



Activity 2: It's Raining Again?!

Using real data from one particular location, students will interpret a graph that relates rainfall to the number of cases of malaria.

Background

The relationship between climate and malaria is complex. Climatic factors such as daily minimum and maximum temperatures, humidity, and rainfall influence both the size of the mosquito population and the maturation of the malaria parasite. This activity focuses on the timing and intensity of the annual rainy season, which is one of the factors affecting malaria in Africa.

Zimbabwe is a landlocked country in southeastern Africa. Its population is approximately 13 million people. In some parts of Zimbabwe, malaria is endemic, so there are always many cases of the disease at any given time. In other parts of Zimbabwe, the number of cases increases and decreases dramatically, depending on the season. The summer rainy season, which lasts from November until April, coincides with a great increase in the number of cases of malaria.

The data for this activity comes from the Hwange area, where malaria is a seasonal problem. Because rainfall and malaria case data are both available, researchers (and students) can make a connection between the two.

Anopheles mosquitoes require water in which to breed. Large amounts of rainfall increase the number of breeding sites available to the mosquito, especially if the rain falls in a short period of time so that it's more likely to create large puddles. When rainfall has been heavy, breeding sites are likely to remain long enough for the mosquito to complete the aquatic part of its life cycle. If rainfall is accompanied by warm temperatures, this leads to a lot of additional mosquitoes, and having more mosquitoes means that there are more opportunities for people to be bitten by a mosquito that is carrying the malaria parasite.

Learning Objectives

The students will:

1. Interpret a graph depicting two variables which change with respect to time.
2. Discuss the relationship between the amount of rainfall and the number of malaria cases.

Materials

1. Student Activity Guide, one per student
2. **two** markers, **one red** and **one blue**, for each student or group of students
3. map of Africa, optional
4. overhead of completed graph, optional

***MISSION DEBRIEFING:* Teacher Guide**

Procedure

Before class:

1. Make one copy of the *Student Activity Guide*, "It's Raining Again?!" for each student and one copy of the graph, "Monthly Malaria Cases and Rainfall in Hwange, Zimbabwe."
2. Obtain a map of Africa. One is available at <http://www.clickandlearn.com/GIFFiles/WhiteAfr.gif>

During class:

1. Briefly introduce malaria and the mosquito life cycle.
2. To help orient students, locate Zimbabwe on the map of Africa.
3. Have students complete the *Student Activity Guide*, "It's Raining Again?!" individually. Next, have them share their answers with a partner. You may need to introduce the concept of a graph with information on the left and right sides if they are not familiar with that style.
4. Discuss the answers to the worksheet as a class.

The actual data graphed on the student graph is listed below for your reference. This data is provided courtesy of Moshe Hoshen at the University of Liverpool.

Month and Year	Monthly Total Rainfall (mm)	# of Malaria Cases
Oct 1995	0.71	2,280
Nov 1995	0.87	3,200
Dec 1995	38.99	2,800
Jan 1996	151.67	3,000
Feb 1996	134.74	9,600
Mar 1996	189.86	19,200
Apr 1996	406.50	39,000
May 1996	7.11	35,000
Jun 1996	8.18	14,000
Jul 1996	15.70	6,400
Aug 1996	0	4,080
Sep 1996	0	5,000
Oct 1996	0	4,480
Nov 1996	0.51	5,520
Dec 1996	17.63	4,400
Jan 1997	124.92	4,160
Feb 1997	55.86	4,880
Mar 1997	241.19	11,520
Apr 1997	162.08	14,840
May 1997	134.19	19,000
Jun 1997	0	10,000
Jul 1997	1.02	8,800
Aug 1997	0	4,800
Sep 1997	0	5,400
Oct 1997	0	5,600
Nov 1997	5.77	5,320
Dec 1997	46.37	5,120

Teacher Key: It's Raining Again?!

The gray circles represent monthly rainfall. With your blue marker, connect the gray circles. On the figure legend, draw a blue line next to the monthly rainfall entry.

The y axis on the left side shows the monthly rainfall in mm. Draw over this y axis in blue.

1. Which month had the highest amount of rainfall?
April 1996
2. During 1996, which months had the lowest recorded rainfall?
August, September and October 1996 (some may include November)
3. About how much rain fell in March 1997?
241 mm
4. Is rainfall consistent from month to month?
No, it varies greatly.

