

ALASKA DEPARTMENT OF FISH AND GAME

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REPRODUCTIVE CHARACTERISTICS OF  
BLACK BEARS IN INTERIOR ALASKA



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of Black Bears in Interior  
Alaska  
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SUMMARY

Minimum breeding age of interior Alaska black bears was studied during 1980 and 1981. Examination of 16 reproductive tracts collected by hunters provided the major source of material for analysis. Three other data sources were used: relative teat size of 86 bears as recorded on black bear sealing documents; maternal status of sows as recorded on these documents; and skull sizes of nearly 600 bears sealed in Game Management Unit 20.

Data are insufficient to clearly define minimum age at first production of young. The hypothesis that both sexes reach sexual maturity at about 4 years of age is suggested and is supported by the limited data available. A better understanding of black bear reproductive biology is necessary in order to effectively manage these populations. It is recommended that this study be terminated since the specimen collection method is inadequate to provide the information required.

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## BACKGROUND

Black bears (*Ursus americanus*) are heavily harvested in some years and in some areas of interior Alaska. Reproductive parameters such as age at maturity, litter size, and frequency of litters influence the dynamics of black bear populations. While reproductive data from black bears in other regions of North America are available, they may not apply to bears in interior Alaska. Without basic reproductive information, harvest data currently being collected through the sealing program may be insufficient to evaluate the impact of harvest, particularly in small areas of some Game Management Units.

Reynolds (1976, 1980) observed that age at first production of young by northern Alaska grizzly bears (*Ursus arctos*) is substantially greater than for grizzlies in other areas of Alaska and in more southern regions of North America. Black bear reproduction may show similar patterns. If this were the case, Interior black bear managers may find it desirable to reduce or prevent increases in black bear harvests in some heavily hunted areas in order to prevent population declines.

Age at first breeding among female black bears varies widely in North America. In Virginia, Wimsatt (1963) suggested that under optimum conditions of nutrition and growth, yearlings in New York could conceivably breed. Stickley (1961) reported 3 yearling sows in estrous. However, the earliest breeding he records occurred at age 2. Sauer (1975), also working in New York, reported the same apparent age of maturity. Wiley (1978) wrote that some Vermont black bears breed at 2 years, but the normal age of breeding is 3 years. Rayburne (1977) reported similar findings for Virginia black bears. Erickson and Nellor (1964), working in Michigan, reported the age at first breeding as 3 years. In Washington, Lindzey (1976) also found that females first bred at age 3; similarly, Poelker and Hartwell (1973) reported that 44% of females first bred at 3 years. Both study areas were in southwest Washington. Jonkel and Cowan (1971) reported the first estrous in bears in their Montana study area at age 4 and the first known successful production of young at age 6, putting the earliest known breeding there at age 5. Rogers (1976) reported Minnesota bears maturing sexually at age 4.

In Alaska, Modafferri (1978) reported that 2 sows bred successfully in the Prince William Sound area at age 3. Rausch (1961) noted the earliest successful breeding of a captive female black bear near Anchorage took place at age 6, although he believed that conception could have taken place earlier had the male been sexually mature. He also reported another captive female in southcentral Alaska gave birth at age 4, although he concluded that the animal was physiologically equivalent to a wild bear of age 8.

Information on reproduction in male black bears is sparse. Erickson et al. (1964) examined 55 males in Michigan and concluded that sexual maturity was attained at age 4 and only rarely at age 3. Rausch (1961) believed that puberty is attained by wild male black bears in southcentral Alaska in the 5th or 6th summer.

#### OBJECTIVE

To determine the minimum breeding age of interior Alaska black bears.

#### PROCEDURES

Black bear reproductive tracts were collected from 1979 to 1981. A reward for black bear testes (\$10) and female reproductive tracts (\$30) was offered from 1 July 1980 to 30 June 1981, but rewards were also paid for the few specimens that came in before and after that time.

