

HARVEST HISTORY OF BROWN BEARS IN THE OSHIMA PENINSULA, HOKKAIDO, JAPAN

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Abstract: I investigated the history of the brown bear (*Ursus arctos yesoensis*) harvest in the Oshima Peninsula, Hokkaido, by analyzing hunting statistics and interviewing hunters. The mean annual harvest between 1909–38 and 1963–93 was 38.8 bears (SD = 21.3) and 76.0 (SD = 29.8) bears, respectively. During 1966–87, when spring prophylactic hunting was allowed, 58% of the harvest ($n = 1,849$) was taken during March–May and 32% during September–November. After the spring prophylactic harvest was abolished in 1990, harvests during March–May declined to 21% ($n = 287$) while September–November harvests increased to 61% of the total. Furthermore, proportions of males and adults in the harvest increased and proportion of females with young bears and cubs declined. Between 1983 and 1987, the spring harvests occurred mainly in the principal bear habitat in the interior of the peninsula, whereas summer and autumn harvests occurred in farmlands or residential areas along the coast or in valleys. Total harvest did not always decline after spring harvest was stopped because of increased autumn harvests resulting primarily from control actions. Further measures should be taken to decrease total harvest of brown bears in this region.

Ursus 10:173–180

Key words: brown bear, Hokkaido, hunting effects, hunting statistics, Japan, *Ursus arctos*.

Brown bears in Hokkaido were harvested for several thousand years as an important game mammal for indigenous people. When modern development of Hokkaido by the Japanese Government began in the late 19th century, brown bears were intensively harvested as a result of conflicts with pioneers. The Hokkaido government has recorded bear harvest statistics from the late 19th century through the present, but several periods lack data. Kaji (1982) reviewed brown bear hunting history and characteristics of bears harvested throughout Hokkaido before 1970. He noted a dramatic shift in the seasonal composition of the harvest after the introduction of the spring prophylactic hunt in 1966 and warned of a rapid population decline as more females with young began to be harvested during spring. During the 1980s, significant population sinks were apparent in northern Hokkaido (Aoi 1990) and the west coast mountain ranges of Teshio-Mashike and Shakotan-Eniwa districts (Hokkaido Gov. 1986), where heavy snows increased the effectiveness of the spring hunt. Over time, the brown bear harvest declined significantly in these areas (Hokkaido Gov. 1986). In the Oshima Peninsula area, however, even though harvest occurred in both spring and autumn, such a drastic decline in harvest was not evident.

Monitoring population trends for species with a low rate of increase like brown bears requires long-term observation of the population (Knight and Eberhardt 1985, Eberhardt and Blanchard 1986). Monitoring of harvest and other mortalities is critical to the management of brown bear populations (Frikovic et al. 1987, Brannon et al. 1988, McLellan and Shackleton 1988). In this paper, I describe the history and characteristics of hunting of the Oshima Peninsula brown bear population using statistical analysis of historical records and literature and sur-

veys of bear hunters. I characterize this population by comparing the harvest with that of the populations in northern Hokkaido.

I am grateful to bear hunters in the study area who cooperated with my research. The persons in charge of wildlife of the Nature Preservation Division and of the Oshima and Hiyama Subprefectural Offices of the Hokkaido Government provided me with unpublished brown bear harvest information. I thank K. Kaji and T. Aoi for providing me with data and for their helpful suggestions. I also thank H. Kudo for allowing me to use facilities. J.P. Moll assisted in English translation and gave many critical comments. This research was carried out in conjunction with the Wildlife Distribution and Abundance research project funded by the Nature Preservation Division of the Hokkaido government.

STUDY AREA AND BEAR HUNTING SYSTEMS

The Oshima Peninsula is about 7,300 km² and is located in southwestern Hokkaido (Fig. 1). The Kuromatsunai Depression, located at the base of the peninsula, is the northern boundary of the study area. The isolation of the brown bear population in the peninsula from other bear populations in the northeast was first recognized in the 1970s; this isolation is related to intensive agricultural development in the depression (Kaji 1982).

Elevation on the peninsula varies from sea level to 1,520 m, and the area is characterized by steep mountain ranges. The temperate, marine climate has a mean annual temperature of 8 C and average annual precipitation of 120 cm. Snow covers much of the area from mid-December to early-April at lower elevations and to mid-May at the

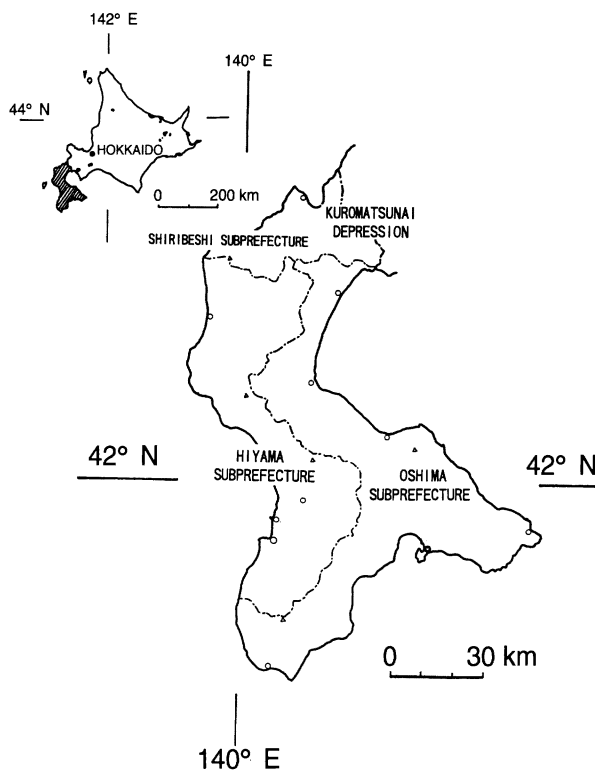


Fig.1. The brown bear study area in the Oshima peninsula, Hokkaido, Japan.

