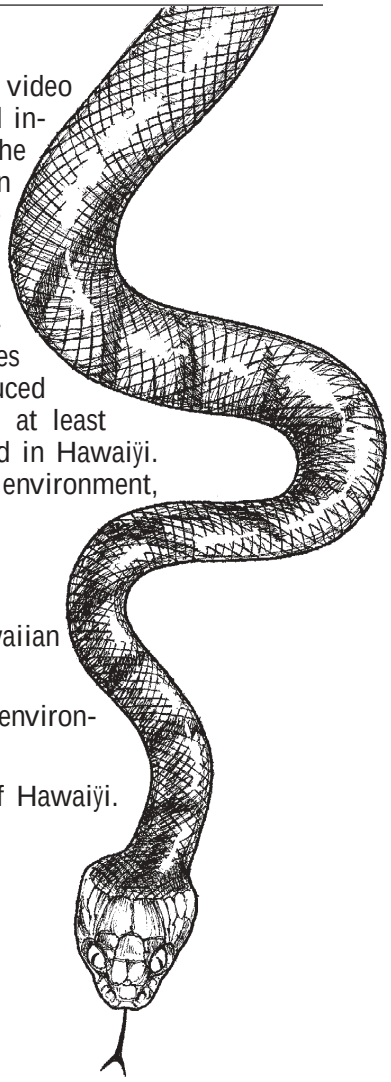
Guam's Snake Story

Grades 9-12



Lesson at a Glance: Students read information and watch a video about the tree snake's impact on Guam. Using data from these sources and information about the snake's fertility rate, students project how rapidly the snake could spread and what its density could reach if it were established in the Hawaiian Islands. Students graph their results and discuss the potential impacts and what can be done to prevent the snake's invasion.

Key Concepts: The brown tree snake, which was accidentally introduced to Guam in the 1940s is a slightly venomous snake that injures people, causes power outages, and has devastated the native and introduced land bird populations. The brown tree snake has been found in Hawaiÿi at least seven times as a stowaway on aircraft from Guam. It is not yet established in Hawaiÿi. It could rapidly spread and pose a serious threat to Hawaiÿi's economy, environment, visitor industry, and quality of life.

Objectives: Students will be able to:

1. Describe the impact the brown tree snake would have on the Hawaiian Islands if it became established.
2. Determine the potential rate of the snake's population growth in an environment with no predators.
3. Identify what needs to be done to keep the brown tree snake out of Hawaiÿi.

Time: two class periods

Subject Areas: science, math, social studies

Materials:
- student reading (provided)
- *The Silent Invader* video (provided)
- graph paper

Preparation: Make a copy of the student readings for each student.

Teacher Background: Of all the pests species that threaten Hawaiÿi, the brown tree snake is the most feared. Since its arrival as a stowaway in military cargo on Guam in the 1940s, this aggressive snake has wreaked havoc on the island's ecology. Many of Guam's forests are now silent. Where native birds once thrived, the snakes have moved in and hunted nine of the eleven endemic species to extinction. This successful invader has also preyed on the island's lizards and fruit bats. The population of Guam's last remaining native fruit bat colony has dropped from 800 to 200 bats as a result of predation by brown tree snakes. Since Guam's native animals did not evolve with a tree-climbing predator, they lack defenses against the snake. And there are no natural enemies to help control the snake on Guam. In its home range of New Guinea, the Solomon Islands and northeast Australia, the snakes may be controlled by hawks and voracious insects that eat the snake's eggs.

Without these natural controls, ecologists on Guam feel they are fighting a losing battle in trying to prevent the extinction of remaining native species. Scientists have resorted to placing electrical barriers on trees with nests to keep the snakes away. They are also taking eggs from nests and raising some endangered birds in captivity. These heroic measures can do little to save Guam's native ecosystems, which have been irreversibly damaged. Scientists fear that native plants that relied on the birds and bats for pollination will decline as well.

