

HARVEST CHARACTERISTICS OF BROWN BEARS IN NORTHERN HOKKAIDO, JAPAN

TOSHIKI AOI, Teshio Experimental Forest, Hokkaido University, Horonobe, Teshio, Japan 098-29

Abstract: A population study of the Ezo brown bear (*Ursus arctos yesoensis*) was initiated in 1975 in northern Hokkaido. One hundred fifty-two brown bear skulls collected from 1980 to 1985 were used to determine age. Most of these bears were killed in nuisance control hunts conducted during the early spring. The youngest age classes of bears (0-5 years old) constituted 67.7% of the harvest, probably a result of high hunting pressure. Subadults (2-5 years old) comprised 41.4% of the sample, with a preponderance of young males. The youngest females with cubs were 5 years old, and the female reproductive rate was 0.67 cubs/adult female/year. The brown bear population in northern Hokkaido is declining.

Int. Conf. Bear Res. and Manage. 7:93-95

The Ezo brown bear is Japan's largest land mammal. It has been consistently harvested during the past century as a nuisance considered harmful to the development of Hokkaido. Hunting is often encouraged by local governments, many of which offer a bounty. However, the population status of this bear has scarcely been investigated (Aoi 1985b). Therefore, my primary objective was to gather information to assess the brown bear population status in northern Hokkaido. Here I discuss my recent findings pertaining to the northern Hokkaido bear population.

I am especially grateful to Dr. S. Takikawa and the staff of Teshio Experimental Forest, particularly H. Mamiya, T. Kamiura, and K. Hasaka. I am also indebted to Dr. H. Abe, Hokkaido Univ., who carefully reviewed the manuscript. This study was supported by many hunters throughout northern Hokkaido, the Hokkaido government, the Brown Bear Research Group of Hokkaido Univ. and, above all, by T. Mano, T. Tsubota, and T. Iimura. I am especially thankful to all of them.

STUDY AREA

This study was conducted in the northern region (Rumoi and Soya subprefectures) of Hokkaido from 1975 to 1983. The study area was later enlarged to include the central northern region (Kamikawa and Abashiri subprefectures); the subsequent total area was 16,000 km². The area consists of farmland (30%) and forest (70%). The latter is mainly a mixed forest of fir (*Abies sachalinensis*), spruce (*Picea jezoensis*), mongolian oak (*Quercus mongolica* var. *grosseserrata*), linden (*Tilia japonica*), birch (*Betula* spp.), and maple (*Acer mono*). The forest floor is usually covered with sasa bamboo (*Sasa* spp.) that is 2-3 m tall. Elevations range from sea level to 500 m in the northern part, and to 1,600 m in the central northern area.

Temperature varies from 35 to -40 C, and averages 6 C. Average annual precipitation is 1,200 mm,

and snow depths vary from 1 to 3 m. Winter extends from November to mid-May.

METHODS

Skulls, reproductive tracts, and pertinent information were collected from 152 brown bears killed in northern Hokkaido since 1980. Most of the bears were killed in nuisance control hunts rather than by sport hunters.

Upper canines were extracted, decalcified, and sectioned to determine age (Marks and Erickson 1966, Yoneda 1976). Reproductive rate was calculated as in Furnell and Schweinsburg (1984).

RESULTS

Annual Harvest

Figure 1 shows the total annual harvest (averaged for 5-year periods) and the number of bears killed under the nuisance control system on all of Hokkaido. The annual kill peaked at more than 500 bears in the late 1960s and then decreased to about 300 in recent years, despite increasing hunting pressure. Annual harvest varied by locality on Hokkaido but has generally declined. Harvest over the past 10 years in the southern region has declined 13%, but it has declined 55% in the northern region (Table 1).

Unlimited nuisance control hunting before snow melt is responsible for virtually all of the harvest in northern Hokkaido, with 76% of the harvest occurring in April and 14% in May. Females with young are not protected in control hunts, and they comprised 37% of the total harvest in northern Hokkaido.

Sex and Age Composition

The overall sex ratio of all harvested bears (Table 2) did not differ from 50:50 in either region; however, more subadult males than subadult females were killed, especially in the northern region.

