

## **Characteristics and Management of Black Bears that Feed in Garbage Dumps, Campgrounds or Residential Areas**

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### **INTRODUCTION**

Many black bears, *Ursus americanus*, in northern Michigan habitually supplement their natural summer diets by feeding in garbage dumps, campgrounds or residential areas. In the past, many of these bears were destroyed as nuisances. To minimize such waste, the Michigan Department of Natural Resources began capturing nuisance bears and releasing them away from areas of human habitation. In conjunction with this program, we estimated the age and recorded the weight, sex and breeding condition of each captured bear in an attempt to learn the sex ratio, age structure, growth rate and fecundity of wild black bears that supplement their diets with garbage. This paper reports and discusses our findings.

### **METHODS**

Data were collected from 126 bears captured between 20 June and 5 September 1968. Forty-two animals were taken with a Cap-chur gun at dumps, and 67 were box-trapped in campgrounds or residential areas. Seventeen cubs that accompanied captured bears were treed and netted. Each animal was immobilized with succinylcholine chloride and anesthetized with pentobarbital sodium as described by Rogers *et al.* (1975).

All bears were sexed, ear-tagged and weighed. A first premolar was extracted from each animal for estimation of age from annuli in the cementum (Stoneberg and Jonkel 1966; Sauer *et al.* 1966; Craighead *et al.* 1970). Tooth sections of inferior quality were prepared from teeth from seven of the study animals; hence, ages of these bears were estimated on the basis of body

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weight, breeding condition and tooth wear features as reported by Stickley (1957), Erickson *et al.* (1964) and Marks and Erickson (1966).

A reference collection of stained first premolar sections from 25 wild black bears captured in Minnesota facilitated interpretation of cementum annuli in study specimens. Teeth in the reference collection were taken from 6 known-age animals 1.5 or 2.5 years old and from 19 older specimens from which premolars had been extracted in successive years to permit determination of annual cementum deposition.

The weights of bears from dumps versus campgrounds or residences were compared where sample sizes of bears of comparable age and sex permitted. Because weight gains by black bears are known to be rapid during summer months (Black 1958; Jonkel and Cowan 1971), comparisons were made only between sex-age groups for which average dates of capture differed by less than a week.

## RESULTS AND DISCUSSION

### Sex Ratio and Mortality

The sex ratio of the 126 bears captured (85 males: 41 females, 67% males) was significantly ( $P < .01$ ) unbalanced toward males according to analysis using Chi-square (Table 1). Several other workers have reported that the proportion of males at sources of garbage is higher than that found elsewhere (Black 1958; Erickson *et al.* 1964; Rogers 1970). This is partially explained by the fact that males range more widely than females (Erickson *et al.* 1964; Jonkel and Cowan 1971; Poelker and Hartwell 1973) and are more likely to encounter sources of garbage. Additionally Erickson *et al.* (1964) suggested that social factors may influence the sex ratio and age structure at such feeding areas.

The percentage of males was significantly ( $P < .05$ ) higher among bears (excluding cubs) captured at garbage dumps (81% males,  $N = 42$ ) than among those captured at campgrounds or residences (61% males,  $N = 67$ ). Garbage was more abundant in dumps than in campgrounds or residential areas, and widely ranging males familiar with several sources of garbage may have concentrated their feeding where they found the most food.

At all sources of garbage, sex ratios changed markedly with age. The sex ratio among cubs did not differ significantly from a 1:1 ratio (59% males,  $N = 17$ ), but the sex ratio among bears 1 through 7 years of age (76% males,  $N = 93$ ) was significantly ( $P < .01$ ) unbalanced toward males. Conversely, females predominated ( $P < .05$ ) among the relatively few bears 8 years of age or older (25% males,  $N = 16$ ), especially among those captured in campgrounds or residential areas (17% males,  $N = 12$ ) (Tables 2 and 3). The reduced percentage of males among older bears probably reflects differential mortality between the sexes from gunshot. Gunshot is a major cause of mortality among bears that feed on garbage, and widely ranging males apparently find and use sources of garbage more often than do the more sedentary females. Bear-hunting pressure during autumn is intense near garbage dumps and campgrounds that attract bears. Additionally, 83 bears were killed as nuisances during the year of this study according to records of the Michigan Department of Natural Resources. Rausch (1961) stated that 'Careless shooting is no doubt the primary cause of injury in bears, at least in populated areas'. The number of deaths from intraspecific fighting is unknown; however, no such deaths of adult black bears have been documented.

TABLE 1. SEX RATIOS AND AGE STRUCTURE OF BLACK BEARS CAPTURED IN GARBAGE DUMPS, CAMPGROUNDS OR RESIDENTIAL AREAS IN THE UPPER PENINSULA OF MICHIGAN, 1968.

Age in years	Number of males	Number of females	Totals
cubs	10	7	17
1	19	5	24
2	18	5	23
3	14	4	18
4	5	4	9
5	8	2	10
6	5	1	6
7	2	1	3
8+	4	12	16
Totals	85	41	126

TABLE 2. AGES AND WEIGHTS OF MALE BLACK BEARS CAPTURED IN GARBAGE DUMPS, CAMP GROUNDS OR RESIDENTIAL AREAS IN THE UPPER PENNINSULA OF MICHIGAN, 1968.

