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SOME ASPECTS OF REPRODUCTION AND AGE STRUCTURES IN THE BLACK BEAR IN NORTH CAROLINA

by

John M. Collins, Wildlife Biologist
North Carolina Wildlife Resources Commission

ABSTRACT

Ages were assigned to 151 North Carolina black bears (*Ursus americanus*) by canine cementum annuli count. Canine teeth collected during the 1969, 1970 and 1971 hunting seasons revealed average ages of 5.17, 4.73 and 4.82 years, respectively. The average age increased in the coastal area but decreased in the mountain region. Ages ranged from 0.75 to 22.75 years. Yearlings, 1.75, represented 29 percent of the kill with a high incidence of males. Forty-eight female reproductive tracts indicated corpora lutea counts of 1.00, 2.71 and 2.81 per pregnant female over the 1969 to 1971 period. Active corpora lutea were found in 80 percent of the 3.75 year old females. Female breeding age ranged from 2.5 to 17.5 years. The sex ratio was established at 106 males:100 females. Embryonic development was noted in only one instance. Egg migration between the horns of the uterus was noted in one instance.

INTRODUCTION

There is limited data available on age structures and reproduction in the black bear. Stickley's (1961) study in Virginia revealed reproductive information on 38

hunter-killed bears and one live bear; however, age structures were not available. Wakefield (1970) presented age structure data for bears harvested by Pennsylvania hunters. No correlation of age and reproduction was made by Wakefield. The study reported here was prompted by the absence of biological information on North Carolina bears upon which to base remedial action in the face of a steadily declining hunter kill (Table 4).

This paper presents data on the age structure by sex and year of 148 hunter-killed bears during the 1969, 1970 and 1971 fall hunting seasons. Ages of three road-killed bears are included also. Reproductive data by age class and year of harvest on 48 female reproductive tracts is presented and correlated with age structure. Fifty canines and 18 reproductive tracts were collected in the coastal region of North Carolina, and 101 canines and 30 reproductive tracts came from the mountain region.

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MATERIALS AND METHODS

During the 1969 through 1971 hunting seasons, 151 canine teeth and 48 female reproductive tracts were collected from hunter-harvested black bears (including three road kills) by Commission personnel. We estimate that specimens were obtained from about 30 percent of the total annual harvest. Canines from five of these bears came from known-aged, pen-reared bears released at 14 months of age by a bear hunting club. Kill sites were located primarily by two-way radio contact between game lands personnel, wildlife protectors and biologists. Upon locating a hunter-killed bear, a 4 inch section of the lower mandible was skinned and severed at the second premolar by sawing. The section of mandible was preserved in 70 percent ethanol. The mandible sections were washed in water and placed in separate cloth bags with an aluminum identification number and boiled for approximately two hours in a 16 quart pressure cooker at 10 pounds of pressure. The canines were then extracted with mechanics' pliers. A one-fourth inch cross section was removed from the sidest portion of the tooth root by sawing. This root section was placed in a two ounce glass vial and preserved with 70 percent ethanol and 5 drops of glycerin. Ages were assigned by cementum annuli count from stained cross sections of canine teeth prepared by the Zoology Department at North Carolina State University following the procedure outlined by Sauer *et al* (1966). However, a modified staining method was employed (Allen and Collins, 1971).

The female reproductive tracts were removed from the carcass, trimmed of fat and preserved in 10 percent formalin. Forty-eight tracts were examined for presence of corpora lutea and placental scars. Each uterus was opened its entire length to detect visible placental scars and embryos. Each ovary was cut longitudinally four or five times with a razor blade for macroscopic evidence of corpora lutea.

RESULTS

Age classes ranged from 0.75 to 22.75±1 years of age. The average age, which was calculated by dividing the total years lived by the total number of bears, decreased from 5.17 in 1969 to 4.73 in 1970 and increased to 4.82 in 1971 (Table

1). In the coastal region the average age increased from 3.91 in 1969 to 6.64 in 1971 while it decreased from 6.05 to 2.73 in the mountain region. The largest year class, yearlings (1.75), represented 29 percent of the harvest (Table 2). Yearlings are more abundant in the population than subsequent age classes due to their shorter exposure to mortality factors. Yearlings are also more vulnerable to the hunter since they are inexperienced. Figure 1 depicts the age and sex composition of the harvest samples from 1969 to 1971. The high harvest rate of males in the yearling and 2.5 year class is not unexpected. This is a beneficial situation in that females typically live longer as indicated by their greater average age in Figure 1 and thus, on the average, they have the opportunity to reproduce several times prior to being taken by the hunter. Each successive year class after 1.75 decreased steadily to age 11.75. The 12.75 year class was absent from the sample and only seven specimens were collected from older year classes. Cubs accounted for 4.6 percent of the harvest. The sex ratio of the harvest over the period 1969 to 1971 was 106 males:100 females. Fifty-two of 73 females (71 percent) were considered to be of breeding age, which is 3.75 years or older.

