

The Disappearing Honeybees

Tracking Honeybee Decline

Skills: Math, Science

Objective: Students use graphing and other math skills to track the number of honeybee colonies present in the US since 1978.

Background

Pollinators are important to us. Without pollination, one-third of the foods we are accustomed to eating could not grow. This includes the majority of fruits, many vegetables (or their seed crops) and even legumes such as alfalfa and clover, which are fed to the livestock we eat as meat.

Many of the foods we grow and eat in the US are from crops that first grew in other parts of the world. Some of these foods depend on another import for pollination—the domestic honeybee.

The Spanish brought the first European honeybee colonies to the Americas in the 16th Century. English colonists brought more honeybees in 1622. Soon honeybees had escaped into the wild and were buzzing all over North America. Native Americans called them "the white man's fly."

MAJOR CROPS DEPENDENT ON
POLLINATORS

Crop category	Dependence on insect pollination	Proportion of pollinators that are honeybees
alfalfa, hay and seed	100%	60%
apples	100%	90%
almonds	100%	90%
citrus	20%-80%	10%-90%
cotton (lint and seed)	20%	80%
soybeans	10%	50%
onions	100%	90%
broccoli	100%	90%
carrots	100%	90%
sunflower	100%	90%

Source: Compiled by Congressional Research Service, using values reported in Morse, RA, and NW Calderone, *The Value of Honey Bees as Pollinators of US Crops in 2000*, March 2000, Cornell University, <http://www.masterbeekeeper.org/pdf/pollination.pdf>

P.A.S.S.

GRADE 6

Math Process—1.2,6; 2.1;

3.3; 4.1; 5.1,4

Math Content—5.2

Science Process—4.2,3

Life Science—4.1

GRADE 7

Math Process—1.2,6; 2.1;

3.3; 4.1; 5.1,4

Math Content—2.2c; 5.1

Science Process—4.2,3

GRADE 8

Math Process—1.2,6; 2.1;

3.3; 4.1; 5.1,4

Math Content—5.1

Science Process—4.2,3

Life Science—3.2

Resources Needed

calculators

WHERE ARE THE BEES?

Beginning in 2006, researchers began to notice that the number of honeybees available for pollination were in decline all over the US. Bees would fly off in search of pollen and nectar and simply never return to their colonies. Nobody could understand why. The behavior is very unusual for a social insect like the honeybee, because honeybees are very colony-oriented. They want to take care of the queen, so to leave the colony and not come back is highly unusual. Researchers called the condition “colony collapse disorder.”

Investigators are exploring a variety of possible causes, including viruses, a fungus and poor bee nutrition.

Mites have also damaged bee colonies, and the insecticides used to try to kill mites harm the ability of queen bees to spawn as many worker bees. Queens are also not living as long as they did in the past.

Source: Barrionevo, Alexei, “Honeybees Vanish, Leaving Keepers in Peril,” *The New York Times*, <http://www.nytimes.com/2007/02/27/business/27bees.html>?

A Cornell University study has estimated that honeybees annually pollinate more than \$14 billion worth of seeds and crops. Growers have tried without success to find other methods for spreading pollen. Some of the more extreme methods include giant blowers, helicopters and mortar shells.

Beekeepers truck tens of billions of bees around the country every year, moving from field to field. Profits from renting beehives to farmers for pollination exceed those from the production of honey. In 2007 the price for renting a bee colony was about \$135.

A typical bee colony ranges from 15,000 to 30,000 bees. In the past 50 years, the population of domesticated honeybees has dropped 50 percent. In some parts of the country, farmers are starting to worry that there are not enough honeybees available to pollinate their crops.

The honeybee decline is mostly the result of diseases spread as a result of mites and other parasites. One of the greatest problems is the non-native varroa mite. The varroa mite feeds much like a tick on the body of a bee. One sign of infection is deformed wings. Varroa mites probably originated in Eastern or Chinese honeybee populations and were carried to the US on a ship in 1987. They quickly infested European honeybees.

The varroa mite also transmits disease, particularly viruses. Left untreated, a varroa mite infestation can wipe out a bee colony within a few months.

Another major bee pest is the tracheal mite, which gets inside adult bees and clogs their breathing tubes. The tracheal mites also impede the bees' ability to fly, making them useless as pollinators. Tracheal mites were first reported in the Isle of Wight in the British Isles but are believed to have entered the US via Mexico in 1984 .

Both the varroa and tracheal mites puncture holes in bees' bodies. The holes serve as pathways for viruses that kill the bees.

Researchers have had some mite-control success by increasing the ventilation of managed bee colonies. Most colonies are airtight by design, to protect honeybees from the elements. Other forms of mite control include increased attention to grooming behaviors and chemical treatments.

Activities

1. Read and discuss background and vocabulary.
 - Use the table of major crops dependent on insect pollinators to lead a discussion of the impact of pollinator loss on the food supply.
 - Ask students to list the foods in the table they have eaten in the past week. Note: alfalfa hay is a major food for meat animals like beef cattle. Cottonseed oil is an ingredient in mayonnaise, salad dressings and other products. Sunflower seed oil is also used in some salad dressings.
2. Discuss the different kinds of graphs. (See “Graphs” in the Resource section.)
 - Divide students into groups.
 - Provide students with copies of the table included with this lesson, “Honeybee Colonies in the US.”
 - Students work in groups to read and complete the instructions/questions following the table.

