

Researchers Scramble to Track Virus's Impact on Wildlife

As mosquito season approaches, researchers strategize about how to stalk West Nile virus and safeguard vulnerable species

EDGEWATER, MARYLAND—Two decades ago, California condors, ancient scavengers with mighty 3-meter wingspans, numbered just two dozen. Now there are nearly 200, thanks largely to breeding programs at several California zoos. But the condor now faces a threat that could undo those gains: West Nile virus.

Since arriving on North America's eastern coast in 1999, the mosquito-borne virus has swept west, killing hundreds of people—and hundreds of thousands of wild and captive birds (*Science*, 20 September 2002, p. 1989). Now, with the virus expected to hit California in full force this year, condor conservationists have taken an extraordinary step: They recently immunized several dozen of their precious captive birds with a new, experimental vaccine.

Saving endangered species was just one of the issues on the minds of the 100 researchers who gathered here earlier this month to develop a blueprint for studying the West Nile virus's impact on wildlife. Over the course of 2 days, they got an update on the virus's impacts so far, and they identified dozens of questions that must be answered before scientists can predict where West Nile virus might strike next and how best to stop it. "It's a fascinating and unpredictable virus," says ornithologist Peter Marra of the Smithsonian Environmental Research Center, which hosted the summit. "But so far, there are many questions and not a lot of answers."

There also isn't a lot of money: Some participants released a letter this week that admonishes the U.S. government for lackluster backing of West Nile science that could help public health officials better combat the threat.

At the meeting, researchers agreed that they do know one thing: West Nile has spread farther and faster than most experts expected. Scientists have found the virus or antibodies to it in 157 species of birds, 37 kinds of mosquitoes, and 18 other vertebrates, ranging from horses to alligators, noted Duane Gubler of the Centers for Disease Control and Prevention (CDC) in Fort Collins, Colorado. In just 4 years, it has spread to 6 of the 13 Canadian provinces and territories and 44 of the lower 48 U.S. states; the virus also appears to have penetrated northern Mexico.

But little is known about which kinds of wild animals are most susceptible to the

virus, researchers said. In laboratory experiments, crows and their kin appear to be the hardest-hit birds, reported CDC's Nicholas Komar, who has infected members of more than two dozen species. Some crows died within just 4 or 5 days. Among more resistant species, survivors often carried the virus for weeks, suggesting that they could be im-



Guinea pigs. Conservationists hope a vaccine will protect captive California condors.

portant reservoirs that hold West Nile and move it across the landscape. Many researchers have speculated that migrating birds are responsible for the West Nile virus's speedy spread—perhaps moving it in a zigzag, north-south pattern during their annual flights.

So far, however, researchers have yet to find a migrating bird carrying live virus, notes Marra—but not for lack of trying. Marra is part of a team that has collected more than 8000 blood samples from 174 species in the mid-Atlantic states, Florida, the Caribbean, and Mexico. Other researchers are also monitoring migrants in their tropical wintering grounds, on the assumption that birds will move the virus south (*Science*, 7 February, p. 821).

Many samples are still waiting to be tested, however, highlighting another issue discussed at the meeting: a shortage of testing facilities.

The few state and federal government laboratories that specialize in testing wildlife have been overwhelmed with corpses of crows, hawks, and other birds, Gubler noted. Overall, CDC says that health officials have reported nearly 125,000 dead birds, of which about 32,000 were tested for West Nile, with half showing signs of the virus. That source of data is drying up, however, because health departments often stop testing birds once they know West Nile has arrived in their area.

Existing numbers give biologists little sense of whether the virus is having a significant impact on bird populations. Researchers reviewing long-term survey data—such as annual winter and spring counts conducted by volunteers—have spotted temporary declines in some populations, but the dips are patchy and inconclusive, said John Sauer of the U.S. Geological Survey's Patuxent Wildlife Research Center in Laurel, Maryland.

One ornithologist, however, was able to track the virus's path through a population of 1100 crows in New York state that he has studied since 1988. In 2001, the virus had little apparent impact, noted Kevin McGowan of Cornell University in Ithaca. But last year, nearly one-third of some flocks died. Because many of his birds had been banded and followed for years, McGowan was able to study whether the virus hit certain demographic groups (young birds, for instance) harder than others. He also looked to see if the fatalities ran in families, perhaps because birds that lived and fed together were passing on the virus. But no clear pattern emerged, he says. He's readying for the possibility of another onslaught this year. "We crow researchers have had West Nile thrust upon us; we don't have much choice," he says.

Other researchers are also preparing for the West Nile season, which they expect to begin when warmer weather arrives in the southeastern U.S. and coaxes mosquitos out of their winter lairs. To help guide their work, a group led by Marra and workshop co-organizer Robert McLean of the U.S. Department of Agriculture's National Wildlife Research Center in Fort Collins, Colorado, is drafting a research agenda. Among other actions, it proposes to draw on a multifaceted surveillance system—using everything from public health offices to wildlife hospitals and zoos—to track the virus and perhaps nail down how it spreads and where it hides during the winter. State and federal budget woes could hamper such work, but scientists hope West Nile's nasty reputation will convince the Bush Administration and Congress to add funds. In the meantime, zoos and endangered-species biologists are nervously watching West Nile's march.

—DAVID MALAKOFF

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