Determining Impacts of **West Nile Virus** on Crows and Other Birds

Carolee Caffrey
Audubon Science Center
545 Almshouse Road
Ivyland, PA 18974
ccaffrey@audubon.org

This female American Crow *(Corvus brachyrhynchos)*—"YL"—and one of her sons survived their first West Nile virus season in Oklahoma, but her other four family members died or disappeared. Photo/Carolee Caffrey

West Nile virus was first detected in North America in New York in the summer of 1999. A dead crow at the Bronx Zoo was one of the first harbingers of what was to come. Within three months, the virus had spread to Connecticut and New Jersey, leaving tens of thousands of dead birds in its wake (Eideson et al. 2001). Over the subsequent three years, West Nile virus (WNV) continued to spread across the continent, and by the end of 2002, it had been detected in 44 U.S. states, the District of Columbia, and five Canadian provinces. Its arrival on the west coast of North America in 2003 is almost assured.

In 2002, the collection by local authorities of birds found dead was commonly halted after only one or two birds in each locale were found to be positive for West Nile virus. Thus, the 14,122 birds that tested positive for WNV in 2002 (CDC 2002b) represent only the "tip of the iceberg" with regard to the number that actually died last year (Nick Komar, arbovirus specialist for the Centers for Disease Control and Prevention)—a number certainly in the millions for birds killed since 1999.

Among those millions were lots of crows—57,053 dead crows have been collected since 1999 (Eideson et al. 2001; CDC 2002a, b; McLean et al. 2002), and thousands went uncollected in 2002 (CDC 2002b). Data from a marked population of Eastern American Crows (*Corvus brachyrhynchos brachyrhynchos*) in Oklahoma that my students and I have been observing for more than five years suggest that those tens of thousands of dead crows may, too, be just the tip of the iceberg (Caffrey et al. 2003).

American Crows are suffering feverish, disorienting deaths within just a few days of being bitten by an infected mosquito. Under laboratory conditions, crows can get the virus from being in contact with infected crows (McLean et al. 2002, Komar et al. 2003) and from eating infected prey (McLean et al. 2002, Komar et al. 2003), and 100 percent of crows infected with West Nile virus die (Komar et al. 2003). Thus, unlike all other birds tested so far (Komar et al. 2003), crows are vulnerable to all known routes of WNV transmission, and their mortality is extremely high.

I have been studying crows for 20 years, in Los Angeles and in Stillwater, Oklahoma. Individual crows are extremely tough to catch; they're smart, quick, and very wary, so not many people choose to study them. Yet by catching crows so that I could mark them and thereby tell individuals apart, I have been able to peer into their world. They are sentient creatures with complex social lives, one of the most civilized animals of which I am aware.

Crows breed cooperatively, that is, breeding pairs are assisted in their nesting attempts by nonbreeding "helpers." (Only about 3 percent of birds—and mammals—breed cooperatively, and for most bird species, the helpers are the sons of the breeding pair.) In my study populations, some offspring of both sexes delayed dispersal from natal areas; they remained home with their parents for extended periods of time rather than dispersing to live independently—sons for up to five years and daughters for up to three. Most but not all of those at home helped feed younger brothers and sisters. My students and I have seen sons and daughters move out to breed, sometimes right next door to their parents. Once the new breeders produce their own offspring, extended families of at least three generations may spend time together. Some individuals that have moved farther away return home to visit their parents for an afternoon every once in awhile. Some individuals visit their siblings living elsewhere, and some move in with their siblings' families. Not many other animals do anything like this.

Family groups of crows have numbered up to 12, including parents and sons and daughters of different ages; many groups have also included individuals that had moved in from other families. Both males and females have left home to move in with neighbors, mostly those next door. Most of these "immigrants" contributed to the feeding of the resident pair's nestlings, but some did not. Some groups included up to three immigrants at a time.

Carolee Caffrey, Ph.D., a behavioral ecologist, has been studying dispersal, social organization, and details of cooperative nesting attempts of American Crows for 20 years. She is a Science Associate with Audubon and is an adjunct professor at Oklahoma State University and The College of New Jersey.

Crows, like us, are loud and opportunistic. They have huge vocal repertoires. They modify and use tools (Caffrey 2000). They play a lot when young, and they play tricks on each other (Caffrey 2001). They have strong, long-term family bonds. They take care of injured family members. Mates sit with and preen each other all year long. Many pairs probably stay together for life, which may last 10 to 20 years…until recently.