- Students display what they have learned.
 - Students use their graphs to agree or disagree with the reasoning of their classmates.
 - Did reported domesticated bee colonies decline more in Oklahoma than they did nationwide?
 - What other reasons besides those presented in the background might have caused the numbers to decline? (fewer people interested in beekeeping, fewer plants available for pollinating)
 - Students will discuss their procedures with a partner.
 - Students will write explanations of their thoughts and answers.
3. Students will write paragraphs comparing the decline in bee colonies in Oklahoma with the decline in the US during the years 1978 and 2003.

Extra Reading

Bishop, Holley, *Robbing the Bees*, Free Press, 2006.

Horn, Tammy, *Bees in America, How the Honey Bee Shaped a Nation*, 2006.

Souza, DM, *Freaky Flowers*, Franklin Watts, 2002.

Vocabulary

domesticated—adapted to living with human beings and serving their purposes

feral—having escaped from domestication and become wild

legume—any of a large family of herbs, shrubs, and trees that have fruits which are dry single-celled pods that split into two pieces when ripe, that bear nodules on the roots that contain nitrogen-fixing bacteria, and that include important food plants (as peas, beans, or clovers)

nomad—a member of a people that has no fixed home but wanders from place to place

parasite—a living thing which lives in or on another living thing in parasitism

pollinate—to place pollen on the stigma of

wild—living in a state of nature and not under human control and care

Honeybee Colonies in the US

The table below shows the number of honeybee colonies kept for honey production reported to the National Ag Statistics Service in the US and in Oklahoma between 1978 and 2006. After 2003, Oklahoma colonies were no longer listed separately to avoid disclosing data for individual beekeeping operations.

	US	OKLAHOMA
2006	2,392,000	not listed separately
2005	2,413,000	not listed separately
2004	2,556,000	not listed separately
2003	2,599,000	3,000
2002	2,574,000	3,000
2001	2,506,000	4,000
2000	2,620,000	7,000
1999	2,688,000	6,000
1998	2,633,000	4,000
1997	2,631,000	4,000
1996	2,564,000	4,000
1995	2,648,000	4,000
1994	2,770,000	5,000
1993	2,876,000	6,000
1992	3,030,000	9,000
1991	3,181,000	9,000
1990	3,210,000	9,000
1989	3,443,000	9,000
1988	3,219,000	10,000
1987	3,190,000	10,000
1986*	3,205,000	15,000
1981	4,213,000	48,000
1980	4,141,000	44,000
1979	4,163,000	55,000
1978	4,081,000	60,000

*Data for 1982-5 unavailable

Source: Honey, February, 2007, Agricultural Statistics Board, NASS, USDA,

<http://usda.mannlib.cornell.edu/usda/current/Hone/Hone-02-28-2007.pdf>

Select the appropriate graph (bar, double bar, circle, line, pictograph, histogram, stem 'n leaf), and graph the numbers of bee colonies from 1978-2006 in the US and Oklahoma. On the back of your graph, answer the following questions:

1. Based on this table, the number of bee colonies in the US was largest in what year? In Oklahoma?
2. Using the years of the largest colonies from the US and Oklahoma, compute the percentage of DECLINE in the following years: 1990, 1995, 2000, 2003.
3. Compare, as a percent, the total number of colonies in Oklahoma to those in the US for the following years: 1978, 1986, 1993, 2003.
4. How did the decline in bee colonies in Oklahoma between 1978 and 2003 compare with the decline in the US? Was there a steady decline for both groups? What are some possible reasons for your findings?

Honeybee Colonies in the US (answers)

The table below is the number of honeybee colonies kept for honey production reported to the National Ag Statistics Service in the US and in Oklahoma between 1978 and 2006. After 2003, Oklahoma colonies were no longer listed separately to avoid disclosing data for individual beekeeping operations.

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Select the appropriate graph (bar, double bar, circle, line, pictograph, histogram, stem 'n leaf), and graph the numbers of bee colonies from 1978-2006 in the US and Oklahoma. On the back of your graph, answer the following questions:

- Based on this table, the number of bee colonies in the US was largest in what year? (1981) In Oklahoma? (1978)
- Using the years of the largest colonies from the US and Oklahoma, compute the percentage of DECLINE in the following years: 1990, 1995, 2000, 2003.

Year	US	OK
1990	23.8%	85%
1995	37%	93.3%
2000	38%	88%
2003	38.3%	95%

- Compare, as a percent, the total number of colonies in Oklahoma to those in the US for the following years: 1978, 1986, 1993, 2003.

1978: 1.5%; 1986: .5%; 1993: 0.2%; 2003: 0.1%

- How did the decline in bee colonies in Oklahoma between 1978 and 2003 compare with the decline in the US? Was there a steady decline for both groups? What are some possible reasons for your findings?