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13.2.5. Avian Cholera: A Major New Cause of Waterfowl Mortality

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Synonyms

Fowl cholera, avian pasteurellosis

Cause

Avian cholera is a highly infectious disease caused by the bacterium, *Pasteurella multocida*. Acute infections are common and can result in death 6 to 12 hours after exposure. Under these circumstances "explosive" die-offs involving more than 1,000 birds per day have occurred in wild waterfowl. More chronic infections with longer incubation times and less dramatic losses also occur. Transmission can occur by bird-to-bird contact, ingestion of contaminated food or water, and perhaps in aerosol form.

Species Affected

It is likely that most species of birds and mammals can become infected with *P. multocida*. Most (if not all) bird species are susceptible to clinical disease following exposure to virulent strains of *P. multocida* commonly found in waterfowl. Specific relations between bird and mammal strains of this bacterium are not well understood. Strains isolated from cattle have not been shown to readily cause clinical disease in birds.

Scavenger species such as crows and gulls are commonly diagnosed as having died from this disease, but deaths of raptors such as hawks and eagles from avian cholera are far less frequent (Figure 1). Species losses for most major outbreaks are closely related to species composition and abundance during the period of the die-off.

Distribution

Avian cholera was unreported in free-living migratory birds in the United States before 1944. Losses have now been reported coast-to-coast and border-to-border. The occurrence of this disease within the United States has increased dramatically since 1970, and avian cholera now ranks with avian botulism and lead poisoning as major causes of waterfowl mortality. The frequency and severity of avian cholera outbreaks vary greatly among areas (Figure 2). This disease has also been diagnosed in waterfowl in many countries, including Canada, but not Mexico. This is probably due to the lack of surveillance and reporting rather than to absence of this disease in Mexico.

In the United States there are four major focal points for avian cholera in waterfowl: the Central Valley of California; the Tulare Lake and Klamath Basins of northern California and southern Oregon; the Texas Panhandle; and Nebraska's Rainwater Basin. The movement of avian cholera from these areas follows the well-defined pathways of waterfowl movement. Spread of this disease along the Missouri and Mississippi river drainages is also

Adapted from: Friend, M., editor. 1987. Field guide to wildlife diseases. U.S. Fish Wildl. Serv., *Resour. Publ.* 167. 225 pp.

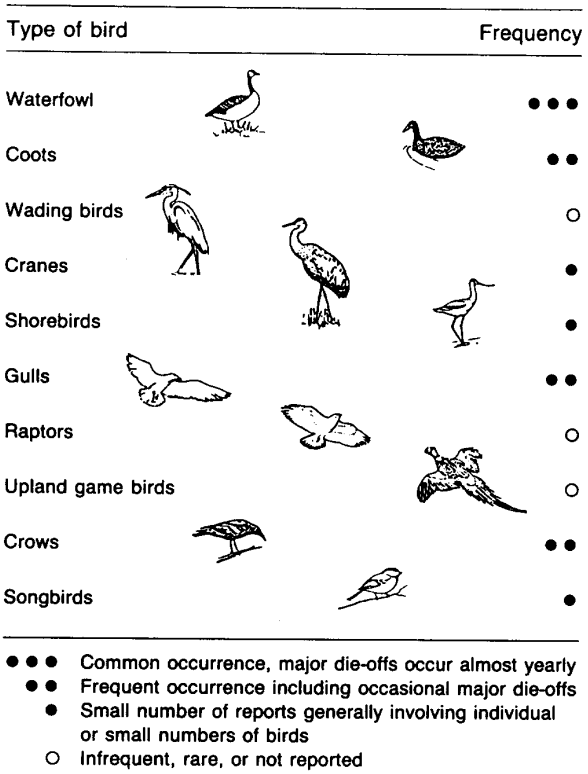

Figure 1. Relative occurrence of avian cholera in wild birds.

consistent with waterfowl movement. No consistent patterns of avian cholera outbreaks exist within the Atlantic Flyway except for periodic occurrences in eiders nesting off the coast of Maine (Figure 3).

Seasonality

Losses can occur at any time of the year. A major loss of snow geese occurred in spring on Canadian breeding grounds, in addition to losses of breeding eiders in Maine and Quebec. Outbreaks in California normally start during fall and continue into spring. Late winter is the peak time for avian cholera in the Texas Panhandle, and spring migration has resulted in annual losses from this disease in Nebraska's Rainwater Basin since 1975 and in western Saskatchewan, Canada, since 1977.

