

Botulism

FACT SHEET

Pennsylvania Sea Grant, as part of the National Sea Grant Program, promotes efforts to improve the environmental and economic health of Pennsylvania's coastlines.

Focusing on the Lake Erie and Delaware River watersheds, Pennsylvania Sea Grant works to increase public awareness of coastal environmental and economic issues through extension, communication, applied research, and education activities.

The National Oceanic and Atmospheric Administration (NOAA) administers the National Sea Grant College Program. Pennsylvania Sea Grant is also supported by the Pennsylvania State University and the Commonwealth of Pennsylvania.

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Botulism is a paralytic, often fatal disease of birds resulting from the ingestion of a toxin produced by the bacterium *Clostridium botulinum*. Sporadic die-offs of fish eating birds such as gulls and loons are usually caused by type E toxin and are common to the Great Lakes. Type C toxin also affects waterfowl, but is more commonly responsible for duck die offs in the western United States.



Figure 1. Healthy gull

C. botulinum can be found in wetlands and lakes and often exists in a spore form that is resistant to heat and drying. In some instances the bacteria may remain viable for years. The production of toxin occurs during multiplication of the vegetative form of the bacteria following spore germination. The vegetative form requires dead organic matter and a complete absence of oxygen (anaerobic) to grow and produce the toxin.



Figure 2. Dead gulls due to botulism

Important environmental factors that contribute to the initiation of botulism outbreaks include low and fluctuating water levels, the presence of vertebrate and invertebrate carcasses, rotting vegetation, and high ambient temperatures. The decay of fish and invertebrates can produce an environment suitable for toxin production. An especially potent toxin is produced in bird, mammal, and a variety of invertebrate carcasses because these substrates provide large amounts of protein for toxin production. In addition, the presence of vertebrate carcasses and high

ambient temperatures are conducive to attracting flies to the carcasses. The flies deposit eggs, which develop into maggots that can concentrate the toxin.

BOTULISM CYCLE

A wide variety of bird species may inhabit preferred nesting and resting locations. This commonly results in healthy (Figure 1), sick, and dead birds (Figure 2) being found together during a botulism outbreak. As the dead birds decompose they become hosts for maggots that carry the toxin. New birds

arriving to the area feed on the maggots that have developed on the dead birds. The new birds are then affected with the toxin, die, and a new botulism cycle begins (Figure 3). This method of transfer affects a wide variety of bird species.

