

# CHARACTERISTICS OF NONSPORT BROWN BEAR DEATHS IN ALASKA

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**Abstract:** The sex, age, and other characteristics of 668 brown bears (*Ursus arctos*) killed in nonsport circumstances in Alaska during the period 1970-85 were examined. These data represent an unknown fraction of total nonsport kills as not all kills were reported. Both sport harvests and nonsport kills are increasing in Alaska. Nonsport harvests averaged 5.1% of total sport and nonsport kills. Areas with the highest human density had the highest ratio of nonsport to sport harvests. Nonsport harvests are most common during periods when most people are in remote areas to hunt or fish. Males predominate in the nonsport kills of younger bears and females in the nonsport kills of older bears. Regulations and other factors make adult male bears more vulnerable to sport hunters than adult female bears. Partially as a result, nonsport kills contain more adult females than sport kills. An analysis based on affidavits from 224 persons killing bears revealed that bears were shot to avoid perceived danger (72%), to protect property (21%), and to eliminate nuisances (7%).

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Human presence in bear habitat usually leads to conflicts between bears and people, frequently with fatal consequences for the bear but rarely leading to injury or death for the person (Herrero 1985). In all of the United States except Alaska, brown-grizzly bears (hereafter brown bears) are so rare that the incidence of such contacts is too small to permit thorough analyses of the characteristics of the bear subpopulation that comes into conflict with humans. Herrero (1985) studied circumstances in which brown bears caused injuries to humans, and others examined circumstances where bears caused depredation problems (Murie 1948, Johnson and Griffel 1982, Jorgensen 1983, Knight and Judd 1983). Greer (1981) investigated deaths of Montana and Wyoming grizzly bears in nonsport circumstances. Jope (1983) presented data on the sex and age composition of aggressive and nonaggressive bears in Glacier National Park and outlined the circumstances during which park hikers were more likely to have an aggressive encounter with bears (Jope, unpubl. data).

This paper examines the circumstances during which nonsport deaths of Alaskan brown bears occurred. It also compares the sex and age characteristics of nonsport deaths with similar data for sport deaths to evaluate whether nonsport kills should be treated differently from sport kills in exploitation models of bear populations.

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## METHODS

The hides and skulls of all brown bears shot in Alaska are required by state regulation to be submitted to a representative of the Alaska Dep. of Fish and Game (ADF&G) for sealing (attachment of metal locking tags). During sealing the hide is examined to determine the sex of the bear, and a premolar is extracted from the skull to estimate age by counting cementum annuli (Mundy and Fuller 1964). For bears killed in nonsport circumstances the hide and skull must be surrendered to the state and the person killing the bear is required to complete an affidavit describing the circumstances in which the bear was killed.

Bears killed in vehicle accidents ( $N = 1$ ), accidentally during research activities ( $N = 23$ ), or confiscated from people hunting illegally ( $N = 25$ ) are also classified as nonsport kills by ADF&G. This report does not include these classifications. The remaining nonsport bear deaths resulted from defense of life or property circumstances or from control actions, usually conducted by ADF&G or Dep. of Public Safety staff, against individual nuisance bears. Bears found dead were not excluded; some of these were probably wounding deaths and natural mortalities while others were probably unreported kills of nuisance or threatening bears.

The circumstances in which game (including bears) may be taken legally in defense of life or property include the following (Chapter 5, Alaska Administrative Code):

1. The necessity for the taking is not brought about by harassment or provocation of the animal or an unreasonable invasion of the animal's habitat; and
2. the necessity for the taking is not brought about

by the improper disposal of garbage or a similar attractive nuisance; and

3. all other practicable means to protect life and property are exhausted before the game is taken.

Data on the location, sex, and age composition of 668 bears dying in nonsport circumstances during the period 1970–84 were available from ADF&G records. We compared these data to ADF&G records of 12,722 bears legally killed by sport hunters during the same period. Some of these records were incomplete, for example, when the skull was not available for age determination or when the sex could not be determined from the hide. An undetermined number of additional bears are killed in sport and nonsport circumstances and not reported to authorities. Such non-reporting is thought to be especially high in rural areas. The total kill includes the number of bears killed in 1985, but 1985 data are not included in sex and age comparisons or in analyses of circumstances of kill.

