GENERAL NOTES

Effects of a severe thunderstorm on airborne ducks.—This note reports the groundings and deaths of over 100 airborne ducks during a severe storm which struck Stuttgart, Arkansas at 15:50 CST on 23 November 1973. Irregularly shaped hail up to 5 cm diameter fell for about 10 min; a brief calm followed before heavy rains and strong winds began. Lightning apparently occurred throughout the storm, the bulk of which had passed by 16:30. During the storm 1 or 2 small funnel clouds passed within 1 km of the southern and eastern edges of Stuttgart. I report the incident here because its daylight occurrence in a populated area yielded numerous immediate observations—circumstances not existent in other such cases reported.

I obtained details from accounts and photographs in a Stuttgart newspaper, *The Daily Leader*, and from a survey form printed in that newspaper on 29 January 1974. On the form I asked persons who picked up ducks or were witnesses to groundings to provide the following information: (1) location and time of observations; (2) number, species, and sex which were (a) dead, (b) crippled and helpless, or (c) grounded but escaped or were released; (3) physical condition of the birds, e.g., broken bones, bruises, wounds, ice-coated; (4) weather conditions before or coinciding with the groundings; and (5) observations of duck flights prior to the groundings. I received 28 forms; newspaper accounts, 4 photographs, and 1 personal contact completed the sources of information. While additional ducks undoubtedly were killed (Ray Roth, pers. comm.), I consider this sample representative. I requested clarifications or verifications of some responses. When this involved species identification, I sent unlabeled pictures clipped from Robbins et al. (Birds of North America, Golden Press, New York, 1966) of both sexes of the species likely to be involved to the respondent with a request to choose the one most resembling the duck reported.

Reports came from a 14.5 × 3.2 km area roughly paralleling the southwest–northeast path of the storm but most were from a 3.2 × 2.1 km area of residential and business sections in the town. There was evidence that additional ducks probably went unobserved in adjacent agricultural land.

Most of the ducks were picked up during or shortly after the storm. Of the 106 ducks tabulated (Table 1), 76 were dead when found; 9 were crippled and helpless; and 9 were grounded but escaped or were released. Twelve were of undetermined condition. Some crippled birds probably died before they were found. The rapid recovery and escape of several dazed birds suggests that the grounded–escaped category may have been larger than reported.

Some ducks had several injuries and 8 had no detected injury. Eighteen of 19 ducks with fractures were dead. The breaks were mostly in wings but also included legs and necks. Two persons who found 18 ducks specifically noted no breaks; of course, subtle fractures could have been undetected. The second most common condition, a frozen or ice-encrusted body, occurred in 18 ducks of which 15 were dead. A photograph in *The Daily Leader* of 26 November 1973 shows a Mallard (*Anas platyrhynchos*) female with chunks of ice 2 cm diameter frozen on the tips of the feathers of the neck, breast and sides. Ice-covered ducks were found up to 1 hr after the hail, during which time most of the ducks were picked up. Three persons expressly said there was no ice on 24 ducks picked up shortly after the storm. Wounds (13 ducks) and bruises (14 ducks) often were associated with broken bones. Eleven of the wounded and 14 bruised ducks were dead. Wounds were described as "torn gashes," large cut on head" and "wounds on back." Bruises were specified as on the back in one case. A unique report described the head

TABLE 1

SPECIES AND SEX OF DUCKS FOUND AFTER STORM, STUTTGART, ARKANSAS, 23 NOVEMBER 1973

Species	Male	Female	Unknown	Total
Mallard	4	9	19	32
Pintail	9	5	15	29
American Wigeon	4	2	5	11
Gadwall	1	0	4	5
Redhead	2	0	0	2
Wood Duck	0	0	2	2
Blue-winged Teal	0	1	0	1
Unknown	0	2	22	24
TOTAL	20	19	67	106

feathers of 4 dead ducks as "kinky, as if burned." In 3 cases where no injury was observed the ducks nevertheless were flightless.

Respondents related 11 ducks to a specific stage of the storm. Six fell during the hail and were dead when retrieved shortly thereafter; 4 were ice-coated and one also had wounds and bruises; 2 were not checked. Most of the grounded ducks probably came down during the hail. The same updrafts, freezing temperatures at high altitudes, and precipitation which formed the hail probably caused the ducks to freeze or become ice-encrusted. Hochbaum (Travels and Traditions of Waterfowl, U. Minn. Press, Minneapolis, 1957) described flightless Starlings (*Sturnus vulgaris*) with iced feathers. The cuts, back bruises, and the broken bones, especially wings, suggest that some birds also were hit by hail while in flight. Broken wings were rare among ducks killed in a hailstorm in Alberta in which the birds apparently remained on the ground (Smith, Aud. Mag. 62: 170, 171, 186, 1960). This was not so in the present case; there were 3 reports of frenzied, confused, low-level flights of 10–100 ducks at the start of the hail and after the storm peak. Massive bruises and neck and skull fractures also have characterized victims of hailstorms (e.g. Smith, op. cit.; Johnston, Kans. Ornithol. Soc. Bull. 18:9–10, 1967). Skull injuries may have gone undetected in the Arkansas case because the heads were not picked during cleaning. Some injuries, of course, may have occurred on impact with the ground. Lightning, heavy rains, and downdrafts may have caused a few groundings including those with no apparent injuries. The person who saw the 4 ducks with possibly burned feathers fall noted that the hail was over and the rain had not started when a "large lightning flash" occurred. The same person caught a dazed duck which he saw land in a street during the ensuing heavy wind and rain. After 30 min it became active, was released and flew away. Torrential rains and heavy winds have caused other groundings (e.g. Hicks and McCullers, Bird-Banding 37:54, 1966).