higher elevations. The study area has approximately 80% forest cover, characterized by beech (*Fagus crenata*) and similar to that of northern Honshu island. Farmland occurs on 18% of the study area and is generally located along the coast and plains.

Regulations for brown bear hunting have changed several times during 1963–92 (Tables 1, 2). The brown bear sport hunting season extends from 1 October to 31 January each year (Table 2). Guns, baited box traps, and foot snares were permitted in the sports hunting season until

Table 1. Changes in brown bear hunting regulations of Hokkaido, Japan, 1963–92.

| Year | Event on brown bear hunting system |
|------|---|
| 1963 | Hokkaido Government established bounty for brown bear control |
| 1966 | Beginning of the Spring Prophylactic Harvest (15 Mar–31 May) |
| 1977 | Repeal of the Hokkaido Government's bounty |
| 1985 | Prohibition of box trap use for sport hunting |
| 1988 | Shortening of the spring harvest season (1–30 Apr) |
| 1990 | Abolishment of the spring harvest |
| 1992 | Prohibition of foot snares for sport hunting |

1985 (traps) and 1992 (snares; Tables 1, 2). The prohibition of box traps throughout Japan may have been the result of a marked decrease in Asiatic black bear (*Ursus thibetanus japonicus*) numbers due to the indiscriminate harvest with baited box traps in Shizuoka Prefecture (Torii 1985) as well as a response to rising public opinion favoring animal protection. There are no legal restrictions on the number, sex, or age of bears that may be hunted. Sports hunting licenses are issued annually by the Hokkaido Government and are valid for all game animals during 1 hunting season.

Nuisance bears may be killed throughout the year (Table 2). As a result of repeated bear-related conflicts during the 1950s and early 1960s, the Hokkaido Government introduced a bounty of 5,000 yen for brown bears in 1963 (Table 1). To further reduce bear numbers, a spring prophylactic hunt allowing easier harvest of denning and emerging bears was opened in 1966 (Hokkaido Gov. 1969). As part of the damage control program, this “prophylactic” season occurred from 15 March to 31 May each year from 1966 through 1987 (Table 2). The spring harvest season was shortened to include only the month of April in 1988 and 1989 (Table 2) and abolished in 1990 (Table 1). Although the Hokkaido Government ended the bounty system for brown bears in 1977, most town offices in the study area still offer bounties (Inukai et al. 1985). Baited box traps and foot snares are allowed for control harvest (Table 2). Nuisance bears may be killed within wildlife protection areas and within the nature parks.

DATA COLLECTION

Information on brown bear harvests for 1884–86 and 1908–38 was obtained from the *Book of Hokkaido Statistics* (Hokkaido Gov. 1886–88, 1910–40). Data was recorded under “Control Killing,” “Fur” and “Bear Related Damage And Its Harvest” headings for the periods 1884–86, 1908–13, and 1914–38, respectively. For 1963–65, bear harvest numbers were obtained from Kaji (1978). For 1966–76, harvest information was obtained from an unpublished Hokkaido Government document that recorded the “success” of the brown bear harvest program. For 1977–82, I obtained information from harvest records of the Nature Preservation Section of the Oshima and Hiyama Subprefecture Offices of the Hokkaido Government. Between 1983 and 1987, I investigated bear harvests firsthand and interviewed hunters in the region (Mano 1995). For this period, brown bear harvest records of the Nature Preservation division of the Hokkaido Government and Nature Preservation Section of Oshima and Hiyama Subprefecture Offices were used to confirm my data on

Table 2. Regulations of the brown bear harvest in Hokkaido, Japan, from 1918 to present.

| Harvest classification | Permitted season | Harvest methods | Effective period |
|-----------------------------|------------------|----------------------------------|------------------|
| Sport hunting | 1 Dec–31 Jan | firearms, foot snares, boxtraps | 1918–84 |
| Sport hunting | 1 Dec–31 Jan | firearms, foot snares | 1985–91 |
| Sport hunting | 1 Dec–31 Jan | firearms | 1992–present |
| Spring prophylactic harvest | 15 Mar–31 May | firearms | 1966–87 |
| Spring prophylactic harvest | 1 Apr–30 Apr | firearms | 1988–89 |
| Nuisance control harvest | Year round | firearms, foot snares, box traps | 1918–present |

numbers and locations of kills. During 1988–93, I obtained bear harvest records from hunters directly or via Subprefecture offices. From 1983, I confirmed hunting methods as often as possible. The number of hunting licenses issued by Subprefecture between 1943 and 1993 was obtained from the annual Hokkaido Forestry Statistics (Hokkaido Gov. 1950–95 unpubl. data).

