STORM MORTALITY IN A WINTER STARLING ROOST

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REPORTS of large-scale mortality among birds resulting from severe weather conditions are frequent in ornithological literature. Kendeigh (Ecolog. Monogr., 4: 342–352, 1934) summarizes a number of these, pointing out the environmental factors concerned. However, accounts of avian catastrophes do not often include attempts to determine the amount of mortality or to measure the causal factors. The ultimate value of records of such incidents can be much augmented by accompanying them with accurate climatic and habitat data. The present report is concerned with mortality among roosting 'blackbirds' at Urbana, Champaign County, Illinois, during a regional rain and wind storm on the night of February 9, 1939. Additional data were obtained after subsequent shooting into the roost on February 25–26, and March 3 or 4, 1939.

The Roost.—During recent years, swarms of 'blackbirds' have roosted in the northern half of a thirteen-acre grove, locally known as the 'forestry,' planted seventy years ago on the south campus of the University of Illinois. The tract is surrounded by more or less open country on south and west sides. Usually the birds massed in a belt of white pines on the northwestern side, but sometimes a part of the flock settled to the east in deciduous trees which are sheltered from prevailing winds by the pines. The density of white pines is about 250 per acre, that of deciduous trees (chiefly green ash) somewhat less; undergrowth is entirely absent.

During the winter of 1938–39, to the best of our knowledge, four species were represented in the roost: Starling (*Sturnus vulgaris vulgaris*), Cowbird (*Molothrus ater ater*), Bronzed Grackle (*Quiscalus quiscula aeneus*), and Red-wing (*Agelaius phoeniceus* ssp.). The latter three species usually occur in central Illinois in small numbers throughout the winter. The number of birds occupying the roost at the time of the storm was estimated at 25,000. Of these probably not more than 3% were cowbirds and grackles. Red-wings, of which only a few individuals were present, were not represented in the mortality.

Storm Mortality.—On the morning of February 10, following the storm, dead birds were found on the ground over most of the roosting area and also to the east, northeast, and north—even to a distance of several blocks in these directions. In exposed places and on the windswept 'forestry' grounds, the carcasses were frozen hard to the ground. They were most numerous in the peripheral areas of the roost in the directions mentioned. Actual counts made by the writers are as follows:

Starling	570	78.5%
Cowbird	93	12.8
Bronzed Grackle	63	8.7
Total	726	100.0%

The grackles and cowbirds were found chiefly under a small group of tall Norway spruces somewhat apart from the main roosting site in a seemingly more protected location. A number of crippled Starlings, at least twenty-five, were observed during the counting. Eight white pines and six or seven deciduous trees were down as a result of the storm.

The total mortality as a result of the storm exceeded the figure given since dead birds were scattered widely beyond the roost chiefly to the east and northeast, but it probably did not pass 1,000. While this is only an approximate 4% of the roost, it is appreciable enough to warrant investigation especially since accurate weather data are available.

Post-Storm Roost Composition.—The proximity of the roost to habitations having proved objectionable, shooting into the roost was carried on on February 25 and 26, causing the birds to shift to evergreens in a cemetery south of the University campus, where further shooting was done on March 3 and/or 4. The counts following the shooting can be regarded as random samples, and the percentages given are believed to be representative of roost composition after storm mortality.

(Dates of shooting)	February 25–26		March 3–4	
Starling	631	97.1%	361	98.6%
Cowbird	9	1.4	3	0.8
Bronzed Grackle	8	1.2	2	0.6
Red-wing	2	0.3	—	—
Totals	650	100.0%	366	100.0%

The cowbirds and grackles in the second shooting are believed to be remnants of the wintering population since no northward migration of early spring birds was detected up to these dates, a point which seems to be supported by the relative constancy of the sex ratio (approximately 2 ♂ : 1 ♀) among the Starlings over the week period (February 25–March 4) during which initial shifting and migratory movements might have been expected.

Number examined	112	361
Males	77 (68.7%)	232 (64.3%)
Females	35 (31.3%)	129 (35.7%)

The variation in sex ratio is comparable to that found by Hicks (Bird-Banding, 5: 103–118, 1934) during the same period in an extended study of Ohio Starling roosts.

