A COMPARISON OF EYE LENS WEIGHT AND TOOTH IRRUPTION PATTERN IN AGE DETERMINATION OF FERAL HOGS *(Sus scrofa)* [1]

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ABSTRACT

A study was conducted on the A.E.C. Savannah River Plant, Aiken, South Carolina, to determine if eye lens weight was a reliable indicator of age in feral swine. A strong correlation (r=0.95) was found between eye lens weight and tooth irruption age. In most cases, when body weight failed, eye lens weight remained a dependable indicator of age in feral hogs. Eye lens weight can therefore be used as a reliable age criterion in feral hogs. With the establishment of an eye lens weight - to - age curve based on known-age animals, eye lens weight may prove to be better than tooth irruption for indicating the age structure of a feral hog population.

INTRODUCTION

Age determination is fundamental in the analyses of wildlife populations. Although some criteria of age are more accurate than others, all are at best only estimators of the actual age of an individual. It is advantageous, therefore, to have several different techniques of age determination for any given species in order to improve the accuracy of estimation. To date, however, the only available method for ageing feral swine is the use of tooth irruption pattern. As part of a preliminary study of the feral hog *(Sus scrofa* L.) population on the Atomic Energy Commission's Savannah River Plant (SRP), the eye lens weights were compared to the ages determined by tooth irruption pattern (Sisson and Grossman 1938).

Eye lens weight has been used with varying degrees of success as an age criterion for many different species (Friend 1968). Friend (1967) determined that eye lens weight was a reflection of age and not nutritional status in Wistar-strain laboratory rats (*Rattus norvegicus*). In a later study of white-tailed deer (*Odocoileus virginianus*) on good versus poor range, Friend and Severinghaus (1967) stated that differences in lens weights among individuals of the same age classes were the result of nutritional deficiencies in the pregnant female affecting the lens growth of fetuses and/or young prior to weaning. In a controlled experiment with pen-raised European wild hogs, Matschke (1963) determined that eye lens weight was a reflection of body weight and as such was not a reliable indicator of age. It remains then, to determine what effect nutrition has on lens growth in feral hogs.

Since it seems likely that body weight may be a reflection of plane of nutrition, and it is also possible that eye lens weight is directly related to either age or plane of nutrition, it is instructive to examine the relationship between eye lens weight and body weight. A positive correlation between these two parameters would essentially invalidate eye lens weight as an age criterion.

PROCEDURE

The S.R.P. is located on the Savannah River near Aiken, South Carolina. The 315 square mile area within the plant boundaries consists of new and old

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pine plantations, old fields, railroad cuts, abandoned home sites, and river swamp (Payne et al. 1966). The actual collection of animals for the present study, however, was restricted to a median section of the river swamp and adjacent bottoms so as to eliminate the influence of domestic herds of swine bordering the plant. The present feral hog population was derived from the domestic hogs left in a state of free range when the plant was closed to public access in 1952.

Hi-powered rifles and large box traps baited with cracked corn were used to collect the animals examined in this study. Collections extended from March 1968 to June 1969. Records were kept on the age, sex, physical condition, and general body measurements (including live weight in pounds) of each hog examined.

Both eyes were removed intact and fixed in 10% formalin for 30 days. Lenses were then extracted, blotted to remove excess moisture, and held in open vials in a desiccator jar until several sets of eyes were collected. Each group of lenses were dried in an oven regulated between 80 and 85 degrees centigrade. After five days the lenses were removed daily, weighed to the nearest tenth of a milligram on a Mettler chemical balance, and replaced in the oven until their weights stabilized (approximately 8 days total drying time). This final weight was considered to be the oven dry weight of the lens.

Three separate analytical treatments were used to determine the relationship of body weight to age. The first was a simple plot of the parameters in question: tooth irruption age (months) over the average eye lens weight (grams) and tooth irruption age over body weight (pounds). The more complicated second and third methods were employed in an effort to establish a more linear regression between age and weights. The second involved the comparison of the tooth irruption age as plotted over the average eye lens weight (gm. x 10)^2 with tooth irruption age as plotted over body weight (lb. x 10-^{1})^2. On the third, the log of the tooth irruption age was plotted over the average eye lens weight and compared with the log of the tooth irruption age over body weight. These relationships are depicted in figure 1.