The Preservation Division of the Hokkaido Government asked hunters to report the sex, reproductive status, hunter-estimated age and body weight, and relevant information for bears killed. Thus, I obtained the sex and age structure of harvested bears from 1988 to 1989 during which the spring prophylactic harvest term was shortened, and from 1990 to 1993, during which there was no spring harvest. I compared these harvest structures with those in 1972–75 and in 1981–84 (Mano 1987; Table 3), during which there had been a spring harvest.

RESULTS

Number of Licenses

The number of hunting licenses issued for hunting with a gun in the study area increased from <500 during the 1950s to 1,777 in 1978 and then declined consistently to

652 in 1993. Relatively few trapping licenses were issued until the 1980s (Fig. 2).

Harvest Numbers

I could not obtain bear harvest records for all of Hokkaido before 1884 or for the periods 1887–1907 and 1939–62. Only records of total annual harvest were available before 1965. Since 1966, monthly totals have been recorded, and since 1983, the location of each kill has been recorded. The average annual harvest in the Oshima and Hiyama subprefectures during 1963–94 (76.0, SD = 29.8) was 1.96 times that of the period 1909–38 (38.8, SD = 21.3; Fig. 3).

Since 1966 when the spring harvest began, the harvest levels fluctuated annually (Fig. 4a). Viewed in 3-year moving averages, the spring harvest increased slightly until the late 1970s, then declined (Fig. 4b). The harvest during other seasons increased before 1970s, then declined and stabilized until the beginning of 1980s before increasing again in the late 1980s (Fig. 4b).

Seasonal proportion of annual harvests also changed by period. After 1966, two peaks of harvests were apparent in every year. During 1966–87, in which the spring harvest system was fully enforced, 58% ($n = 1,849$) of the total harvest was achieved in spring, and 32% was in

Table 3. Sex ratios, ages, and percents of females with cubs for brown bear harvest between 1972–75, 1981–84, 1988–89, and 1990–93 in Oshima Peninsula, Hokkaido, Japan.

| | 1972–75 | | | | | 1981–84 | | | | | 1988–89 | | | | | 1990–93 | | | | |
|----------------|---------|-----|------|-----|----|---------|-----|------|-----|----|---------|----|------|----|----|---------|----|------|-----|----|
| | Total | | | | | Total | | | | | Total | | | | | Total | | | | |
| | M | F | Unk. | n | % | M | F | Unk. | n | % | M | F | Unk. | n | % | M | F | Unk. | n | % |
| Cubs | 45 | 35 | 2 | 82 | 22 | 48 | 32 | 0 | 80 | 22 | 8 | 6 | 0 | 14 | 15 | 18 | 3 | 4 | 25 | 9 |
| Subadults | 45 | 44 | 0 | 89 | 24 | 42 | 35 | 0 | 77 | 21 | 9 | 10 | 0 | 19 | 20 | 31 | 14 | 0 | 45 | 17 |
| Adults | 108 | 88 | 0 | 196 | 53 | 108 | 95 | 0 | 203 | 56 | 37 | 24 | 0 | 61 | 65 | 139 | 62 | 1 | 202 | 74 |
| Females w/cubs | | 33 | | 33 | 9 | | 33 | | 33 | 9 | | 4 | | 4 | 4 | | 16 | | 16 | 6 |
| Unknown | 2 | 3 | 0 | 5 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 200 | 170 | 2 | 372 | | 198 | 162 | 1 | 361 | | 54 | 40 | 0 | 94 | | 188 | 79 | 5 | 272 | |
| Sex Ratio | 54:46 | | | | | 55:45 | | | | | 57:43 | | | | | 70:30 | | | | |

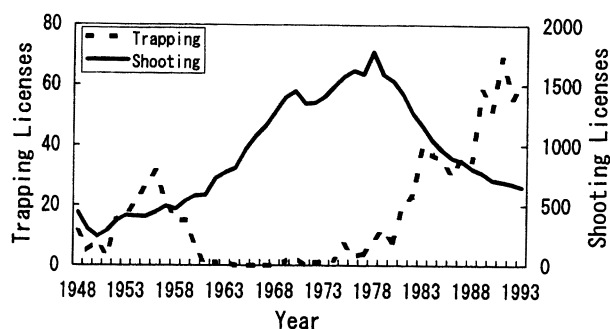


Fig. 2. Number of hunting licenses and trapping permits (valid for all game) issued in the Oshima and Hiyama Subprefectures, Japan, during 1948–93.

autumn (Fig. 5). After the spring harvest system was abolished in 1990, the harvest peak moved from spring to autumn, with spring harvest declining to 21% ($n = 287$) and autumn harvests increasing to 60% of the total (Fig. 5).

Location of Harvests

During 1983–87, there were significant differences in the distribution of harvest locations between spring and other seasons. Brown bear harvests tended to occur in the interior of the peninsula during spring and along the coast or plain in other seasons (Fig. 6). Although the location of harvests by foot snare was limited to a small area before 1987, it extended to other areas of the peninsula later (Fig. 7). In recent years, box traps have been used more often in control kill, especially in the western part of the peninsula (Fig. 8).

