



Mosquitoes: Their Place On the Planet

By Robyn Vaughan

Focus

Most people view mosquitoes as a nuisance, a common insect that causes discomfort. By understanding the role mosquitoes play in the **food web**, students can easily see that all creatures, great or small, are vital to the global environment.

Students will observe and record various stages of mosquito **metamorphosis**, noting they are aquatic insects in need of water for the completion of their life cycle. Mosquitoes are an excellent species to study because they complete their life stages relatively quickly.

Background

Mosquitoes are pests that annoy and bite humans and animals, but they play an important role in the food web on the planet.

Mosquitoes belong to the Phylum Arthropoda, Family Culicidae, Order Diptera. The name mosquito is derived from the Spanish *musketas*, which means “little fly”. This turns out to be a very descriptive name for the mosquito, because mosquitoes are part of the Order Diptera, the group in which all “true flies” are found. Like other flies, they have two wings, but unlike other members of this order, they have scales on the veins of the wings and female mosquitoes possess a long piercing-sucking mouthpart called a proboscis.

Only female mosquitoes bite animals and drink blood. Blood is required to develop fertile eggs. Male mosquitoes can be distinguished from females by their feathery antennae and their mouthparts, which are not suitable for piercing skin. Nectar is the principal food of male mosquitoes.

When a female mosquito bites an animal, she pushes her proboscis into the skin. She then injects a small amount of saliva into the wound before beginning to draw blood. The saliva makes penetration easier and prevents the blood from clotting in the narrow channel of her food canal. The welts that appears after a mosquito bites is an allergic

reaction to the saliva that the mosquito injected to prevent clotting.

Some mosquitoes can be extremely harmful to humans and animals. They transmit malaria, encephalitis, yellow fever, dengue fever, and dog heartworms. Every precaution should be taken to eliminate environmental conditions that are suitable for mosquito breeding. Always empty standing water from flower pots, fountains, empty tires, buckets and bird baths.

DID YOU KNOW...

- **3000 species of mosquitoes have been described on a world-wide basis. Approximately 150 are known to occur in North America.**
- **The most common backyard mosquito is the Asian Tiger Mosquito, *Aedes albopictus*, which is native to Asia and is now an invasive species in the United States. It is very aggressive and feeds during the day.**
- **There are 65 species of mosquitoes in Louisiana.**
- ***Culex quinquefasciatus*, the southern house mosquito, can live for more than 50 days, but travels only 300 to 500 yards in its lifetime.**

Dr. Lamar Meek
Louisiana State University Agricultural Center

| Grade Level | Subject Areas | Process Skills | Vocabulary |
|---------------------|---------------------------------------|--|--|
| Middle School (6-8) | Life Science Environmental Science | Observing, Analyzing, Interpreting, Recording | Food Web, Egg, Larva, Pupa, Metamorphosis, Algae, Adult, Filter-Feeders, Wigglers |

A cooperative project between the Undergraduate Biological Sciences Education Program Grant from the Howard Hughes Medical Institute to Louisiana State University and the Louisiana Sea Grant College Program. ©Louisiana Sea Grant, September 2000.