Bears < 5 years old comprised 70% of the harvest; in the northern region young bears comprised 78%. Subadult bears (2–5 years old) have comprised an increasingly large proportion of the harvest in northern Hokkaido since 1981 (Table 3). The oldest bear killed was a 34-year-old female (Aoi 1985a).

Reproductive Parameters

Of the subadult and adult female bears I studied ($N = 45$), 73% had cubs or yearlings. No bears younger than 5 years old had successfully reproduced. Four of 6 5-year-old females had cubs. The oldest female with cubs was 26 years old (Aoi 1985a).

The average litter size was 1.85 cubs ($N = 13$) and 1.63 yearlings ($N = 8$). Reproductive rate for females at least 5 years old was 0.67 cubs/female/year.

DISCUSSION

Because of the dense forest understory in northern Hokkaido, it is difficult to hunt bears during the traditional 1 October–31 January hunting season. Consequently, most harvest occurs during nuisance control hunts in early spring before the snow melts. Gradually nuisance control hunting has increased in

popularity and presently is as popular as sport hunting.

Bear habitat has certainly become more restricted in northern Hokkaido. Between 2,000 and 3,000 ha of natural forest are clear-cut each year. This has reduced the natural forest by about 16% in the last 20 years. Concurrently, the forest road network in bear habitat has doubled, greatly improving access for hunting.

Nevertheless, despite increasing hunting pressure, harvest over the past 10 years has declined. Other than the destruction of beehives, damage by nuisance bears has declined significantly in recent years (Hokkaido Government 1984).

McIlroy (1972) reported that the average age of black bears (*U. americanus*) in a harvested population tended to become younger under excessive harvest. The increasing number of subadult bears, especially males, killed in this study area may reflect a similar trend. Beecham (1980) reported that subadult male black bears dispersed more extensively than females, and this undoubtedly increased their vulnerability to hunting. Such dispersion of young male bears may also be an important factor in my study area, especially in the north, where hunting pressure is high.

In addition, I believe that the population in the northern region was partly maintained by dispersion of subadult males from the central mountainous region of Hokkaido. If true, the population in this region would be reduced quickly if those bears were unable to disperse because of discontinuous habitat. Furthermore, heavy hunting pressure on family groups may seriously affect the population. Females with

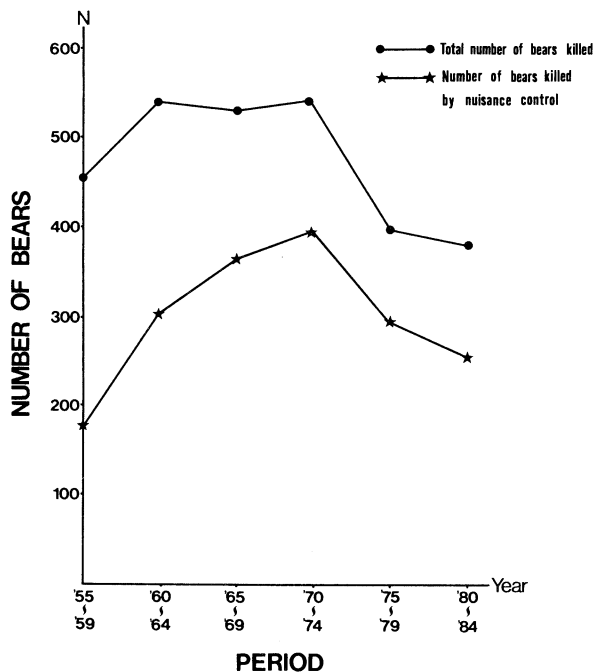


Fig. 1. Total number of brown bears killed since 1955 and the number of nuisance control kills in Hokkaido. Points represent 5-year averages.

Table 1. Brown bears killed in Hokkaido, 1976–85.

Year	Northern region	Southern region
1976	31	50
1977	47	143
1978	20	118
1979	31	104
1980	32	84
5-year average	32.2	99.8
1981	18	99
1982	17	77
1983	13	95
1984	8	97
1985	17	67
5-year average	14.6	87.0
No. of animals killed/km ² 1980–85	1/507	1/80

Table 2. Sex and age composition of brown bears killed in northern Hokkaido, 1980-85.

