RELATIONSHIPS BETWEEN LENS-WEIGHT, SEX, AND AGE IN BOBWHITES

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Dry weight of the lens has been used as a criterion of age in several species of mammals (Lord, 1959, 1961, 1962; Sanderson, 1961; Kolenosky and Miller, 1962; Beale, 1962). Lord (1959, p. 358) believed that the technique might be used to determine the ages of birds. Payne (1961, p. 339) reported that lens-weights were of little value for determining the ages of house sparrows (*Passer domesticus*) that were more than two months old. He also cited unpublished data which suggested that lens-weights could not be used as a criterion for separating juveniles and adults of pheasants (*Phasianus colchicus*), redwinged blackbirds (*Agelaius phoeniceus*), and scaled quail (*Callipepla squamata*). Campbell and Tomlinson (1962), in a study of lens-weights of pen-reared chukars (*Alectoris graeca*), found considerable overlap in lens-weights of juvenile and adult birds, but a significant difference between mean lens-weights of the two age classes. They found no significant difference between mean lens-weights of 1-year old and 2-year old birds. The paucity of published material concerning lens-weight to age relationships among birds, particularly among wild game birds, appears to warrant further research.

Methods

A sample consisting of the head and one wing from each of 135 bobwhites (*Colinus virginianus*) was collected during the first 12 days of the 1962 hunting season (November 17-29) from six counties in southern Illinois. Because there is evidence that freezing may cause changes which affect the dry weight of the lens (Montgomery, 1963, p. 481), precautions were taken to prevent freezing of the heads. Eyes which were intact were removed from the heads on the day of collection and preserved in vials in a 10 percent formalin solution. After storage in formalin for two months, lenses were removed from the eyes and dried in an electric oven at 80° C for 48 hours. Vials containing the dried lenses were stoppered immediately after removal from the oven to prevent the lenses from absorbing moisture from the air. Remnants of the ciliary membranes were removed from the lenses by tapping the vials against the palm of the hand; a few lenses were chipped by this process. Lenses which appeared to be pitted or chipped were discarded. Dried lenses were weighed on a Roller-Smith precision balance to the nearest 0.1 mg.

Sex of the bobwhites was recognized by the plumage of the head and neck. Exact ages of the bobwhites were not known. Juveniles were distinguished from adults by the presence of the buffy fringe on the tips of their primary coverts; ages of juveniles were estimated by the sequence of the molt and replacement of the primary wing feathers (Petrides and Nestler, 1952, p. 109). Because of small numbers of specimens less than 150 days old, juveniles were separated into only three age classes (65-105 days; 111-149 days; 150 days or older) for purposes of analysis.

Results

Weights of 87 pairs of lenses and 38 single lenses were available from the original sample. Eight pairs, in which the weights of individual lenses differed by 1.0 mg or more, were discarded because such large differences in weight probably were caused by absorption of moisture from the air, weighing errors, or unnoticed chips in one of the lenses. The mean difference in weight between the two lenses of the remaining 79 pairs was 0.3 ± 0.05 mg. Data for 117 birds were obtained from the mean weight of the two lenses from 79 bobwhites and from weights of single lenses from 38 bobwhites.

Payne (1961, p. 339) reported no apparent difference in the lens-weights of male and female house sparrows. In contrast, Campbell and Tomlinson (1962, p. 407) found lenses of male chukars to be significantly heavier than those of females. Among adult bobwhites, and among juvenile bobwhites more than 150 days old, lens-weights of males were significantly heavier than those of females ($P<0.001$). Because the mean growth rate of the lenses of bobwhites decreases with age (Table 1) we believe that differences in lens-weights caused by differences in age within these groups is overshadowed by differences due to sex. Numbers of lens-weights from birds in the 65-105 day old and the 111-149 day old groups were too few for similar analyses of differences in lens-weights of the two sexes (Table 2).

Mean lens-weights of the various age classes of bobwhites are compared in Table 1; t tests indicated significant differences ($P<0.05$) between all adjacent age groups. Identical tests between age groups segregated by sex disclosed similar differences in all comparisons except between the 111-149 day old and the 150 or more day old groups among females.

A frequency distribution of lens-weights (Table 2) revealed that 70.5 percent of the lens-weights of juvenile bobwhites exceeded the lightest lens-weight of an adult, and that 20.6 percent exceeded the mean lens-weight of adults.