Harvest Structure

A comparison of sex ratio, ages, and percent of females with cubs among the periods was shown in Table 3. The

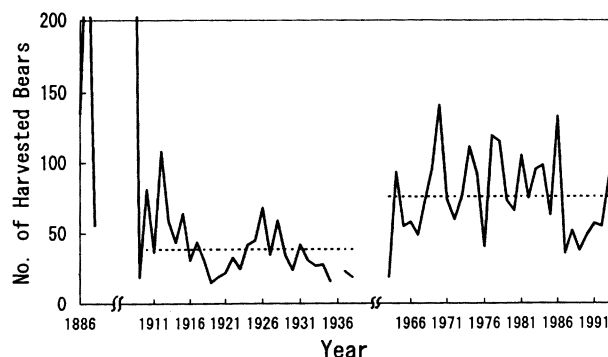


Fig. 3. Brown bear harvest in the Oshima and Hiyama Subprefectures, Hokkaido, Japan, during 1886–1993.

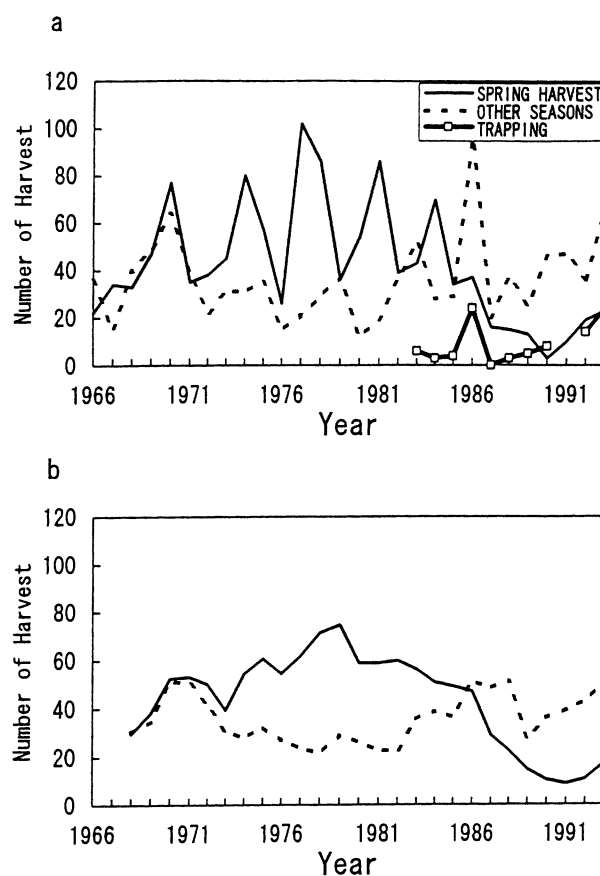


Fig. 4. Seasonal brown bear harvest (a) and its 3-year moving average (b) in the Oshima and Hiyama Subprefectures, Hokkaido, Japan, during 1966–93.

sex ratio (M:F) was 54:46 ($n = 370$), 55:45 ($n = 360$), 57:43 ($n = 94$), and 70:30 ($n = 267$) for the periods of 1972–75, 1981–84, 1988–89, and 1990–93, respectively (Table 3). Although there were no differences in sex ratio between 1981–84 and 1988–89 ($G = 0.180$, 1 df, $P = 0.67$), significant differences were found between 1981–84 and 1990–93 ($G = 15.55$, 1 df, $P = 0.0001$) and between 1988–89 and 1990–93 ($G = 5.12$, 1 df, $P = 0.02$) respectively.

There were no differences in age structure (cubs, subadults, adults) between the periods 1981–84 and 1988–89 ($G = 3.02$, 2 df, $P = 0.22$), and between 1988–89 and 1990–93 ($G = 3.33$, 2 df, $P = 0.19$). However, there was a significant difference between 1981–84 and 1990–93 ($G = 26.37$, 2 df, $P < 0.0001$). Proportion of mother bears and cubs declined from 22% in 1972–75 to 15% in 1990–93, but proportion of adults increased from 53% in 1972–75 to 74% in 1990–93 (Table 3).

The subadult to adult ratio increased from 1:2.20 during 1972–75 to 1:4.49, during 1990–93. This trend occurred in both sexes (Table 3).

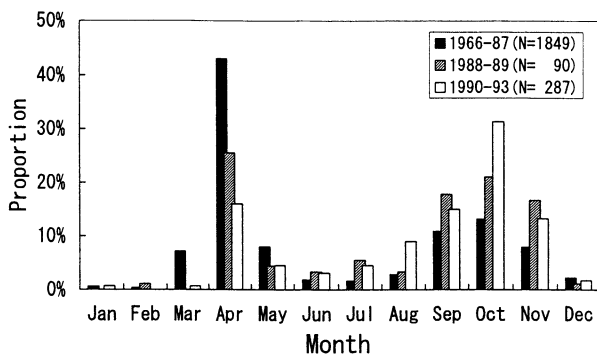


Fig. 5. Monthly brown bear harvest in the Oshima and Hiyama Subprefectures, Hokkaido, Japan, during 1966–93.