Placental scars were found in 16 of the 48 reproductive tracts. Four of the 12 specimens collected in 1969 had placental scars; 11 of 22 in 1970 and one of 14 in 1971. Four of the pregnant females collected in 1970 had very old scars indicating that some scars may remain for two years. A placental scar was found in a 3.75 year old specimen from Jones County. Active corpora lutea were not present in the ovaries. This indicates that this bear conceived when it was 2.50 years old.

Active corpora lutea were found in 65 percent of the adult females over the period 1969-1971. Fifty-five percent were pregnant in 1969, 50 percent in 1970, and 91.5 percent in 1971. Individual corpora lutea counts ranged from 0 to 4. The average number of corpora lutea per pregnant female was 1.0 in 1969, 2.71 in 1970, and 2.81 in 1971 (Table 3). One 17.75 year old specimen collected in Pender County December 11, 1971 had two implanted embryos in the left horn of the uterus enlarging it to 10 mm in diameter. One implant in the right horn enlarged it to 11.5 mm. Only one corpora lutea was found in the left ovary. Two were found in the right ovary; indicating a migration of an egg produced by the right ovary to the left horn of the uterus. This specimen exhibited the only evidence of embryonic development in the 48 reproductive tracts examined. The latest date that a reproductive tract was collected from a pregnant female was January 5 and no evidence of embryonic development was noted in this specimen.

DISCUSSION AND CONCLUSIONS

The relatively low average age of this sample and the high occurrence of 1.75 and 2.75 year olds inidicates that the age structure of the population is low. Such a low average age structure could have resulted from an overharvest in preceding hunting seasons as suggested by Wakefield (1970). He found a heavy kill in the first four year classes, up to age 3.75, with the highest in year class 3.75. The current study reveals the highest kill rate in age class 1.75, representing 29 percent of the kill (Figure 1). Yearling and 2.75 year old males comprise the bulk of the annual harvest. The older age classes, from 3.75 to the very oldest bears nearing 20 years, are predominantly females. It appears that young females are less vulnerable to hunting, and their survival to the older age classes insures a greater probability of reaching reproductive maturity and producing offspring. Miller (1970) reported that the 1.75 year class accounted for 23.6 percent of the kill over a four year period in New York, but ranged from 4.8 to 38.7 percent.

A low average age structure could also be a reflection of a high reproductive rate in a low population density situation. Corpora lutea counts do not reflect an unusually high reproductive rate; therefore, I conclude that the low age structure is a direct result of a low survival rate and high hunting mortality especially in young males. The trend in the mountain region, where the average age has dropped from 6.05 to 2.73, is particularly alarming and worthy of attention. In the coastal region the average age has increased from 3.96 to 6.64 which may reflect an increase of survival in response to greater harvest restrictions in this area.

A preponderance of males were found in age classes 1.75, 2.75 and 4.75 with a higher occurrence of females in the older age classes. Wakefield (1970) demonstrates similar findings. This would tend to indicate that young males are more vulnerable to the hunter than young females. Males may exhibit a greater tendency to wander in search for food, especially in years of poor mast. Stickley (1961) reported that males moved much more than females and that yearling males moved almost as much as adult males.

The sex ratio of 106 males:100 females is a nearly equal ratio. Wakefield (1970) reported a ratio of 96 males:100 females in the 1967 Pennsylvania harvest and 117 males:100 females in the 1968 kill. Miller (1970) found the ratio to be 118.6 males:100 females during a four year period in New York.

Litter size as calculated from corpora lutea counts averaged 2.17 per pregnant female. This compares favorably with the values of 2.4 reported in Virginia by Stickley (1961) and 2.2 reported in Florida by Harlow (1961). The great variability between the 1969 index of 1 and the 2.7 and 2.8 values in 1970 and 1971 is difficult to understand. The small sample sizes (12 in 1969, 22 in 1970, and 14 in 1971) could be responsible for this marked difference. In that case the difference would not necessarily be real, but would be attributed to sampling error. There is some evidence to support the hypothesis that at least a part of the marked decrease in pregnancy in 1969 was due to a complete oak mast failure in the mountain region that fall. A change to other food items and decreased food intake could affect the nutritional plane of female bears and result in lower corpora lutea counts.