RESULTS

The lens weights, tooth irruption ages, and body weights of the 34 hogs collected are recorded in Table 1. The direct application of age over weight (Treatment 1) was apparently the most accurate method of comparing body weight to age, while Treatments 1 and 2 were found to be the most accurate mthods of comparing eye lens weight to age (Table 2). Treatment one was therefore utilized to compare the relative merits of eye lens weight and body weight as age criteria. Table 3 summarizes the ages of all hogs as predicted by eye lens weight and body weight under the three different analytical treatments.

DISCUSSION

At best, the correlation established for body weight and age is much less significant than the correlation established for eye lens weight and age. The loose correlation between body weight and age indicated that body weight is not a dependable age criterion in feral hogs. If eye lens weight was simply a function of body weight, it too would be a poor indicator of age. However, in many cases where body weight failed as an age criterion, eye lens weight continued to function as a reliable indicator of age as established by tooth irruption. This means there is more than a simple relationship of eye lens weight to body weight. Since nutrition apparently does not exert a significant influence on lens growth, eye lens weight can probably be used as a reliable age criterion in feral hogs.

Although known-age animals were not available to establish the eye lens weight-to-age curve (Fig. 2), the linear regression developed for ages up to 15

months is probably accurate. Tooth wear and gross body features indicate that beyond this point the eye lens graph may assume a curvilinear relationship (dotted line, Fig. 2). The exact shape and departure of this curve can only be obtained through the use of known-age animals. A project is presently being undertaken to locate and tag new-born pigs on the SRP for this purpose.

After the establishment of an eye lens weight-to-age curve based on known-age animals, eye lens weight will probably prove to be better than tooth irruption in indicating the age structure of a feral hog population. Ageing swine by tooth irruption patterns tends to clump animals into established age classes. After ageing a few feral hogs using this technique it becomes readily apparent that many individuals are actually between age classes. This is because tooth irruption and replacement time vary considerably among hogs even when they are litter mates and raised under the same conditions (Matschke 1967). Assignment to specific age classes then becomes a subjective decision. However, the investigator is not faced with a similar decision when using eye lens weight as the age criterion. The average eye lens weight is a specific figure, which in turn assigns a specific age to the hog. This age, rounded off to the nearest month to minimize the affects of mechanical errors, more closely approximates the actual age structure of the population. The use of tooth irruption in ageing feral hogs is still, however, a very good field technique in that it is more easily obtained than lens weight.

LITERATURE CITED

Friend, M. 1967. Relationship between eye lens weight and variations in diet. N. Y. Fish and Game J. 14(2): 122-151.

_____. 1968. The lens technique. Trans. N. A. Wildl. Conf. 33:279-298.

_____, and C. W. Severinghaus. 1967. Influence of nutrition on eye-lens weight in deer. N. Y. Fish and Game J. 14(2):166-175.

Matschke, G. H. 1963. An eye lens-nutrition study of penned European wild hogs. Proc. Annl. Conf. S. E. Association Game and Fish Commr. 17:20-27.

_____.1967. Aging European wild hogs by dentition. J. Wildl. Mgmt. 31 (1):109-113.

Payne, R. L., E. E. Provost, and D. F. Urbston. 1966. Delineation of the period of rut and breeding season of a white-tailed deer population. Proc. Annl. Conf. S. E. Assoc. Game and Fish Commr. 20: 130-139.