DISCUSSION

The difference in harvest locations between spring and other seasons reflects differences in seasonal hunting situations. Spring harvest resulted from sport hunting; almost all summer and autumn harvests were control actions against nuisance bears. From summer to autumn, bears

often move to farmland or residential areas and damage crops and livestock or search for garbage. These bears are often killed near cultivated land or residential areas. Late-season snow conditions among years may have influenced spring harvest success, while changes in autumn food supplies, especially acorns and berries, may influence bear movements in autumn. Both factors would contribute to fluctuations of harvest with time.

According to a retired bear hunter who shot >50 bears from 1966 to 1986, the major part of the harvest was during autumn, and illegal hunting methods such as mouth blast, automatic shooting devices, or poisoning were tacitly permitted before 1966. Generally, it was believed that the pursuit of bears was useless and successful hunting could occur while just waiting at home. However, new hunters to the spring harvest eventually learned to shoot brown bears while snow remained in the mountains. Many hunters in the study area told me that they could not take bears easily in the early years of spring harvest. Some learned hunting skills from old hunters of Ainu descent who had continued traditional spring har-

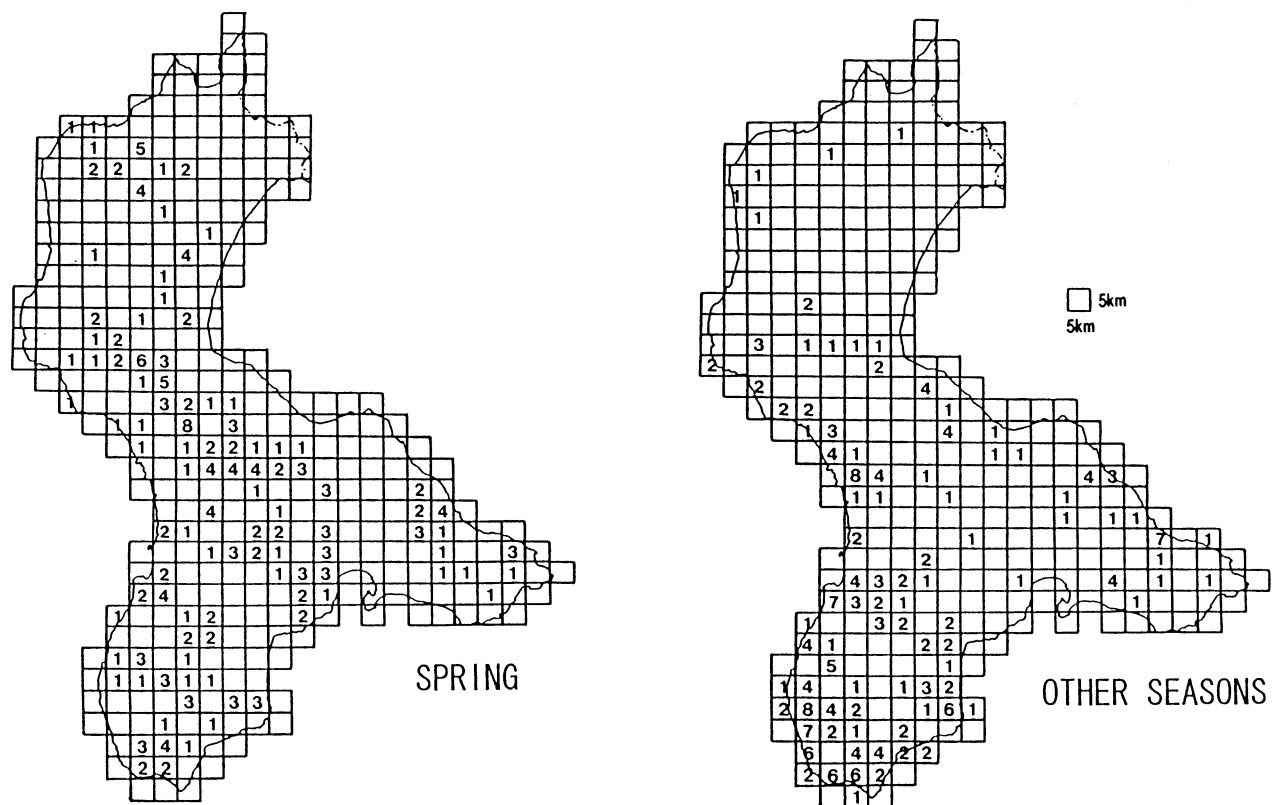


Fig. 6. Location of brown bear kills in the Oshima Peninsula, Japan, 1983–87. Spring refers to Jan–May and other seasons to Jun–Dec.

