AN OUTBREAK OF FOWL CHOLERA IN EVERGLADES NATIONAL PARK

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Although fowl cholera has been recognized as an important cause of losses among wild waterfowl in both California and Texas since 1944 (Rosen and Bischoff. 1949. Calif. Fish and Game, 35: 185-192; Quortrup, Queen and Merovka. 1944. Jour. Amer. Vet. Med. Assoc., 108: 94-100). The disease was not reported in waterfowl along the Atlantic Flyway until 1963, when Gershman, Witter, Spencer and Kalvaitis (1964. Jour. Wildl. Mgmt., 28(3): 587-589) reported it in common eiders *(Somateria mollissima)* nesting on rocky islets along the Maine coast. Subsequently the disease has appeared in common eiders nesting on islands in the St. Lawrence River. (Reed and Cousineau. 1967. Naturaliste Can., 94: 327-334).

This paper reports the occurrence of fowl cholera, primarily among coots *(Fulica americana)*, in Everglades National Park from late December 1967 to mid-February 1968. Coots have frequently been involved in fowl cholera outbreaks in California and are often the first species in which losses occur. This first report of the disease in coots in Florida appears to be the first record of a major fowl cholera outbreak in wintering waterfowl along the Atlantic Flyway.

In the last week of December 1967 and early January 1968, sick and dead coots were reported along the western shoreline of West Lake, Everglades National Park, Florida. This lake is about 4 miles long and 1 mile wide and averages 4 to 5 ft. deep. It is bordered on all sides by salt tolerant trees such as red mangrove *(Rhizophora mangle)*, black mangrove *(Aricennia nitida)*, white mangrove *(Laguncularia racemosa)*, and buttonwood *(Conocarpus erectus)*. Submergent vegetation is abundant within the lake. Salinity levels in this area are believed to range from the upper limits of fresh water (4-5000 ppm) to salty (17,000+ ppm) and reflect to a great extent seasonal and year-to-year abundance of rainfall. On January 10, 1968, water samples were collected at the western end of the lake and about midway along the northern shoreline. Analysis of these samples by the Miami office of the U.S. Geological Survey determined that salinities were 6,200 and 7,100 ppm respectively, well into the brackish range.

West Lake is connected to Florida Bay through a series of ponds, lakes, and creeks which lie to the south. Many other ponds and lakes are 6 to 10 miles to the west, east, and southeast of West Lake. These areas were surveyed by boat and plane for evidence of waterfowl mortality. Aerial observations showed that an estimated 50,000 coots and 1,000 to 2,000 ducks (primarily lesser scaup *(Aythya affinis)* blue-winged teal *(Anas discors)*, ring-necked ducks *(Aythya collaris)*, and American widgeon *(Mareca americana)* were present on West Lake during the die-off period. This location seemed to be the only area where such a heavy concentration of coots was present within the Park. Other water areas to the west had high concentrations of ducks (estimated to total 30,000 birds*), including pintails *(Anas acuta)*, American widgeon, blue-winged teal, ring-necked ducks, and lesser scaup, but no die-offs were observed in any locations other than West Lake.

On January 5 a survey was made along the western shoreline of West Lake. Dead birds appeared to be most concentrated here, and a total of 72 birds was collected in three sampling areas totalling 370 ft of shoreline. As the entire shoreline on which the birds were concentrated measured 9,500 ft, the number of dead birds was estimated to be about 2,000. Some sick coots were observed swimming in circles. Others

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were too weak to swim or dive. Several were collected and of these two exhibited shivering just prior to death, and one had a frothy, bloody nasal discharge. Although more than 95 per cent of the affected birds were coots, three dead and one sick lesser scaup *(Aythya affinis)* were seen on this day. An estimated 5,000 to 6,000 coots are believed to have died before the cholera outbreak subsided in mid-February. Mortality among other species of waterfowl was estimated at 50 to 100 birds.

A total of 395 sick or dead birds was collected during the period of die-off. All were incinerated except those submitted for laboratory analysis. About 95 per cent of the birds collected were coots; the rest were predominantly lesser scaup.

