about, some young fish were nibbling at patches of algae near the surface of a still stretch of river. Because there wasn't a breath of wind, the water surface was extremely still except for the fish who made tiny ripples where they were feeding.

Milo, a large-footed myotis, is a specialist in catching small fish. He darted above the water and through echolocation identified the ripples the fish were making. Because there was no moon, Milo was invisible to the fish below. Knowing where he was going to make his run, he stopped using echolocation, swooped down, dragged his large feet through the water and picked up a fish for his meal.

As Milo was making his fishing run, he didn't notice a large powerful owl that was flying above. The owl silently flew in and snatched Milo while he was in flight - still clasping his fish in his feet.

The owl landed in a nearby tree and made a meal out of Milo. Poor Milo.

ACTIVITY SHEET 1.3A

Population percentages

When people study the populations of creatures it is important to understand the different mathematical terms that help us compare them. Some useful ways of looking at the populations in micro-bat colonies are using number out of 100, percentage, decimals and fractions.

Looking at the number out of 100 allows us look at how many micro-bats out of 100 have a particular feature. This means we don't have to use ridiculously big numbers.	**EXAMPLE 1** If there are 9,000 adults in the maternity colony of 18,000 = 50 out of 100 bats are adults
Percentage is another way of looking at numbers out of 100. Percentages are out of 100 so we just have to put a percent sign (%) next to the number.	**EXAMPLE 2** 50 out of 100 bats are adults = 50%
These percentages can then be turned into decimals. Decimals change the number into parts of 1.	**EXAMPLE 3** 50% of bats are adults = 0.50 = 0.5
Numbers out of 100, percentages and decimals can also be used to change numbers into fractions.	**EXAMPLE 4** 50 out of 100 = 50% = 0.5 = 50/100 = ½

1. Convert the following numbers out of 100 into percentages.

25 out of 100	40 out of 100	75 out of 100	80 out of 100	30 out of 100
(a)	(b)	(c)	(d)	(e)

2. Convert the percentages in question 1 into decimals.

(a) (b) (c) (d) (e)

3. Convert the decimals in question 2 into fractions (or use question 1 percentages).

(a) (b) (c) (d) (e)

ACTIVITY SHEET 1.3B

Consumption calculations

Micro-bats may be little but they have enormous appetites.
These hungry bats can eat up to 300 bugs in an hour.

1. If Minnie the micro-bat leaves her Maryborough home at dusk (7:00pm) and returns at dawn (5:00am) how many hours does she spend hunting?

2. On Monday night Minnie catches 200 insects every hour. What is the total amount of insects she catches for the night (using your previous answer)?

HINT = hours x insects

On Tuesday night Minnie's big insect hunt was very successful. The table below shows how many insects she caught every hour that she was out hunting.

TIME	INSECT COUNT	TIME	INSECT COUNT
7:00pm - 8:00pm	110	12:00am - 1:00am	360
8:00pm - 9:00pm	150	1:00am - 1:00am	230
9:00pm - 10:00pm	180	2:00am - 3:00am	200
10:00pm - 11:00pm	230	3:00am - 4:00am	150
11:00pm - 12:00am	300	4:00am - 5:00am	100

3. How many hours does Minnie hunt for on Tuesday night?

4. How many insects in total does Minnie eat on Tuesday night?

5. What is the average number of insects that Minnie eats in an hour on Tuesday night?

Average = total insects ÷ total hours

6. In which hour did Minnie catch the most insects?

7. In which hour did Minnie catch the least insects?

8. How many hours did she catch more than the average amount?

9. How many hours did she catch less than the average amount?

ACTIVITY SHEET 1.3C

Ecosystem equations

Minnie is an eastern bent-wing bat. She is part of a huge maternity colony and all the females have given birth in the same cave. Minnie and her fellow mothers need to go hunt a lot more insects than usual to give them enough energy to produce milk for their young who stay in the cave.

1. There are 10,000 adult females in the cave and each of them eat 10 grams of insects per night

   (a) How many grams of insects are removed from the ecosystem each night?

   HINT: total females x amount of insects

   (b) How many kilograms is this?

   HINT: 1000 grams = 1 kilogram

   (c) The females stay for 150 days in the maternity cave. How many kilograms of insects are eaten over this time by the 10,000 females?

   HINT: days x amount of insects

A local farmer, Jack, installs micro-bat boxes in the trees surrounding his crops. Jack hopes that by encouraging micro-bats in the area that they will help reduce the insects that are eating his crops. This will help Jack so he doesn't have to spend more money on pesticides.

2. The mother's in Minnie's maternity colony leave the cave in March and spread out to find food elsewhere over the colder months. Minnie finds one of the bat boxes and roosts in there with 9 other eastern bent-wing bats.

   (a) If the bat box is home to 10 micro-bats, what is Minnie's percentage of the total?

   HINT: percentage is a number out-of-100

   (b) Minnie and her bat box companions are now eating 12 grams of insects each night. What is the total nightly consumption of insects (in grams)?

   (c) Jack has installed 25 bat boxes on his property. If each contain 10 micro-bats, how many micro-bats are helping the farmer?

   (d) A huge storm comes through the area and 5 of the 20 bat boxes are destroyed. What is the fraction of bat boxes that have been lost?