Age in years	Males from campgrounds or residential areas			Males from garbage dumps		
	Weight in kg.			Weight in kg.		
	sample size	Mean	Range	sample size	Mean	Range
Cubs	7	11	7-14	3	25	23-27
1	11	45	32-65	8	45	31-59
2	10	56	39-75	8	65	35-75
3	7	75	66-83	7	94	58-132
4	4	91	88-98	1	97	
5	4	92	84-109	4	134	80-168
6	1	153		4	124	97-173
7	2	103	98-108	0		
8+	2	161	129-194	2	196	182-210
Totals	48			37		

TABLE 3. AGES AND WEIGHTS OF FEMALE BLACK BEARS CAPTURED IN GARBAGE DUMPS, CAMPGROUNDS OR RESIDENTIAL AREAS IN THE UPPER PENINSULA OF MICHIGAN, 1968.

Age in years	Females from campgrounds or residential areas			Females from garbage dumps		
	Weight in kg.			Weight in kg.		
	Sample size	Mean	Range	Sample size	Mean	Range
Cubs	5	11	7-16	2	9	9-9
1	4	37	28-48	1	35	
2	5	50	34-59	0		
3	2	55	53-56	2	61	56-66
4	2	72	71-73	2	103	102-104
5	1	55		1	114	
6	1	84		0		
7	1	75		0		
8+	10	76	64-93	2	120	116-124
Totals	31			10		

### Reproduction

In spite of the mortality factors associated with feeding on garbage, 24 (28%) of the 85 males and 20 (49%) of the 41 females captured at sources of garbage were 4 or more years of age and were judged to be mature (Table 1).

Rausch (1961) found that black bears fed a rich diet in captivity grew faster and matured two to four years earlier than did wild black bears in Alaska. Bears that supplement their diets with garbage may maintain a higher reproductive rate, on the average, than those that subsist entirely upon wild foods, which periodically are in scant supply. This study was conducted in a year when natural foods were judged to be relatively scarce; nevertheless, the seven litters observed with females at sources of garbage ranged from 2 to 5 cubs and averaged 3.1. Using Student's *t* test, this mean was found to be significantly ( $P < .01$ ) larger than the average of 1.99 cubs per litter reported by Erickson *et al.* (1964) from observations by hunters in the Upper Peninsula of Michigan. The difference remained significant ( $P < .01$ ) even when the unusually large litter of five was omitted. In Montana, Jonkel and Cowan (1971) found that during years when natural food was scarce none of the mature females they captured was accompanied by cubs.

### Weights

Bears captured in garbage dumps tended to be heavier than those of the same age and sex captured elsewhere (Tables 2 and 3). Student's *t* tests indicated

that males 4 years or older captured at garbage dumps (N = 11) were significantly ( $P < .05$ ) heavier than males of similar age (N = 13) captured at campgrounds or residences (Table 1). Two- or three-year-old dump males (N = 7 for both 2 and 3 year olds) also appeared to be heavier than other males of the same ages (N = 10 and 7, respectively), but in each case these differences in weight were significant only at the  $P < .10$  level. Five mature (4 years plus), non-lactating females captured at dumps were significantly ( $P < .01$ ) heavier than 4 mature non-lactating females captured at campgrounds and residences. These findings appear to reflect the fact that garbage was much more abundant in dumps than in campgrounds and residential areas.

### Management Considerations

Our observations indicate that bears destroyed as nuisances during the summer usually are not used for food or trophies. However, over 36 percent of the bears killed during autumn hunting seasons in Wisconsin are utilized as food or trophies or both (Dahlen 1959). Our limited observations during autumn hunting seasons in Upper Michigan are consistent with those of Dahlen. It would appear, therefore, that from the standpoint of wise use, the policy of relocating nuisance bears in summer to spare some of them until autumn should be continued.

Recent studies have provided some information on the practicality of relocating bears. Harger (1970) showed that of 164 nuisance bears that were relocated in Upper Michigan, 25 (15%) eventually were harvested by hunters, 27 (16%) were shot or recaptured as nuisances, 8 (5%) were killed by automobiles, 1 (1%) was killed in an undetermined manner, and 103 (63%) provided no further data.

The distance beyond which a bear will not return to its place of capture is unknown. Harger (1970) reported that a bear returned to within 0.5 miles of its original site of capture after being transported a straightline distance of 142.5 miles. However, Sauer *et al.* (1969) reported that in New York only three black bears of 14 that were transported more than 40 miles returned to within 8.6 miles of the original sites of capture. Harger (1970) found that 10 of 27 bears returned after being transported more than 40 miles but that none of the 13 yearlings returned (the distance that the yearlings were transported was not stated). Barnes and Bray (1967) also found that 'Homing behavior was more prevalent among full-grown bears than among young animals.'