Affidavits were available for 224 nonsport kills from 1970 to 1984. No format for these affidavits was required so descriptions of the kill range from complete to very sketchy.

We tested differences between mean ages of bears in different sex or circumstance of kill groups with Student's *t*-test and differences in sex ratios with chi-square. Differences between the age distributions of bears killed in sport and nonsport circumstances were examined using adjusted residuals calculated by SPSS/PC+ (Norusis 1986) for 3 age categories (<5, 5–9, and 10+) for each sex. The game management units (GMUs) referred to in this report are illustrated in Figure 1.

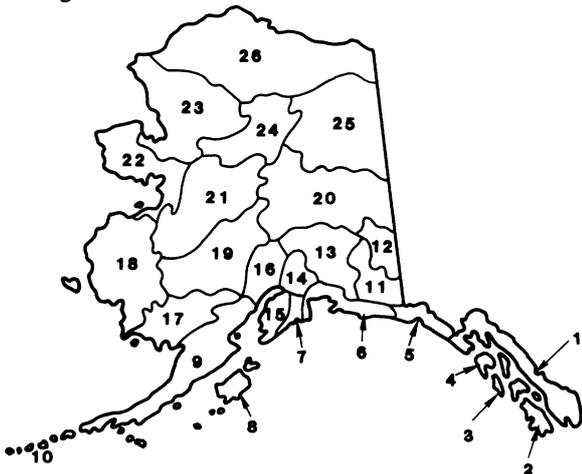


Fig. 1. Alaskan game management units.

## RESULTS

### Numbers and Trends

Reports of nonsport kills increased from 1970 to 1985 (Table 1). A linear regression of number of kills on time had a slope of 2.05 bears/year ( $r = 0.77$ ) (Fig. 2). Attempts to fit a curvilinear function to the data illustrated in Figure 1 did not significantly improve the fit (an exponential function had  $r = 0.75$ ). This indicates that although numbers of nonsport kills are increasing, they are not increasing at a faster rate in recent years.

Legal kills by sport hunters in Alaska also increased from 1970 to 1985 (Table 1). A linear regression of number of sport kills on time had a slope of 21.2 bears/year ( $r = 0.77$ ) (Fig. 2). As for nonsport kills, curvilinear functions did not significantly improve the fit of these data. During this 16-year period, total reported nonsport and sport deaths were 14,619 bears (Table 1); nonsport kills were 5.1% of these deaths (annual range 3.1%–6.5%) (Table 1). A linear regression of the percentage of total kills that were nonsport over this period has a slight positive slope (0.07%), but the relationship is weak ( $r = 0.36$ ).

The bulk of nonsport kills came from 3 coastal game management units (GMUs 8, 9, and 4; Fig. 1) where salmon are abundant and bear densities of 1.6  $\text{km}^2/\text{bear}$  or higher have been reported (Troyer and Hensel 1964, Miller and Ballard 1982). Together, these 3 areas include about 11% of all brown bear

Table 1. Annual nonsport and sport brown bear kills in Alaska, 1970–85.

Year	Nonsport	Sport	% Nonsport
1970	37	632	5.5
1971	24	740	3.1
1972	42	834	4.8
1973	40	927	4.1
1974	41	779	5.0
1975	46	827	5.3
1976	39	832	4.5
1977	45	774	5.5
1978	57	819	6.5
1979	32	883	3.5
1980	47	882	5.1
1981	53	887	5.6
1982	44	821	5.1
1983	59	974	5.7
1984	62	1,118	5.3
1985	77	1,145	6.3
Totals	745	13,874	5.1
Mean	46.6	867.1	5.1
SD	12.8	129.7	0.91