Field Signs

Few sick birds are seen during avian cholera outbreaks because of the acute nature of this disease. However, the number of sick birds increases when a die-off is prolonged over several weeks. Sick birds often appear lethargic or drowsy and can be approached quite closely before attempting escape. When captured, these birds often die quickly, sometimes within a few seconds or minutes after being handled. Other birds have convulsions, swim in circles, or throw their heads back between their wings and die. These signs are similar to those seen in duck plague and in some types of pesticide poisoning. Other signs include erratic flight, such as flying upside down before plunging into the water or onto the ground and attempting to land a foot or more above the surface of the water.

Always suspect avian cholera when large numbers of dead waterfowl are found in a short time, few sick birds are seen, and the dead birds appear to be in good flesh. When sick birds are captured and die within a few minutes, avian cholera should also be suspected. None of the signs described above are unique to this disease; their occurrence should be recorded as part of any history being submitted with specimens and must be considered along with lesions seen at necropsy.

Gross Lesions

Under most conditions, birds that have died of avian cholera have substantial amounts of subcutaneous and visceral fat (except for seasonal losses of fat). The most prominent lesions seen at necropsy involve the heart and liver and sometimes the gizzard. Hemorrhages of various sizes are frequently found on the surface of the heart muscle or the coronary band. Hemorrhages are also sometimes visible on the surface of the gizzard. Areas of tissue death that appear as small white to yellow spots are commonly seen within the liver. Where the area of tissue death is greater, the spots are larger and in some instances the area of tissue death is quite extensive.

The lower portions of the digestive tract (below the gizzard) commonly contain thickened yellowish fluid that is heavily laden with *P. multocida*.

Diagnosis

As with all diseases, isolation of the causative agent is required for a definitive diagnosis. Submitting a whole carcass provides the diagnostician with the opportunity to evaluate gross lesions seen at necropsy and also provides all appropriate tissues for isolation of *P. multocida*.

When it is not possible to send whole carcasses, tissues should be sent that can be collected in as