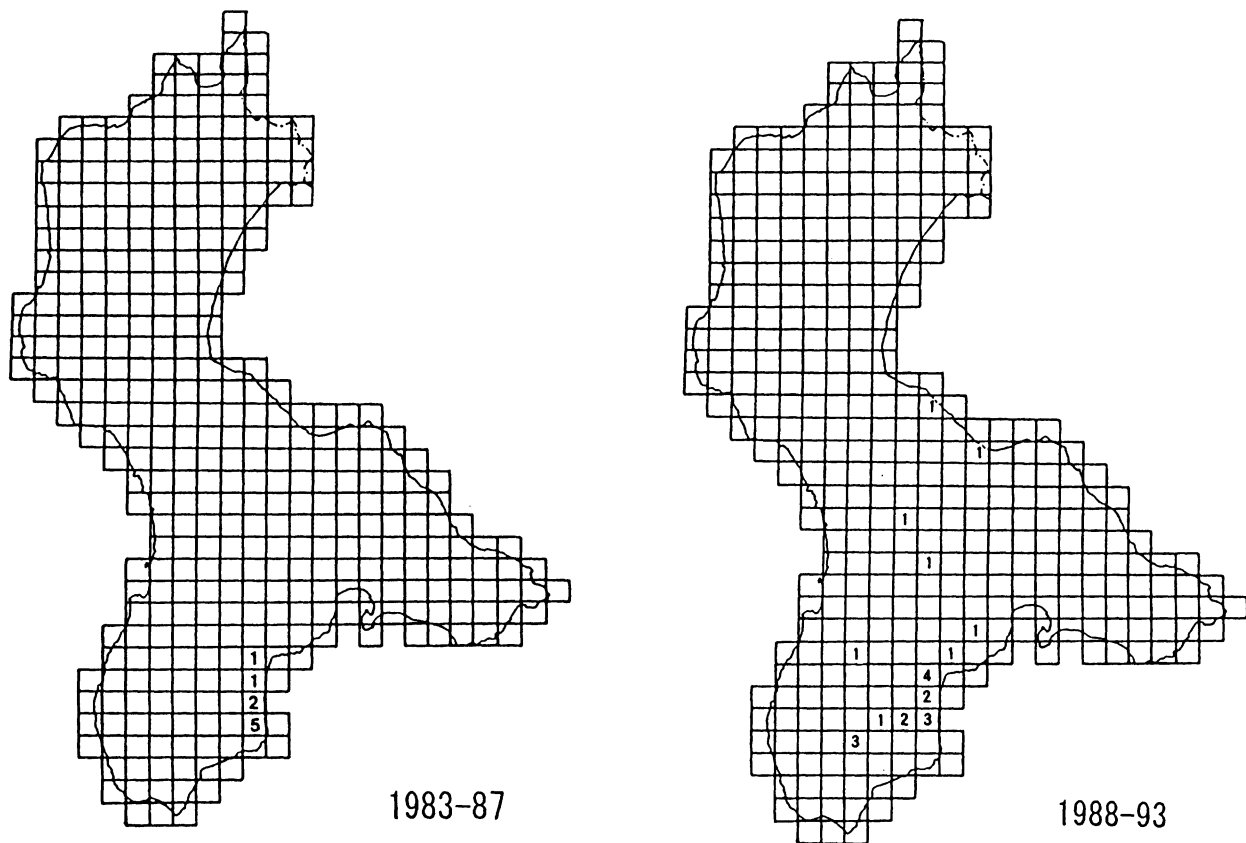


Fig. 7. Location of brown bear kills with foot snares in the Oshima Peninsula, Japan, 1983-93.

vests that had been the source of the cubs-of-the-year used in the Iyomante ceremony. Successful hunting required a good working knowledge of the mountainous terrain. The moderate increase in spring harvest numbers between 1966 and the late 1970s could reflect both recruitment of new hunters (Fig. 2) and a general increase in the level of hunting skill and familiarity with the terrain. Improvement in firearms and other hunting equipment, as well as the increased use of motor vehicles, also could have contributed to greater hunting success.

The decline and comparatively lower level of spring harvests after 1987 reflect the restriction and abolition of the spring harvest. The increasing brown bear harvest during other seasons was a direct result of the increased number of trapping licenses issued for damage control (Fig. 2). Officers of the Oshima and Hiyama subprefectures report the recent increase in trapping license applications reflects increasing demand for red fox (*Vulpes vulpes*) and brown bear damage control (T. Togashi, Esashi, Hokkaido, Japan, pers. commun., 1995; K. Sasaki, Hakodate, Hokkaido, Japan, pers. commun., 1995.)

Proportions of male and of adult segment in the harvest increased after abolishing the spring prophylactic harvest. During the summer and autumn of 1983-87, males represented a larger portion of the brown bear trap harvest than of firearm harvest (Mano 1995). Increased trap harvest during summer and autumn and abolishing spring harvest could lead to an increased male portion of the total harvest.

Although no records of hunting effort are available, the decline in shooting license applications after 1978 may not have produced an equivalent decline in hunting effort during spring because there was a great deal of variation in hunting ability. Group hunting was common during the spring harvest (Mano 1987). In interviews conducted from 1983 to 1987, many bear hunters who had participated in spring harvests from 1966 estimated group numbers and hunting days/season in each district. They also pointed out a declining trend of bear observations and field signs on the snow. The declining trend of spring harvest numbers appeared by 1979 (Fig. 4b), before the spring harvest was restricted. If hunters' observations were accurate, the decline of