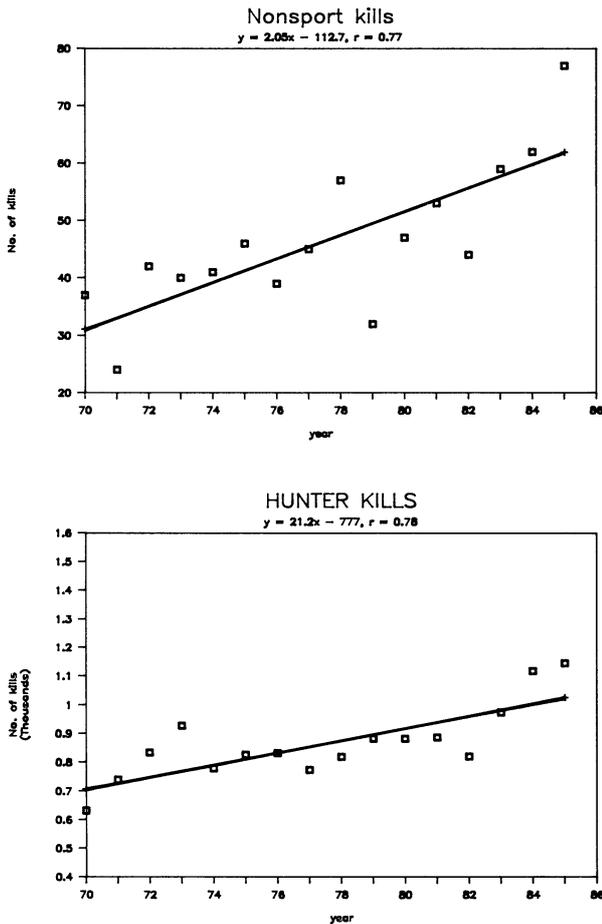


Fig. 2. Trends in number of sport and nonsport bears killed in Alaska, 1970–85.

habitat in Alaska but accounted for 40% of all nonsport kills in 1970–84. These areas are also the 3 most heavily hunted GMUs in Alaska and together account for 49% of the sport harvest. Nonsport kills were 4.1% of total documented kills in these 3 units (range 3.2%–5.0%).

Nonsport kills represented a higher proportion of total kills in areas with higher human populations regardless of bear density. In the heavily populated Anchorage, Kenai Peninsula, and Matanuska Valley areas (GMUs 7, 14, and 15), 24.4% of kills were nonsport (range 22.2%–26.1% in different units). In the rest of the state 4.6% of kills were nonsport (range 3.0%–10.3% in different units).

The proportion of the population removed by sport or nonsport kills is difficult to determine because only rough estimates are typically available on the number

of bears present. Given this limitation, however, on Kodiak and adjacent islands, which represent GMU 8 (approximately 22,660 km<sup>2</sup>), the ADF&G biologist in this unit estimates a total population of 3,000–3,500 bears (Roger Smith, pers. commun.); here 108 bears have been reported killed in nonsport circumstances from 1970 to 1984. We estimate a total population of 1,200–1,500 bears in GMU 13 (59,200 km<sup>2</sup>) in interior Alaska where the senior author has been studying bears (Miller et al., this volume); here 48 bears were killed in nonsport circumstances from 1970 to 1984. The lower limit of these population estimates provides a rough idea of the proportion of the population in these 2 areas that are killed annually in nonsport circumstances: 0.24% for the high-density coastal bear population in Unit 8 and 0.27% for the moderate-density interior bear population in Unit 13.

### Characteristics of Nonsport Kills

The sex ratio of nonsport kills is nearly equal on a statewide basis, but males predominate in younger age-classes and females in older age-classes (Table 2). The predominance of females in older age-classes may in part reflect a predominance of older females in the population as expected in hunted populations (Bunnell and Tait 1981). Most males shot in nonsport circumstances are 1–3 years old (45.5%) whereas most females are over 10 years old (35.8%) (Table 2).

