Pennsylvania Game Commission Wildlife Disease Reference Library

Botulism

<u>Other Names</u>: Limberneck, western duck sickness, duck disease, alkali poisoning

Cause

Botulism is caused by a toxin that affects nerves, and in that sense it is not an infectious disease. The botulism toxin is produced by the bacteria *Clostridium botulinum*, and is one of the deadliest known toxins. There are 7 different types of botulism toxin labeled A through F. Types C and E are most important in wild birds. While this toxin can also affect humans it is not a zoonotic disease.

Significance

Avian botulism is one of the most significant diseases of migratory birds. Botulism in wild birds has not been known to cause botulism in humans, but waterfowl hunters should cook game birds properly because heating kills the toxin.

Species Affected

It is likely that all bird species are susceptible to botulism with a few exceptions. Vultures and other scavengers may be resistant to the toxin. Waterfowl and shorebirds are most susceptible. Filter feeding and dabbling waterfowl such as Mallards, teal, and shovelers seem to be at greater risk because of their feeding habits. Fish eating birds such as common loons and gulls are also at high risk. Mergansers, mute swans, and grebes are also at risk, but not as much so as loons and gulls. Botulism can probably occur in any bird or mammal that scavenges dead fish, and it has been observed in bald eagles, wood ducks, and muskrats.

Many species of mammals and some fish are known to be affected by botulinum toxin. More commonly affected mammals include mink, foxes, cattle, horses, and sheep. Cats, dogs, and swine appear to be somewhat resistant, although this toxicity is occasionally diagnosed in dogs and swine. Humans can contract botulism from food poisoning and wound contamination. Botulism is usually associated with aquatic habitats, so some cases of human botulism result from consumption of fish or marine products containing the toxins. Human cases are also often associated with home canned food items that have not been heated sufficiently.

Distribution

Botulism has been reported in wild birds on every continent except Antarctica, but outbreaks occur more often in the United States and Canada than in other countries. The western United States in particular experiences large die-offs of waterfowl with relative frequency, especially dabbling ducks, due to type C botulism . Type E botulism is relatively common in wild birds of the Great Lakes region, particularly fish eating birds. In Michigan, birds inhabiting Lakes Huron and Michigan are often affected, while Ontario, Ohio, Pennsylvania, and New York observe botulism toxicities in birds near Lakes Ontario and Erie. Outbreaks usually occur in late summer or early fall when water temperatures are highest and water levels are low.

Avian botulism was first detected around Lake Erie in 1964. Outbreaks of botulism in wild birds have occurred on the Pennsylvania border of Lake Erie from 1999 through 2004 and as recently as 2008. In 2008 roughly 10,000 birds from the Lake Erie region died of avian botulism, while in 2002 as many as 19,000 birds died in the area.