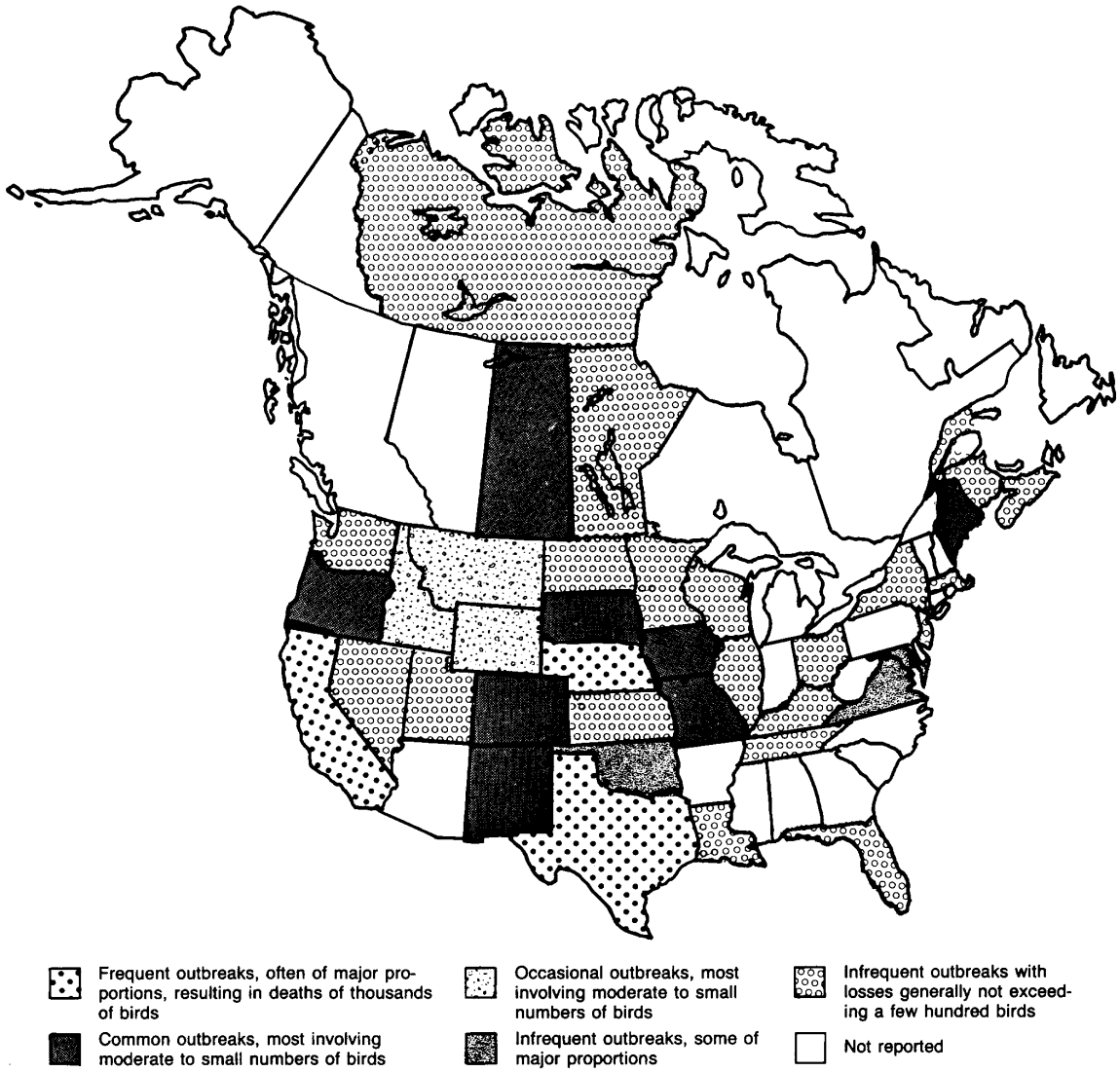

Figure 2. Reported distribution of avian cholera in wild birds.

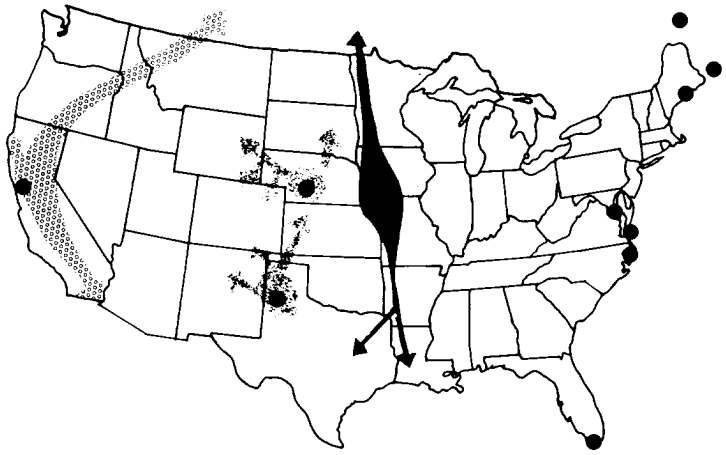

Figure 3. The occurrence of avian cholera in waterfowl seems to be closely related to bird movements west of the Mississippi River. There is no apparent pattern for outbreaks along the Atlantic seaboard.

sterile a manner as possible in the field. The most suitable tissues for culturing are heart blood, liver, and bone marrow. Remove the entire heart and place in a Whirl-Pak bag for shipment as identified in the "Field Guide to Wildlife Diseases"; do not attempt to remove the blood from the heart. The liver should also be removed and placed in a separate bag; if it cannot be removed intact, submit a major portion of this organ (at least half). Refrigerate these samples as soon as possible after collection and insure that they are kept cool during shipment. When shipment is to be delayed for more than a day or transit time is expected to exceed 24 hours, freeze these specimens.

Pasteurella multocida persists for several weeks to several months in bone marrow. The wings of badly scavenged or decomposed carcasses should be submitted whenever avian cholera is suspected as the cause of death and more suitable tissue samples are not available.

Control

Spread of avian cholera through waterfowl and other migratory bird populations is enhanced by the gregarious nature of most waterfowl species and by dense concentrations of birds that result from habitat limitations. Prolonged environmental persistence of this bacteria further promotes new outbreaks. Pond water remained infective for 3 weeks after dead birds were removed from one area in California; survival in soil for up to 4 months was reported in another study; persistence of this organism in decaying bird carcasses occurred for at least 3 months.

Early detection of avian cholera outbreaks should include frequent surveillance of areas where migratory birds are concentrated, as a first line of defense in controlling this disease. The opportunity to prevent substantial losses is greatest during the early stages of outbreaks. Control actions need to be focused on minimizing exposure of migratory and scavenger bird species to *P. multocida* and minimizing environmental contamination by this organism.

We recommend rigorous collection and incineration of carcasses as standard procedures. Carcass collection contributes to avian cholera control in several ways. Several milliliters of fluids containing large concentrations of *P. multocida* are often discharged from the mouths of birds dying from this disease, resulting in heavy contamination of the surrounding area. Carcass decomposition results in additional contamination. These carcasses serve to attract (decoy) other birds, thereby increasing the probability for infection. Scavenging of carcasses also results in disease transmission through the direct consumption of diseased tissue (oral exposure).

Care must be exercised during carcass collection to minimize the amount of fluid discharged into the environment from the mouths of birds. Pick birds up head first, preferably by the bill, and immediately place in plastic bags. Double-bagging is recommended to prevent fluids leaking from punctures that may occur in the inner bag. Bags of carcasses should always be securely closed before being removed from the area.