Life Cycle of a Mosquito

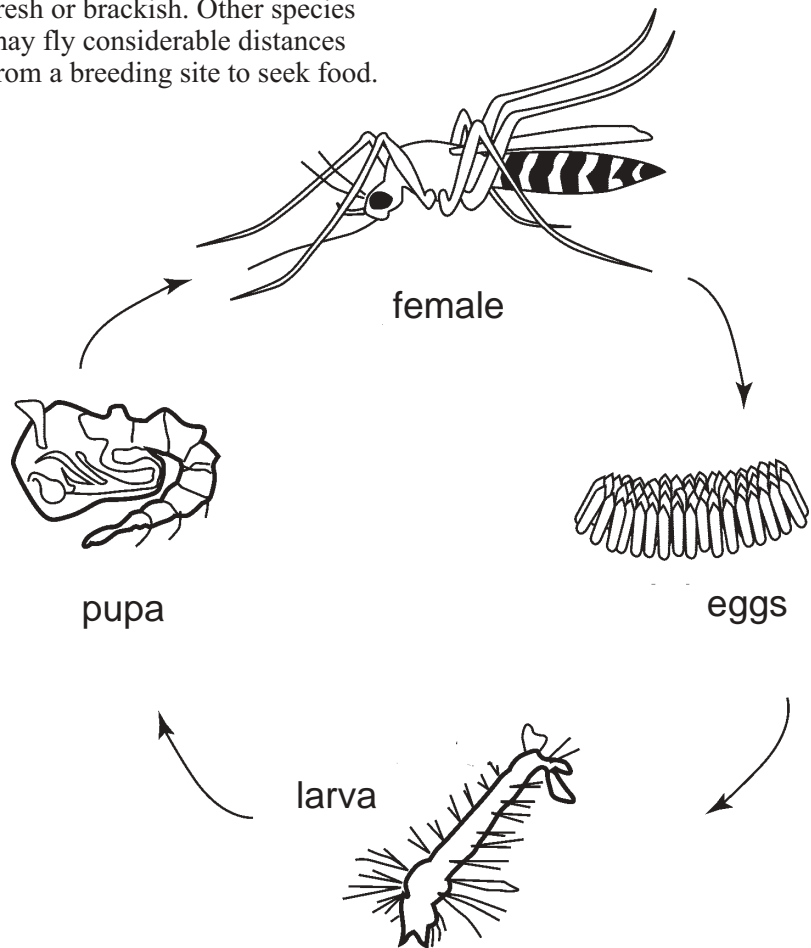
Water is essential for the development of the mosquito, which goes through complete **metamorphosis**—**egg, larva, pupa, and adult**. The **egg** is laid by the adult female directly on the water's surface or on a solid structure that is subject to flooding. Eggs laid on a structure will not hatch until flooded and can remain viable for several years waiting for water. Eggs appear whitish or yellowish when laid, but later become brown: they may be laid singly or in floats. Many insects such as **cockroaches** and **pill bugs** feed on mosquito eggs. Out of the 100-400 eggs laid by a female, only a few adults develop successfully.

The second life stage is the **larva**. Larvae always live in water and cannot survive long out of it. They get air at the water's surface. When disturbed, larvae actively move in an s-shaped motion that gives them their common name, "wiggler". They can swim down from the surface but need to return to it shortly in order to breathe. Larvae are **filter feeders**, eating **algae** and other organic matter in the water, which they collect by using their bristle-like mouth parts.

The third life stage is the **pupa**. Pupae are **comma-shaped** and stay at the water's surface. If disturbed they tumble downward to escape. Pupae do not feed, and this stage lasts only for two or three days. Both larvae and pupae are eaten by dragonflies, fish, tadpoles, frogs, and turtles.

The **adult** stage appears in as few as 7-10 days in some mosquitoes. Adult behaviors vary depending upon the species. Some breed and live near water, which may be fresh or brackish. Other species may fly considerable distances from a breeding site to seek food.

Some species are active only at dusk, while others are active during the day. Only the females seek blood, which they need as a protein source to produce eggs. Males as well as females feed on **flower nectar** or plant juices for energy. Adult mosquitoes provide a food source for **bats, birds, and dragonflies**.



Mosquitoes' Place on the Planet

Most people can't say many good things about mosquitoes. However, mosquitoes do play an important role in the food web. During the course of their lifespan, mosquito eggs, larvae, pupae, and adults are important sources of food for many animals. For instance, the common "mosquito fish," *Gambusia affinis*, survives by eating larvae deposited in freshwater lakes. A large female can eat 100-200+ mosquito larvae in a day. Many other aquatic insect predators and small fish depend on the mosquito as an important link in the food chain.

Mosquitoes: Their Place on the Planet

Pre-lab preparation

Order a *mosquito kit* at least two weeks prior to this lesson from:

East Baton Rouge Mosquito Abatement and Rodent Control
2829 Lt. Gen. Ben Davis Jr. Ave.

Baton Rouge, LA, 70807. Phone: (225) 356-3297

The cost is approximately \$8.00 and the kit is easy to use.

or

You can order mosquito kits from a biological supply house.

or

Collect samples from students' backyards.

