

# Botulism in waterbirds: Mortality rates and new insights into how it spreads

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Outbreaks of botulism killed large percentages of waterbirds inhabiting a wetland in Spain. During one season, more than 80 percent of gadwalls and black-winged stilts died. The botulinum toxin's spread may have been abetted by an invasive species of water snail which frequently carries the toxin-producing bacterium, *Clostridium botulinum*, and which is well adapted to wetlands polluted by sewage. Global warming will likely increase outbreaks, said corresponding author Rafael Mateo, PhD. The research was published March 25th in *Applied and Environmental Microbiology*, a journal of the American Society for Microbiology.

Botulism is a major killer of waterbirds, including some endangered [species](#). In earlier studies, some also published in *Applied and Environmental Microbiology*, these investigators had found that eutrophication of some of these wetlands, due to effluent from [waste water treatment](#) plants, was encouraging growth of *C. botulinum* and other bacterial pathogens of birds.

In the current study, the investigators surveyed mortality among the resident waterbirds, and investigated how the bacterium is spread. During two [outbreaks](#), the investigators collected 43 dead white-headed ducks, representing seven percent and 17 percent of their maximum population on Navaseca lake during 2011 and 2012, respectively, said Mateo, who is Head of the Group of Wildlife Toxicology, at the Spanish Institute of Game and Wildlife Research, Ciudad Real, Spain. White-headed ducks are highly endangered, with only about ten thousand

surviving individuals worldwide.

Additionally, the team found death rates of greater than 80 percent among gadwalls and black-winged stilts in 2011. Mortality estimates for white-headed ducks are probably low, said Mateo, explaining that scavengers frequently devour dead birds, and that it is difficult to find ailing or expired avians in the dense vegetation along the lake shore.

The team also investigated how the disease spreads. The main source of spread, previously known, is the "carcass-maggot cycle," said Mateo. "Birds feed on maggots growing in a carcass containing *C. botulinum* and its neurotoxin," and then die, with the cycle beginning anew as the dead birds become food for more maggots. "The spread of the outbreak is exponential," said Mateo.

Additionally, the investigators found that 30 percent of an invasive species of freshwater snail, collected during outbreaks, carried *C. botulinum*. These snails, *Physa acuta*, are an [invasive species](#) that is well adapted to wetlands polluted by sewage. They are likely sources of food for a number of different waterbird species, including mallards, gulls, and coots, said Mateo.

Differences in diets result in different levels of vulnerability among bird species. Flamingos and grebes appeared untouched by outbreaks, likely because they appear to feed mainly on prey species that do not carry *C. botulinum*, such as certain crustaceans, and/or possibly because they are more resistant genetically than other species to this pathogen.

Mateo warned that outbreaks would likely occur more frequently due to [global warming](#). In earlier research, also published in *Applied and Environmental Microbiology*, his group showed that higher summer temperatures are associated with higher mortality rates among waterbirds during outbreaks. "We have observed that outbreaks occur when the

mean temperature in July exceeds 26o C [79o F.]," he said. Additionally, when water is scarce due to drought, wetlands eutrophy more frequently, which favors anaerobic bacteria such as *C. botulinum*. Finally, birds tend to concentrate in the few wetlands that are maintained with treated sewage, which boosts mortality from botulism and other diseases, he said.

These wetlands, which are located in La Mancha, which was made famous by the novel, Don Quixote, and which are rich in biodiversity, are a UNESCO "biosphere reserve." Their unique habitat is important for many bird species, including migratory birds that breed there, such as the afore-mentioned white-headed duck. But outbreaks of botulism are common. "We wanted to characterize the ecology of the avian botulism in these wetlands to know to what degree human action—notably poor treatment of sewage—was determining the outbreaks' occurrence," said Mateo.

Provided by American Society for Microbiology

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