Nonresidents account for a smaller proportion of nonsport harvests relative to sport harvests. Nonresidents accounted for 56.7% of sport harvests during the study period (ADF&G files) but only 6.5% of the nonsport kills where residency was indicated.

Table 2. Nonsport brown bear kills in Alaska by age-class and sex, 1970–84.

Age Class	Number of males	Number of females	% Males
0–1	36	15	70.6
2–3	79	64	55.2
4–5	35	21	62.5
6–7	21	18	53.8
8–10	17	28	37.8
11–15	26	43	37.7
16–19	5	17	22.7
20+	12	6	66.7
Subtotal	231	212	52.1
Age unknown	91	61	—
Totals	322	273	54.1

Residency was not indicated for 40% of the nonsport kill records.

As would be expected, the chronology of nonsport kills indicates they are most frequent during periods when people are most prevalent in bear habitat. State-wide, numbers of nonsport kills peak in September (19%), when many armed hunters are in the field (Fig. 3). The most common time for nonsport kills varies among areas, depending on the chronology of human activities. On the Alaska Peninsula (GMU 9) many salmon fishermen come into contact with bears from shore-based fishing sites in July, and this is reflected in a July peak of nonsport kills (Fig. 3). The other peak on the Alaska Peninsula occurs in October, when many caribou (*Rangifer tarandus*), moose (*Alces alces*) and bear hunters are in the field (Fig. 3). There is also an October peak in the Kodiak-Afognak Island area (GMU 8) when many deer (*Odocoileus hemionus*), elk (*Cervus elaphus*), and bear hunters are out (Fig. 3). Bears in the maritime environment of Kodiak Island spend little time in dens (Roger Smith, pers. commun.) compared to bears in other regions of Alaska; this may be why there are relatively more winter kills in Unit 8 than elsewhere in the state (Fig. 3). On the Kenai Peninsula (GMU 15) where large numbers of sport fishermen gather, nonsport kills are most prevalent during the salmon runs in July and August (44.8%). Unit 13 is typical of most of the other interior portions of Alaska; nonsport kills are most prevalent from July to September, when fishermen and hunters are prevalent in bear habitat (Fig. 3).

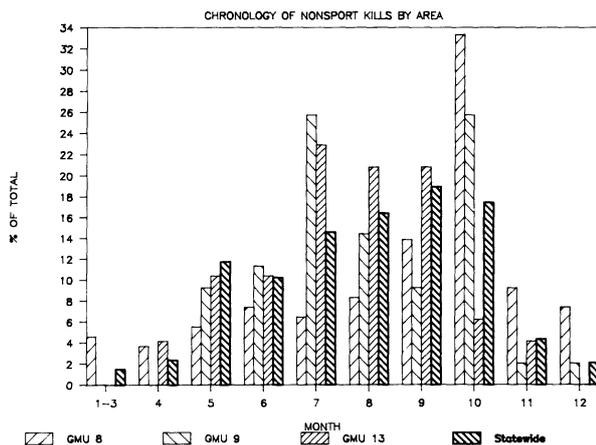


Fig. 3. Chronology of nonsport kills in 3 Alaskan game management units and in the whole state.

### Comparisons with Sport Harvests

The sex and age composition of sport-harvested bears may vary with differences in season timing, hunter motives, fee requirements, levels of non-resident effort, and other factors (Tait 1983). As these conditions vary in different parts of Alaska, the age structure of sport-harvested bears in the whole state cannot be usefully compared with the age structure of bears killed in nonsport circumstances. These comparisons must be made within an area, such as a GMU, where conditions and regulations have remained relatively constant. In GMUs 8 and 9 sufficient numbers of nonsport bears were killed to permit such comparisons of age structures with those of bears harvested by sport hunters (Table 3). Both of these units have light-to-moderate hunting pressure (because of conservative regulations) and high levels of trophy hunting. Correspondingly, it would be reasonable to combine these units, as we suspect they are similar in the conditions that lead to nonsport kills and in the structure of the living populations from which the nonsport kills were taken. These areas were considered separately to assure that any significant conclusion from 1 unit was supported by a similar result in the other unit.