It has been approximately 50 years since the brown tree snake invaded Guam. In this time, it has reached a population of one million! In some areas there are an estimated 12,000 snakes per square mile—the highest terrestrial snake density in the world. With little hope of eradicating this new predator, Guam is working to contain the snake and prevent it from reaching other destinations. It has been found on Oÿahu at least seven times coming in on aircraft from Guam. To prevent the snake from arriving and becoming established in Hawaiÿi, State and federal agencies including the military, need additional funding and personnel to:

- Inspect all aircraft and ships leaving Guam and Australia.
- Inspect all aircraft and ships arriving in Hawaiÿi from Guam and Australia.
- Conduct regular surveys near harbors and airports to find any snakes that enter Hawaiÿi and catch them as soon as possible.
- Train and maintain Snake Watch Attack Teams on each island to respond if a snake is found.
- Conduct more research to develop better snake control methods.
- Train military personnel to be more conscious of the threat of transporting snakes in Army tanks and other vehicles that are shipped to Hawaiÿi.

Teaching Suggestions:

1. Distribute the *Wanted* notice on the brown tree snake for students to read. Then ask students to describe their reactions to the threat. List students' ideas on the board.
2. Show the video *The Silent Invader* which describes the impact of the snake on Guam and how people can play a key role in preventing the spread of the brown tree snake.
3. After viewing the video, initiate a class discussion either as a whole class or in small groups with one student recording and another reporting students' ideas.

   Discussion Questions:

   - Why did it take years for Guam's people to be aware of the brown tree snakes that had invaded their island?
   - If the snake kills Guam's birds and fruit bats, how might the native plants be affected?
   - In what ways could your life be affected if the brown tree snake invaded Hawaiÿi?
4. Challenge groups of students to collaborate and figure out what the population of snakes could be after seven years if one pregnant female successfully invaded Hawaiÿi. Assume that:

   - Females give birth to 8 eggs per year (actual clutch size 4-12 eggs).
   - The snakes are mature enough to reproduce at 3 years of age.
   - Half of the offspring are female in each generation.
   - The snakes live for 15 years (actual life-span 10-20 years).
   - There are no predators.
   - The first female lays/hatches her eggs immediately after arriving in Hawaiÿi.

- Snakes mate and raise only 1 set of offspring (8 eggs) per year.
- Eggs incubate less than a month before hatching.
- There is no loss of fertility due to inbreeding.

This is a very challenging task and students may need assistance. See diagram below and information on page 4 and sample graph on page 5 to follow how the population grows. Distribute graph paper and have students graph their results.

5. Discuss control measures on Guam and preventive measures in Hawaiÿi. Explain that State and Federal agencies do not have enough funding to inspect all aircraft and ships leaving Guam and Australia and arriving in Hawaiÿi. If students are concerned about this issue, encourage them to write to their State and Federal government representatives and to spread the word to others in the community.

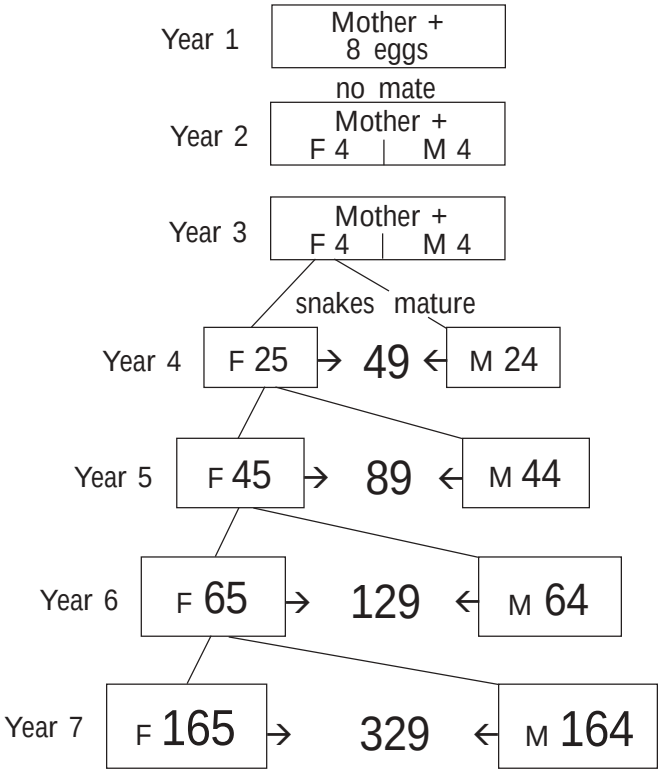
Extended Activities:

