A Monarchy Deposed: The Demise of the Monarch Butterfly

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2.94 acres (1.19 ha) is about the size of 2.2 U.S. football fields, or about 1.5 international soccer fields. Imagine sitting high in the stands, looking out over the field below and thinking that the entire fate of a population of a species relies on an ecosystem only slightly larger.

The question is not hypothetical. The species in question is the monarch butterfly (scientific name: *Danaus plexippus*; Figure 1), and the latest scientific assessment found that the 9 remaining hibernating colonies in Mexico occupied just 2.94 acres, down from 7.14 acres a year earlier.

What is happening to this species? Is the decline natural, or a result of human impact? Can the species be saved? Is it worth saving? You will answer these and other questions in this activity.

Question 1: What is the percentage decrease in area occupied by overwintering monarch butterflies in Mexico from 2012 – 2013?

Question 2: Previous surveys (about 20 years earlier) found a maximum 50 acres of overwintering habitat. What is the percentage decrease from 50 to 2.94 acres?

Question 3: Explain whether you think declines of this magnitude are cause for alarm. In other words, explain whether you think the species may be endangered by this decrease in population.

Recall the concept of *doubling time* (or *halving time*): When a population grows exponentially (by a percentage of the original number), the time it takes for the population to double, called *doubling time* (symbol “**t**”), can be approximately calculated using the following formula:

**t** = **(70**/**r)**

where t is the doubling time (usually in years) and r is the growth rate expressed as the decimal increase or decrease ×100 (for example, you would enter 7 for a 7% increase).

Question 4: Use the doubling time formula to calculate how long it will take for the overwintering area to be halved (to 1.47 ac).

Scientists calculate the overwintering area instead of the actual population size as an indicator of the health of the species because determining the latter is too difficult. Thus, *overwintering area* is a *proxy* for population size.

To determine the health of the species, in addition to knowing the population size (or the proxy of overwintering area), scientists need to know the monarch’s *critical number.* For any species or population of organisms, there exists a population size below which thatgroup is doomed to extinction. This is known as a critical number. When the number ofadult individuals drops to this critical level, there is simply not a large enough reservoir ofgenetic variability and potential for mating to allow the population or species to propagate

and successfully face the rigors of its environment, including competition with other species. Genetic variation is central to the survival of a species because it is the raw material for natural selection. When a population’s environment changes, genetic variation can

produce some individuals that have the characteristics necessary for survival. Critical numbers are difficult to determine, and efforts to do so are often not undertaken until a species is near extinction. Thus, it is unclear whether monarchs have reached the critical level, but given the magnitude and trajectory of the decline, it would not be unreasonable to conclude that the population is critically stressed.

Question 5: What kind of threats do you think migrating monarch butterflies might face? List as many as you can.

According to conservation biologists, the most recent decline owes to higher-than-normal temperatures and drought in parts of their range in North America. The higher temperatures resulted in monarchs arriving at their breeding sites in North America earlier than usual. The monarchs also nested farther north than they have done in the past. The result: The timing of breeding was affected, and eggs desiccated in the face of the heat and dryness. Moreover, the nectar content of their main food – milkweed, declined as a result of the weather and the female monarchs were weakened and laid fewer eggs.

The milkweed also suffered from increased use if herbicides on corn and soybean crops.

Declines in the past have been attributed to logging in forests in Mexico.

According to Chip Taylor, director of the conservation group *Monarch Watch* atthe University of Kansas, “That habitat is virtually gone. We’ve lost well over 120 million acres, and probably closer to 150 million acres.”

Question 6: Is it worth saving the monarch butterfly? Justify your answer.

Question 7: Do you think there may be other organisms like the monarch whose populations have declined but of which you are unaware?

Question 8: Do monarch butterflies live or migrate through your area? If so, what actions could you take to protect monarchs in your area?

If not, what responsibility do you have to protect monarch butterflies?

Question 9: Summarize the issues in this activity.

For Further Thought

Research the issue of monarch butterflies.