The black triangles represent the number of malaria cases recorded.

With your red marker, connect the black triangles. On the figure legend, draw a red line next to the “number of malaria cases” entry.

The y axis on the right side shows the number of malaria cases. Draw over this y axis in red.

5. During which month were the most malaria cases seen?
April 1996
6. What is the lowest number of malaria cases?
About 2,300
7. How many malaria cases were seen in June 1997?
About 10,000
8. Is the number of malaria cases consistent from month to month? Explain.
No, it varies greatly, but it never reaches zero.
9. The months between December and May are the rainy season. During which rainy season did the largest number of malaria cases occur?
1995 -1996
10. The increase in the number of malaria cases happens a few weeks after the beginning of the rainy season. Why?
It takes time for the mosquitoes to grow, for the parasite to be transmitted from mosquito to human, and for the disease to cause symptoms and be diagnosed in the human.
11. Scientists predict that climate change will lead to changes in the amount and timing of rainfall. This might cause the length of the rainy season to change in parts of the world. What do you think the effect of a shorter rainy season would be on the number of malaria cases?
A shorter rainy season would probably mean fewer cases of malaria.

Extension Activities

Mathematics – Calculate the total rainfall (mm) during the first rainy season (Dec-May, '95-'96) and compare it to the total rainfall during the second rainy season (Dec-May, '96-'97). Calculate the average rainfall for 1996 and 1997.

Science – Research ways to reduce the number of malaria cases. Recommend solutions depending on the season.

Standards

National Science Education Standards, Grades 5-8

- Science Content Standard A: All students should develop abilities necessary to do science.
- Science Content Standard C: All students should develop understanding of the diversity and adaptations of organisms.
- Science Content Standard F: All students should develop understanding of personal health.
- Science Content Standard F: All students should develop understanding of science and technology in society.

Reading Material for Teachers

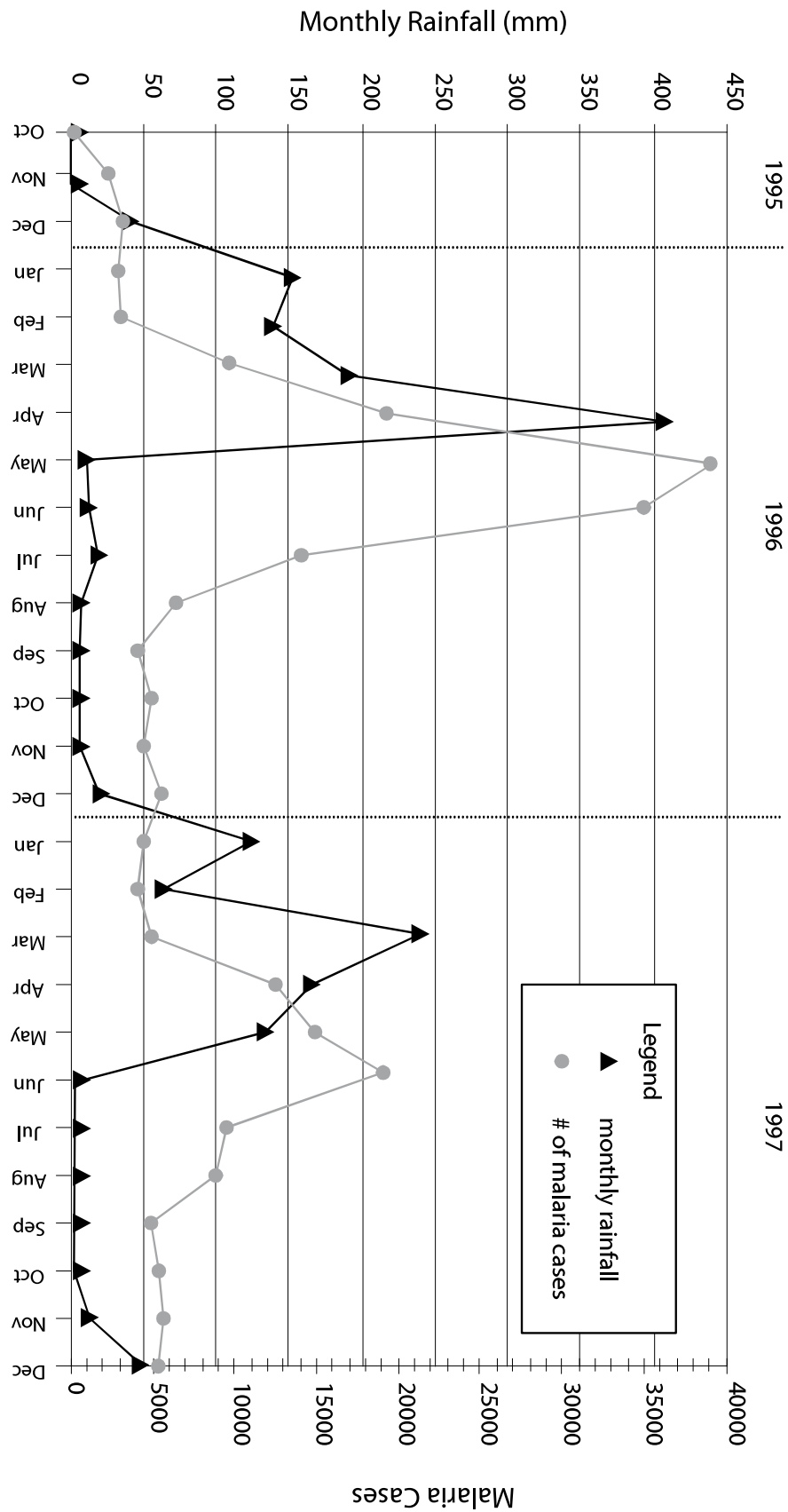
- Spielman, A. and D'Antonio, M. 2001. Mosquito: A Natural History of Our Most Persistent and Deadly Foe. New York: Hyperion. This book provides a good layman's introduction to mankind's interaction with mosquitoes. It includes extensive information on the history and life cycle of malaria.
- Dunavan, CP 2005. "Malaria." *Scientific American*, December 2005, p. 76-83. This article is an excellent overview of current efforts to prevent and treat malaria. It includes a life cycle graphic.

