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Source: Journal of Wildlife Diseases, 8(1) : 75-78

Published By: Wildlife Disease Association

URL: <https://doi.org/10.7589/0090-3558-8.1.75>

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THE 1970-71 AVIAN CHOLERA EPORNIC'S IMPACT ON CERTAIN SPECIES[†]

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Abstract: The 1970-71 avian cholera epornitic was the third highest in waterfowl mortalities during the 22 annual California recurrences for which we have records. The most serious aspect of this outbreak was its impact on species which, although not classified as rare and endangered, nonetheless are in low numbers. For example, 7.3 percent of the Ross goose (*Chen rossii*), and 3.9 percent of the whistling swan (*Olor columbianus*) populations wintering in California died of avian cholera as well as ten sandhill cranes (*Grus canadensis*) and one bald eagle (*Haliaeetus leucocephalus*). A possible cause of the large losses of waterfowl was a late winter drought with resultant local high concentrations of birds and heavy contamination of the water.

INTRODUCTION

Previous reports of avian cholera affecting the wintering waterfowl in California^{6,7,8,9,10} have indicated those species which had the largest number of dead birds: namely, ducks, coots (*Fulica americana*), lesser snow geese (*Chen hyperborea*), and whistling swans. For comparative purposes and as a continuous index of mortalities, each year the rates per thousand were calculated for whistling swans alone.⁸

The total loss of waterfowl from avian cholera in California each winter since the 40,000 in 1948-49 has varied from a low of about 500 to a peak of 70,000 in 1965-66. During the winter of 1970-71 the third highest loss occurred with the death of about 37,000 waterfowl. Some new and unusual observations were made during the epornitic, and these are included in this report.

METHODS

Surveillance was conducted annually for the appearance of avian cholera in the waterfowl populations of California. Department of Fish and Game field per-

sonnel submitted dead birds for examination. The refuge biologist at Tule Lake — Lower Klamath National Wildlife Areas excised the hearts of dead waterfowl, wrapped them in cotton surrounded by plastic bags of ice and shipped them to the laboratory.

During the height of this epornitic, because of the number of carcasses involved, field biologists collected most of the dead birds for disposal and recorded the numbers by species. Identification of the individual species of ducks as well as accurate counts was discontinued and estimates were substituted, inasmuch as many of the dead birds were enmeshed in windrows of weeds and tules and large numbers were decomposed.

All birds received were examined by necropsy. Blood smears from the hearts were treated with Wright's stain for microscopic examination. Cultures were made from heart blood and the isolates were inoculated into biochemical testing media. Hemagglutination tests^{1,2} of the isolates were conducted. Two isolates from snow geese and a culture from a bald eagle were forwarded to the National Animal Disease Laboratory at Ames for serotyping.

[†] Supported in part by Federal Aid in Wildlife Restoration Project W52-R, Wildlife Investigations.

RESULTS

Avian cholera killed 54 lesser snow geese, 2 cackling geese (*Branta canadensis*), and 1 white-fronted goose (*Anser albifrons*) on the Delevan National Wildlife Area, Colusa County, during the week of November 17, 1970. All carcasses were retrieved. A week later, 2 lesser snow geese and 1 white-fronted goose were found dead of the same cause at Sutter National Wildlife Area, Sutter County, less than 50 km from the former site, and the carcasses were removed. No further losses occurred on these areas from avian cholera during the winter.

On December 21, 1970, 1,331 ducks, geese, swans, and coots were found dead on the islands of the Sacramento - San Joaquin Delta. This marked the beginning of the widespread epornitic. The outbreak increased in January and continued unabated through February. At the beginning of March a few isolated lesser snow geese died of the disease at Tule Lake National Wildlife Area. As the spring migration gained momentum, the losses in central California diminished and the toll increased sharply at Tule Lake. The last large northern flights of the snow and Ross geese from Tule Lake during the third week of April marked the end of the major outbreak, with some continued losses among coots and a few western Canada geese (*Branta canadensis moffitti*).

During March a farmer in the Delta complained that he could not disc his fields for spring planting because of the large number of carcasses. Field men gathered them, and within 64 hectares (160 acres) there were well over 2,000, of which 981 were whistling swans.

Laboratory Studies

Most of the birds examined in the laboratory had focal necrosis in the liver and petechial hemorrhages on the heart. Bacteria in the stained blood smears had typical bipolar morphology. Biochemical tests indicated that the organisms were *Pasteurella multocida*. The hemagglutination tests showed them to be type A (Carter's classification), and Dr. Ken

Heddleston reported the isolates as serotype 1 (Little and Lyon's classification).

