



## CHAPTER 3

# WEST NILE VIRUS IN NORTH AMERICAN BIRDS

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**ABSTRACT.**—Following the introduction of West Nile virus (WNV) into the United States, in New York City in 1999, from its historical range in the eastern hemisphere, this mosquito-borne virus caused an intense outbreak in local bird populations and a small epidemic in the associated human population. West Nile virus became established in this focal area, and in 2000 it spread north and south from there during the summer transmission season. The virus continued to expand during the next six years, ultimately affecting all the continental states and most of North America. The strain of WNV introduced was uncharacteristically virulent as a disease agent in native avian species in North America. Corvid species, particularly the American Crow (*Corvus brachyrhynchos*), were affected the most, and mortality in American Crows and other corvid species was used as a sensitive sentinel system to detect the presence and movement of the virus through a public-health-reporting and laboratory-testing national surveillance program. American Crows were also the earliest indicator of virus activity in most locations and a useful predictor of human cases. The temporal and spatial pattern and rapidity of the continental spread of WNV, as detected by the national surveillance system, matched the semiannual migratory movements of hundreds of millions of North American birds. Subsequent dissemination of the virus to Canada, the Caribbean, Mexico, and Central America fit this method of spread as well.

Nationwide bird mortality from WNV infections has been dramatic in North America during the past seven years, with ~48,000 dead birds of >200 species reported as WNV-positive. Experimental studies have elucidated the susceptibility and reservoir competence of a number of bird species. The actual effect of the mortality on bird populations is not known because of the insensitivity of national population-census data available on birds. Few regional declines in bird populations have been detected; however, effects of WNV on local populations of American Crow and Greater Sage-Grouse (*Centrocercus urophasianus*) has been observed in some localities. Geographic distribution of WNV transmission is not continuous across local landscapes, and unexposed birds of susceptible species can serve as a source to repopulate local affected areas when overall populations are high.

Bird infections and mortality from WNV peak during August–September, at the height of the mosquito-transmission period, but extend from April to November each year in some states. West Nile virus is able to persist through winter and reappear annually in spring in temperate regions of the continent, and the mechanisms responsible for this recrudescence are unique and largely unknown. Prevention of WNV focuses on mosquito control to suppress virus transmission, particularly during the summer amplification period, but other strategies, such as early targeted mosquito control and possibly wildlife vaccines, would be beneficial. Information from ecological studies and realistic mathematical models are needed for management of this disease. Received 6 June 2005, accepted 30 November 2005.

**RESUMEN.**—Después de la llegada del virus del Oeste del Nilo (VON) a los Estados Unidos, específicamente a la ciudad de Nueva York en 1999, causó un brote intenso en las poblaciones de aves locales y una pequeña epidemia en la población humana. El virus del Oeste del Nilo se estableció en esta área en particular, y en el año 2000 se extendió hacia el norte y sur durante el verano. El virus continuó extendiéndose por los siguientes seis años, para finalmente llegar a afectar todos los estados continentales y la mayoría de Norte América. La cepa introducida

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