Make copies of the Lab Observation Sheet.

SOAR set-up (see *SOAR How-To Book*)

Use INVERT AND VIEW

- Set-up #7: 200X magnification works best for viewing eggs
- Set-up #6: 1X magnification works best for viewing adults

Use STAND AND VIEW

- Set-up #4: 30X magnification works best for viewing larvae and pupae

Day One (about 1-2 hours)

(1) Read and follow mosquito kit directions.

One hour before class, begin the hatching process

- Unscrew the top (container w/screen) from the bottom clear plastic part of the kit. Water used must be free of chlorine. You can use purchased spring water, tap water that has been allowed to sit for 24 hours, or water that has been treated with dechlorinating chemicals. Rainwater also works well. Fill half of the bottom container.
- A pinch of food should then be added to the water.
- Drop all but one of the pieces of paper with eggs into the water mixture. These mosquito eggs will be used later.
- Place some of the water mixture into the test tube with the remaining eggs and reseal it. These are the eggs to be used today.

(2) Before viewing mosquito eggs, discuss with students their attitudes concerning mosquitoes.

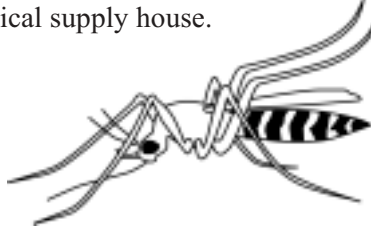
- **Write on a sheet of paper three descriptive words that come to mind when you hear the word *mosquito*.** You may want to write a collective list on the board.
- **Why do you think we have negative feelings about mosquitoes?**
- **Do you think there are any positive reasons for mosquitoes to exist?**
- **What role or purpose do you think mosquitoes have on our planet?**

(3) **Discuss background information** with students. You may want to duplicate "The Life Cycle of a Mosquito" and give each student a copy.

(4) Using SOAR at 200X magnification, **view and draw the floaters.**

(5) After the test tube has been allowed to sit in a warm place, like your pocket, for an hour, use SOAR at 200X magnification to **view and draw the eggs hatching.** They should appear whitish or yellowish.

(6) **Discuss** what would happen if there were no water for the eggs to hatch in.



Grade Level:

Middle

Group Size:

Whole group

Summary:

Mosquitoes have distinct stages of metamorphosis, each playing a unique role in the food web. By observing each stage of metamorphosis, students will analyze growth and development of mosquitoes.

Objectives:

- To determine the role water plays in the life cycle of a mosquito
- To describe the life cycle of the mosquito
- To determine the role mosquitoes play in the world's food web
- To identify the stages of mosquito metamorphosis

Materials:

- The Scope-On-A-Rope
- Instant Mosquito Kit
- Deep-well slides
- Poster board
- Yarn
- One-liter soft drink bottle
- Four 250ml beakers
- Ball of string

Duration:

Five to ten days, varying from one hour to 30-minute time periods

Extensions:

Reading, Language Arts

National Science Standards:

Life Science (5-8)

- Populations & ecosystems

Science as Inquiry (5-8)

- Abilities necessary to do scientific inquiry

Day Two (~30-40 minutes)

- (1) Using the pipette **extract mosquito larvae** from the mosquito kit and place them in a deep-well slide.
- (2) Using SOAR at **1X magnification**, view the **swimming larvae**. Freeze frame and have a student use a monitor ruler to **measure their length** on the monitor.
- (3) Using SOAR at **30X magnification**, view the **swimming larvae**. Freeze frame and have a student use a ruler to measure their length on the monitor.
- (4) Students should **observe and draw the larvae**.
- (5) **Discuss** the difference between the appearance of the eggs and larvae, noting the amount of time it took to make these changes.
- (6) Optional: Place the larvae in the freezer for 20 minutes. This will “slow” the larvae down and allow for observation with the 200X lens.

