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HOW HAS FUKUSHIMA'S NUCLEAR DISASTER AFFECTED THE ENVIRONMENT?

A YEAR AFTER JAPAN'S NUCLEAR MELTDOWN, SCIENTISTS ARE INVESTIGATING THE EFFECTS OF RADIATION EXPOSURE ON BIRDS, OTHER WILDLIFE, AND PLANTS.

BY JANE BRAXTON LITTLE

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Along the deserted roadways wending inland from the northeast coast of Japan, a team of scientists wearing face masks is counting birds flitting in the foliage. As they pick their way past rice paddies and wooded villages left empty by fleeing families, they also collect samples of insects, wildflowers, and other plants. At each stop they measure the radiation level with a handheld device called a dosimeter.

This is Fukushima Province: scenic, rich in biodiversity, and heavily contaminated by what Japan's former Prime Minister Naoto Kan calls "the invisible enemy." Radioactive fallout has tainted hundreds of square miles north of Tokyo since March 11, 2011, when a magnitude 9.0 earthquake triggered a tsunami that caused three reactors at the Fukushima Daiichi Nuclear Power Plant to melt down.

The scientists following transects across mountainsides and through valleys are conducting the first investigation into the disaster's effects on plants and wildlife. They completed an initial survey last summer and a second in February and are now comparing those findings with what they might have expected under normal conditions. Amid the horrific loss of life and property, the researchers are buoyed by the hope that understanding how radioactive exposure affects various species over time will help scientists and policy makers assess the risks to ecosystems and humans, says Timothy Mousseau, a professor of biological sciences at University of South Carolina. "We know so little about how the biological community responds to changes in the environment, especially after this kind of radiation exposure," says Mousseau. "It's urgent that we learn everything we can as soon as we can."

Four months after the Daiichi meltdown, Mousseau began studying local ecosystems with a team that includes Danish researcher Anders Pape Moller and scientists from Nagasaki, Tokyo, and Fukushima universities. Using 300 sampling points in the forested areas west of the 12-mile exclusion zone around the power plant, they recorded the number of individual birds they saw or heard during five-minute counts.

Birds are the ideal sentinels for studying potential impacts of radiation to humans because they share many basic biological processes and are easy to observe, Mousseau says. For more than a decade he and Moller have been analyzing avian species in another irradiated area, the 77,000 square miles contaminated by the 1986 explosion at the Chernobyl Nuclear Power Plant in Ukraine. Among their findings there: reduced numbers and longevity of birds; diminished fertility in male birds; smaller brains in some birds; and mutations in swallows and other species that indicate significant genetic damage. Barn swallows and wood warblers, among other species, are locally extinct.

At Fukushima the scientists are using the protocols established in Chernobyl to study house martins, great reed warblers, white wagtails, Eurasian wrens, and 10 other common species found in both places. They've had some unexpected results. The actual bird tally during the July survey was about 30 percent lower than what they had predicted based on the normal biodiversity at each sampling point—that's double the losses found in a comparable study at Chernobyl 20 years after the accident. "It's quite a surprise to see such strong impacts so soon," Mousseau says. He suspects many birds may have died from exposure to the iodine, cesium, and other radioactive isotopes released by Fukushima's meltdown.

Mousseau and his team will repeat their 2011 bird survey this coming summer, eventually evaluating the life history of 10 generations of birds in the Fukushima contaminated area. They also plan to examine rates of photosynthesis in trees to see how varying contamination levels affect them. The scientists' goal is to combine annual field and laboratory studies into a computer database that will track changes both in genetic damage and in the composition of biological communities at Fukushima as well as Chernobyl.

The team will in addition launch a detailed analysis of barn swallows, renowned for migrations that can take them from Japan to Indonesia, more than 3,500 miles away. Mousseau and Moller are especially interested in migrating birds, which use enormous amounts of antioxidants during their annual journeys between summer and winter habitats. Radiation can cause dramatic reductions in antioxidants, making the birds that travel farthest the most vulnerable to nuclear contamination. Mousseau and his colleagues plan to capture barn swallows in Fukushima and outfit them with tiny dosimeters to measure the radiation doses each bird receives. They will correlate that information with an individual bird's survival, reproductive abilities, and genetic mutations over several generations.

Grim as it is, the work Mousseau and Moller are doing in Fukushima has a scientific advantage over their research at Chernobyl. There, authorities of what was then the Soviet Union attempted to conceal the scale of the explosion and fire, delaying evacuations for two days and imposing secrecy that continues today. Moller's visit in 1991 was among the first by Western research scientists. "We don't really know how things began in Chernobyl," Mousseau says. "Fukushima offers us the opportunity to follow these organisms from the beginning."

Studying birds and other wildlife in Fukushima cannot reverse the heartache or the losses caused by the tsunami and Daiichi power plant accident. But it can lead to knowledge about how nuclear accidents affect life—plant, animal, and human—and, ultimately, to a deeper understanding of the invisible enemy.

AUTHOR PROFILE

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