Reading Material for Students

- Dunavan, CP 2005. "Malaria." *Scientific American*, December 2005, p. 76-83. This article is an excellent overview of current efforts to prevent and treat malaria. It includes a life cycle graphic. This article is most appropriate for strong readers.

Web sites

- <http://www.epa.gov/globalwarming/kids/climateweather.html>
This site by the Environmental Protection Agency gives a basic overview of weather, climate, and how people might be changing the earth's climate. It is geared toward children.
- <http://www.exploratorium.edu/climate/index.html>
The Exploratorium in San Francisco includes data on and explanations of different aspects of climate and climate change. This site is geared toward adults.





Name _____

Activity 2: It's Raining Again?!

In some parts of the world, the number of malaria cases varies according to the season. You will use data from one area of Africa to determine the relationship between malaria and rainfall.

Materials

1. one red and one blue marker
2. Copy of the handout *Monthly Malaria Cases and Rainfall in Hwange, Zimbabwe*

Procedure

Using the graph, complete the steps below and answer questions where indicated. Use complete sentences when the answer is longer than just a single word or number.

The gray circles represent monthly rainfall. With your blue marker, connect the gray circles. On the figure legend, draw a blue line next to the “monthly rainfall” entry.

The y axis on the left side shows the rainfall in millimeters (mm). Draw over this y axis in blue.

1. Which month had the highest amount of rainfall?
2. During 1996, which months had the lowest recorded rainfall?
3. About how much rain fell in March 1997?
4. Is rainfall consistent from month to month?

The black triangles represent the number of malaria cases recorded. With your red marker, connect the black triangles. On the figure legend, draw a red line next to the “number of malaria cases” entry.

The y axis on the right side shows the number of malaria cases. Draw over this y axis in red.

5. During which month were the most malaria cases seen?

6. What is the lowest number of malaria cases?

7. How many malaria cases were seen in June 1997?

8. Is the number of malaria cases consistent from month to month? Explain.

9. The months between December and May are the rainy season. During which rainy season were the most number of malaria cases recorded?

10. The increase in the number of malaria cases happens a few weeks after the beginning of the rainy season. Why?

11. Scientists predict that climate change will lead to changes in the amount and timing of rainfall. This might cause the length of the rainy season to change in parts of the world. What do you think the effect of a shorter rainy season would be on the number of malaria cases? Explain your answer.

