

## Lesson Plan

Lesson Title	Ecology of Mosquitoes
Grade Level	5 <sup>th</sup> grade
Topic	Mosquitoes
Lesson time	45-55 minutes
Materials Required	<ul style="list-style-type: none"><li>• Digital microscope</li><li>• Ecology of Mosquitoes PowerPoint (<a href="#">available here</a>)</li><li>• Mosquito Life Cycle Kit</li><li>• Observation journal (<a href="#">available here</a>)</li></ul>
Standards addressed	<ul style="list-style-type: none"><li>• 5-LS2-1 Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment</li><li>• 5-LS2-1 Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment</li></ul>

### Step 1: Introduction and Expectations

### Step 2: Microscope Study

We have provided notes at the end of this document about observing mosquito larvae with a digital microscope. Allow the students to observe and share observations.

### Step 3: PowerPoint Presentation Ecology of Mosquitoes

Slide 1: See if the students can define ecology. An ecosystem consists of the interactions among organisms (plants, animals, etc.) and the nonliving environment (soil, water, etc.)

#### Slide 2: Mosquito Life Cycle

Click/tap through the life cycle. In order to understand the ecology of mosquitoes, students will need to know that there are aquatic stages of the life cycle as well as the adult mosquitoes that they are probably familiar with.

#### Slide 3: Energy and Ecosystem

- This is a lengthy slide, and each “click” (or tap) will reveal more about the ecosystem and the roles that mosquitoes and other organisms play. It is important that students understand that the sun constantly provides ecosystems with a source of energy (thus the constant wiggly lines emanating from the sun). What organisms have the ability to trap this energy?
- Click 1: (Answer) Plants, algae, and certain bacteria are able to trap this energy and change it to another kind of energy called chemical energy. This energy is stored in their tissues. Since these organisms produce food for other organisms, we call them producers. What organisms use the energy that is stored in plants and algae as food? Answers: Animals, herbivores, consumers, etc.
- Click 2: Many different organisms eat plants or algae. These animals consume the chemical energy stored in plants and store it or change it to mechanical energy so that they can

move. We call these animals consumers. Mosquito larvae, aquatic snails, and many other small aquatic creatures often consume aquatic plants or algae, so they are storing energy from algae, and the algae originally captured the energy from the sun. What eats mosquito larvae?

- Click 3: (Answer) There are many aquatic predators of mosquitoes. These include other insects like backswimmers or dragonfly nymphs, and especially fish. These predators are gaining nutrition from other organisms that trapped energy from the sun. Are there larger predators that might prey upon these smaller predators?
- Click 4: (Answer) Yes! Larger predators such as egrets may prey upon the fish or insects that were feeding on smaller animals. Mosquitoes are members of a food chain or food web.
- Click 5: In most cases, not all of the mosquitoes are eaten by predators. In fact, often times far more mosquitoes grow than the predators can consume. These mosquitoes leave the water, and some are consumed by other predators. Can you think of any predators that might eat adult mosquitoes?
- Click 6: (Answer) Adult dragonflies are one example of a predator that may consume adult mosquitoes. Other predators include certain bats, birds, and spiders. Unfortunately, once the mosquitoes leave the water, many are not eaten by predators. After feeding on nectar, female mosquitoes will search for a host. What is a host? (Answer) A host is an animal or plant from which a parasite gains nutrition. And yes, mosquitoes are parasites, even though they don't live inside or on people. Other than people, what kinds of animals do mosquitoes bite?
- Click 7: (Answer) Different kinds of mosquitoes bite many different kinds of animals, and some kinds of mosquitoes prefer to bite birds. The protein in the blood the mosquito obtains from the host nourishes mosquito eggs, but remember that the blood is essentially a form of stored energy that you could trace back to the sun! Unfortunately, female mosquitoes will take more than one blood meal in their lifetime, and if a mosquito bites an animal and becomes infected with a disease, they could potentially pass the disease to a person.
- Click 8: An animal that can spread a disease to a person is called a vector. Worldwide, mosquitoes pass many different diseases such as malaria, dengue fever and yellow fever to people. Locally, mosquitoes sometimes pass West Nile virus to people and birds, and pass dog heartworm to dogs and coyotes. Mosquitoes are not just a nuisance; they can actually be very dangerous to people, pets, and wild animals!

#### Slide 4: Blood-feeding

Unfortunately, mosquitoes share their saliva when they bite. This is unfortunate, because sometimes they carry pathogens that can move from the mosquito into the host, with the transfer of saliva. In many cases, the pathogen is a virus (example: west Nile virus), but sometimes a parasite (example: malaria).