Subadult males are particularly prone to wander (Stickley 1961; Jonkel and Cowan 1961), and they probably exhibit less attachment to a particular area than do females and older males. Experiments to determine the homing success of subadult males could provide valuable information for black bear management because subadult males comprise a large proportion of the bears involved in nuisance activity. In fact, 42% of the bears (excluding cubs) we captured in campgrounds or residential areas were males less than 4 years of age.

Observations made during this and other studies suggest that the number of nuisance bears in campgrounds and residential areas probably could be reduced if (1) garbage in such areas were made less available to bears through its prompt removal and by the use of 'bearproof' garbage cans (Barnes and Bray 1967) and (2) if garbage dumps were located at least a mile from campgrounds or residential areas (Rogers 1970).

## SUMMARY

One hundred and twenty-six black bears were captured at garbage dumps, campgrounds or residential areas in the Upper Peninsula of Michigan during the summer of 1968. The sex, weight and breeding condition of each were recorded and the age of each was estimated from counts of annuli in the cementum of a first premolar. The sex ratio among cubs (59 males, N = 17) did not differ significantly from a 1:1 ratio, but the sex ratio among bears 1 through 7 years of age (76% males, N = 93) was significantly ( $P < .01$ ) unbalanced toward males. Conversely, females predominated ( $P < .05$ ) among the relatively few bears 8 years of age or older (25% males, N = 16), especially among those captured in campgrounds or residential areas (17% males, N = 12). Garbage was more abundant in dumps than in campgrounds or residential areas, and bears captured at dumps tended to be heavier than those of the same age and sex captured elsewhere. Seven litters observed with females captured at sources of garbage ranged from 2 to 5 cubs and averaged 3.1, which is significantly ( $P < .01$ ) more than the average of 1.99 cubs per litter reported for bears in Upper Michigan. Forty-two percent of the bears (excluding cubs) captured as nuisances in campgrounds or residential areas were males less than 4 years of age. Young males may exhibit less attachment to an area than do females or older males, so may be less likely to return after being transported away from human habitation.

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## REFERENCES

- BARNES, V. G. and BRAY, O. E. 1967. Population characteristics and activities of black bears in Yellowstone National Park. *Natl. Park Serv. Rept.* 199pp.
- BLACK, H. C. 1958. Second progress report on the black bear investigation in New York State. *Trans. N. E. Wildlife Conf. 1:* 208-226.
- CRAIGHEAD, J.J., CRAIGHEAD, F.C.Jr., and McCUTCHEN, H.E. 1970, Age determination of grizzly bears from fourth premolar tooth sections. *J. Wildl. Mgmt.* 34: 353-363.
- DAHLEN, J.H. 1959. Black bear distribution and harvest. Wisconsin Dept. Nat. Resour. Job VI-B Compl. Rept. Project W-79-R-5. 11pp.
- ERICKSON, A.W., NELLOR, J.E. and PETRIDES, G.A. 1964. The black bear in Michigan. *Agr. Exp. Sta. Res. Bul.*, Michigan State Univ., 4: 1-102.
- HARGER, E. M. 1970. A study of homing behavior of black bears. Unpublished MS thesis, Northern Michigan Univ., Marquette, 81pp.

- JONKEL, C.J AND COWAN, I. McT. 1971. The black bear in the spruce-fir forest. *Wildlife Monogr.* 27, 57pp.
- MARKS, S. A. AND ERICKSON, A. W. 1966. Age determination in the black bear. *J. Wildlife Mgmt.* 30: 389-410.
- POELKER, R. J. and HARTWELL, H. D. 1973. Black bear of Washington. *Washington State Game Dept. Biol. Bull.* 14. 180pp.
- RAUSCH, R. L. 1961. Notes on the black bear, *Ursus americanus* Pallas in Alaska, with particular reference to dentition and growth. *Zeitschrift fur Sdugetierkunde* 26: 1-31.
- ROGERS, L. L. 1970. Black bear of Minnesota. *Naturalist* 21 (4): 42-47.
- ROGERS, L. L., STOWE, C. M. and ERICKSON, A. W. 1975. Succinylcholine chloride immobilization of black bears. This volume Paper 43.
- SAUER, P.R., FREE, S. and BROWNE, S. 1966. Age determination in black bears from canine tooth sections. *New York Fish and Game J.* 13: 125-139.
- SAUER, P.R., FREE, S. and BROWNE, S. 1969. Movement of tagged black bears in the Adirondacks. *New York Fish and Game J.* 16: 205: 223.
- STICKLEY, A.R. 1957. The status and characteristics of the black bear in Virginia. Unpublished MS thesis, Virginia Polytechnic Institute, Blacksburg. 142pp.
- STICKLEY, A.R. 1961. A black bear tagging study in Virginia. *Proc. 15th Ann. Conf. S. E. Assoc. Game and Fish Comms.:* 43-52.
- STONEBERG, R. P. and JONKEL, C. J. 1966. Age determination of black bears by cementum layers. *J. Wildl. Mgmt.* 30:411-414.

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