Sisson, S. and J. D. Grossman. 1938. The anatomy of the domestic animals. W. B. Saunders Co., Philadelphia p. 485-488.
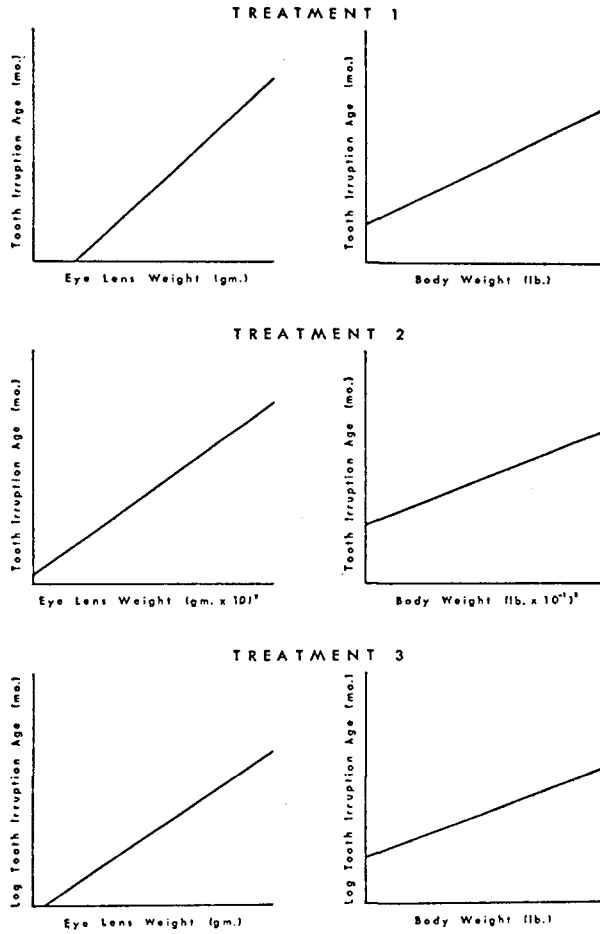
Figure 1. Three analytical treatments used to compare the relationship of age as determined by tooth irruption with eye lens weight and body weight.

288

Table 1. Eye lens weight and body weight of 34 feral hogs collected on the SRP. 3/68-6/69.

Hog Number	Tooth Irruption Age (mo.)	Eye Lens Weight (gms.)	Body Weight (lbs.)
45	½-1	.0412	2
14	1-2	.0538	20
51	1-2	.0559	8
50	1-2	.0562	6
27	1½-3	.0568	19
7	2-4	.0835	54
8	2-4	.0844	40
15	4-6	.1038	70
37	4-6	.1070	37
6	5-9	.0966	57
30	5-9	.1122	74
13	5-9	.1153	117
36	5-9	.1192	53
35	5-9	.1371	57
49	8-10	.1574	60
55	8-10	.1618	47
9	9-10	.1484	174
1	9-12	.1450	180
56	9-12	.1584	52
44	9-12	.1590	145
38	9-12	.1608	132
43	9-12	.1624	153
10	9-12	.1662	86
16	9-12	.1670	209
40	9-12	.1956	138
58	12-15	.1606	115
57	12-15	.1672	115
46	12-15	.1760	100
41	12-15	.1773	75
60	12-16	.1938	90
39	12-18	.1902	83
47	14-18	.1962	164
4	16-19	.1904	268
23	16-19	.2163	240

Table 2. Correlation coefficient and error of prediction for the linear regressions developed for tooth irruption age on eye lens weight and body weight.

Treatment*	Regression	Number Wrong In 34 Predictions	Correlation Coefficient
1a	Y=-3.95+93.85X	6	0.95
1b	Y= 4.18+0.05X	21	0.76
2a	Y= 1.16+3.67X	6	0.95
2b	Y= 6.52+0.02X	24	0.64
3a	Y= 0.0914+8568X	9	0.95
3b	Y= 0.4886+0.0038X	23	0.71

*Analytical treatments used are as follows:

1a. Age by tooth irruption (mo.) over eye lens weight (gm.).
1b. Age by tooth irruption (mo.) over body weight (lb.)
2a. Age by tooth irruption (mo.) over eye lens weight (gm.x 10)^2.
2b. Age by tooth irruption (mo.) over body weight (lb. x 10^{-1})^2.
3a. Log of the age by tooth irruption (mo.) over eye lens weight (bm.)
3b. Log of the age by tooth irruption (mo.) over body weight (lb.)

