

FOOD HABITS OF JAPANESE BLACK BEAR

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Abstract: The food habits of Japanese black bears (*Selenarctos thibetanus japonicus*) were studied in the Neo Nishitani Valley, Gifu Prefecture, between 1973 and 1977. The bear live in the temperate forest zone where beech (*Fagus crenata*), Mongolian oak (*Quercus mongolica* var. *grosserrata*), and Japanese white oak (*Q. serrata*) dominate. Their diet was composed mostly of plant matter throughout the year. During spring, bear ate nuts of beech and oaks which had fallen in the previous year, beech buds and shoots of herbaceous plants. During summer, bears ate a large quantity of animal matter such as ants and other insects, and much plant matter such as the fruits of Japanese cluster cherry (*Prunus grayana*) and dogwood (*Cornus controversa*). Nuts of oaks and beech were consumed in large quantities during fall. A census of the numbers of fruit trees with branches broken by bears revealed that the animals mainly used beech in 1973, Japanese white oak and Japanese chestnut (*Castanea crenata*) in 1974, chestnut and Mongolian oak in 1975, beech in 1976, and chestnut in 1977. In 1976, when few broken branches of beech tree were found, fallen beechnuts were eaten.

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The seasonal food habits and changes in habitat utilization of Japanese black bears were studied from 1973 to 1977 in a natural deciduous forest of the Querco-Fagetea region, which is considered to be the principal natural habitat of the species in Japan. The present study supplements other fragmentary information on food habits reported by Yamamoto (1973, 1974), Watanabe (1974), and Takada (1979).

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STUDY AREA

The area, which is roughly 30 km² in size, is located at the foothills of Mt. Nogo-hakusan on the border of Gifu and Fukui Prefectures. A part

of the area is designated by the administration of Gifu Prefecture as a Nature Conservation Area.

The altitude ranges from 500 to 1600 m above sea level. The topography is characterized by very steep mountainsides, the average slope being 25°.

Average annual precipitation is very high: 277 cm. In winter, there is heavy snowfall. Snow depth in January averages 150 cm. The first snow comes in early December.

Vegetation between 500 and 800 m above sea level is composed of artificial plantations of Japanese cryptomeria (*Cryptomeria japonica*), Japanese white cedar (*Chamaecyparis obtusa* and *C. pisifera*), and Japanese larch (*Larix leptolepis*), as well as the secondary deciduous forest used for the production of firewood and charcoal. The latter type of vegetation is dominated by Japanese white oak, Japanese chestnut, dogwood, and Japanese cluster cherry. The rest of the study area is a virgin deciduous forest dominated by beech, Mongolian oak, and maples (*Acer* spp.). Sasa (*Sasa kurilensis*) is dominant on ridges, and natural *Chamaecyparis* forest with Rhododendron shrubs occurs at lower elevations. Sasa is found in grassland, interspersed with stunted birches (*Betula ermani*) on the summit of Nogo-hakusan.

The population of black bears in the study area was estimated from observation and field signs at 8 animals (0.19–0.29 bears/km²) (Azuma and Torii 1980). Bear hunting on a limited scale

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Table 1. Seasonal changes in the diet of Japanese black bears, as suggested by percent point-contact values of food remnants in fecal samples.

Food item	1973		1974			
	fall (9 ^a)	Apr (19)	May (3)	Jul (1)	Aug (3)	Oct–Nov (22)
Plant matter						
<i>Quercus</i> spp.(nuts)	35.7	23.2	20.0			29.6
<i>Fagus crenata</i> (nuts)	14.3	8.7	20.0			
(buds)		20.3	60.0			
<i>Castanea crenata</i> (scales)						4.2
<i>Evodiopanax innovans</i> (fruits)						8.5
<i>Vitis picifolia</i> (fruits)						11.3
<i>Vitis coignetiae</i> (fruits)						1.4
<i>Cornus controversa</i> (fruits)						1.4
<i>Viburnum furcatum</i> (fruits)					6.3	
<i>Prunus grayana</i> (fruits)					18.8	
Compositae spp.(stems)		2.9		16.7		
<i>Carex</i> spp.(seeds)		1.4				
<i>Tripetaleia paniculata</i> (capsules)		1.4				
<i>Carpinus japonica</i> (seeds)		1.4			6.3	
<i>Acer</i> spp.(seeds and petioles)		1.4				1.4
<i>Sasa curilensis</i> (shoots)				16.7	6.3	
<i>Parthenocissus tricucpidata</i> (stems)				16.7		
<i>Chamaecyparis obtusa</i> (leaves)		4.3		16.7		2.8
<i>Cryptomeria japonica</i> (leaves)						1.4
Mosses, lichens, dead leaves, and unident. veg.	28.6	21.7		16.7	25.0	23.9
Bark and twigs	7.1	4.3				5.6
Wood fragments	14.3	4.3			12.5	2.8
Total	100.0	95.3	100.0	83.3	75.2	94.3
Animal matter						
Lucanidae		1.4				
<i>Vespa xanthoptera</i>		1.4				4.2
Formicidae		1.4			12.5	
Other insects				16.7	12.5	1.4
Total		4.2		16.7	25.0	5.6
Score of food residue	14	69	5	6	16	71

^a Number of scats in sample.

occurs during the hunting season, and control kills occur in the adjacent area outside of the hunting season.