- Have students make presentations to alert other classes to the threat of brown tree snakes.
- Distribute the *Miconia* wanted notice to students and share it with others to raise awareness about the *Miconia* invasion and what is being done to control this aggressive plant. Discuss the reading with students.

Discussion Questions:

- If *Miconia* is such an attractive plant, why should we be concerned about it spreading in Hawaiÿi?
- Why is this plant such a successful invader?
- If *Miconia* destroys more of Hawaiÿi's forest, will it make any difference in your life? Explain.

The (Snake) Family Tree



Brown Tree Snake Growth Rates

Chart by Coleen Cory, Ecologist
The Nature Conservancy of Hawaii

Year	Activity	Female	Male	Total
Begin Year 1:	Population at beginning of Year 1	1	0	1
	1 female mother (generation 1) lays/hatches 8 eggs	+4	+4	8
End Year 1:	Daughters (generation 2) are 1 year old			
	Population at end of Year 1	**5**	**4**	**9**
Begin Year 2:	Population at beginning of Year 2	5	4	9
	No one mates (males are too young)			
End Year 2:	Daughters (generation 2) are 2 years old			
	Population at end of Year 2	**5**	**4**	**9**
Begin Year 3:	Population at beginning of Year 3	5	4	9
	No one mates (males are too young)			
End Year 3:	Daughters (generation 2) are 3 years old			
	Population at end of Year 3	**5**	**4**	**9**
Begin Year 4:	Population at beginning of Year 4	5	4	9
	1 mother (generation 1) and 4 daughters (generation 2) mate/hatch 8 eggs each (generation 3A)	+20	+20	+40
End Year 4:	Granddaughters (generation 3A) are 1 year old			
	Population at end of Year 4	**25**	**24**	**49**
Begin Year 5:	Population at beginning of Year 5	25	24	49
	1 mother (generation 1) and 4 daughters (generation 2) mate/hatch 8 eggs each (generation 3B)	+20	+20	+40
End Year 5:	Granddaughters (generation 3A) are 2 years old			
	Granddaughters (generation 3B) are 1 year old			
	Population at end of Year 5	**45**	**44**	**89**
Begin Year 6:	Population at beginning of Year 6	45	44	89
	1 mother (generation 1) and 4 daughters (generation 2) mate/hatch 8 eggs each (generation 3C)	+20	+20	+40
End Year 6:	Granddaughters (generation 3A) are 3 years old			
	Granddaughters (generation 3B) are 2 years old			
	Granddaughters (generation 3C) are 1 year old			
	Population at end of Year 6	**65**	**64**	**129**
Begin Year 7:	Population at beginning of Year 7	65	64	129
	1 mother (generation 1) and 4 daughters (generation 2) mate/hatch 8 eggs each (generation 3D)	+20	+20	+40
	20 granddaughters (generation 3A) mate/hatch 8 eggs each (generation 4A)	+80	+80	+160
End Year 7:	Granddaughters (generation 3B) are 3 years old			
	Granddaughters (generation 3C) are 2 years old			
	Granddaughters (generation 3D) are 1 year old			
	Great-granddaughters (generation 4A) are 1 year old			
	Population at end of Year 7	**165**	**164**	**329**

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