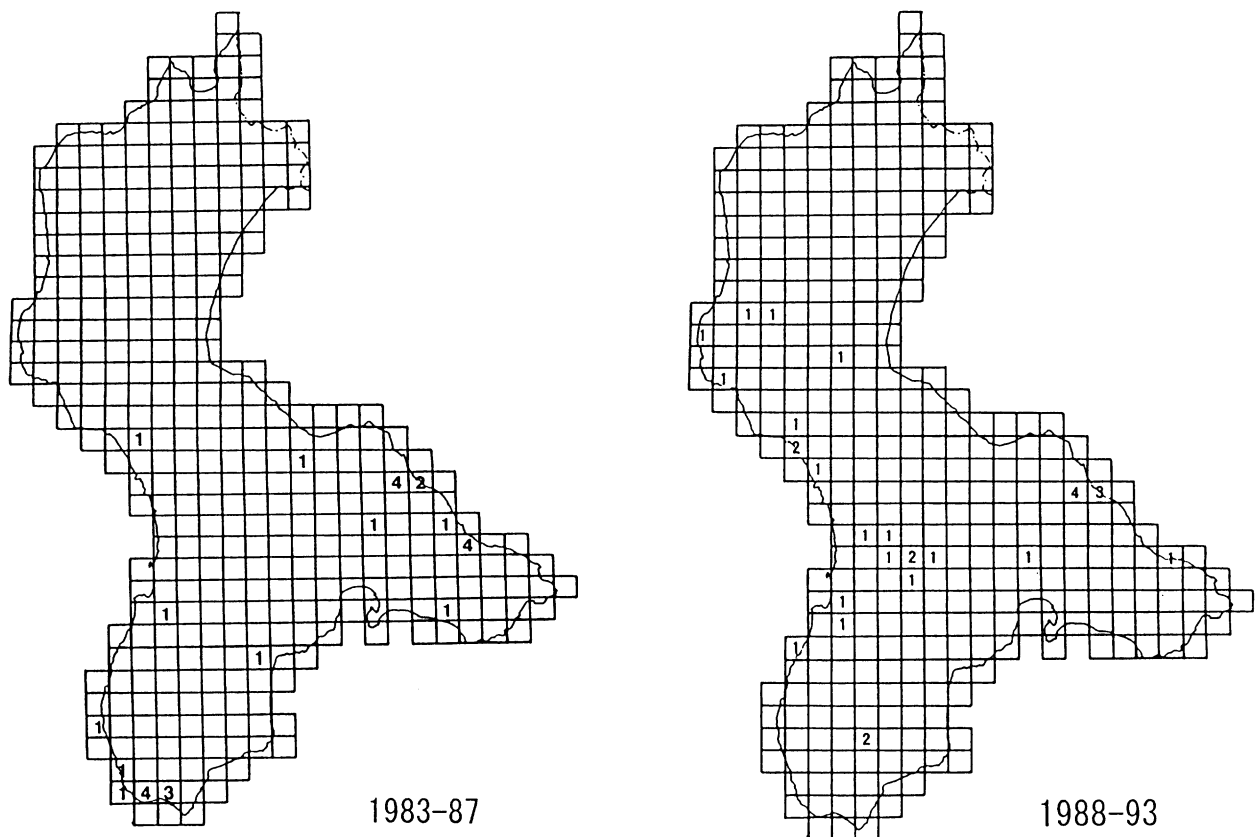


Fig. 8. Location of brown bear kills with box traps in the Oshima Peninsula, Japan, 1983–93.

spring harvest may reflect a decline in the bear population.

The recent increase of harvests during summer and autumn might be a result of increased observations of bears by people. In the Oshima and Hiyama subprefectures, the doubling of forest road density between 1963 and 1983 (Hokkaido Gov. 1965, 1985) provided easier access to bear habitat. This influx of people into bear habitat would have increased encounters with bears and may have facilitated habituation (Herrero 1985). Recent research (Hokkaido Gov. 1992) has shown that many bears in the study area were attracted to garbage and were consequently killed. Changes in bear behavior after habituation to humans appears to have been an important source of conflict.

From 1966 through 1993, 20.1% of Hokkaido's total brown bear harvest occurred in the Oshima and Hiyama area, which constitutes only 7.8% of Hokkaido's total area. Nevertheless, the Oshima-Hiyama population persists in high numbers. In contrast, although fewer bears/area were taken in northern Hokkaido, the effects of the spring hunt on the decline of the bear population there were apparent

(Aoi 1990). In this area, the average harvest density of 0.47 bears/100 km² during 1967–71 declined continuously to 0.05 bears/100 km² in 1982–86 (Aoi 1990). In the Oshima Peninsula, the harvest density during 1966–93 was 1.31 bears/100 km², or nearly 2.8 times that of the highest recorded density in northern Hokkaido. This demonstrates the significant differences in the hunting effectiveness and population characteristics between the Oshima Peninsula and other areas.

The gentle hills of northern Hokkaido allowed skis and snowmobiles to be used in the pursuit of bears when snow is present. The steep mountains and deeply cut valleys of the Oshima Peninsula make it difficult to use such equipment and therefore limit hunters' mobility. This difficulty of hunting in the Oshima Peninsula terrain could be an important reason for the persistence of its bear populations. This persistence might also be related to the higher population density in the Oshima Peninsula than in the northern areas. While there appears to be no significant difference in reproductive potentials of these 2 populations (Mano unpublished), the relatively small home range sizes of brown bears in the Oshima area (Mano 1994,

Hokkaido Institute of Environmental Sciences 1994) may reflect the richness of the habitat where beech forests remain. This is in contrast to the spruce (*Picea* spp.) and fir (*Abies sachalinensis*) dominated forests of the northern region. Further research on the effects of habitat quality on brown bear densities and another demographic parameters are needed to support these hypotheses.