West Nile virus was detected in Oklahoma in August 2002, and within three months 40 percent of 120 marked crows in my study population were dead or missing (Caffrey et al. 2003). Individuals of both sexes and all ages were affected; young of the year were orphaned and whole families disappeared. Some of the survivors have moved out on their own and some have merged with those of other families, and several groups now include unmarked individuals that have moved into the population. New pairs have formed, and they and surviving pairs were working on nests or sitting on eggs as of early April (2003). But the weather is warming, and mosquitoes will soon become active again.

Did the survivors survive because they are immune—their bodies successfully fought back the virus—or because they have yet to be bitten by an infected mosquito? What's going to happen this year, when the virus will be present throughout all of spring, summer, and fall? For how many years will this high level of mortality continue before things level off, if they ever do?

In a similar fashion, scientists across the country wait with bated breath for the 2003 West Nile season. How far and how fast will it spread? Which species will suffer high losses and which ones will not? What will happen when the virus gets to California and Central America, and then Hawaii and South America? How many populations of endangered and threatened birds in these areas will be lost, forever? Is there anything that can be done to alleviate the damage?

These and many other questions related to the spread of West Nile virus and its impacts on wildlife were under discussion at a workshop at the Smithsonian Environmental Research Center in February 2003, cosponsored by Audubon, the Smithsonian Institution, the United States Geological Service, and the U.S. Department of Agriculture. Scientists from many disciplines assembled to compile the available information regarding the threat to wildlife, particularly birds, and to prioritize the many future research needs; many more questions remain unanswered than answered at the moment. Scientists will be examining the various mechanisms by which the virus may remain present in populations over winter months, the various routes by which the virus may be transmitted among hosts, and the various routes by which it is spread from one geographic area to another. Determining the actual short- and long-term impacts of WNV on avian populations and communities will require the combined efforts of many people over many years.

Close monitoring of endangered and threatened populations will enable assessment of both the likelihood of their continued existence and the feasibility of possible management options. For more abundant species, field studies of marked individuals, begun before the arrival of West Nile virus and continuing thereafter, will provide details on within-population mortality and survivorship. Such studies, combined with analyses of the blood of individuals, will hopefully shed light on the immunological capabilities of particular species. But such studies are not numerous, nor do they address population dynamics across species' ranges, or among interacting species within communities and ecosystems. Large-scale citizen science programs—the Christmas Bird Count, the Great Backyard Bird Count, the Breeding Bird Survey, Project FeederWatch, Neighborhood Nest Watch—may be our best means of estimating the broad-level effects of West Nile virus' New World emergence.

Understanding how the WNV phenomenon will play out in the Americas awaits years of continued data collection and analysis. With increased involvement in citizen science, including that occurring in urban and suburban areas—our newest "ecosystem" types—our abilities to track avian population trends will improve. We will all then be in a better position to monitor the responses of wild birds to diseases introduced in the future, inevitable given the continued growth of human air travel and trade.

For more information on West Nile virus—the virus, the mosquito vectors, and the victims—visit Audubon's WNV web site: www.audubon.org/bird/wnv. Additional information on the workshop at the Smithsonian Environmental Research Center is available at www.audubon.org/bird/wnv/workshop.html.

Literature Cited

Caffrey, C. 2000. Tool modification and use by an American Crow. *Wilson Bulletin* 112: 283-284.

Caffrey, C. 2001. Goal-directed use of objects by American Crows. *Wilson Bulletin* 113: 114-115.

Caffrey, C., T.J. Weston, and S.C.R. Smith. 2003. High mortality among marked crows subsequent to the arrival of West Nile virus. *Wildlife Society Bulletin*, in press.

Centers for Disease Control and Prevention (CDC). 2002a. West Nile virus activity—United States 2001. *Morbidity and Mortality Weekly Report* 51(23): 497-501.

CDC. 2002b. *Morbidity and Mortality Weekly Report* 51(50): 1129-1133.

Eideson, M., N. Komar, F. Sorhage, R. Nelson, T. Talbot, F. Mostashari, R. McLean, and the West Nile virus Avian Mortality Surveillance Group. 2001. Crow deaths as a sentinel surveillance system for West Nile virus in the northeastern United States, 1999. *Emerging Infectious Diseases* 7(4): 615-620.

Komar, N., S. Langevin, S. Hinten, N. Nemeth, E. Edwards, D. Hettler, B. Davis, R. Bowen, and M. Bunning. 2003. Experimental infection of North American birds with the New York 1999 strain of West Nile virus. *Emerging Infectious Diseases* 9(3): 311-323.

McLean, R., S.R. Ubico, D. Bourne, and N. Komar. 2002. West Nile virus in livestock and wildlife. *Current Topics in Microbiology and Immunology* 267: 271-308.