Hunters were advised of the specimen collection program through a series of large (up to 30 column-inches) and small newspaper display advertisements (Fig. 1) in the daily newspaper servicing most of the area from which specimens were sought. The drawing was from Wiley (1978). Advertisements were run on the following dates:

<u>1980</u>	<u>1981</u>
July 23	May 22, 27
August 13, 16, 20, 23, 30	June 3

Where possible, the ads were placed on the "Outdoor Page."

Posters on green 8-1/2 x 11-inch card stock were placed in area sporting goods stores and other locations within Game Management Unit 20.

The specimen collecting program was also mentioned on several occasions on the weekly radio and television program sponsored by the Alaska Department of Fish and Game.

Specimens were examined as they came in or, in most cases, frozen at 0°F (-18°C) for later examination. Each testis was removed from the tunica vaginalis, and the epididymis was left in contact

STATE OF ALASKA  
**BLACK BEAR HUNTERS**  
**REWARD**  
**OFFERED**

**\*10 for testes**  
**\*30 for female reproductive tract**

to qualify for reward:

- ☆ bear must be from unit 20
- ☆ bring or send specimen to Fairbanks ADF&G office within 5 days of taking
- ☆ Specimens must be accompanied by skull
- ☆ reward offer valid through June 30, 1981

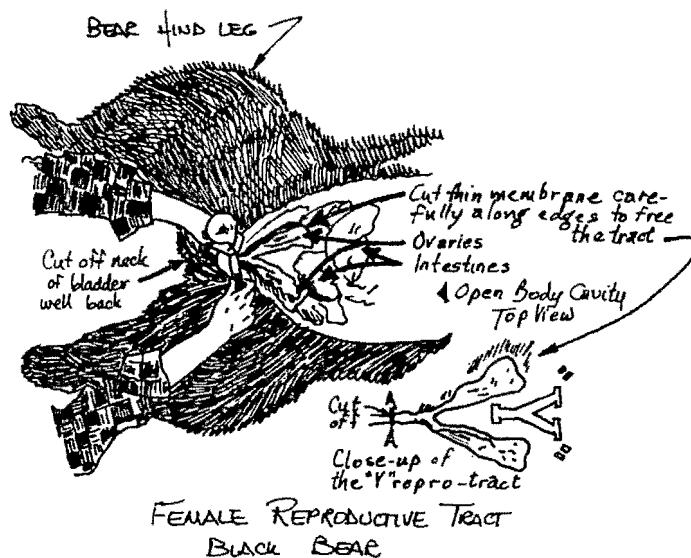


Fig. 1. Advertisement of reward for black bear reproductive tracts.

with the testis. Weight, length, greatest width, and volume were recorded. Secretions from the epididymis were placed on a glass slide and were examined microscopically for the presence of spermatozoa. Female reproductive tracts were examined for placental scars, cornua were measured for length, and the ovaries were removed and fixed in AFA. The ovaries were weighed and measured, then incised transversely with several cuts and each section examined for presence of corpora lutea.

Ages of bears from which specimens were obtained were derived from routine age determination of black bears harvested in Unit 20, where black bear hides and skulls must be sealed. A first premolar tooth is collected from each skull presented for sealing. The age determination technique using cementum layering of premolars is similar to that described in Wiley (1974).

Three other ancillary procedures were used to collect data on minimum breeding age. First, in those few cases where female black bears accompanied by cubs or yearlings were killed and subsequently sealed, maternity status information was taken from sealing certificates. Second, a space on the sealing certificates exists for recording the relative size of black bear teats: L for large and M for medium. Reynolds (1980) reported that female brown bears not producing milk have teats about 10 mm in length; producing females have teats about 40% longer. Assuming a similar relationship exists in black bears, this relative indication of teat size may be additional evidence for past production of young. Sealing certificates for female black bears harvested in GMU 20 were segregated by age and teat size, and results were recorded.

Skull size information has been collected in the process of sealing since 1974. A computer program was written to graph the relationship of skull zygomatic width versus age, so the point at which growth rates diminish could be determined. Nearly 600 skull widths were plotted.

#### FINDINGS AND DISCUSSION

In sufficient specimens were collected to clearly indicate minimum breeding ages of interior Alaska black bears. However, the limited data available suggest the hypothesis that both boars and sows may mature sexually at about age 4 (Tables 1 and 2).