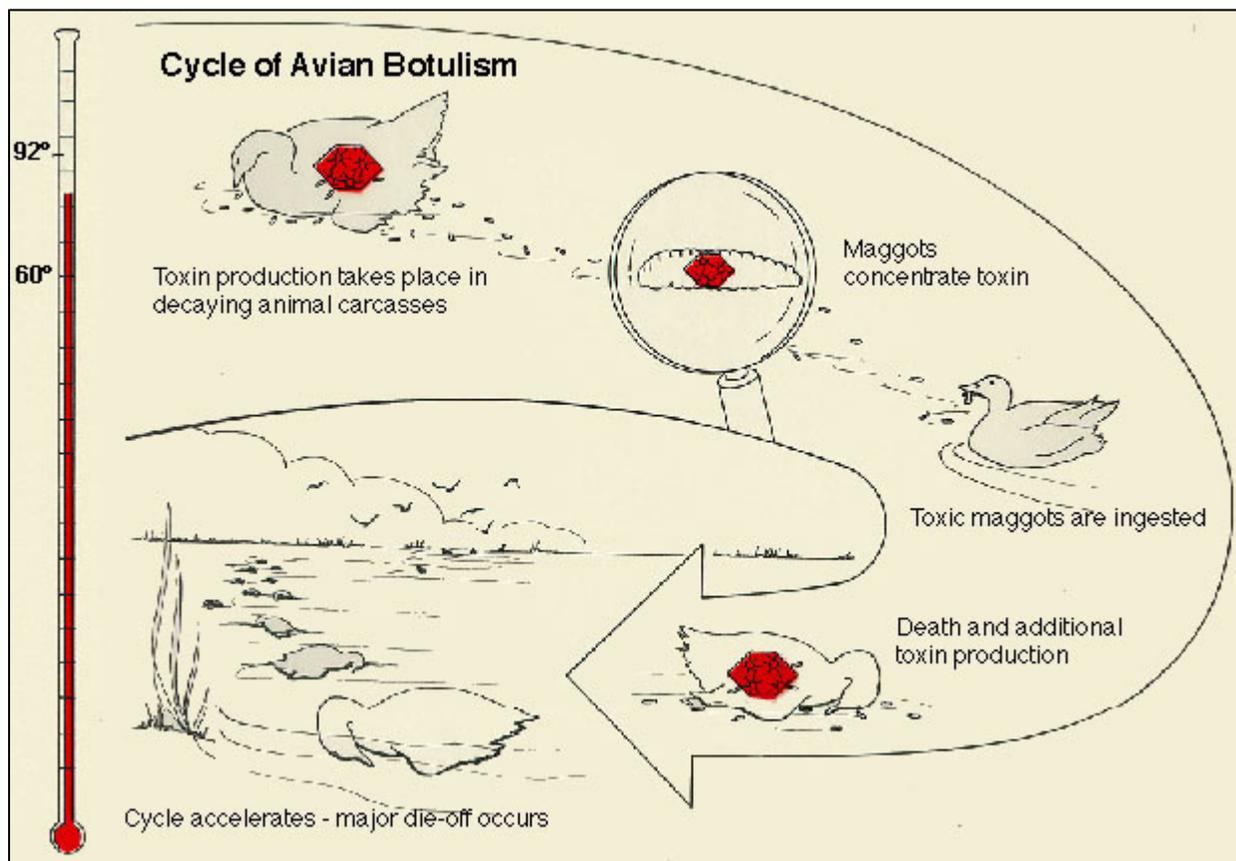


Figure 3. Avian botulism cycle

PHYSIOLOGICAL EFFECTS OF BOTULISM

Botulism affects the peripheral nerves of the bird and results in paralysis of the voluntary muscles. This results in an inability of the bird to sustain flight which is observed in the early stages of botulism. Once this has occurred, birds suffering from botulism are commonly observed propelling themselves across the water with just their wings (Figure 4). The next effect to occur is paralysis of the inner eyelid membrane followed by paralysis of the neck muscles. This paralysis results in an inability of the bird to hold its head erect causing "limp neck". Loss of flight and limp neck are the most recognizable signs of botulism. Once birds reach this stage, death from drowning often occurs before they reach the next stage or respiratory failure.



Figure 4. An intoxicated bird propelling itself across the water with its wings

HOW SERIOUS IS IT?

Losses vary from year to year and from species to species. A few hundred birds may die one year at a specific location and tens of thousands the next year. As many as a million deaths from avian botulism have been reported from localized outbreaks in a single year; however, outbreaks causing losses of 50,000 birds are more common.

PREVENTION AND CARCASS REMOVAL

The unfortunate problem associated with botulism is that bacteria formed in bird and fish carcasses are quite stable and can serve as the source of outbreaks for many months to come. Die-offs increase during periods of hot daytime temperatures and warm nights; therefore, prompt removal of carcasses is essential for preventing transmission of the toxin to other birds (Figure 5). The carcasses should be removed and incinerated, or double wrapped in plastic bags and placed in the trash in order to eliminate the major source of toxin production and maggot development.



Figure 5. Removal of carcasses

CAN SICK BIRDS BE TREATED?

In dealing with botulism, the emphasis should be on prevention and control of outbreaks, rather than treatment of sick birds. Identifying possible cases of avian botulism at the early stages is the key to effective control. Public awareness of the conditions that lead to avian botulism and prompt corrective action can greatly reduce the epidemics which now claim hundreds of thousands of birds each year. Sick and dead birds in areas of avian botulism epidemics should be reported immediately to state and federal wildlife agencies. Agency phone numbers are listed on the last page.

BOTULISM AND FISH DIE-OFFS

Field investigations have suggested that the die-offs observed in Lake Erie may be the result of botulism type E poisoning. Species commonly found during die-off events include: Freshwater Drum (Sheepshead), Smallmouth Bass, Rock Bass, Stonecats, Round Gobies, Sturgeon, and Channel Catfish. It is suspected that zebra and quagga mussels are ingesting the *botulinum* bacteria (invertebrates are not affected by botulism). Round gobies are known to heavily feed on mussels; therefore, they are thought to be ingesting the bacteria. Native fish species such as those commonly associated with the die-off are starting to feed primarily on the round



Figure 6. Dead sturgeon

goby; thus, they become affected by botulism. This movement of botulism is believed to be leading to the fish die-offs commonly observed in Lake Erie.

HUMAN HEALTH CONSIDERATIONS

Botulism in humans is usually caused by the consumption of improperly home-canned foods and is most often a result of type A or type B *botulinum* toxin. A few cases of type E botulism have been reported in North America as the result of eating improperly smoked or cooked fish. Thorough cooking is necessary to destroy the bacteria. Health agencies recommend cooking fish or waterfowl to an internal temperature of at least 180°F to destroy the *botulinum* toxin. As a precaution, anglers and hunters should never harvest fish or waterfowl that appear sick or dying in areas where avian botulism is known to be present.

SYMPTOMS OF BOTULISM IN HUMANS

Symptoms of human botulism include blurred vision, dry mouth, difficulty in swallowing or speaking, general weakness, and shortness of breath. If you are affected by these symptoms after consuming fish or waterfowl from known areas of avian botulism, seek medical attention immediately. The illness may progress to complete paralysis, respiratory failure, and possibly death.

HOW YOU CAN HELP

If you observe a large fish die-off or find carcasses of marine birds such as ducks, gulls, or loons, please report them to the proper authorities. Reports on Presque Isle State Park should be submitted to the nearest park official.

Follow these simple recommendations:

- Dead birds should be removed immediately to slow the spread of bacteria.
- Play it safe, never eat fish or waterfowl that you have found dead or dying.
- Do not eat undercooked or improperly prepared fish or waterfowl.

By following some simple guidelines, botulism should pose a minimal health threat to you.

To report dead or dying birds on Presque Isle call (814) 833-7424. For reports from other locations call the PA Game Commission at 1-877-877-0299 or PA Sea Grant at (814) 898-6420.

For more information:

Visit the Pennsylvania Sea Grant Web site: <http://www.pserie.psu.edu/seagrants/seagindex.htm>

Visit the New York Sea Grant Web site: <http://www.seagrants.sunysb.edu/>

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Photo Credits

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Figures 3 and 4 – Images from Locke, L.N. and Friend, M. Avian Botulism: Geographic Expansion of a Historic Disease. U.S.G.S. National Wildlife Health Research Center. 1989.

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