#### Slide 5: West Nile virus

In California, certain mosquitoes can spread West Nile virus. Click/tap through slide to see the cycle of this disease. Here are a few things for students to understand:

- This is primarily a bird disease
- An infected mosquito can spread the virus to a bird
- An uninfected mosquito can acquire the virus from an infected bird
- Certain local birds (especially crows, scrub-jays, and robins) often die from the virus
- Humans sometimes are infected with the virus and can become very sick, but not everyone who is infected experiences symptoms

Slide 6: Life Cycle Review

This is a convenient slide to have up for questions.

Step 4: Demonstrate how to use the life cycle kit and talk about the various tasks they will be responsible for (observing, activity sheets, feeding fish, making nectar, etc.)

Visit the [Mosquito School website](#) for more information or email [erice@msmosquito.com](mailto:erice@msmosquito.com)

## Notes about Using a Digital Microscope in the Classroom

Digital microscopes are a profoundly powerful tool for enhancing classroom presentations. There are a wide variety of relatively inexpensive digital microscopes available, and we currently use a ProScope Micro Mobile made by Bodelin technologies. This particular microscope attaches directly to an iPad (no cords) and uses the camera application that comes preinstalled on iPads. The iPad is either wirelessly connected to an Apple TV (if the classroom is equipped with one) or connected to a projector. Either way enables the entire classroom to study live mosquito larvae at the same time. This can be used to a quick introduction to the main lesson, as a means of generating interest and discussion during a question/answer portion of a lesson, or even as the focus of the lesson (as in our 4<sup>th</sup> grade “Adaptations of Mosquitoes” lesson). Here are a few suggestions if you plan to utilize this technology:

- Do not attempt to place the microscope directly over a dish of water. Even if there are large numbers of larvae present, they will tend to swim away from the light produced by the microscope. Instead, use a pipette to capture a small number of early-instar larvae in a drop of water, and place the drop on a flat, white surface (we use a plastic lid). If the bubble of water remains intact, you can place the microscope over the drop without displacing it, focus on the larvae, and they will not be able to wiggle away (see photo).
- It is imperative that you prepare students for this exercise prior to showing them a live magnified mosquito larvae. If you suddenly turn on the microscope and students see large, strange-looking creatures wiggling about, you will have an instant classroom management nightmare. Students will giggle, blurt out comments, and you will have to spend valuable and uncomfortable time regaining their focus. Preparing the students for this activity simply involves gaining their attention, informing them what is going to happen, and how they are expected to behave. Hold up the jar with the tiny wiggling larvae, and explain that a microscope will be used to magnify a few of them. Be very clear that when the microscope is turned on, everyone needs to observe silently. If students forget the expectations and are disruptive as soon as you turn it on, simply turn it back off and re-explain the expectations. After a short time of silent observation (30 seconds is more than enough), invite the students to raise their hand if they have a question or observation about what they see on the screen. This exercise can be an extremely valuable tool for generating interest and stimulating conversation about the topic.
- Prior to leading this activity in a classroom, spend a little time observing the mosquitoes on your own, so that you are prepared to help students understand what they are observing. The following list includes some of the behaviors that you are likely to observe:
  - **Feeding:** usually, after the larvae have been under the microscope for a few minutes, they will begin feeding. If small particles of food are present, they will be sucked in.



Some larger particles will get sucked in and then “spit out” the side of the head. You can ask if anyone knows of another animal that feeds in a similar manner (many students are familiar with other filter-feeding animals, especially baleen whales).

- **Thrashing movements:** typically, when the microscope is first turned on, the mosquitoes respond with a flurry of movement. They bump into one another, and students often describe this as “fighting” or “dancing”. You can mention that mosquito larvae have very thin, flexible exoskeletons, and they move by flexing their entire bodies. You can also point out that they have sensory hairs that help them sense what is around them.
- **Breathing:** When the mosquitoes move, their breathing tubes are often visible from the side. Once they calm down, they tend to begin breathing, and the tip of the tube breaks the surface of the water. You can explain how mosquitoes do not have gills, and instead breathe at the surface. For older students you can ask/explore this adaptation and see if they can figure out why it is so important (they can survive in oxygen poor conditions where predators that depend on gills, especially fish, cannot survive).
- **Grooming:** sometimes students will observe mosquitoes bending around, so that their head is touching their “tail”. You can inform the students that this is how mosquitoes clean their mouthparts.
- **Molting:** Occasionally, students will observe a mosquito larva that is in the process of splitting open and escaping from its older exoskeleton. This is a great time to talk about metamorphosis.
- **Defecating:** Fortunately, the mosquito larvae *usually do not* defecate “on camera”, but it does occasionally happen, and there is probably nothing much you can do to prevent a heightened and intense student response. Good luck swiftly regaining the collective focus of the classroom if this happens.