Region	Cub and yearling	Subadult (2-5 years)	Adult (> 5 years)	Total
Northern				
Male	8	23	9	40
Female	9	12	13	34
Total	17	35	22	74
Central				
Male	9	16	15	40
Female	14	12	12	38
Total	23	28	27	78
Entire N. Hokkaido				
Male	17	39	24	80
Female	23	24	25	72
Total	40	63	49	152

young should be protected to maintain viable and vigorous bear populations (Stirling et al. 1976).

My data on the age at 1st reproduction are similar to those for grizzly bears (*U. arctos*) in Yellowstone National Park (Craighead et al. 1976). I found that 4 of 6 5-year-old females had produced cubs. Craighead et al. (1976) reported nearly 70% of 5-year-old females observed from 1959 to 1970 had cubs; however, Knight and Eberhardt (1985) stated that only 2 of 14 5-year-old females observed between 1974 and 1982 in the same area had cubs. They speculated that earlier maturation in 1959-70 was associated with rapid growth made possible by the concentrated and consistent food supply in garbage dumps.

Rogers (1976) reported that reproductive parameters in black bears were strongly related to nutrition and thus body weight. Unfortunately, I have no data on the nutritional status of the northern Hokkaido bear population or the habitat quality, which will be the subjects of future research. I could not calculate the mortality rate because a reliable population estimate was not available. It is apparent that the Hokkaido bear population is influenced by many interrelated factors. Until these relationships are clearly defined, it seems a conservative management approach is appropriate.

Table 3. Annual harvest of brown bears by age class in northern Hokkaido, 1980-85.

Year	Cub and yearling	Subadult (2-5 years)	Adult (> 5 years)	Total
1980	4	5	12	21
1981	5	3	7	15
1982	6	9	7	22
1983	3	10	3	16
1984	13	23	11	47
1985	9	13	4	31
Total	40	63	49	152

LITERATURE CITED

- AOI, T. 1985a. Two twenty-six-year-old, with pups, and a thirty-four-year-old wild female Ezo brown bear, *Ursus arctos yesoensis*, from Hokkaido. J. Mammal. Soc. Japan 10:165-167. (In Japanese.)
- _____. 1985b. Actual situation of harvest and status of population of Ezo brown bear, *Ursus arctos yesoensis* L. in Hokkaido. Mammalian Science, Japan. 50:17-26. (In Japanese.)
- BEECHAM, J. J. 1980. Population characteristics, denning, and growth patterns of black bears in Idaho. Ph.D. Thesis, Univ. Mont., Missoula. 101pp.
- CRAIGHEAD, J. J., F. C. CRAIGHEAD, JR., AND J. SUMNER. 1976. Reproductive cycles and rates in the grizzly bear, *Ursus arctos horribilis*, of the Yellowstone ecosystem. Int. Conf. Bear Res. and Manage. 3:337-356.
- FURNELL, J. D., AND R. E. SCHWEINSBURG. 1984. Population dynamics of central Canadian arctic island polar bears. J. Wildl. Manage. 43:722-728.
- HOKKAIDO GOVERNMENT. 1984. Data on hunting statistics. Sapporo, Japan. (In Japanese.)
- KNIGHT, R. R., AND L. L. EBERHARDT. 1985. Population dynamics of Yellowstone grizzly bears. Ecology 66:389-410.
- MARKS, S. A., AND A. ERICKSON. 1966. Age determination in black bear. J. Wildl. Manage. 30:389-410.
- MCILROY, L. L. 1972. Effects of hunting on black bears in Prince William Sound. J. Wildl. Manage. 36:828-837.
- ROGERS, L. L. 1976. Effects of mast and berry crop failures on survival, growth, and reproductive success of black bears. Trans. North Am. Wildl. and Nat. Resour. Conf. 41:431-438.
- STIRLING, I., A. M. PEARSON, AND F. L. BUNNELL. 1976. Population ecology studies of polar and grizzly bears in northern Canada. Trans. North Am. Wildl. and Nat. Res. Conf. 41:421-430.
- YONEDA, M. 1976. Age determination and age structure of the Ezo brown bear. J. Mammal. Soc. Japan 7:1-8. (In Japanese, with English abstract.)