Analysis of teat size data indicates an increase in the number of certificates marked "L" (large) after age 4 (Table 3). These data lend additional support to the hypothesis but are a source of bias. The sealing certificates are printed with the following information only: "Teats:          ." Some sealing officers may have misunderstood the question and entered erroneous information. The trend, however, is clear.

Beecham (1980) suggested that puberty may be more a function of growth than age: "Analyses of growth curves for specific popula-

Table 1. Size and reproductive condition of black bear testes.

Skull No.	Date	Age (yrs)	Wt. (g)		Length (cm)		Width (cm)		Vol. (ml)		Game Mgmt. Unit	Sperm Present
			No. 1	No. 2	No. 1	No. 2	No. 1	No. 2	No. 1	No. 2		
53131	1 Aug 80	8	31	31	5.5	5.8	3.3	3.7	30	34	20B	yes
53139	24 Jul 80	12	37	40	5.9	6.6	3.3	3.7	35	39	20B	yes
54270	21 May 81	13	45	46	6.3	6.2	2.8	2.8	42	42	20C	yes
54273	4 Jun 81	2	19	18	5.0	4.9	2.1	2.0	20	17	20B	no
55493	22 May 81		40	40	6.0	5.9	2.8	2.8	40	40	20A	yes
55485	23 May 81	8	39	38	5.7	6.0	2.5	2.7	30	37	20C	yes
54110	19 Jun 81		17	13	5.0	4.6	2.0	1.7	13	16	20B	no
54268	10 May 81	8	38	36	6.1	5.9	2.6	2.6	47	37	20C	yes
54152	25 Jun 81	3	15	15	4.8	4.6	1.8	1.8	12	11	20B	no
54275	30 May 81	4	21	23	4.5	4.8	2.2	2.5	19	21	20D	yes
54148	28 Jun 81	3	34	31	5.6	5.6	2.7	2.5	32	35	20F	yes
54259	30 May 81	5	32	31	5.4	5.5	2.5	2.5	30	30	20C	yes

Table 2. Size and condition of female black bear reproductive tracts.

Skull No.	Date	Age (yrs)	Ovaries		Corna		Corpora lutea		Placental Scars		Game Mgmt. Unit	Bred
			No. 1	No. 2	No. 1	No. 2	No. 1	No. 2	No. 1	No. 2		
47606	19 Jun 79	4	2.8	2.5	15.7	14.5	yes	yes	no	no	20B	yes
47635	25 Jun 79	11	2.6	-	13.1	14.7	no	no	no	no	20C	no
53111	23 Aug 80	7	1.9	1.6	12.0	12.5	yes	yes	no	no	20C	yes
none <sup>1</sup>	23 Aug 80	-	1.3	1.1	-	6.5	no	no	no	no	20B	no
53112	23 Aug 80	8	3.8	4.0	-	-	no	no	yes	yes	20C	yes <sup>2</sup>
21312	14 May 74	8	accompanied by yearling cubs - bred at age 6									yes <sup>3</sup>
37409	13 Aug 76	22	accompanied by cubs - bred at age 21									yes <sup>3</sup>
40592	5 Sep 77	7	accompanied by cubs - bred at age 6									yes <sup>3</sup>
34037	19 Jul 78	10	accompanied by yearling cubs - bred at age 8									yes <sup>3</sup>
51571	14 May 80	10	accompanied by cubs - bred at age 9									yes <sup>3</sup>

<sup>1</sup> Skull lost by hunter.

<sup>2</sup> Placental scar indicates previous pregnancy.

<sup>3</sup> From sealing records.



Table 3. Age of female black bears compared to the percentage of sealing certificates which designated female teat size as "large."

Age	Percent "L"	Sample Size
2	13	8
3	0	9
4	6	16
5	38	16
6	30	10
7	44	9
8	25	4
9	0	5
≥10	56	9

Fig. 2. Relationship between female black bear skull width and age class in Game Management Unit 20, 1974-1979.