Table 3. Age of 34 feral hogs collected on the SRP, 3/68-6/69, as determined by eye lens weight and body weight.

| Hog No.	Tooth Irruption Age*	Treatment 1		Treatment 2		Treatment 3	
		Eye Lens Weight Age*	Body Weight Age*	Eye Lens Weight Age*	Body Weight Age*	Eye Lens Weight Age*	Body Weight Age*
45	½-1	0	4½	2	6½	1½	3
14	1-2	1	5	2	6½	2	3½
50	1-2	1½	4½	2	6½	2	3
51	1-2	1½	4½	2	6½	2	3½
27	1½-3	1½	5	2	6½	2	3½
8	2-4	4	6½	4	7	3	4½
7	2-4	4	7	4	7	3	5
37	4-6	6	6	5	7	4½	4½
15	4-6	6	7½	5	7½	4	5½
6	5-9	5	7	5	7	3½	5
30	5-9	6½	8	8	7½	5	4½
36	5-9	7	7	6	7	5½	5
13	5-9	7	10	6	9	5	8½
35	5-9	9	7	8	7	7	5
55	8-10	11	6½	11	7	10½	4½
49	8-10	11	7	10	7	10	5
9	9-10	10	13	9	10½	8½	14
1	9-12	9½	11½	9	13	8	15
56	9-12	11	7	10	7	10	5
38	9-12	11	11	11	10	10	10
44	9-12	11	11½	10	11	10	11
10	9-12	11½	8½	11	8	11	6½
43	9-12	11½	12	11	11	10½	12
16	9-12	11½	14½	11	15	11	19
40	9-12	14½	11	15	10½	18	10
58	12-15	11	10	11	9	10	8½
57	12-15	12	10	11	9	11	8½
41	12-15	12½	8	13	7½	13	6
46	12-15	12½	9	13	8½	13	7½
60	12-16	14½	8½	15	8	17½	7
39	12-18	14	8½	14	8	16	6½
47	14-18	14½	12½	15	12	18	13
4	16-19	14	17½	14	21	16	32½
23	16-19	16½	16	18	18	24½	25

*All ages given in months.

290
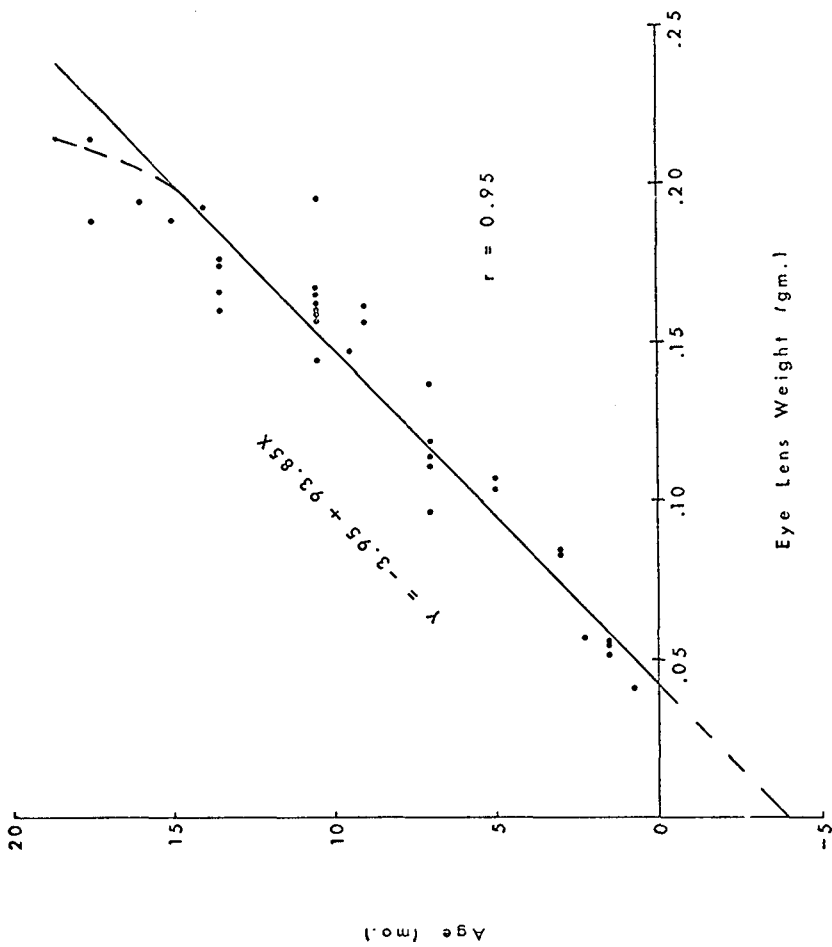
Figure 2. Comparison of age by tooth irruption and weights of eye lenses taken from feral hogs on the SRP, 3/68-6/69 (dotted line represents probable departure in upper age classes).

291