Day Three (~30-40 minutes)

- (1) Same procedure as Day Two
- (2) Food Chain Activity

Day Four (~30-40 minutes)

- (1) Same as Day Two
- (2) Food Web Activity

Days Five-Ten (~30-40 minutes)

- (1) Same as Day Two

Assessment (~30-40 minutes)

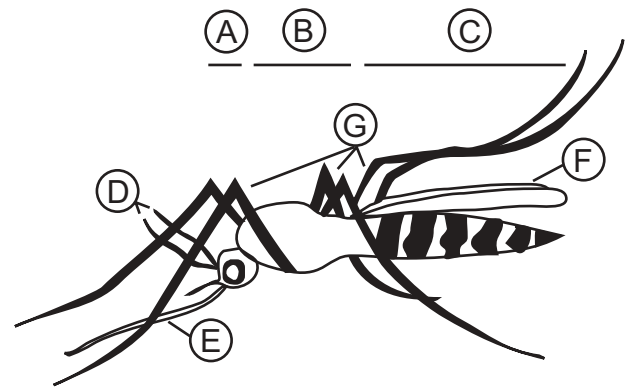
- (1) A blackline master of a standard assessment tool is provided in this folio.
- (2) A videotaped “lab practical” may be prepared in advance by recording several stages of the mosquito larvae development using SOAR. Students can be asked to identify larval stages, estimate or measure the length of the larvae, or identify particular parts of the adult mosquito.

Mosquito Anatomy 101

The mosquito belongs to the same order of insects as flies and gnats—the order Diptera, and thus it has the same body structure. Its soft body is covered by an exoskeleton and is divided into three parts: the **head (A)**, the **thorax (B)**, and the **abdomen (C)**. It has six **legs (G)**. It has two narrow **wings (F)** and two small knob-like structures called **halteres (not shown)**. The mosquito’s legs and wings are attached to the thorax. The abdomen is composed of 10 segments.

The head of the mosquito is small and round, with two **antennae (D)**. It has large compound eyes. The female mosquito has a modified mouthpart called a **proboscis (E)** that is used for piercing and sucking. The proboscis looks like a long, thin tube.

Not all species of mosquitoes suck blood. However, in some species, blood is an essential part of the



reproductive cycle and must be obtained by the female. The mouthparts of a male mosquito are modified for feeding on plant juices.

In most species of mosquitoes, the females, like the males, feed primarily on nectar and other plant juices for nourishment.

An Extension... researching diseases carried by mosquitoes

Mosquitoes are responsible for the spread of many diseases, in particular, yellow fever (a virus) and malaria (a parasite). Different species of mosquitoes transmit these two diseases. Have students research these two diseases and the mosquitoes responsible for their transmission. In their presentations, have them describe

the symptoms of the diseases, the geographic distribution of the diseases, and the life cycle of the parasite (in the case of malaria). Other diseases transmitted by mosquitoes include viral encephalitis and dengue fever. As part of their presentation, have students focus on how humans have sought to control mosquito populations.

Reinforcement Activity 1: Food Web



Objectives

- Students will determine the role mosquitoes have on the planet.
- Students will determine the role water plays in the life cycle of mosquitoes.

Materials

posters, yarn and a ball of string



Pre-activity Planning:

- (1) Make activity cards by cutting 16 6" x 10" rectangles of poster board.
- (2) Label each rectangle with one of the following:
water frogs pill bugs sun bats
algae turtles plant nectar eggs tadpoles
fish birds cockroaches dragonflies
larvae and pupae adult (mosquito)
- (3) Punch holes in the upper corners of the rectangles and tie yarn long enough to hang the signs from student's necks.



Directions

- (1) Students will be given the role of either an abiotic or biotic factor from the environment.
- (2) Hand the student wearing the sun card a ball of string. He or she will hold the end of the string and pass the ball to another student in the circle with whom she or he can be "related." The first person will then explain to the whole group what this relationship is. For example, if the sun passes the string to algae, the student should say, "algae, because algae needs the sun for photosynthesis." The algae student may then pass the string to the larvae/pupae student and explain that larvae and pupae feed on algae. This continues one move at a time showing relationships.

Evaluation

- (1) You may end up holding portions of the string coming from and going to many different things. Now, what happens if one part of the environment is removed? Test your prediction.
- (2) What parts of the environment would you want not to let go of? Which parts seem to be the most important for maintaining the relationships in the circle? Look at the connections to water. Why are there so many of them?

