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Storm in Mexico Devastates Monarch Butterfly Colonies. (Foreign Desk) *Carol Kaesuk Yoon.*

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After a severe winter storm in mid-January, in the mountains of central Mexico, dead monarch butterflies lay in piles on the ground, in some places more than a foot high. Between 220 and 270 million frozen butterflies had rained down from roosts where they normally festooned towering trees, researchers estimated.

"It was really macabre," said Dr. Lincoln P. Brower, a butterfly biologist. "I've been going down there for 25 years, and I've never seen anything like it."

Most of the monarchs in the two biggest colonies in Mexico were killed in the storm, in the largest known die-off ever of these butterflies, according to a report by Dr. Brower and a team of researchers from **Mexico** and the United States. But the loss of life is not expected to threaten the species, they said.

In the report Dr. Brower, of Sweet Briar College in Sweet Briar, Va., and his colleagues estimated that 74 percent of the monarchs at the Sierra Chincua colony and 80 percent at the Rosario colony had been killed. Along with a few smaller colonies, which scientists have not surveyed, the butterflies in these major colonies make up the entire breeding stock of monarchs for the eastern United States and Canada.

The spectacle of the monarchs' long and rugged mass migration north from Mexico each spring, a highly unusual behavior for an insect, has made the species a favorite of nature lovers. The butterflies fly north, stopping to lay eggs in the southern United States. The monarchs that develop from those eggs continue the journey, and by summer butterflies reach as far north as Canada.

The monarchs' epic migration is so exceptional that scientists have called it an "endangered biological phenomenon." If the populations that fly north each year from Mexico were to disappear, the mysteries of that migration might never be solved.

While saying it was unlikely that a single event could ring the death knell for the Mexican monarch populations, researchers said the radically reduced numbers left the butterflies vulnerable to future whims of weather, disease and continuing deforestation in and around their winter resting grounds in Mexico.

Scientists noted that the species as a whole was not in danger because other, smaller populations of monarchs that did not migrate to Mexico could be found elsewhere, such as in the western United States.

Scientists will know in coming weeks how precarious the situation of the devastated populations has become, as they get a better sense of how many millions survived and what shape the butterflies are in as they begin to move north.

"A bad winter followed by a bad spring could be catastrophic," said Dr. Karen Oberhauser, a monarch ecologist at the University of Minnesota.

Casual observers are unlikely to notice an obvious drop in monarch numbers this spring, in part because of the natural variability in population size from year to year.

The Rosario and Sierra Chincua colonies are thought to harbor perhaps two-thirds of all the butterflies in Mexico's monarch sanctuaries, which are in mountains in the state of Michoacan, west of Mexico City.

The results of the report, based on research in late January, were released yesterday by World Wildlife Fund Mexico, which financed the research along with Sweet Briar College and the Monarch Butterfly Sanctuary Foundation.

Scientists who did not take part in the study expressed confidence in the team of researchers and the data, which have not yet been published in a scientific journal. Dr. Chip Taylor, an ecologist at the University of Kansas, called the findings "clear and compelling."

According to the report, the storm on Jan. 12 and 13 dropped about four inches of rain in the area and was followed by freezing temperatures, a deadly combination as monarchs are known to be particularly susceptible to freezing if they become wet. While noting that records were spotty, Dr. Brower said temperatures following the storm were the lowest recorded in the winter colonies in the last 25 years.

Because forest trees can act as an umbrella against the rain and a blanket that can retain heat, scientists and conservationists have been warning for years that the thinning of the forests in the relatively small area they have chosen for their habitats could threaten the butterflies by increasing their exposure to these elements. And an earlier study showed that in the last 30 years, nearly half the prime forest in the area had been degraded or destroyed.

Dr. Brower said that he believed the loss of forests had contributed to the die-off. But Dr. Taylor suggested the that storm was so severe it might have taken its huge toll even with the cover of intact forests.

Every year some of the millions of monarchs that spend the winter in these high mountain forests die from predation, freezing or other causes. Last year, hundreds of thousands of butterflies were found dead in another colony, raising concern that they had been intentionally killed with pesticides. But the butterflies were found to be free of insecticides when tested in the laboratory, and scientists soon reached a consensus instead that a severe cold snap was the cause of death. Scientists still do not have precise estimates of the typical numbers of monarchs that die in Mexico each winter, but researchers agree it is considerably lower than the estimates of mortality from the storm in January.

Scientists say monarch butterflies tend to gather in similar densities in the colonies from year to year. As a result, the number of acres covered by monarchs and counts of monarch-filled trees are thought to provide reliable estimates of colony size. So researchers compared the size of the area covered by monarchs and the numbers of trees, both before and after the storm, to determine the reduction in colony sizes.

"This is the lowest known number of butterflies at these sites over the last 27 years," Dr. Taylor observed.

The team also took random samples throughout the two colonies to estimate total numbers of dead monarchs in the forests.

Dr. Brower said he feared that the numbers, if anything, were an underestimate of the actual death toll, as researchers only counted the butterflies on the ground. He said he had just received word from researchers in Mexico that the storm had left monarchs dead everywhere, including at their roosts in the trees.

"Some of these clusters hanging on the trees are just all dead," he said. "It's terrible."

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