The breeding age was well defined at 3.75 years with 80 percent of that year class having active corpora lutea. There was one case indicating that a 2.5 year female is capable of breeding in the wild. A placental scar was found in a 3.75 year old specimen indicating that this animal became pregnant the previous year at age 2.5. The breeding age for females ranged from 2.5 to 17.5 years. No reproductive tracts older than 17.5 years were collected. Jonkel and Cowan (1971) reported the minimum breeding age of black bears in Montana at 4.5 years. The latest a reproductive tract was collected was January 5 and no evidence of embryonic development was found in this specimen. The only evidence of embryonic development was noted in a 17.75 year old female taken on December 11. Three embryos were present; two had enlarged the uteri to 10 mm and one to 11.5 mm. If cubs are born in late January or early February this represents an extremely short development period. This would account for the extremely small size and undeveloped state of cubs at birth.

YEAR	AVERAGE AGE (NUMBER)		
	MOUNTAINS	COAST	STATEWIDE
1969	6.05 (27)	3.91 (17)	5.17 (44)
1970	4.48 (50)	5.53 (15)	4.73 (65)
1971	2.73 (26)	6.64 (16)	4.82 (42)
	(103)	(48)	(151)

Table 1. Average Age of Black Bears Harvested in North Carolina from 1969-1971.

Table 2. Age Classes by Sex and Year — 1969-1971 Statewide.

AGE CLASS	1969		1970		1971		TOTAL	%	TOTAL	%	GRAND	% GRAND
	M	F	M	F	M	F	M	M	F	F	TOTAL	TOTAL
.75			2	4	1		3	2.00	4	2.65	7	4.65
1.75	8	4	11	4	13	4	32	21.10	12	7.95	44	29.05
2.75	6	2	4	3	2		12	7.95	5	3.31	17	11.26
3.75	4	2	1	3	1	4	6	3.98	9	5.96	15	9.94
4.75	3		4	4	1	1	8	5.30	5	3.31	13	8.61
5.75		1	2	6		3	2	1.32	10	6.62	12	7.94
6.75	2	2	3	2		4	5	3.31	8	5.30	13	8.61
7.75		1		2	1		1	.66	3	2.00	4	2.66
8.75	1	2	1	2	1	3	3	2.00	7	4.64	10	6.64
9.75		1	1	2			1	.66	3	2.00	4	2.66
10.75	1	1					1	.66	1	.66	2	1.32
11.75				2		1			3	2.00	3	2.00
13.75	1						1	.66			1	.66
14.75		1	1				1	.66	1	.66	2	1.32
15.75				1					1	.66	1	.66
17.75						1			1	.66	1	.66
21.75					1		1	.66			1	.66
22.75	1						1	.66			1	.66
Totals	27	17	30	35	21	21	78	51.58	73	48.38	*151	99.96

*Includes 3 Road Kills.

Table 3. Statewide Reproductive Data by Age Class and Year of Harvest — 1969-1971.

TABLE 3.

STATEWIDE REPRODUCTIVE DATA BY AGE CLASS
AND YEAR OF HARVEST--1969-1971

AGE CLASS	1969 NO. OF REPROD. TRACTS	1969 ACTIVE CORPORA LUTEA	1970 NO. OF REPROD. TRACTS	1970 ACTIVE CORPORA LUTEA	1971 NO. OF REPROD. TRACTS	1971 ACTIVE CORPORA LUTEA	TOTAL NO. OF REP. TRACTS	TOTAL NO. OF CORPORA LUTEA	AVERAGE NO. OF C. LUTEA PER TRACT	% PREG.
.75			3	0			3	0		0
1.75	1	0	4	0	1	0	6	0		0
2.75	1	0					1	0		0
3.75	2	1	1	3	2	4	5	8	1.60	80
4.75			2	0			2	0		0
5.75	1	0	2	0	2	5	5	5	1.00	40
6.75	2	1	1	2	3	10	6	13	2.17	83
8.75	1	1	2	3	3	9	6	13	2.17	83
9.75	1	1	2	5			3	6	2.00	100
11.75			2	3	1	0	3	3	1.00	33
14.75	1	0					1	0		0
15.75			1	3			1	3	3.00	100
17.75					1	3	1	3	3.00	100
Totals	10	4	20	19	13	31	43	54	1.25	

YEAR	TOTAL NUMBER OF REPRODUCTIVE TRACTS COLLECTED	NUMBER PREGNANT	AVERAGE NUMBER OF CORPORA LUTEA PER PREGNANT FEMALE
1969	12*	5	1.00
1970	22*	7	2.71
1971	14*	11	2.81

*Ages not available for 2 specimens in 1969, 2 in 1970, and 1 in 1971.

Table 4. Black Bear Hunter Kill.

TABLE 4.

BLACK BEAR HUNTER KILL

AREA	1968	1969	1970	1971
Coast	194	101	47	84
Mountains	237	79	128	77
Total (Statewide)	431	180	175*	161**
Western Game Lands	19	21	31	-

The 1970 kill figures include 6 Cubs.

*Includes 4 depredation kills.
**Includes 3 road kills.

