MOVEMENTS AND HOME RANGES OF JAPANESE BLACK BEARS IN NIKKO

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The Japanese black bear (*Selenarctos thibetanus*) has been extirpated from Kyushu Island and populations are very small on Shikoku Island and in the Chugoku and Kinki districts of Honshu Island, Japan. However, bears are still widespread in the montane areas of eastern Honshu, mainly in the Tohoku and Chubu districts (Furubayashi et al. 1979, Environment Agency of Japan 1979). We believe that these bear populations have declined as a result of human encroachment on bear habitat and overhunting, but data are lacking. Before we can make sound ecological decisions regarding black bear management we must collect data pertaining to the species' status and habitat requirements. Therefore, studies of black bear ecology were initiated in 1977.

A major problem with previous studies in Japan is the difficulty of observing bears directly in their natural habitat of dense forests, heavy undergrowth, and complex topography. Radiotelemetry was unsuccessful at Ashiu, Kyoto Prefecture, because of the steep, rugged topography and an inadequate monitoring system. However, Hazumi et al. (1981) successfully used radiotelemetry at Nikko, Tochigi Prefecture, an area with gentler topography.

Since 1977, we have studied black bear ecology in Nikko. This is a progress report describing movements and home ranges of radio-collared bears through 1982.

STUDY AREA

The study area includes about 90 km^2 of the Nikko Mountain region in northwest Tochigi Prefecture, central Honshu. Elevations range from the montane zone below 1600 m to the subalpine zone above 2400 m. Two types of climate divide this area. The climate of Outer Nikko, the eastern half of the area, is dominated by the Pacific Ocean. It receives abundant summer rainfall; snow accumulation is usually less than 30 cm. The Japan Sea dominates the climate of Inner Nikko, the western half of the area. Annual rainfall is 200–250 cm and snow accumulations of more than 1 m are common late November-March.

Most of the montane zone with gentle slopes is dominated by conifer plantations such as larch (*Larix leptolepis*), Japanese cedar (*Chamaecyparis obtusa*), Japanese red pine (*Pinus densiflora*), and logged areas. Steep slopes along rivers are covered by deciduous broad-leaved trees such as Japanese oak (*Quercus mongolica var. grosserrata*), beech (*Fagus crenata, F. japonica*), birch (*Betula ermanii*), and Nikko fir (*Abies homolepis*). The subalpine area is steep and dominated by mixed forests of hemlock (*Tsuga diversifolia*) and birch or fir (*A. veitchii, A. mariesii*) and birch. A bamboo (*Sasa nipponica*) dominates the understory on most gentle slopes from the montane to the subalpine zone. Several other species of herbaceous plants occupy steep slopes along ravines and rivers.

The study area includes the Nikko Wildlife Protection area and Nikko National Park, where bear hunting is prohibited but control kills are allowed. The southern end of the area includes towns and farmland, and other montane terrains.

METHODS

Eight black bears were captured (Table 1) with 7 Tanaka box traps using buckwheat honey as bait. Trapping was conducted spring through fall, 1977–78 and 1980–82. Bears were immobilized with ketamine-hydrochloride and xylazine-hydrochloride. A 50-MHz radiotransmitter was attached to a collar around the neck of each animal. TR-1300 portable receivers (TRIO Co., Ltd.), and 3 5-element and 3 4-element yagi stationary antennas were used for monitoring. Because accurate radiolocations from stationary antennas in complex topography are difficult to obtain, supplemental data were provided by a 3-element yagi antenna mounted on a vehicle and several hand-held dipole antennas.

One hundred fifty-nine locations were obtained from these animals allowing us to evaluate movements and home ranges. Home ranges were determined by connecting the outermost location points for individual animals.

RESULTS

Individual home ranges were determined from radiolocations, sightings, and trap site locations. An

Table 1. Japanese black bears captured and monitored in Nikko, Japan, 1978–82.

Bear	Sex	Age	Period of tracking	No. of locations	Range (ha)
1	M	Ad	11 Jul 1978–14 Aug 1978	25	322
2	F	Ad	16 Jul 1978–18 Jul 1978 10 Aug 1980–19 Aug 1980 19 Jun 1979 (obs.)	22	1,183
3[a]	F	Ad	26 Oct 1980–11 May 1981	24	392
5	M	Ad	27 May 1981–10 Jun 1981 11 Aug 1982–25 Sep 1982	7	—
6	M	Subad	3 Sep 1981–6 Nov 1981 15 Jul 1982–20 Jul 1982 20 Jul 1981 (obs.)	48	2,814
7	F	Ad	15 Jul 1982–present	18	1,288
8	M	Ad	3 Sep 1982–present	17	1,540

[a] Adult female accompanied by 2 cubs.

average of 23 radiolocations were obtained for each bear (range 7–48). Home ranges averaged 1,256 ha and ranged 322–2,814 ha in size. Bear 5 was excluded from the analysis because our relocation data was inadequate. We suspect several bears wandered from the study area for varying periods. Therefore, their home ranges extend beyond the study area though our data do not reflect this.

Radiolocations for individual bears tended to cluster in comparatively small areas within their respective home ranges. We identified 5 such clusters or core areas, averaging 53 ha and ranging 20–115 ha in size (Table 2). Three summer core areas in the home ranges of bears 1 and 2 were located in closed canopy, middle-aged conifer plantations. Two fall core areas were located in oak stands with comparatively rich acorn crops. In fall 1980, a female and her cub remained in a 115 ha core area where acorns were abundant 26 October–3 December. The acorn crop was poor in 1981 and 1982. Bears moved over much larger areas during these years and probably moved from the study area.

We also located 3 den sites. All were located in rocky cliffs in the subalpine conifer forest above 2,000 m. Snow accumulation of more than 1 m throughout the winter is characteristic of such sites. Bears moved to the den sites in late November and early December.

DISCUSSION

Core areas of 20–115 ha were identified as sites used intensively by bears for foraging and cover. Bears probably wandered from 1 core to another. Consequently, home ranges may be composed of several core areas and the connecting corridors.

Fall core areas were probably related to food distribution, primarily acorns. Acorns were found by Yamamoto (1973) and Takada (1979) to be the most important food for Japanese black bears in the fall. They also reported that when acorn crops failed, bears did not use oak stands, but moved out of the study area, presumably seeking other foods. Our results indicate this is also true for Nikko black bears.

Summer core areas in middle-aged conifer plantations were apparently related to cover, not food

Table 2. Characteristics of core areas used by Japanese black bears in Nikko, 1978–82.

Bear	Period in core area	Locations in core area	Size of core area (ha)
1	11 Jul 1978–13 Jul 1978	13	53
	21 Jul 1978–14 Aug 1978	12	38
2	16 Jul 1978–18 Jul 1978	19	20
3	26 Oct 1980–3 Dec 1981	18	115
5	—	—	—
6	20 Sep 1981–23 Sep 1981	18	39
7	—	—	—
8	—	—	—

availability. Bear foods are not abundant in the understory of these closed canopy plantations. Hazumi et al. (1981), however, reported that a dump adjacent to one of these sites provided a ready food source.

Because monitored bears frequently moved out of the study area, we could not determine actual home range sizes. However, we suspect that home ranges may be typically more than 2,000 ha. When fall acorn crops are abundant, bears stayed in small core areas; when food was not abundant, bears moved from the study area. Consequently, home ranges probably change in size and location in response to the availability of food in their habitats.

Den sites could also be treated as core areas. Den sites were located in subalpine areas where deep snows acummulate and temperatures remain cold. At lower elevations, fluctuating temperatures and lack of snow cover may preclude denning.

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