We interpret data in Tables 1 and 2 to indicate a direct lens-weight to age correlation among bobwhites. The degree of overlap in the ranges of lens-weights between age groups appears to be too great for lens-weights to be used as a satisfactory criterion for determination of age. It appears possible, however, to use lens-weight data in comparative studies of age composition of different populations.

TABLE 1.—Analyses of Lens-weights of Various Age Classes of 117 Bobwhites Taken in Southern Illinois, November 17-29, 1962.

Classes Compared	N (birds)	$\overline{X}$ (mg)	$\overline{X}_1 - \overline{X}_2$ (mg)	s (mg)	Range (mg)	t	Level of Significance $\overline{X}_1 - \overline{X}_2$
65-105 days:	11	7.1		.934	5.0-8.3		
111-149 days.....	27	8.0	0.9	.720	6.4-9.4	6.92	0.999
111-149 days:	27	8.0		.720	6.4-9.4		
150+days[1]	34	8.5	0.5	.704	6.8-10.0	4.78	0.999
150+days[1]:	34	8.5		.704	6.8-10.0		
Adults	15	8.8	0.2	.760	7.8-10.1	2.22	0.95
Juveniles:	102	8.2		.850	5.0-10.0		
Adults	15	8.8	0.6	.760	7.8-10.1	3.03	0.99

[1] Maximum age of any individual in this group would not be expected to exceed 208 days.

TABLE 2.—Frequency Distribution of 117 Lens-weights of Bobwhites Taken in Southern Illinois, November 17-29, 1962.

Lens-weight classes (mg)	Age classes			
	Juveniles[1]			Adults[1]
	65-105 days	111-149 days	150+ days	
10.0-10.3			X	O
9.6-9.9			XXXXO	XXO
9.2-9.5		OC	XXXXXX	X
8.8-9.1		XXO	XXXXXXOO	X
8.4-8.7		XO	XXXXXXXXXOOOOOOOO	OOO
8.0-8.3	XO	XXXOOO	XXXXXXOOOOOOOOOO	XOOOO
7.6-7.9	XX	XXXOOOOOO	OOOO	O
7.2-7.5	O	XO	XOOO	
6.8-7.1	XOO	XXO	XOO	
6.4-6.7	O	X		
6.0-6.3	X			
5.6-5.9				
5.2-5.5				
4.8-5.1	X			

[1] Males indicated by X; females by O.

SUMMARY

Analyses of dry weights of lenses from 117 bobwhites collected in southern Illinois during November, 1962, indicated that lens-weights of males were significantly heavier than those of females among adults and among juveniles 150 or more days old. Mean lens-weights of various age groups were significantly different, indicating a direct correlation between lens-weight and age. The degree of overlap in ranges of lens-weights between age groups appears to be too great for the lens-weight technique to be used to determine age of individual bobwhites.

LITERATURE CITED

BEALE, D. M. 1962. Growth of the eye lens in relation to age in fox squirrels. J. Wildl. Mgmt. 26(2):208-211.

CAMPBELL, H., and R. K. TOMLINSON. 1962. Lens weight in chukar partridges. J. Wildl. Mgmt. 26(4):407-409.

KELSINGERY, C. B., and R. S. MILLER. 1962. Growth of the lens of the pronghorn antelope. J. Wildl. Mgmt. 26(1):112-113.

LORD, R. D., JR. 1959. The lens as an indicator of age in cottontail rabbits. J. Wildl. Mgmt. 23(3):358-360.

———. 1961. The lens as an indicator of age in the gray fox. J. Mammal. 42(1):109-111.

———. 1962. Aging deer and determination of their nutritional status by the lens technique. Proc. 1st Natl. White-tailed Deer Disease Symposium, Univ. of Georgia Center for Continu-

ing Educ., Athens. February 13-15, 1962. Pp. 89-94.

MONTGOMERY, G. G. 1963. Freezing, decomposition, and raccoon lens weights. J. Wildl. Mgmt. 27(3):481-483.

PAYNE, R. B. 1961. Growth rates of the lens of the eye of house sparrows. Condor 63(4): 338-340.

PETRIDES, G. A., and R. B. NESTLER. 1952. Further notes on age determination in juvenile bobwhite quails. J. Wildl. Mgmt. 16(1):109-110.

SANDERSON, G. C. 1961. The lens as an indicator of age in the raccoon. Amer. Midl. Nat. 65(2):481-485.

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