Thickness of 1967-69 Whooping Crane eggshells compared to that of pre-1910 specimens.—Table 1 summarizes measurements of pre-1910 Whooping Crane (*Grus americana*) eggshells obtained from 10 North American museums and private egg collections. They include 30 eggs from Iowa, 5 from North Dakota, 13 from Manitoba, and 2 each from Saskatchewan and Alberta; 11 of the eggs were classified as subelliptical and 41 as oval according to the shapes described by Palmer (1962: 13). Mean clutch size of 29 sets averaged 1.83. We found no significant geographical variations ($P < 0.20$) among eggs from different portions of the former range (Allen, 1952: 19) of the Whooping Crane, although geographical variations in size and weight are known to occur in the eggshells of the Sandhill Cranes (*G. canadensis*), which are more widely distributed and more taxonomically diverse (Walkinshaw, 1949: 68–70). The average thickness and weight of the 52 eggshells were 0.60 mm and 20.1 g, respectively. These measurements are similar to those of Allen (1952: 180), citing M. Schönwetter, who gives the average thickness of Whooping Crane eggshells as 0.58 mm and the average shell weight as 20.75 g ($n = 14$ weights).

During 1967 to 1969, biologists in the Endangered Species Program of the Bureau of Sport Fisheries and Wildlife, assisted by the Canadian Wildlife Service, collected 17 Whooping Crane eggs in the Northwest Territories, Canada (U. S. Fish and Wildl. Serv., 1969: 86; A.O.U. Committee on Conservation, 1969: 743). Shell thickness of these eggs averaged 0.612 mm (Table 1). This average is essentially the same as the pre-1910 mean. Some difficulty was encountered in measuring thickness of the 1967–69 eggs, because they were not measured until after hatching when the membranes had separated from the shells. Because of membrane separation (see Terepka, 1963a, 1963b), these thickness estimates are probably high. Any fragments of cone layer (Simkiss, 1967: 186) deposited on the separated membrane during hatching might result in a 0.01 to 0.02 mm increase in a thickness measurement of membranes alone. Thus, when shell and membranes are pressed together for measurement, any separation caused by cone fragments might result in a similar overestimate of thickness. We believe this potential bias is not serious, and comparisons between the two sets of data are valid.

Our comparisons of shell thickness in Whooping Cranes suggest that eggshell thinning did not occur in our sample as reported for other species of wild birds (Ratcliffe, 1967; Hickey and Anderson, 1968; Anderson et al., 1969; Porter and Wiemeyer, 1969; Heath et al., 1969; Lehner and Egbert, 1969; Anderson and Hickey, 1970; and others). Recent eggshell thinning has been linked to the presence of *p,p'*-DDE, a metabolite of DDT, and possibly other chlorinated hydrocarbons in

TABLE 1
MEASUREMENTS OF PRE-1910 AND 1967–69 WHOOPING CRANE EGGSHELLS

Measurement	Mean	SE	95% C.L.
Pre–1910 eggshells (52 shells)			
Weight	20.07 g	0.32 g	0.63 g
Size index[1]	62.14	0.50	0.99
Volume[2]	193.16	2.37	4.71
Thickness index[3]	3.23	0.04	0.08
Thickness (incl. membrane)[4]	0.064 mm	0.007 mm	0.014 mm
1967–69 eggshells (17 shells)[5]			
Thickness (incl. membrane)	0.612 mm	0.027 mm	0.057 mm

[1] Length in cm × breadth in cm, Ratcliffe (1967).
[2] After Ratcliffe (ibid.), 10 × weight (g)/size index.
[3] (πr^2 × length) × water displacement factor for a given shape.
[4] Forty shells measured.
[5] Only thickness measurements could be taken.

laying females (see references above). On the basis of our thickness data, we would not expect to find high residues in Whooping Cranes.

Residue analysis of carcass remains from an immature wild Whooping Crane found dead at Aransas National Wildlife Refuge, Texas, showed chlorinated hydrocarbon residues present in small amounts (Robison et al., 1965: 35–36). Subsequent analyses of tissues from an adult, a subadult, and an embryo (Lamont and Reichel, 1970) have shown that chlorinated hydrocarbon residues were generally low. In the various tissues analyzed, only one value, 0.59 ppm, exceeded 0.2 ppm.

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