Reinforcement Activity 2: Food Chain

Objectives

- Students will determine the role mosquitoes play in the food chain on the planet.
- Students will understand energy loss that occurs between successive levels of a food chain.

Materials

1 bottle containing 1,000 ml (1 liter) of any soft drink
4 - 250ml beakers or cups
1 pipette
4 cards from food web activity
(algae, mosquitoes, dragonfly, bird)

Procedure

- (1) The 1000 ml of soft drink represent 1000 joules of energy from the sun (1000 joules equal 238.66 calories)
- (2) Four students receive cards representing algae, mosquito, dragonfly, and bird. Each also receives a beaker or cup.
- (3) Measure 100 ml of drink and pour it into the algae person's cup. Now pour the other 900 ml of drink down the drain. This is the 90% of the sun's energy not used in photosynthesis and therefore does not become part of the food chain.

- (4) Have the algae person pour 10 ml of the drink into the mosquito person's cup. The algae person may now consume 90 ml of the drink.
- (5) The mosquito person measures 1 ml of the drink into the cup of the dragonfly person. The mosquito person may now drink the remaining 90%.
- (6) The dragonfly person measures 10% of the drink into the cup of the bird. The dragonfly now drinks the remaining portion.
- (7) The bird now drinks 1 ml, if it can be poured out of the cup!



Expected Results

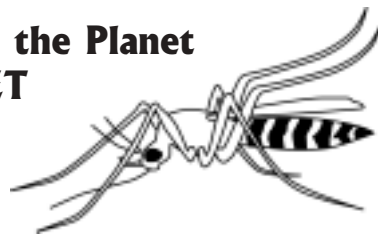
Students will notice the role the mosquito plays in the food chain and note the amount of energy that is transferred.

Evaluation Questions

- (1) What role did the mosquito play in the food chain?
- (2) What might happen if the mosquito was not a part of this food chain?

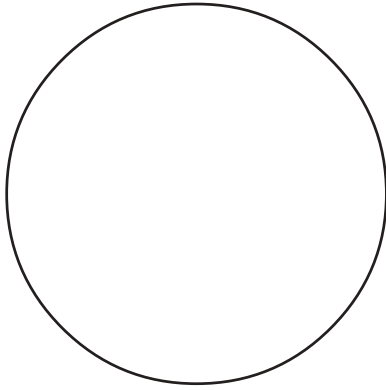
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LAB OBSERVATION SHEET

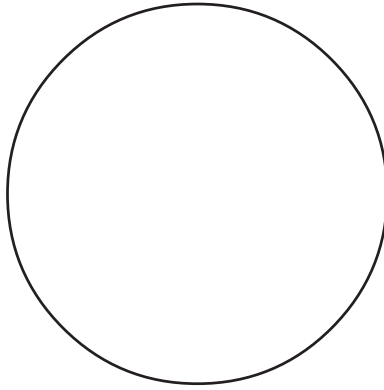


Name _____
Date _____

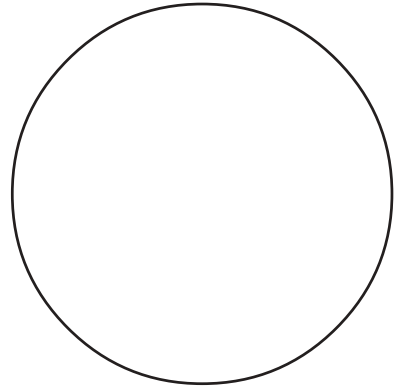
Day _____ since egg stage.



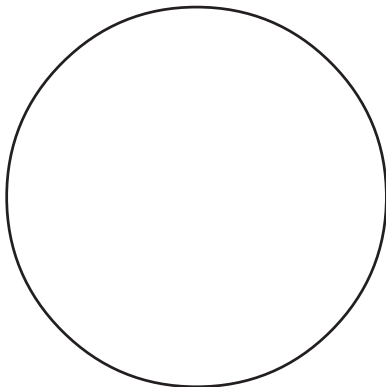
Day _____ since egg stage.