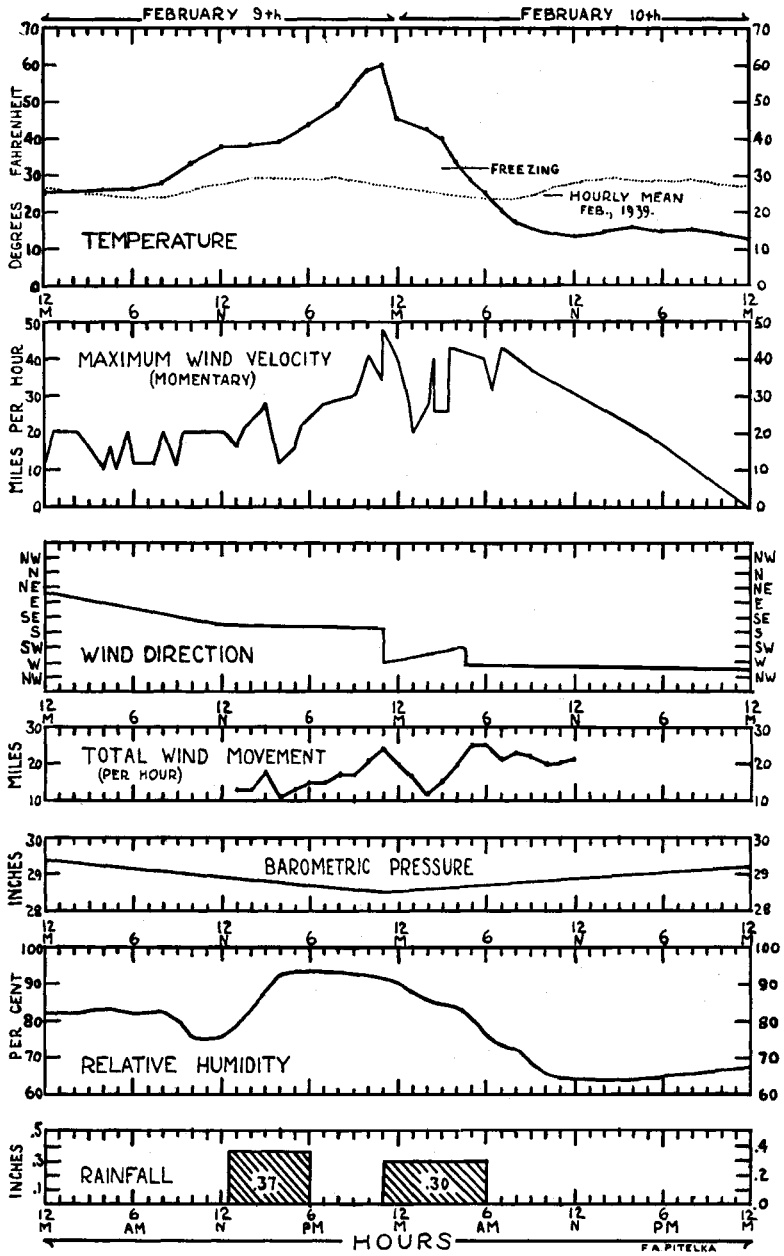
Weather Data.—The accompanying graphs illustrate the actual weather conditions on February 9 and 10, 1939, before, during, and after the storm. All data except relative humidity, which was obtained at the University Woods, a few miles east of Urbana, were provided by the University of Illinois meteorological station on the campus. For comparison and emphasis of extremes, the temperature graph is accompanied by a daily fluctuation line based on the hourly means for the month of February, 1939. The graph of maximum wind velocity shows the approximate trend and does not include minor variations from minute to minute. Unfortunately, hourly readings of rainfall are not available; however, amounts together with period of duration are shown. The greater part of the 0.3 in. of rainfall between 11.00 p. m. on February 9 and the following morning fell during the high wind between 11.00 p. m. and midnight.

Analysis.—A study of these graphic records reveals two critical periods which were probably responsible for the mortality: (1) high wind and warm rain storm from 11 o'clock to midnight; (2) sharp drop in temperature to below freezing accompanied by high wind during the remainder of the night. Which of these was the more important would be difficult to state, but probably both contributed.

Undoubtedly many birds were killed outright as a result of the high wind (48 miles per hour) as evidenced by the number of cripples, the distance of some birds from the roost, and the obviously mangled condition of others lying about the wind-fallen trees. At the height of the storm about 11.30, one Starling crashed through the window of a nearby house (several hundred feet northeast of the roost).

On the other hand, the drop in temperature from a remarkable high of 60° F. to below freezing in five hours likewise seems to be important. Increased vulnerability of birds to low temperatures would seem to be caused by thorough wetting especially during the night when they are without food. It was evident that many birds perhaps dislodged by wind, were later killed by cold. Positions of some of the birds indicated attempts to find protection under logs and in pockets at the bases of trees, where they died and froze. From this angle of the probable mortality causes, it is interesting to note the report of a Starling which attempted to roost on the warmer inner sill of an opened window about 1 a. m. and again at about 3 a. m. approximately half a block east of the roost; the bird vigorously ruffled its feathers and attracted the attention of the occupant of the room each time. Obviously dislodged by the wind and soaked by the rain, it was having difficulty drying its feathers and finding a protected spot in which to roost.

The proportion of Bronzed Grackles and Cowbirds to Starlings in the total storm mortality was certainly much greater than that in the total roosting flock as indicated by observation and especially by results of later



TEXT-FIG. 1.—Graphic representation of specific climatic data coordinated on the same time scale, correlating possible factors involved in mortality of birds during storm period.

shooting (an average 2% cowbirds and grackles from random sample shooting as compared with 21.5% killed in the storm). This together with the fact that the grackles and cowbirds were roosting in a more protected spot would indicate a differential mortality among the three species, these two being considerably less resistant and dying in proportionally greatest numbers. Several grackles and cowbirds were frozen in the Norway spruces (see above) without having fallen to the ground, and the greater number of them were lying directly below the evergreens, indicating that they had fallen out rather than been blown out.

SUMMARY

1. A 'blackbird' roost was subjected to a driving wind and rain storm from relatively unprotected southwest and west sides.

2. The wind reached a maximum velocity of 48 miles per hour and was followed by a sharp drop in temperature and continued high wind.

3. The destructive combination of weather conditions occurred when a warm southeast wind suddenly shifted to the southwest and west.

4. A mortality of approximately 4% resulted in the 'blackbird' roost, the size of which was estimated at 25,000 birds.

5. A differential mortality among the species of the roost was apparent; the proportion of Grackles and Cowbirds to Starlings in the total mortality was considerably greater than that in the total roosting flock.

Conclusions.—In an analysis of storm mortality, the time of occurrence, intensity, duration, and relation of specific weather factors must all be considered. Such examination of weather records provides a basis for more accurate judgment of the causes of mortality than can be made from simple observation alone. Furthermore, comparisons with records of subsequent severe storms can be made; these may reveal more clearly the factors most critical to winter roosting flocks.

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