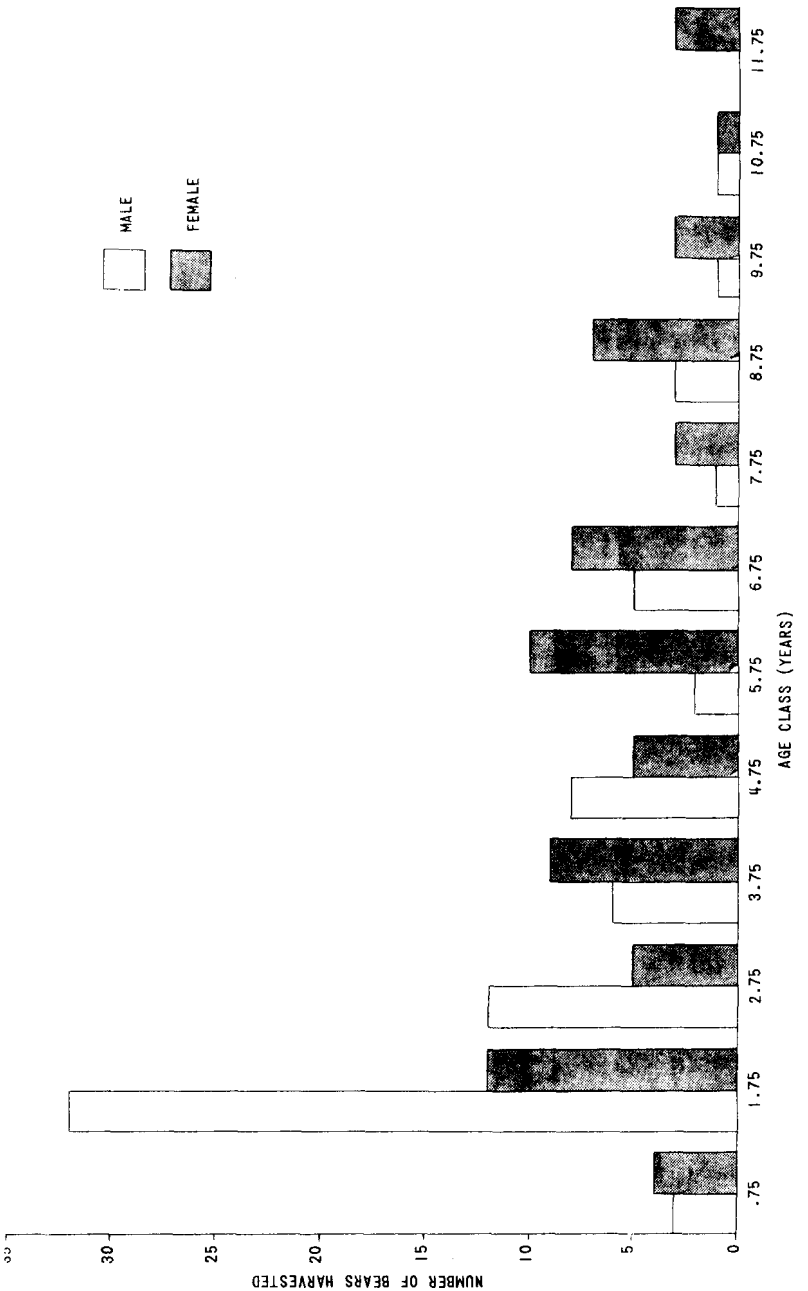

Figure 1. Harvest by Age Class and Sex 1969-1971 of 151 Bears in North Carolina.

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PRELIMINARY REPORT ON THE MOVEMENT AND FATE OF RACCOONS RELEASED IN UNFAMILIAR TERRITORY

by

John E. Frampton
Baruch Research Fellow
Department of Entomology and Economic Zoology
Clemson University, Clemson, S. C. 29631

Lloyd G. Webb
South Carolina Wildlife and Marine Resources Department
Associate Professor, Clemson University, Clemson, S. C. 29631

ABSTRACT

Twelve raccoons (*Procyon lotor*) were trapped in the lower Coastal Plain of South Carolina and transported to the upper Piedmont of the state. The raccoons were held from one to three weeks during which time they were equipped with radio transmitters. Ten raccoons were released between 4 April and 28 May 1973 and their movements were monitored from 3 to 51 days (mean of 26.8). From 4 April to 17 July 1973 movements ranged from 0.1 to 14.5 linear kilometers (mean of 3.28). The health of the remaining two raccoons was not normal and therefore they were not released.

The raccoons remained relatively close to their sites of release for at least a few days following release (mean of 12.6). They often returned to areas where they had been found previously and their movements generally followed close to existing water courses with no apparent preference for direction of travel.

This study suggests that the relocating of raccoons into areas in which low populations exist can be successful. Also indicated was a need to hold the raccoons for a period of time before releasing them to determine their state of health.