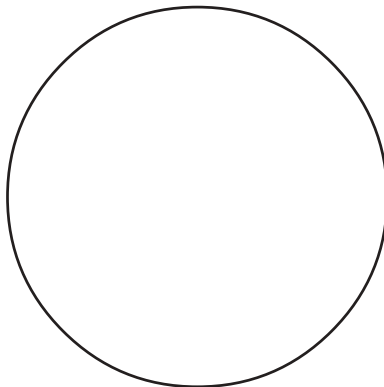
Day _____ since egg stage.



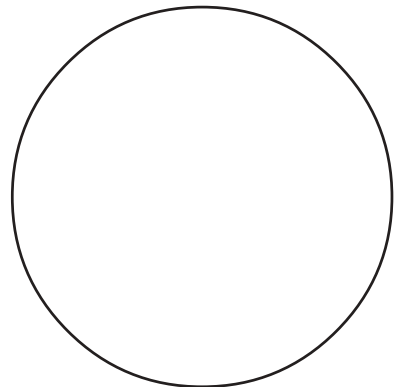
Day _____ since egg stage.



Day _____ since egg stage.



Day _____ since egg stage.





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ASSESSMENT

Name _____

Date _____

Answer the following questions in complete sentences.

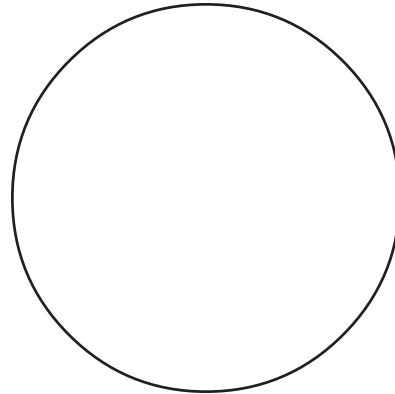
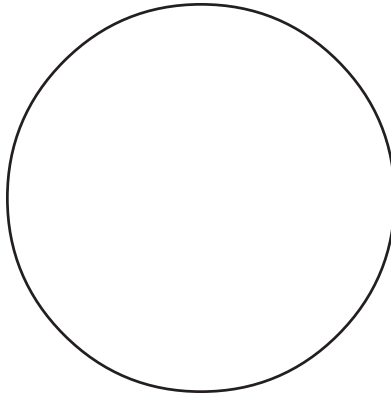
(1) Explain why water is essential to a mosquito. _____

(2) "To everything there is a purpose." Explain what purpose mosquitoes have on the planet.

(3) Draw four stages of mosquito metamorphosis. Label each metamorphosis stage in the space given.

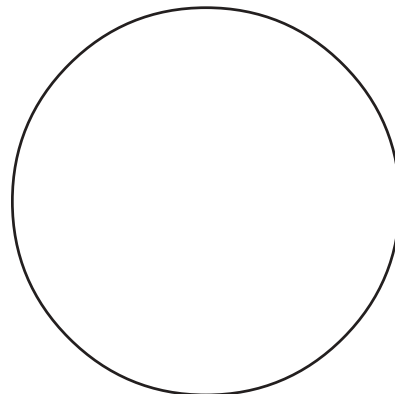
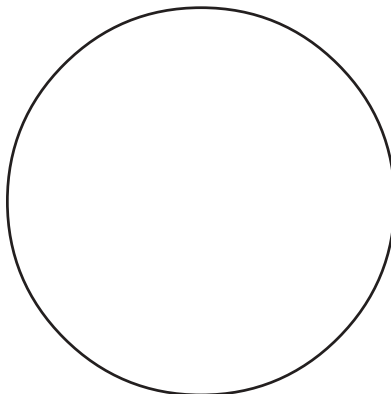
Stage Name _____

Stage Name _____



Stage Name _____

Stage Name _____



(4) Explain how mosquitoes are harmful and what precautions humans take to control them.