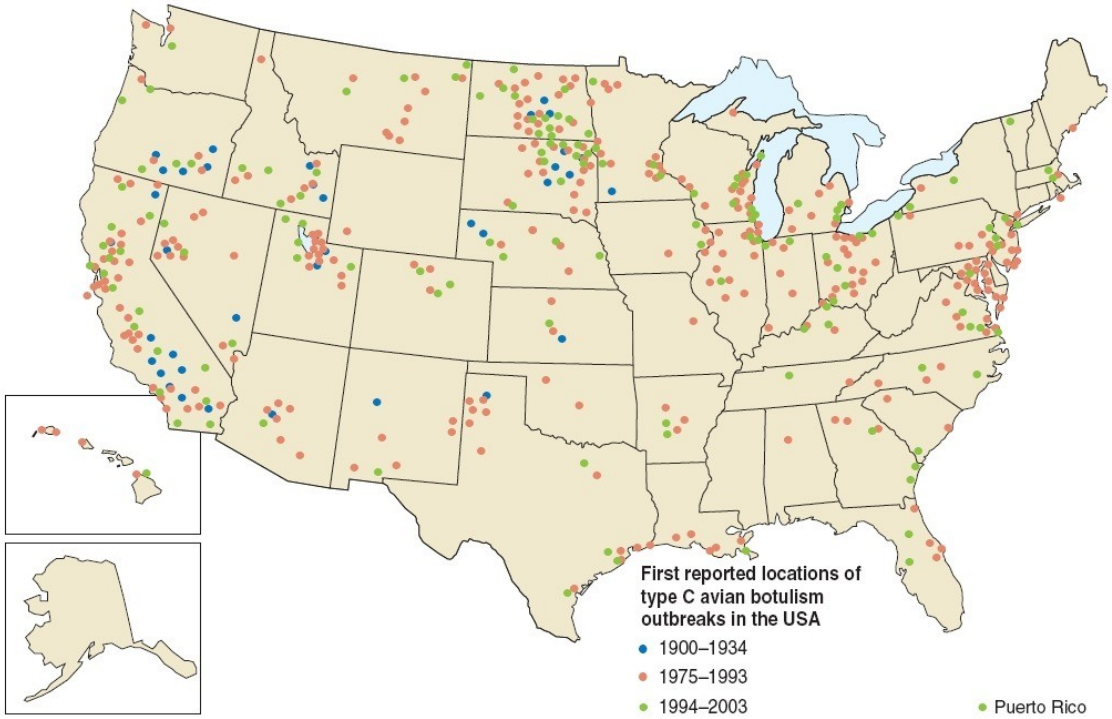

Figure 2.1 Locations of type C avian botulism outbreaks in the United States.

Friend, Milton, 2006, Disease Emergence and Resurgence: The Wildlife-Human Connection: Reston, Va., U.S. Geological Survey, Circular 1285, 26 p.

Map courtesy of wildlifedisease.nbii.gov

Transmission

C. botulinum, the bacteria that produces the botulism toxin, is common in the soil of both terrestrial and aquatic environments, but the bacteria will only produce toxin under certain environmental conditions that favor bacterial growth. The bacteria will only grow at higher temperatures and with no oxygen.

Aquatic invertebrates ingest *C. botulinum* when feeding on sediment, and many die during the summer because of high water temperatures and low water levels. The

bacteria within the invertebrates produce the toxin as the invertebrates decay, and waterfowl become intoxicated when they consume the dead invertebrates. The affected birds then die and maggots feeding on the carcasses pick up the toxin. These maggots are then eaten by other birds, which become sick, and the cycle continues. Large-scale bird die-offs occur as a result of this toxin amplification. This mode of transmission is common with type C botulism in the western United States, but the maggot-carcass cycle also occurs with type E botulism outbreaks in the Great Lakes.

Fish can also ingest the bacteria by directly feeding on sediment or by consuming invertebrates carrying the bacteria. After the fish die, toxin is produced in the decaying carcasses and can affect any bird or mammal that may scavenge the dead fish.

The zebra mussel and round gobie, both invasive species now common to the Great Lakes, appear to play a role in the transmission of botulism in the Eastern US. Zebra mussels seem to create an environment that is favorable for the growth of *C. botulinum* type E. The type E toxin becomes concentrated within the zebra mussels as they filter the water. Round gobies, a small fish, feed on these intoxicated zebra mussels. It is theorized that the botulinum toxin causes the round gobies to become easy prey for fish-eating and scavenging birds, which in turn become intoxicated and suffer from botulism.

Photograph courtesy of nabc.ksu.edu

<u>Clinical Signs</u>

The severity of clinical signs is influenced by multiple factors including the amount of toxin consumed, the type of toxin, and the animal species. Clinical signs appear more quickly and are more severe when animals consume larger amounts of toxin. The toxin prevents nerves from transmitting signals, which leads to muscle paralysis. Intoxicated birds will exhibit progressive weakness. At first they may have difficulty flying due to weakening muscles. This will progress to a complete inability to fly, followed by inability to stand. Some birds drown because they are unable to hold their head above the water, while others die from an inability to breath due to paralysis of the respiratory muscles. Many affected animals will remain conscious and alert even though they cannot move.

During outbreaks many birds are simply found dead without being observed showing clinical signs. Birds found dead from botulism have no obvious post-mortem lesions and are usually in good body condition.

Diagnosis

Laboratory tests must be performed to isolate the toxin from blood or tissue.

Treatment

Birds with mild clinical signs can often be successfully treated by removing them from the contaminated environment and providing shelter, fresh water, and food. More severely affected birds require more intensive supportive care and may not survive. Antitoxins may be helpful, but they are rarely used for wildlife because of high cost and the need for large quantities during major outbreaks.

Management/Prevention

Clostridium botulinum occurs naturally in soil and aquatic sediments, so it is unrealistic to attempt to completely eliminate botulism from wildlife populations. Most outbreaks occur in aquatic habitats in late summer when water temperatures are higher and water levels are lower, so attempts to stabilize water level and temperature may help prevent outbreaks. Prompt removal of dead fish, bird, and other animal carcasses can help prevent botulism outbreaks, and also figures into the management of outbreaks.

Suggested Reading

Ballmann, A., L. White, and D. Blehert. September 2009. 10 year review of type E avian botulism mortality in Lake Michigan. United States Geological Survey, National Wildlife Health Center.

Botulism. August 2005. OIE. Center for Food Security & Public Health. College of Veterinary Medicine, Iowa State University, Ames, Iowa, USA. <http://www.cfsph.iastate.edu/DiseaseInfo/disease.php?name=botulism&lang=en>.

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