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A *Salmonella* outbreak in wild songbirds

Christopher C. Fichtel

During February and March 1977, a dieoff of wintering birds occurred at Carnegie Museum of Natural History's field station, Powdermill Nature Reserve, 3 miles south of Rector, Westmoreland County, Pennsylvania. The dead birds were found in the vicinity of a feeding station and were routinely picked up, weighed, and then sent frozen to the Museum in Pittsburgh for preparation as specimens. At least 16 individuals of 4 species were involved: 6 Cardinals (*Cardinalis cardinalis*), 8 Tree Sparrows (*Spizella arborea*), 1 White-throated Sparrow (*Zonotrichia albicollis*), and 1 Dark-eyed Junco (*Junco hyemalis*).

When the first birds were found, it was noticed that their weights were exceptionally low for that time of year. Three Tree Sparrows found on 3, 4, and 10 February weighed 14.2, 13.3, and 13.6 g, respectively. In a sample of 105 adult Tree Sparrows weighed at the Reserve in February in previous years, the mean weight was 19.4 g, the range of the sample being 16.5 to 22.5 g. The dead sparrows thus were several grams lighter than any previously handled in February. In addition, their emaciated pectoral muscles suggested death from starvation. The weather during the previous weeks had been exceptionally severe, with record-breaking low temperatures and persistent snow cover. The unusual number of dead birds in the vicinity was at first attributed to the effects of the winter weather.

During preparation of the first birds, I dissected and examined them and found thickenings of the crop musculature. Enlargement of the crops could easily be felt, and upon dissection the walls of the crops appeared as cheesy masses. These first birds could not be formally necropsied (cultured) because they had been frozen, but 6 individuals found later were delivered immediately to the Poultry Diagnostic Laboratory, Pennsylvania Department of Agriculture, for necropsy. Culture methods used are those described by the American Association of Avian Pathologists (1975) and the American Association of Veterinary Laboratory Diagnosticians (1976). Tests were run

for aerobic pathogens such as *E. coli*, *Pasteurella*, and *Staphylococci* bacteria as well as anerobic pathogens, especially *Salmonella*. Of these, 3 Cardinals and 1 Tree Sparrow were diagnosed as having died of salmonellosis, an infectious bacterial disease, in this case, specifically caused by *Salmonella typhimurium*. The other two specimens were in poor condition for specific diagnosis. Because of the similar symptoms in all 12 of the informally necropsied birds, however, salmonellosis was strongly suspected in them as well.

It is unfortunate that the severe winter weather prevented a more thorough search for dead birds in the area, and that some of those that were found were not in good enough condition to necropsy or even to yield meaningful weights.

It is apparent from the banding records at Powdermill during the period of the outbreak, that the epizootic was probably restricted to these 4 species, and affected only a portion of the populations. Tree Sparrows seemed to be most severely affected, with 8 found dead: 1 definitely diagnosed as salmonellosis and the other 7 all showing the signs of emaciation, very low weight, and cheesy masses in an enlarged crop. Another 3 banded Tree Sparrows showed serious weight loss the last time they were handled (in early to mid February) but these birds were not subsequently found. That only some of the local Tree Sparrows were affected by the epizootic is indicated by the normal-sized population of the species present at the Reserve all winter (e.g., 82 banded between 1 January and 31 March 1977) and many of these birds continued to be handled at normal weight through early spring, when they left on migration.

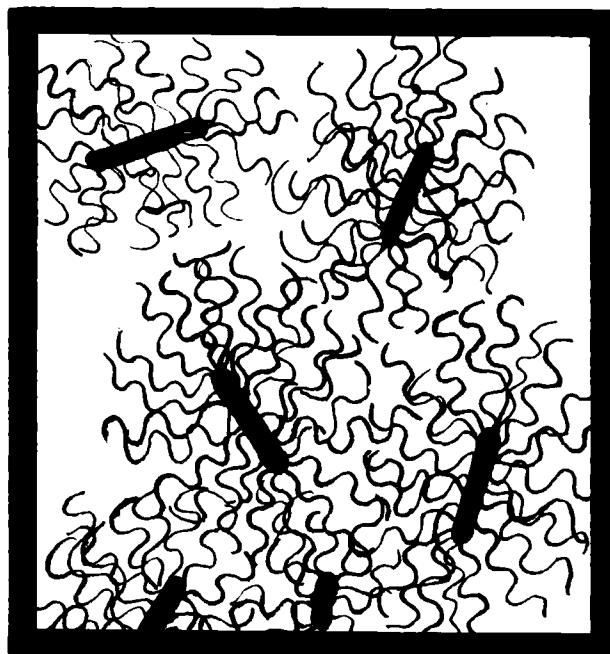
Cardinals were also seriously affected. Six were found dead: 3 with salmonellosis signs and 3 definitely diagnosed as being infested with *Salmonella typhimurium*. One of the suspected Cardinals was a male that weighed 34.9 g when it was found dead on 12 February; it had been banded on 24 February 4 years earlier, weighing

51.5 g. One of the dead Cardinals was a female that had been banded on 8 March 1975, weighing 41.0 g; she was rehandled on 27 March 1976 at 44.1 g and on 16 February and 1 March 1977 at 43.1 and 41.8 g respectively. The following day, on 2 March, she was found dead, weighing 36.6 g — a loss of 5.2 g in approximately 24 hours.