The age structure of males was the same in both sport and nonsport kills in Unit 8 (Table 3). In Unit 9, however, young males (ages 1-4) were more prevalent than expected in nonsport kills compared to sport kills (Table 3). In Unit 9, males were also less prevalent than expected in the nonsport kills of bears aged 5-9 compared to the sport harvest (Table 3).

The age structure of females was the same in both sport and nonsport kills in Unit 9 but not in Unit 8 (Table 3). Compared to the sport harvest, the number of Unit 8 females taken in nonsport circumstances was less than expected for age-classes 1-4 and 5-9 but greater than expected in age-class 10+ (Table 3).

Because females accompanied by newborn or yearling offspring are legally protected from sport hunting, it would be expected that adult females would be more prevalent in the nonsport kill than in the sport harvest (data for these comparisons are the same as for the age ratio comparisons [Table 3]). The expected difference in sex ratio was observed for bears aged 10+ in Unit 8 ( $P < 0.001$ ) and for bears aged 5-9 in Unit 9 ( $P = 0.01$ ). Combining all ages, females were more abundant in the nonsport kills than in sport kills in both units ( $P < 0.01$ ). No significant differences were observed in the interior Unit 13 for

Table 3. Age structure comparisons for sport and nonsport brown-grizzly bear kills by sex, in Alaska's Game Management Units 8 and 9, 1970-84.

	Age			Total	X <sup>2a</sup>	Significance
	1-4	5-9	10+			
<b>GMU 8 (Kodiak)</b>						
<b>Males</b>						
No. sport kills	555	450	226	1,231		
No. nonsport kills	17	10	9	36		
E(x) nonsport	16.2	13.2	6.6	—	1.6	0.45
Adjusted residuals (±)	0.3	1.1	1.0	—		
<b>Females</b>						
No. sport kills	339 <sup>b</sup>	228 <sup>b</sup>	173	740		
No. nonsport kills	13	7	24 <sup>b</sup>	44		
E(x) nonsport	20.2	13.6	10.3	—	21.6	<0.01
Adjusted residuals (±)	2.1	2.1	4.6	—		
<b>GMU 9 (Alaska Peninsula)</b>						
<b>Males</b>						
No. sport kills	914	573 <sup>b</sup>	268	1,755		
No. nonsport kills	21 <sup>b</sup>	4	4	29		
E(x) nonsport	15.1	9.5	4.4	—	5.4	0.07
Adjusted residuals (±)	2.2	2.2	0.2	—		
<b>Females</b>						
No. sport kills	536	284	221	1,041		
No. nonsport kills	21	8	7	36		
E(x) nonsport	18.5	9.8	7.6	—	0.7	0.71
Adjusted residuals (±)	0.8	0.7	0.3	—		

<sup>a</sup> H<sub>0</sub> = distribution between age-classes is the same for sport and nonsport kills.

<sup>b</sup> Observed value significantly greater than expected ( $P < 0.05$ ).

any of these 3 age-groupings or for all ages combined ( $P > 0.20$ ).

**Circumstances of Nonsport Kills**

We evaluated the circumstances during which bears were killed in 224 affidavits filled out by persons killing bears in nonsport circumstances. The primary circumstance leading to these kills was a charging bear perceived as immediately threatening (43%), a bear perceived as potentially dangerous (29%), protection of property (21%), and elimination of nuisance bears by a member of the public or a wildlife agency (7%). An additional contributing circumstance leading to the kill was also listed in 117 of the 224 affidavits. Of these the bear was most commonly perceived as a threat to property (52%), followed by potentially dangerous (39%), or a nuisance bear removed by public or wildlife agency staff (9%).