Prompt carcass removal also prevents scavenging by birds that can mechanically transport infected material to other sites or by feeding or drinking at other locations following consumption of infected tissue. This situation is aggravated by apparent longer disease incubation times in gulls, crows, and some other avian scavengers. Instead of dying within hours or 1 to 2 days after exposure to virulent strains of *P. multocida*, death more typically occurs after several days to 1 to 2 weeks. Death may occur at locations far from the site where the bird was exposed. When these birds die, they serve as new potential focal points for contamination.

Population reduction of infected American coots, crows, eiders, gulls, and terns has been used to combat avian cholera. Destruction of migratory birds infected with this disease can be justified only under special circumstances and conditions: (1) the outbreak must be discrete and localized rather than generalized and widespread; (2) techniques must be available that will allow complete eradication without causing widespread dispersal of potentially infected birds; (3) methods used must be specific for target species and pose no significant risk for nontarget species; (4) eradication must be justified on the basis of risk to other populations if the outbreak is allowed to continue; and (5) the outbreak represents a new geographic extension of avian cholera into an important migratory bird population.

Habitat management is another useful tool in combating avian cholera outbreaks. In some instances it may be necessary to prevent further use of a specific wetland or impoundment because it is a focal point for infection of waterfowl migrating into the area. Drainage, in conjunction with creating or enhancing other habitat within the area through water diversion (from other sources), or pumping operations serves to deny bird use of the problem area and redistributes waterfowl into

more desirable habitat. Ability to add a large volume of water to a problem area can also help dilute concentrations of *P. multocida* to less dangerous levels. These actions require careful evaluation of bird movement patterns and the avian cholera disease cycle. Moving birds infected with avian cholera from one geographic location to another site is seldom desirable.

Under extreme conditions, disinfection procedures to kill *P. multocida* may be warranted in wetlands where large numbers of birds have died during a short time. The environmental effect of such measures needs to be evaluated and appropriate approvals obtained before these actions are undertaken.

Hazing with aircraft has been successfully used to move whooping cranes away from a major outbreak of avian cholera. Eagles can be attracted to other feeding sites using road-killed deer as a food source. During an avian cholera outbreak in South Dakota, a large refuge area was temporarily created to hold infected snow geese in an area by closing hunting. At the same time, a much larger population of snow geese about 10 miles away was moved out of the area to prevent transmission of the disease into that population. The area closed to hunting was reopened once the desired bird movement had occurred.

Vaccination and postexposure treatment of waterfowl have both been successfully used in combatting avian cholera in Canada goose propagation flocks. The National Wildlife Health Research Center has developed and tested a bacterin (a killed vaccine) that totally protected Canada geese from avian cholera for the entire 12 months of a laboratory study. This product has been used for several years with good results in a Canada goose propagation flock that has much contact with free-flying wild waterfowl and field outbreaks of avian cholera. Before use of the bacterin, this same flock of Canada geese suffered an outbreak of avian cholera and was successfully treated with intramuscular injections of 50 mg of oxytetracycline followed by a 30-day regimen of 500 g of tetracycline per ton of feed.

As yet, there is no practical method of immunizing large numbers of free-living migratory birds against avian cholera. However, captive propagation flocks can be protected by this method. Endangered species can be trapped and immunized if the degree of risk warrants this action. Live vaccines should not be used for migratory birds without adequate safety testing.

Human Health Considerations

Avian cholera is not considered a high risk disease for man because of differences in species susceptibility to different strains of *P. multocida*. However, *P. multocida* infections in humans are not uncommon. Most of these infections result from an animal bite or scratch, primarily from dogs and cats. The use of dogs is not recommended for picking up carcasses during avian cholera outbreaks because of potential contamination of their mouths with *P. multocida* and later exposure of people as a result of licking hands or faces. Regardless, the wisdom of wearing gloves and thoroughly washing skin surfaces is obvious when handling birds that have died from avian cholera.

Infections unrelated to wounds are also common, and in the majority of human cases these involve respiratory tract exposure. This is most apt to occur in confined areas with restricted air movement where a large amount of infected material is present. Processing of carcasses associated with avian cholera die-offs should be done outdoors or in other areas with adequate ventilation. When disposing of carcasses by open burning, avoid direct exposure to smoke from the fire.

Suggested Reading

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Appendix. Common and Scientific Names of Animals Named in Text.

Canada goose	*Branta canadensis*
Snow goose	*Chen caerulescens*
Crows	*Corvus* sp.
American coot	*Fulica americana*
Whooping crane	*Grus americana*
Gulls	Larinae
Eiders	*Somateria* sp.
Terns	*Sterna* sp.
Deer	*Odocoileus* sp.

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