Of the very small wintering population of White-throated Sparrow, (only 5 were banded from January — March), 1 was found dead on 10 February (originally banded on 19 November 1976). From the large population of wintering Dark-eyed Juncos (270 banded between 1 January and 31 March), only 1 was found dead and exhibiting salmonellosis signs; it had been banded on 28 November 1976, weighing 23.4 g, but at its death on 24 February 1977 it weighed only 16.3 g.

That the salmonellosis brought rapid weight loss and death is shown by two banded Tree Sparrows as well as the female Cardinal noted above. One individual banded on 3 February 1977 weighed 23.0 g; on 10 February it weighed 20.3 g; on 13 February, 16.7 g; and on 15 February it was found dead. The second individual was banded on 10 November 1976 at 20.6 g; it was rehandled 4 more times through December with its weight ranging between 20.1 and 22.0 g. On 26 January it weighed 24.1 g; on 10 February, 18.5 g; and on 15 February it was found dead. The only Tree Sparrow with a long banding record and a death weight was one that was banded in January 1975 and rehandled 4 more times during that winter (weight range between 20.8—23.8 g); it was encountered only once in 1977 when it was found dead on 10 March, weighing 12.8 g. Any weight loss after death would probably be minimal since, (1) the weather was so cold and (2) the birds were weighed immediately after being picked up.

In wild birds *Salmonella typhimurium* is the most common type of *Salmonella* reported. Certain predisposing stress factors such as inadequate nutrition and exposure to extreme temperatures lower the resistance of birds (Steele and Galton, 1971:56). The Powdermill birds had experienced severe winter conditions during January and early February, and at least 2 individuals were further stressed by sarcosporidiosis infections (as shown by necropsy). These were fungal infections manifested as small, hard nodules scattered over the pectoral muscles and liver. Williams (in Hofstad et al., 1972) points out that mortality from paratyphoid infection (e.g., *S. typhimurium*) under natural conditions varies, depending upon the environment, the strain of infecting organism, and the presence of concurrent infection.



Salmonella typhimurium

It is possible that the infection at Powdermill originated with dogs or rodents; it may also have been brought into the area by infected birds. Dogs and cats often carry *Salmonella* organisms in their digestive tracts without showing any clinical symptoms; they may be chronically infected, shedding the organisms in large numbers in their feces (Buxton 1957). Several dogs frequent the Powdermill feeder area, but cats are not commonly seen. Bruner and Moran (1949) reported 26 *Salmonella* types recovered from dogs, with approximately 40% of the cultures being *S. typhimurium*. Rats and mice also are frequently carriers of paratyphoid, particularly *S. typhimurium*. Rats occur in the feeder area, and mice are common there. Thus, as some of the bird seed falls to the ground beneath the feeders, transmission from infected feces — mammalian or avian — is possible. All of the bird species infected during the Powdermill outbreak are those that habitually feed on seed on the ground, and that will form loose or dense flocks to do so. Thus transmission was probably through seed infected by feces, and it affected many of the birds feeding in the area. Wilson and MacDonald (1967) found that the occurrence of large outbreaks of *S. typhimurium* infection was attributed primarily to this avian habit of gathering in large flocks to feed. Samples of fresh seed were examined and cultured for pathogens; none were found.

Because the Powdermill outbreak occurred in late

winter, mostly in the first half of February, and because the affected birds seemed to succumb quickly, it is improbable that many survived to migrate and carry the disease any appreciable distance. Steele and Galton (1971:56) note that infections may last from one to several weeks and death may not be the end result. Young birds are more susceptible and mortality is higher. Age and susceptibility factors may influence the spread of the disease, but the time of year in the present case was too late for accurate age determinations of most of the individuals of the affected species. Some of the banded birds, however, were known to be several years old. The first bird known or suspected to have died from salmonellosis at Powdermill was found on 26 January; 8 more (plus 3 suspected banded birds) were found through mid February; 2 in late February; the last migratory bird (a Tree Sparrow) on 10 March; and the last non-migratory species (a Cardinal) on 29 March. The first migrants to leave in the spring are Tree Sparrows, and most of the locally wintering individuals are gone by late March. Hence it is possible that a few Tree Sparrows could have carried the infection north.

A similar avian dieoff occurred in Florida (Nesbitt and White 1974). This instance also involved a feeding station and *S. typhimurium*, and it took place during late winter — early spring. Nesbitt and White suggest that such dieoffs might be prevented by cleaning affected areas. In severe winter seasons such as that of 1976-77 large feeding stations probably should be cleaned regularly, removing old seed and hulls from the ground every few days. As a practical matter, however, cleaning the area under an elevated feeder can be difficult to accomplish in a thorough manner, especially if the ground is grassy.

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Note: Five dead House Sparrows (*Passer domesticus*) were brought in to the museum during the winter of 1977-78. They were all recovered from the Pittsburgh city area and showed the same signs as those mentioned in this paper, e.g. cheesy masses in the walls of the crop and emaciation. The birds were frozen and therefore could not be formally necropsied. *Salmonella* may not have been the causative agent, but this must be considered since the flock feeding behavior of House Sparrows and existence of many dogs, cats, and rodents in the area are conducive to incidence and spread of *Salmonella*.

Section of Birds, Carnegie Museum of Natural History, Pittsburgh, PA 15213