

Hawaii Girds Itself for Arrival of West Nile Virus

Health officials and wildlife biologists hope vigilant surveillance and rapid response will prevent infected mosquitoes from establishing a beachhead

On 24 September, officials at the Hawaii Department of Health (DOH) got the news that they'd been dreading for several years: An island bird had tested positive for West Nile virus. Although infected birds are now routine across the continental United States, Hawaii has so far been spared. And it is fighting to stay that way. Immediately after the discovery, the health department launched an assault; all night long a truck fogged the Kahului Airport on Maui, where the bird had been caught, with insecticide. Additional crews with backpack sprayers doused off-road sites to kill any potentially infected mosquitoes.

State officials breathed a sigh of relief the following week when the case turned out to be a false positive. But they aren't letting down their guard. Should West Nile become established on the islands, virus-ridden mosquitoes could spread the disease year round. And many of the state's remaining endemic birds, already hammered by avian malaria and pox, might go extinct. "The effects could be disastrous," says ornithologist Peter Marra of the Smithsonian Environmental Research Center in Edgewater, Maryland.

To avert such a catastrophe, researchers have been scrambling to improve surveillance and eradication plans. Observers on other Pacific islands, which also face a similar threat, are hoping to learn from Hawaii's efforts to stamp out the virus as soon as it enters. "We're not just throwing our hands up in the air," says epidemiologist Shokufeh Ramirez, who coordinates West Nile prevention efforts for the Hawaii DOH.

On the mainland, West Nile virus has proved unstoppable. After first appearing on the East Coast, in New York in 1999, West Nile virus marched steadily across the country. The virus is transmitted by mosquitoes, which pass it on to birds and humans. Although infection is rarely deadly to people, it kills some bird species such as crows with a vengeance; other infected birds remain healthy enough to fly and spread the virus. Last year, it reached California.

But Hawaii has a chance, if not to keep West Nile virus out, at least to stop it upon

arrival. That's because researchers know how it's likely to get there. Rather than infected humans or migratory birds, the most probable culprits are mosquitoes in the cargo holds of planes, concluded A. Marm Kilpatrick of the Consortium for Conservation



No barriers. Mosquitoes hitching a ride inside airplanes could bring West Nile virus to Hawaii, threatening honeycreepers and other native birds.



Medicine at Wildlife Trust in Palisades, New York, and others in a paper published in *EcoHealth* in May. Based on previous research, they estimated that seven to 70 infected mosquitoes probably reach Hawaii each year. Far less is known about the risks of introduction via shipping containers, some 1200 of which arrive in Hawaiian harbors each day. The number of overseas flights—about 80 a day—also makes prevention difficult. Moreover, airlines have balked at treating their cargo holds with insecticides that kill mosquitoes on contact. The state has made progress on another front: preventing infected poultry and pet birds from entering by mail. In 2002, the U.S. Postal Service prohibited the mailing of most live birds to Hawaii. Quarantine regulations have also been strengthened.

The health department has focused primarily on monitoring 11 airports and harbors. In 2002, they began checking dead birds by polymerase chain reaction (PCR)

for West Nile virus. Last year, they added mosquito traps that are sampled each week and also examined by PCR for the virus.

At the same time, researchers are trying to figure out just what might happen if West Nile virus manages to evade detection. "Bird biodiversity will probably be severely impacted," says Jeff Burgett of the U.S. Fish and Wildlife Service in Honolulu, who heads an interagency task force. One reason is that Hawaii's endemic birds have not had a chance to build resistance to West Nile through exposure to related viruses, such as St. Louis encephalitis, that are not present on the islands. Those species that survive only in captive breeding programs, such as the Hawaiian crow, might never be able to return to the wild.

As a first step to gauge the consequences, biologists with the U.S. Geological Survey (USGS) have sent 20 native Hawaiian honeycreepers (*Hemignathus virens*) to the survey's National Wildlife Health Center in Madison, Wisconsin. There, veterinarian Erik Hofmeister has injected some of the birds with West Nile virus and is following their health and ability to serve as reservoirs for the virus. He also plans to investigate how efficiently the primary vector in Hawaii, the mosquito *Culex quinquefasciatus*, can infect these birds.

A similar experiment should help solve a problem that hampers the effort to spot the virus in dead birds. Hawaii doesn't have the North American birds—crows, magpies, jays—that provide the most obvious warning of the virus. So Hofmeister plans in December to examine which introduced birds in Hawaii, such as minahs, might be most susceptible to the virus. This will assist efforts to model potential spread of the virus. "It will also tell you which species might be amplifying the virus, and which species you may want to control," says ecologist Dennis LaPointe of USGS.

While the health department waits for these results, it is trying to speed its lab testing and streamline the response plan. Meanwhile, DOH and wildlife biologists have their fingers crossed that Hawaii's defenses will be adequate to stave off the virus—forever. "Every year it's going to be knocking on Hawaii's door," says Peter Daszak of the Consortium for Conservation Medicine at Wildlife Trust.

—ERIK STOKSTAD

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