The sex ratio of bears shot where the primary circumstance of kill was perception of immediate or potential danger (72% of all kills) was equally split between 75 males and 70 females ( $P = 0.70$ ); for an additional 14 bears the sex was not reported. Of these 70 females, 61% were listed as alone, 31% with off-

spring, 6% with another adult, and 2% with an apparent sibling. Sex ratios were also not different from 50:50 for bears >4.9 years old (33 males and 38 females,  $P = 0.55$ ). Counting only adult females (>4.9 years old), 14 were alone and 21 were with offspring. An additional 6 females, all alone, had no age information.

For comparisons of ages based on circumstances of kill, we classified as "dangerous" bears that were killed when the primary reason was the perception of immediate or potential danger. We classified bears shot when the primary circumstance of kill was protection of property or elimination of a nuisance as "nuisances." Sixty dangerous males had equivalent mean age (7.7 years) as 60 dangerous females (8.7 years) ( $P = 0.19$ ), and 24 nuisance males had equivalent mean age (5.3 years) as 18 nuisance females (5.1 years) ( $P = 0.44$ ). For both males ( $P = 0.06$ ) and females ( $P = 0.01$ ), however, dangerous animals were older than nuisance animals.

The people who shot nonsport bears listed their activity as in cabins or dwellings (32.6%), hunting (31.3%), working (including logging) (8.9%), sport fishing (4.5%), hiking (3.6%), conducting control actions or wildlife-fisheries research (each with

2.2%), and camping, mining, subsistence fishing, and commercial fishing (each with 1.8%). Other activities, each representing less than 1% of the 224 affidavits, along with unspecified activities, accounted for the remaining 7.5% of nonsport kills. The likelihood of a person reporting a nonsport kill probably varies depending on activity; we believe these data substantially underrepresent the frequency with which nonsport bears are killed by subsistence fishermen, commercial fishermen, miners and loggers.

Of the 73 bears shot around cabins or dwellings, kills of bears perceived as potentially or immediately dangerous represented 38.4% and 15.1%, respectively. The remaining reasons were protection of property (32.9%) and elimination of nuisance bears by members of the public (8.2%) or a wildlife agency (5.5%). Twenty-four bears were killed around cabins or dwellings primarily to protect property. Of these, 15 were listed as having caused damage <\$100; 5, damage of \$100–\$1,000; and 4, with no estimated value of damage. We are aware of instances in which bears caused damages totaling thousands of dollars to airplanes or houses. These cases were not part of our data because the bears were not killed or no affidavit was completed.

The 2nd most common activity in which nonsport bears were shot was hunting ( $N = 70$ ). Of these, 71% were perceived as immediately threatening, 16% were perceived as potentially dangerous, and 13% were shot by persons protecting property. The property being protected was meat caches in 7 cases and a cabin and camping gear in 1 case each. In some cases the bear that was perceived as threatening was probably not.

For all of the affidavits examined, bears were listed as having caused damage in 76 instances; in 50 cases damages were less than \$100 and in 26 cases damages were \$100–\$1,000. Damage was most frequently caused to buildings (34%), followed by livestock, including poultry (16%), a game cache (13%), camp gear (12%), food supplies (9%), fish cache (5%), people (3%), boat (1%), pets (1%), commercial fishing gear (1%), and other (4%).

## DISCUSSION

Kills of brown bears in nonsport and sport circumstances increased from 1970 to 1985. Nonsport kills have averaged a relatively constant 5% of total documented bear deaths in Alaska during this period. On a statewide basis, documented nonsport kills con-

stitute a numerically insignificant impact on bear numbers in Alaska compared to documented sport kills. Nonsport kills were, however, a significant portion (24%) of total brown bear deaths in the most urban parts of the state, where human populations are concentrated. This relatively high nonsport kill in urban areas leads to bear hunting regulations that are typically more conservative than in areas with fewer people.

If, as expected, Alaska continues to convert remote areas to more urban, industrial, developed, or heavily settled uses, and as recreation use of remote areas expands, we expect the percentage of total deaths that come from nonsport kills to increase in these areas. Some increasingly common developments probably have already caused an undocumented increase in numbers of nonsport kills; these include homesteading in formerly remote areas, increased logging, mining, and subsistence hunting or fishing. We believe participants in these activities are especially disinclined to report nonsport bear kills and that there may have been more of an increase in such deaths than indicated by our data.