Resources

Educator References

- Clements, A. N. 1992. **The Biology of Mosquitoes**. New York: Chapman & Hall [ISBN: 0412401800]
- Darsie, R. F. 1981. **Identification and Geographical Distribution of the Mosquitoes of North America, north of Mexico**, Fresno, California: American Mosquito Control Association, 313 pp.
QL 535.1 D37 1981
- Dashefsky, H. S. 1994. **Entomology: Science Fair Experiments**. T A B Books, 192 pp. [ISBN: 0830645160]
- Dunn, G. A., and Dunn, D. K. 1998. **Insect Identification Guide**, 4th ed. Young Entomologists' Society, Inc., 72 pp. [ISBN: 1884256163]
- Elementary Science Study (Education Development Center). 1971. **Mosquitoes: A Resource Book for the Classroom**. New York: Webster Division, McGraw-Hill, 26 pp. QL 536 .E39 1971
- Imes, R. 1992. **The Practical Entomologist**, Simon & Schuster Trade, 151 pp. [ISBN: 0671746952]
- Stokes, D. 1984. **A Guide to Observing Insect Lives**. Vol. 1, Little, Brown & Company, 371 pp.
Introduction covers insect facts and the eight major orders. The volume is divided into spring, summer, fall, and winter insects. The information presented for the 54 insects or groups includes relationships, life cycles, and what and how to observe. [ISBN: 0316817279]

Newspaper Articles

- The New York Times, July 5, 1997. **Mosquitoes: The Life and Death of a Mosquito**, (Editorial), v. 146, pp. 20, 22.
- USA Today (Magazine), August 1987. **Mosquitoes May Be Beneficial**, v. 116, pp. 14.

Tradebooks and Resources for Children

- Aardema, V. 1992. **Why Mosquitos Buzz in People's Ears: A West African Tale**. Dial Books for Young Readers, 28 pp. [ISBN: 0140549056]
- Anderson, S. 1998. **The Mosquito Book**. Dennoch Publishing Co., 128 pp. [ISBN: 0964452111] *The authors have gathered swarms of fascinating facts and off-beat information for a fun and enlightening look at living with the bane of summertime fun, the mosquito.*
- Bailey, J., 1998. **Mosquito**. Heinemann Library, 32 pp. *A simple introduction to the physical characteristics, diet, life cycle, predators, habitat, and lifespan of mosquitoes. Lower elementary.* [ISBN: 1575726637]
- Coldrey, J. 1997. **Mosquito**. Silver Burdett Press, 25 pp. *In photographs and brief text, examines the life cycle of the mosquito. Lower elementary.* [ISBN: 0382397630]
- Goor, R. 1998. **Insect Metamorphosis: From Egg to Adult** (Aladdin Picture Books), Aladdin Paperbacks, 32 pp. *Reading level: Ages 9-12. The book is divided into sections by the type of metamorphosis insects undergo: Incomplete and complete metamorphosis.* [ISBN: 0689821964]
- Miller, S. S. 1999. **Flies: From Flower Flies to Mosquitoes**. Watts Franklin, 48 pp. *Describes the group (order) of insects known as the flies. It includes mosquitoes, horse flies, crane flies, houseflies, fruit flies, etc. The group is characterized by a set of club-like structures called halteres, which make them excellent at flight. A section at the end of the book describes observing and collecting these insects. Elementary.* [ISBN: 0531159191]
- Reese, R. 1975. **Mosquito**. A R O Publishing Company, *Lower elementary.* [ISBN: 089868014X]

WWW Links

- Associated Executives of Mosquito Control Work, 2000, January 7, **New Jersey Mosquitoes: Biology and Control**, <http://www.rci.rutgers.edu/~insects/njmos.htm>. *An excellent resource site for mosquito biology and links. Has a great frequently asked question list.*
- Wachtel, Beverly, 1999, June 21, **The Buzz on Mosquitoes**, World of Science: Earth and Sky website, <<http://earthsky.com/1998/es980731.html>>. *This webpage answers the question, "Is there any good or useful purpose that mosquitoes serve on earth?"*
- Floore, T., 2000, January 7, **Mosquito Information**, American Mosquito Control Association, <<http://www.mosquito.org/mosquito.html>>. *Excellent information on mosquito life cycle and control. Great drawings.*

Others Resources

- Contact your local and/or state mosquito abatement division for additional resources, such as mosquito egg hatching kits.