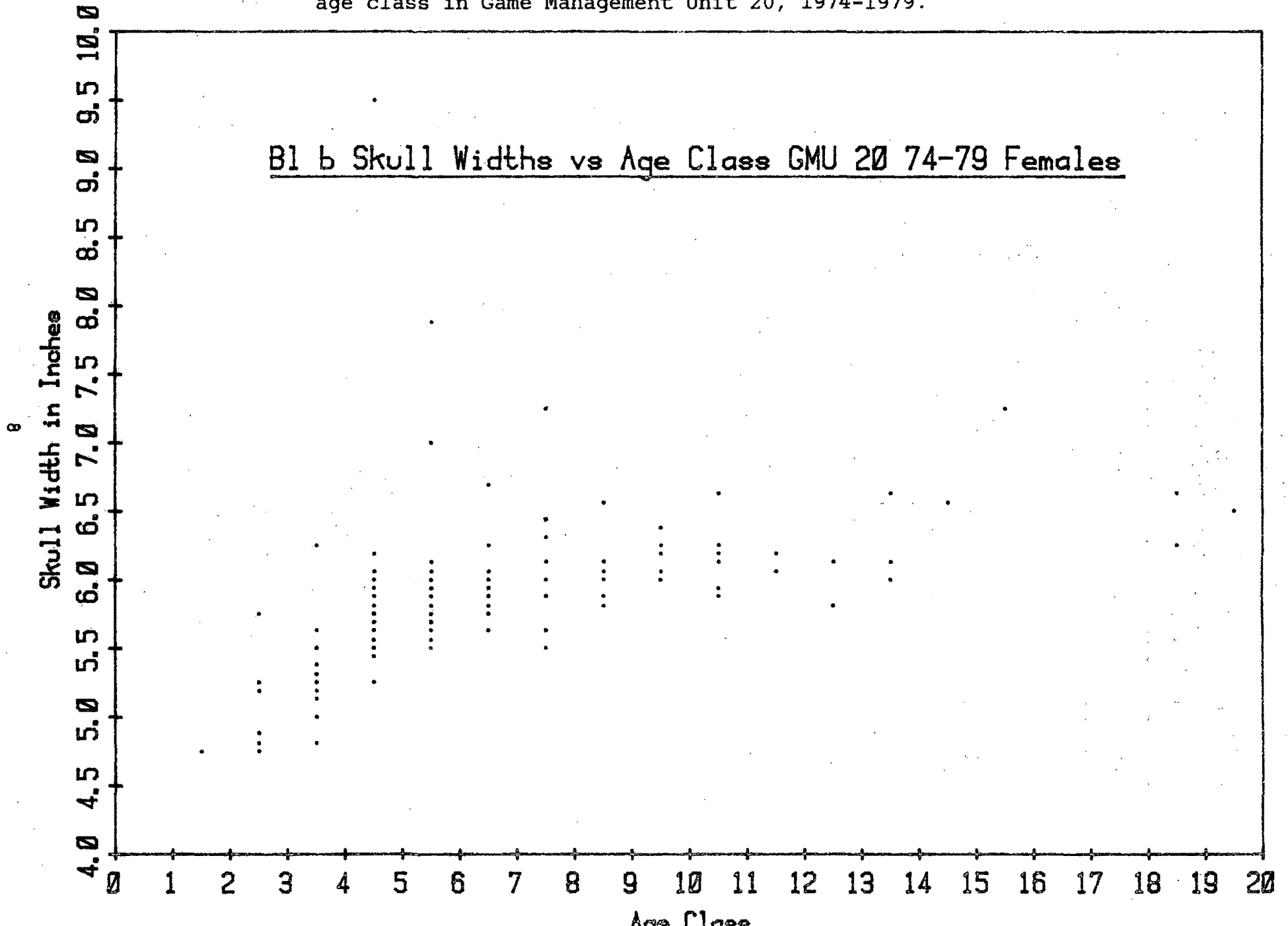