The bald eagle specimen was badly contaminated with a rapidly growing and spreading bacterial species. Attempts to obtain a pure culture by mouse inoculation were unsuccessful. Trials were conducted with Das medium but failed. The two descriptions of the medium in Das's original paper⁴ did not coincide. Various combinations of the ingredients were tested with pure cultures of *P. multocida* until a satisfactory formulation was found. The formula includes starch dextrose agar (Difco), 2 ml of 0.1% solution gentian violet, 1 ml of 10% solution of cobalt chloride, and 1 g of esculin in a liter. With this modified Das medium a pure culture of *P. multocida* was isolated easily from the eagle's heart.

Practically all of the birds were found dead. Very few were in the agonal stages of the disease, and one sick lesser snow goose was brought to the laboratory and put in isolation. The goose appeared to recover and was then placed in a pen with other waterfowl. At the end of May, three months after it had been picked up, the goose suddenly died. The bird was in excellent condition, but the typical bacteremia of peracute cholera was present, and *P. multocida* was isolated.

Statistical Studies

Of the 37,000 waterfowl deaths, 31,500 died in the central valley of California and 5,500 succumbed at Tule Lake - Lower Klamath on the Oregon border. The mortality rates of some of the species are summarized in Table 1.

About 7,000 geese died in the Delta. During the hunting season a corrected estimate of hunter kill in the same area was 6,400 however, the hunter postcard survey has inherent inaccuracies. This postcard survey showed a total hunter goose kill for California of 378,000 while the avian cholera goose loss was about 11,000. Nevertheless there is an indication that on one area within the state the same number or more geese died of the disease than were killed by hunters, although admittedly this is an extreme example.

TABLE 1. Comparative mortality of species during the 1970-71 avian cholera epornitic in California.

Species	Wintering Populations	Dead Birds	Comparative Mortality	Percent of each species dead
Whistling swan	91,950	3,600	9.8	3.9
Lesser snow geese	457,000	7,000	19.0	1.5
Ross geese	27,500	2,000	5.4	7.3
White-fronted geese	106,260	1,500	4.1	1.4
Cackling geese	112,300	250	0.7	0.2
Ducks	6,387,000	14,000	37.9	0.2
Coots	362,400	8,500	23.0	2.4
Sandhill cranes	5,600	10	—	0.2
Shorebirds		50	—	—
Gulls		20	—	—
Bald eagle	87	1	—	1.2
TOTALS	7,549,900	36,930	99.9	0.5*

*Average of all losses.

DISCUSSION

Ducks, coots, and snow geese comprised the largest number of dead birds, but the Ross geese and whistling swans suffered the greatest mortality on the basis of their populations. Ten sandhill cranes died. None of the latter species are classified as rare or endangered; however, the swans and sandhill cranes are completely protected. In the recent past the Ross geese have been protected during California's hunting seasons. These actions were prompted by the low numbers in the waterfowl populations.

The report of an outbreak of this disease in the Florida Everglades⁴ indicated that 10 to 14 bald eagles were in the area. There was scavenger activity by them but none died. The Tule Lake Refuge biologist reported similar scavenger activity by bald eagles during the 1970-71 outbreak, and he found some eagles dead. All carcasses were submitted to an analytical laboratory for pesticide examination, with the exception of the one specimen reported herein which had cholera. Since the other carcasses were not examined for cholera, it is possible that more than one eagle of this endan-

gered species had died from this disease.

In Butte County 20 coots died on a pond. Shortly afterwards 21 French gray domestic geese in the area succumbed to avian cholera. This was the first record of transmission between wild and domestic waterfowl in California. Since the coots had died in the water, transmission probably resulted from their nasal discharges contaminating the water. This observation lends support to the experimental work on turkey transmission via water as a natural means of disease spread.⁵

During the middle of May a western Canada goose died in the nesting area of the Lower Klamath. The pathology was typical of cholera and *P. multocida* was isolated from the heart. This case, coupled with the death of the lesser snow goose at the laboratory during the last week of May, would indicate that the waterfowl carry the disease north to the nesting grounds and there sustain a low level mortality.

Heavy rainfall occurred in California late in November. The series of storms extended into December with considerable flooding during the period. In

January there was no precipitation and an almost drought condition extended well into February. As a result, water areas decreased in number and size so that the wintering waterfowl became unduly concentrated. Contamination of

water by nasal discharges of the dead birds provided a rapid means of transmission through the flocks. This could have been the reason for the unusually high mortality in 1970-71.

Acknowledgements

Serotyping was done by Dr. Ken Heddlestone of the National Animal Disease Laboratory, Ames, Iowa, to whom the author is grateful. Appreciation is expressed for the field work performed by U.S. Bureau of Sports Fisheries and Wildlife Refuge biologist, Ed O'Neill California Fish and Game biologists William Clark, Roger Schoonover, William Bailey; Fish and Game Wardens William Donovan and Webb Fisher; and other departmental personnel. Gratitude is extended to personnel of the Waterfowl Project, especially Frank Kozlik and John LeDonne.

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Received for publication September 8, 1971