Although the proportion of total kills that occur in nonsport circumstances is highest in urban areas, only 9.4% of total number of nonsport kills occur in such areas. The areas with the most dense bear populations and with the highest number of sport-harvested bears also had the highest proportion of nonsport kills.

Comparisons between 2 coastal and 1 interior area on the proportion of the estimated bear population killed in nonsport circumstances provide no support for the theory that interior (“grizzly”) bears are more aggressive (likely to be shot in nonsport circumstances) than coastal (“brown”) bears.

No state or federal agency is responsible for maintaining records on the incidence of injuries or deaths from bear attacks in Alaska. The epidemiologist for the State of Alaska has researched this topic using newspaper accounts, hospital records and death certificates (Middaugh 1987). From 1900 to 1985 Middaugh documented 17 fatalities from brown bear attacks (plus 4 from black bear attack) in Alaska. In addition, he documented 67 injuries from brown bear attacks that led to hospitalization (plus 15 from black bears). Middaugh felt that the incidence of bear attacks is increasing in Alaska in correlation with increased human presence in bear habitat.

When nonsport kills occur varies in different portions of Alaska; however, these kills are well corre-

lated with the periods when people in these different areas are most abundant in bear habitat. Similar results were found in Glacier National Park (Kendall, unpubl. data). These data also support the conclusion that increasing human presence in bear habitat, for whatever cause, will increase nonsport kills of bears.

Subadult males tend to disperse from maternal home ranges (Glenn and Miller 1980). The predominance of males in the younger age classes of nonsport-killed bears may reflect higher probability that dispersing subadult males will come into contact, and conflict, with humans than will more sedentary subadult females. Dispersing males may have more of a tendency than other bears to occupy habitats where other bears are less abundant. Many such areas may be unoccupied by other bears because they have been previously claimed by humans for their activities, which subsequently eliminated resident bears.

Most Alaskan bear populations are hunted by humans. As a result, many bears that could become problems requiring management actions in unhunted areas are killed by hunters. Behavioral traits common to garbage or nuisance bears that have lost some of their fear of humans, doubtless make such bears more vulnerable to hunters than other bears are. This also means that the sex and age characteristics of bears killed in nonsport circumstances in Alaska may not correspond with data from unhunted areas.

The ages of nonsport kills were not consistently different from those of sport-killed bears in Alaskan areas with sample sizes sufficient to indicate such differences, but there were differences in sex ratio. In all cases where this difference was significant, females were more common in the nonsport harvest than in the sport harvest. This difference is potentially important to managers of bear populations because deaths of females can affect the dynamics of bear populations more quickly than deaths of males.

Some of this difference results from trophy hunting, which selects larger males over smaller female bears. This difference also results from sport hunting regulations that protect adult female brown bears that are accompanied by cub or yearling offspring. Because of these regulations, adult female bears are legally vulnerable to sport hunters more infrequently than other bears.

Although there are differences between sex ratios of bears killed in sport and nonsport circumstances, the sex ratio of adult bears killed in nonsport circumstances probably reflects what is present in the bear population. Herrero (1985) reported that females

with offspring may be more likely than other bears to attack humans. In Alaska, adult females constituted 56% of the nonsport kill of 220 adult bears of known sex and age. This value was slightly larger than expected under a null hypothesis that the population's sex ratio was 50:50 ( $X^2 = 3.1$ ,  $P = 0.08$ ). However, the living population of bears is probably biased in favor of females and may be near the 56% females observed in the nonsport kill of adults. Miller (unpubl. data) found 55% females in the population of bears (> 5.0 years) in GMU 13. This suggests no selection for females in the nonsport kill of adult bears.