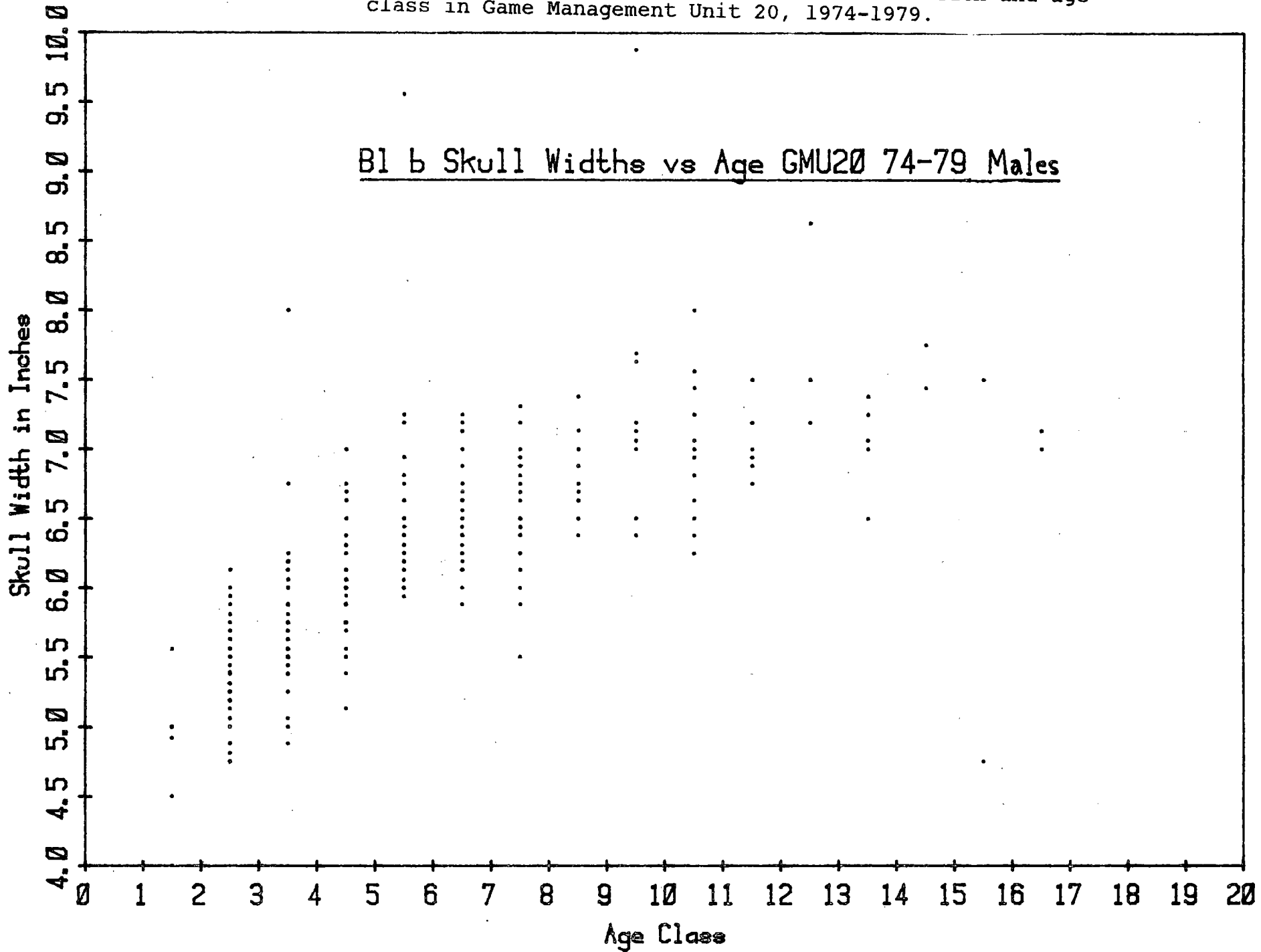