MANAGEMENT IMPLICATIONS

My greatest concern both in this study and in the management of brown bears in the Oshima Peninsula is protection of the remaining viable population. The brown bear population in the Oshima Peninsula has been hunted for centuries but persists today. Although total harvest numbers did not seem to decline (Fig. 3), careful control of harvest will be required to maintain population levels. Although the decline of the proportion of females with young bears and cubs in the harvest could reduce the impact to the population trend, recent radio tracking evidence suggests that hunting mortality has been excessive (Mano 1993). Although the spring prophylactic harvest was abolished to decrease harvest pressure, total harvest did not decline because of the increase in the number of bears taken in autumn (Fig. 5) when control kills dominated. Further measures should be taken to decrease the total harvest.

LITERATURE CITED

- AOI, T. 1990. The effects of hunting and forest environmental change upon the population trend for brown bears (*Ursus arctos yezoensis* Lydekker) in northern Hokkaido. Hokkaido Coll. Exp. For. Res. Bull. 42:249–298. (In Japanese with English summary).
- BRANNON, R.D., R.C. MACE, AND A.R. DOOD. 1988. Grizzly bear mortality in the Northern Continental Divide Ecosystem, Montana. Wildl. Soc. Bull. 16:262–69.
- EBERHARDT, L.L., AND B. M. BLANCHARD. 1986. Monitoring grizzly bear population trends. J. Wildl. Manage. 50:613–618.
- FRIKOVIC, A., R.L. RUFF, L. CINJAK, AND D. HUBER. 1987. Brown bear mortality during 1946–85 in Gorski Kotar, Yugoslavia. Int. Conf. Bear Res. and Manage. 7:87–92.
- HERRERO, S. 1985. Bear attacks—their causes and avoidance. Lyons and Burford, New York, N.Y. 287pp.
- HOKKAIDO GOVERNMENT. 1965. Annual forestry statistics of Hokkaido. Hokkaido Gov., Sapporo, Japan.
- . 1969. Hunting policy of Hokkaido. Hokkaido Gov., Sapporo, Japan. 123pp. (In Japanese.)
- . 1985. Annual forestry statistics of Hokkaido. Hokkaido Gov., Sapporo, Japan. (In Japanese.)
- . 1986. Results of a survey related to sika deer and brown bear sightings in Hokkaido. Hokkaido Nat. Preserv. Div., Sapporo, Japan. 115pp. (In Japanese.)
- . 1992. Report of a biological survey on sika deer and brown bear in Hokkaido. Hokkaido Nat. Preserv. Div., Sapporo. 50pp. (In Japanese.)
- HOKKAIDO INSTITUTE OF ENVIRONMENTAL SCIENCES. 1994. Results of a survey related to sika deer and brown bear sightings in Hokkaido. Hokkaido Inst. Environ. Sci., Sapporo, Japan. 63pp. (In Japanese.)
- . 1995. Results of a survey of brown bear and sika deer ecology and management (I). Hokkaido Institute of Environmental Sciences, Sapporo. 164+30pp. (In Japanese.)
- INUKAI, T., M. KADOSAKI, T. TOMIKAWA, T. MIKAMI, J. IZUKA, T. HATAKEYAMA, AND K. OWARI. 1985. Status of the capture and inhabitation of brown bears in Hokkaido, Japan (II). Annu. Rep. Hist. Mus. Hokkaido 13:55–84. (In Japanese with English summary.)
- KAJI, K. 1978. Distribution and status of Hokkaido brown bears. Graduate Thesis of Hokkaido Univ. 55pp. (In Japanese.)
- . 1982. Distribution of brown bears in Hokkaido. Hoppo-Ringyo 34:16–20. (In Japanese.)
- KNIGHT, R.R., AND L.L. EBERHARDT. 1985. Population dynamics of Yellowstone grizzly bears. Ecology 66:323–334.
- MANO, T. 1987. Population characteristics of brown bears on Oshima Peninsula, Hokkaido. Int. Conf. Bear Res. and Manage. 7:69–73.
- . 1993. Monitoring and management of brown bear populations. Mamm. Sci. 30:2–20. (In Japanese.)
- . 1994. Home range and habitat use of brown bears in the southwestern Oshima Peninsula, Hokkaido. Int. Conf. Bear Res. and Manage. 9(1):319–325.
- . 1995. Sex and age characteristics of harvested brown bears in the Oshima Peninsula, Japan. J. Wildl. Manage. 59:199–204.
- McLELLAN, B.N., AND D.M. SHACKLETON. 1988. A comparison of grizzly bear harvest data from Montana and southeastern British Columbia. Wildl. Soc. Bull. 16:371–375.
- TORII, H. 1985. Black bear hunting and its effect in Shizuoka Prefecture. Pages 100–111 in A report on the fundamental research on forest environmental change and dynamics of large wildlife. Japan Environmental Agency, Tokyo. 310pp. (In Japanese.)