Data from affidavits filed by persons killing bears in nonsport circumstances also suggest that females accompanied by offspring were not more dangerous than adult females without offspring. Sixty percent of adult female bears of known age shot because they were considered dangerous were with offspring and 40% were alone. This is not significantly different than expected under null hypotheses that half ( $P = 0.23$ ), a third ( $P = 0.40$ ), or a quarter ( $P = 0.16$ ) of the adult female population is accompanied by offspring.

Females with offspring may be more likely to cause injury than other bears if encountered suddenly (Herrero 1985), but such females may have lower probabilities of encountering humans. In Alaska, females with offspring, especially newborns, may tend to inhabit more remote, higher-elevation locations than other bears and have smaller home ranges (Miller, unpubl. data). Also, females with offspring may be more likely to avoid areas heavily used by humans (Jope 1983). Both tendencies would lead to lower encounter rates.

Bears shot because the shooter considered them dangerous were older than bears shot to protect property or eliminate a nuisance. This was true for both sexes and may reflect a propensity for younger bears to become nuisances and for older bears to be more aggressive.

According to affidavits filed by persons killing bears in nonsport circumstances, most nonsport kills resulted because the bear was perceived to be immediately (43%) or potentially (29%) dangerous. Relative to areas where bears are not hunted, proportionally fewer of our nonsport kills probably result from motives of property protection or nuisance elimination (respectively 21% and 7% in Alaska). This may be because, in Alaska, bears that may have lost some fear of humans and are therefore likely to be

come nuisances are highly vulnerable to hunters and end up as sport kills.

#### LITERATURE CITED

- BUNNELL, F. E., AND D. E. N. TAIT. 1981. Bears in models and reality—implications to management. *Int. Conf. Bear Res. and Manage.* 3:15–23.
- GLENN, L. P., AND L. H. MILLER. 1980. Seasonal movements of an Alaska Peninsula brown bear population. *Int. Conf. Bear Res. and Manage.* 3:308–312.
- GREER, K. R. 1981. Grizzly bear mortality studies. 1980. *Mont. Dep. Fish, Wildl. and Parks, Fed. Aid in Wildl. Restor., Proj. W-120-R-12.* 21pp.
- HERRERO, S. 1985. *Bear attacks—their causes and avoidance.* Nick Lyons Books, Winchester Press, Piscataway, New Jersey. 287pp.
- JOHNSON, S. J., AND D. E. GRIFFEL. 1982. Sheep losses on grizzly bear range. *J. Wildl. Manage.* 46:786–790.
- JOPE, K. L. MCARTHUR 1983. Habituation of grizzly bears to people: a hypothesis. *Int. Conf. Bear Res. and Manage.* 5:322–327.
- JORGENSEN, C. J. 1983. Bear-sheep interactions, Targhee National Forest. *Int. Conf. Bear Res. and Manage.* 5:191–200.
- KNIGHT, R. R., AND S. L. JUDD. 1983. Grizzly bears that kill livestock. *Int. Conf. Bear Res. and Manage.* 5:186–190.
- MIDDAUGH, J. P. 1987. Human injury from bear attacks in Alaska, 1900–1985. *Alaska Medicine.* 29:121–126.
- MILLER, S. D., AND W. B. BALLARD. 1982. Density and biomass estimates for an interior Alaskan brown bear, *Ursus arctos*, population. *Can. Field-Nat.* 96:448–454.
- MUNDY, K. R. D., AND D. R. FULLER. 1964. Age determination in the grizzly bear. *J. Wildl. Manage.* 28:863–866.
- MURIE, A. 1948. Cattle on grizzly bear range. *J. Wildl. Manage.* 12:57–72.
- NORUSIS, M. J. 1986. *Statistical package for the social sciences, SPSS/PC+ for the IBM PC/XT/AT.* SPSS Inc., Chicago, Ill. 643pp.
- TAIT, D. E. N. 1983. *An analysis of hunter kill data.* Ph.D. Thesis, Univ. British Columbia, Vancouver. 129pp.
- TROYER, W. A., AND R. J. HENSEL. 1964. Structure and distribution of a Kodiak bear population. *J. Wildl. Manage.* 28:769–772.