of these migrating cranes seemed to stimulate migration in remaining cranes. On 2 occasions, cranes were observed to join Wood Storks (*Mycteria americana*) flying over the prairie in a northerly direction.

The supposition by Bowman and Whitman (Auk 89:660, 1972) that cranes migrate simultaneously throughout the state is confirmed by these over-flying cranes. During 10 migration days in 1972 and 1973, 337 cranes were observed passing over Paynes Prairie, some as late as 14:30. Assuming 10:15 as a mean departure time, these cranes had been in the air for over 4 hours. A hypothetical ground speed of 80 km/hr would make the point of departure at about the known southern limit for Sandhill Cranes wintering in Florida (Lewis et al., *In* Management of Migratory Shore and Upland Game Birds in North America, G. C. Sanderson, ed., U. S. Fish and Wildlife Service, Washington, D.C., in press).

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**Optical and gamma radiation measurements of the effects of chlorinated hydrocarbons on egg shells of Red-winged Blackbirds.**—The relation between the thickness of egg shells of Red-winged Blackbirds (*Agelaius phoeniceus*) and the use of chlorinated hydrocarbons as insecticides was investigated by Fred J. Alsop (Ph.D. thesis, Univ. of Tennessee, 1972). He measured the thickness of each shell microscopically with an image splitting eyepiece allowing an accuracy of approximately 2.4 microns. He found that shells from eggs laid before 1940, before DDT was introduced, were thicker than egg shells laid in 1970 and 1971, and that eggs laid in these latter years in areas where chlorinated hydrocarbons are heavily used had thinner shells than those from other areas.

After completion of Alsop's study, an instrument was developed at the University of Tennessee to measure the density of very small sections of wood cores using gamma radiation from an iron-55 source (Woods and Lawhon, Forest Sci. 20:269–271, 1974). We decided to see if this radiation densitometer could be used to detect thinning and possibly other changes in eggshells due to insecticide use. Eggs collected by Alsop in 1970–71 in 2 areas were used. Hamilton County in southeastern Tennessee includes relatively little agricultural land, and insecticide use is light. Crittenden County, eastern Arkansas, is cotton country where insecticides are frequently dispersed from planes. Sixteen clutches had been collected from each county, 35 eggs from Hamilton and 33 from Crittenden. Samples of egg shell were prepared by cutting pieces about 1 cm square from the flattest part of the shell. Each piece was placed in the beam (circular, 1 mm diameter) of gamma radiation, and the amount of radiation transmitted from the source through the shell to the detector was measured for a period of 100 sec. The radiation transmitted through air alone was measured frequently for a similar interval to allow calculation of the fraction of radiation transmitted by each shell. The thickness of each piece of shell used in the radiation measurements was measured by the same optical apparatus used by Alsop; to facilitate doing this, the pieces were first placed in a weak solution of trypsin for 2 or 3 days until the membranes could be peeled away to leave only the shell.

Of the radiation entering a material, the fraction transmitted through it is an ex-

ponential function of the thickness and the absorption coefficient of the transmitting material (U. Fano, *in* Principles of Radiation Biology, A. Hollaender, ed. vol. 1, p. 103. 1954); i.e., the logarithm of the fraction transmitted is a linear function of the product of the thickness and the absorption coefficient.

Statistical tests were first performed separately on shell thickness measured optically and on radiation data (logarithm of the fraction transmitted). Eggs from Hamilton Co. had thicker shells than those from Crittenden Co. Using the data from all eggs, the difference in thickness was not significant at the 5% level, but when 3 eggs from Hamilton and 2 from Crittenden Co.—eggs with shell thickness at least 2 standard deviations removed from the mean of their respective groups—were eliminated from the data, the difference was significant at the 1% level. Similarly, eggs from Hamilton Co. transmitted less radiation than the others; using the measurements from all eggs, the difference was significant at the 5% level. The radiation technique, therefore, gave slightly better results in differentiating between the groups. Also, the radiation measurements had slightly smaller coefficients of variation indicating more consistency.

We also calculated linear regressions with the logarithm of the fraction of radiation transmitted being a function of the shell thickness. The 5 eggs mentioned in the preceding paragraph were omitted from these calculations. Regression coefficients from the data for each county were not significantly different, but were in fact almost identical. This indicates that the samples differed only in shell thickness, and that chlorinated hydrocarbons affect only this characteristic and have no effect on the chemical and physical characteristics determining the absorption coefficient. A single regression was calculated from the data of both counties combined, and the resulting equation is:

$$(\log \text{ of fraction transmitted}) = -0.880 - (0.0199/\text{micron})\ (\text{thickness in microns}).$$

The regression coefficient is very significantly different from zero.

In conclusion, the effect of chlorinated hydrocarbons on egg shells is primarily if not entirely on their thickness, and radiation absorption methods are only slightly superior to optical methods in measuring this effect. The optical methods are much faster and cheaper.—James T. Tanner and Wayne W. Tolbert, *Graduate Program in Ecology, Univ. of Tennessee, Knoxville 37916.* *Accepted 24 Jan. 1975.*

**Two female Wood Ducks call brood from nest box.**—At the Duck Creek Wildlife Area, Puxico, Missouri, on 5 June and again on 12 June, 1973 I found 2 female Wood Ducks (*Aix sponsa*) incubating a clutch of 21 eggs. The number of eggs in the clutch and the rate of egg laying suggested that both females contributed to the clutch simultaneously.

One female (756-00205) was banded as a nesting female in 1971. Her 1971 nest and her subsequent nest in 1972 were both dump nests. Thus she was at least 3 years old and tolerant of intrusion by other females into her nesting box when she nested in 1973. The second female (756-00296) was identified by a web tag as having hatched in a dump nest in 1970; she was not found nesting on Duck Creek prior to 1973. No earlier association of the 2 females is known.

On 13 June 1973 at 06:48 (CDT) one female flushed from the nest box then containing 13 dry ducklings, 3 dead ducklings, and 2 eggs with dead embryos; 3 other eggs were missing. At 07:11 a pair of Wood Ducks flew into the area, the female landed in the mouth of the nest box and entered, the male kept flying and left the