I received no mention of any birds other than 7 species of ducks being affected by the storm. Mallard, Pintail (*Anas acuta*), and American Wigeon (*Anas americana*) predominated (Table 1). The Redheads (*Aythya americana*), uncommon in that area, were identified by an experienced duck hunter. The Blue-winged Teal (*Anas discors*) was unusual since most should have migrated from Arkansas by that time (Dave Donaldson, pers. comm.). The identification was verified from pictures of Blue- and Green-winged Teal (*Anas crecca*). Pictures of Gadwalls (*Anas strepera*) and American Wigeon were

sent to persons reporting "Wigeon" to clarify those identifications. Failure to include a female Pintail in this choice may have produced some error. No attempt was made to verify the identity of the Wood Ducks (*Aix sponsa*) or to identify any of the unknowns. Sex identification of 39 ducks gave a 1:1 sex ratio overall.

The species involved often are found together in the flooded rice and soybean fields of eastern Arkansas in winter. Dave Donaldson (pers. comm.) noted that there was much surface water in the fields at that time and suggested that the mixture of species probably reflects the composition of ducks which were feeding in the fields. Thus, the mixed flock may have been caught up in the rapidly moving storm as they tried to move ahead of it out of the fields. The other possibility is that a locally migrating flock happened to move into the storm path. There was no major migration occurring on that day (Dave Donaldson, pers. comm.).

Garner Allen of *The Daily Leader* expedited the printing of the survey form and encouraged responses through the paper's columns. I thank the 28 persons who took time to respond, including some who kindly answered requests for clarification. Dave Donaldson, Waterfowl Biologist, Arkansas Game and Fish Commission, also provided useful information. E. G. Bolen, D. F. Bray, J. R. Karr, J. K. Rosenberger, and Aileen and R. W. Rust made suggestions on the manuscript. Mr. and Mrs. Ray Roth, my parents, called my attention to the event, provided a first-hand report, and aided me in other ways. This is Miscellaneous Paper No. 709 of the Delaware Agricultural Experiment Station and Publication No. 434 of the Department of Entomology and Applied Ecology, University of Delaware.—ROLAND R. ROTH, *Dept. of Entomology and Applied Ecology, Univ. of Delaware, Newark 19711.* *Accepted 25 July 1975.*

Feeding rhythm in nestling White Ibis.—Daily rhythms are important homeostatic mechanisms in most animal species (Kleitman, Physiol. Rev. 29:1–30, 1949; Bunning, The Physiological Clock, Springer-Verlag, N. Y., 1973). Diel feeding rhythms exist in most species. Hunting techniques, food availability, and exposure to predation interact to produce an adaptive complex of feeding and hunting patterns. Young, cared for by adults, must have a daily feeding pattern adjusted to the adult's foraging regime. It is not so obvious whether the diurnal feeding patterns of nestlings are merely the result of the pattern of adult attentiveness or are instinctive on the part of the young and can continue without the mediating influence of parental care. Here I present the results of an experiment which shows the existence of an inherent feeding rhythm in nestling White Ibis (*Eudocimus albus*) removed from parental care at hatching.

Nestlings were removed from nests in Broward and Highland counties, Florida as pipped eggs and maintained at 30°C. Each hour they were fed as much as they would eat of a ground mixture of shrimp, sardines, water, and vitamin supplement. The feeding rhythm of 30 captive nestlings was measured over a total of 150 bird-days as the percentage of the daily ration consumed each hour. Data on wild birds were collected during 5 min periods at hourly intervals. The feeding rhythm of 50 wild nestlings was measured as the percentage of the total number of feedings observed. Nest attentiveness by male and female White Ibis was measured as the percent of the total number of adults on nests. All data were collected for chicks less than 3 weeks old. Data were combined into 3-hour blocks starting at 0300.

In the wild, adult White Ibis, the sexes of which are distinguishable in the field, differed in their patterns of nest attentiveness. Males were present most of the day and females most of the night (Fig. 1a). There were 2 exchanges of nest duties, one in the morning and one in the evening. Wild nestlings showed a bimodal pattern of feeding