Fig. 3. Relationship between male black bear skull width and age class in Game Management Unit 20, 1974-1979.



tions probably yield more accurate predictions of minimum reproductive age over the long-term in a particular area." If this were true, habitat quality as it affects the growth potential of bears may be more important than age in determining timing of sexual maturity.

Growth as indicated by skull size, is well known for Game Management Unit 20 black bears. Computer-generated analyses (Figs. 2, 3) suggest that growth rate climbs steeply until about age 4 for both sexes. If puberty accompanies this change in growth rate as Beecham (1980) suggested, further strength is lent to the hypothesis that puberty generally occurs at about age 4 for both sexes. Habitat quality probably varies considerably over the Unit, so there may be local variations in age of maturity.

#### RECOMMENDATIONS

While the minimum breeding age of Interior black bears has not been confirmed, it seems safe to assume that if the average age of a black bear population (as indicated by sealing information) falls below age 4, the population may decline. Continued decline in average age may indicate a population consisting largely of immigrant bears born in adjacent, less heavily hunted areas. If the management goal is to provide for an optimum harvest, average age should be maintained at a level above age 4.

Because the method of collecting specimens has produced too few data, this study should be terminated. A clearer picture of breeding biology remains important and requires a more comprehensive study of Interior black bear biology.

#### LITERATURE CITED

- Beecham, J. J. 1980. Population characteristics, denning, and growth patterns of black bears in Idaho. Ph.D. Thesis, Univ. of Montana, Missoula. 100pp.
- Erickson, A. W., J. E. Nellor, and G. A. Petrides. 1964. The black bear in Michigan. Michigan Agr. Exp. Sta. Res. Bull. 4. 102pp.
- Jonkel, C. J., and I. McT. Cowan. 1971. The black bear in the spruce-fir forest. Wildl. Monogr. 27:1-57.
- Lindzey, F. C. 1976. Black bear population ecology. Ph.D. Thesis, Oregon State Univ., Corvallis. 105pp.
- Modafferri, R. D. 1978. Black bear movements and home range study. Alaska Dep. Fish and Game, Fed. Aid in Wildl. Rest., Proj. Prog. Rep. W-17-10. Juneau. 23pp.
- Poelker, R. J., and H. D. Hartwell. 1973. The black bear of Washington. Wash. State Game Dep. Biol. Bull. 14, Olympia. 180pp.

- Rausch, R. L. 1961. Notes on the black bear (*Ursus americanus* Pallas) in Alaska, with particular reference to dentition and growth. *Zeitschrift Saugetierkunde* 26:65-128.
- Rayburne, J. W. 1977. A study of black bear populations in Virginia. *Trans. N.E. Sect. Wildl. Soc.* 33:71-81.
- Reynolds, H. V. 1976. North Slope grizzly bear studies. Alaska Dep. Fish and Game, Fed. Aid in Wildl. Rest. Rep., Proj. Final Rep. W-17-6 and W-17-7. 20pp.
- \_\_\_\_\_. 1980. North Slope grizzly bear studies. Alaska Dep. Fish and Game, Fed. Aid in Wildl. Rest. Rep., Proj. Prog. Rep. W-17-11. Juneau. 65pp.
- Rogers, L. L. 1976. Effects of mast and berry crop failures on survival, growth, and reproductive success of black bears. *Trans. N. Am. Wildl. Resour. Conf.* 41:431-438.
- Sauer, P. R. 1975. Relationship of growth characteristics to sex and age for black bears from the Adirondacks region of New York. *N.Y. Fish and Game J.* 22(2):81-113.
- Stickley, A. R. 1961. Black bear tagging study in Virginia. *Proc. Am. Conf. S.E. Assoc. Game and Fish Comm.* 15:43-54.
- Wiley, C. H. 1974. Aging black bears from first premolar tooth sections. *J. Wildl. Manage.* 38(1):97-100.
- \_\_\_\_\_. 1978. The Vermont black bear. Vermont Fish and Game Dep., Montpelier. 73pp.
- Wimsatt, W. A. 1963. Delayed implantation in the Ursidae, with particular reference to the black bear (*Ursus americanus* Pallas). Pages 49-76 in A. C. Enders, ed. *Delayed Implantation*. Univ. Chicago Press, Chicago.

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