The greatest numbers of dead and dying birds were found along the western shoreline and in a small 2 to 3 acre bay connected to the north-west corner of the lake, despite the fairly even dispersal of coots feeding throughout the lake during daylight hours. It was assumed that the prevailing easterly winds carried dead and weakened birds to the western shore. Also significant was the heavy roosting activity in the small bay mentioned above. Coots gathered in extremely dense concentrations to roost on the aerial roots of the red mangrove trees bordering this small bay. Many hundreds of these birds appeared to have died while on this roost or shortly after leaving it.

A great deal of scavenger activity was associated with the die-off. The most common scavenger species were the turkey and black vultures *(Cathartes aura and Coragyps atratus)*, bald eagle *(Haliaeetus leucocephalus)*, and blue crabs *(Callinectes sapidus)*. At times several hundred vultures and 8 to 10 bald eagles were seen feeding in the die-off area. Other species observed feeding on dead coots included crows *(Corvus brachyrhynchos)*, red-winged blackbirds *(Agelaius phoeniceus)*, and the green heron *(Butorides virescens)*. Also, some evidence indicated that American alligators *(Alligator mississippiensis)*, American crocodiles *(Crocodylus actus)*, and racoons *(Procyon lotor)* were feeding upon dead or dying victims of avian cholera.

There was some concern that the disease might spread to one or more rare or endangered avian species found within the Park. Several of these species, such as the bald eagle (at times as many as 8 to 10 sub-adults and 2 to 4 adults), wood ibis *(Mycteria americana)*, and the roseate spoonbill *(Ajaia ajaja)* were feeding in the West Lake area during or after the die-off period. The annual bald eagle nesting census, conducted after the die-off, showed no decline in nesting pairs or nesting success per pair. No mortality attributable to avian cholera was noted in any species of birds other than those listed in Table I. Other birds commonly noted in the West Lake area during the die-off period were blue-winged teal, ring-necked duck, shoveler *(Spatula clypeata)*, pied-billed grebe *(Podilymbus podiceps)*, pintail, common egret *(Casmerodius albus)*, great white heron *(Ardea occidentalis)*, great blue heron *(Ardea herodias)*, white ibis *(Eudocimus albus)*, cardinal *(Richmondena cardinalis)*, mockingbird *(Mimus polyglottos)*, marsh hawk *(Circus cyaneus)*, red-shouldered hawk *(Buteo lineatus)* osprey *(Pandion haliaetus)*, laughing gull *(Larus atricilla)*, and ring-billed gull *(Larus delawarensis)*.

Seven coots were collected on January 5 for diagnostic studies and sent to the Patuxent Wildlife Research Center. Later a blue-winged teal, two pied-billed grebes, seven lesser scaup, and two black skimmers *(Rynchops nigra)* were sent to the Patuxent Center Laboratory. The results of the laboratory studies are summarized in Table I.

TABLE I. *Results of Laboratory Tests on Birds Collected during Die-off.*

	Number Submitted	Fowl Cholera positive
Coots	7	7
Blue-winged Teal	1	1
Lesser Scaup	9	2
Black Skimmer	2	0
Pied-billed Grebe	2	1

Areas of focal necrosis were scattered throughout the livers of all coots examined. No subserosal or myocardial hemorrhages were found, although these have been reported frequently in both coots and ducks dead of fowl cholera. The heart blood and liver impressions contained large numbers of a bipolar-staining, gram - negative coccobacillus. Mice inoculated intraperitoneally with 0.5 cc suspension of coot heart blood died in 18 to 36 hr, and the bipolar, gram-negative coccobacillus was recovered from their blood, hearts, lungs, and livers. The bacterium produced small, dewdrop-like, non-hemolytic colonies on 5 per cent sheep blood agar after incubation for 18 to 24 hr at 37.5 C. The bacterium produced acid but no gas from mannitol, glucose, and sucrose. No change was observed in litmus milk.

On the basis of the typical morphology, cultural characteristics, and its ability to kill mice in 18 to 24 hr, the bacterium was identified as *Pasteurella multocida.*

Avian cholera was not observed in the Park during the 1968-69 waterfowl wintering period. An aerial census of the area, by Dr. William B. Robertson, Jr. and John C. Ogden, made during this period found an estimated 5,000 coots on West Lake and an additional 20,000 on the lakes and ponds to the south and east. It appeared that coots were far fewer during this most recent season than during the die-off period a year earlier. In contrast, the wintering duck populations during the two seasons were about the same.

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