METHODS

Collection of bear scats and observation of feeding and other activities were from November 1973 through November 1977. Fifty-seven scats obtained in 1973 and 1974 were used in the present analysis. Scats were collected opportunistically when encountered and were frozen or placed in alcohol for preservation. To process for identification of food items, we softened the samples in water, then separated the material into homogeneous groups by use of sieves. Plants were identified to species through macroscopic and microscopic examination. Reference collections were gathered at the study area.

Survey routes evenly distributed throughout the study area were used to sample bear activity. Broken branches seemed to be one of the best

Table 2. Seasonal changes in the diet of Japanese black bears, as suggested by the percent dry weight of food remnants in fecal samples.

Food item	1973		1974	
	Fall	Spring	Summer	Fall
Plant matter				
<i>Fagus crenata</i> (nuts)	22.40	6.50		
(buds)		15.75		
Acorns	77.36	77.54		87.33
Berries			19.81	11.11
Other fruits and seeds				0.01
Herbs	0.07		19.48	
Leaves, buds, and bark of trees	0.01	0.02	0.04	0.37
Mosses and lichens	0.02	0.10	1.14	0.01
Total	99.88	99.96	40.48	98.84
Animal matter			0.37	0.04
Other material				
Wood, fragments	0.07	0.03	5.62	0.55
Stones and sands	0.01		53.51	0.49
Others	0.02			0.02
Total	0.11	0.03	59.13	1.06
Total grams fecal remnants	178.98	278.91	67.38	398.85
Number of scats analyzed	9	22	4	22

indicators of activity. Broken branches were easy to locate from a distance, and the tree species climbed seasonally by bears seemed to be those used seasonally as food by bears.

RESULTS AND DISCUSSION

Scat Analyses

Fifty-seven scats were analyzed to obtain information about food habits (Tables 1 and 2).

Plant Matter.—Plant matter was present in all samples during all months in which bears were active (April through December). Acorns were found in scats in April, May, October, and November.

Scat samples during spring (April and May) contained remnants of 12 plant items (Table 1). Nuts of beech and Mongolian oak amounted to 84% and buds of beech to 16% of the dry weight of fecal remnants during spring (Table 2).

Only 4 scat samples could be obtained during summer (July and August). These contained remnants of 9 species of plants; seeds of Japanese cluster cherry and *Viburnum furcatum*, shoots of *Sasa*, and stems of *Parthenocissus* (vines) were the most commonly represented. The proportion of plant matter in the feces was lower in the summer than in other seasons.

Twelve types of plant matter were found in scats collected during fall (September, October, and November). Nuts of oaks, beeches, and

Table 3. Frequency of occurrence of plants eaten by Japanese black bears, based on sign and feeding observation, 1973–1977.

Food item	Spring	Summer	Fall
<i>Fagus crenata</i> (buds)	8		
<i>Cryptomeria japonica</i> (bark)	2		
<i>Magnolia obovata</i> (barks)	2		
<i>Symplocarpus foetidus</i> (stems)	2		
<i>Magnolia kobus</i> (flowers)	1		
<i>Cirsium purpuratum</i> (leaves)	1		
<i>Urtica thunbergiana</i> (shoots)	1		
<i>Angelica pubescens</i> (shoots)	1		
<i>Prunus grayana</i> (fruits)		3	21
<i>Cardocrinum cordatum</i> (shoots)		2	
<i>Rubus</i> spp.(berries)		2	
<i>Rubus parvifolius</i> (berries)		1	
<i>Anthriscus sylvestris</i> (stems)		1	
<i>Pestisites japonicus</i> (leaves)		1	
<i>Cornus controversa</i> (fruits)		1	
<i>Pilea hamanoi</i> (stems)		1	
<i>Fagus crenata</i> (nuts)			34
<i>Quercus mongolica</i> (acorn)			24
<i>Quercus serrata</i> (acorn)			88
<i>Castanea crenata</i> (nuts)			67
<i>Evodiopanax innovans</i> (fruits)			4
<i>Sorbus alnifolia</i> (fruits)			1
<i>Cornus kousa</i> (fruits)			1
Total	18	12	240

chestnuts, and numerous fruits were especially important. Nuts of oaks and beeches comprised 87% of all plant matter present in the fall samples (Table 2).

Animal Matter—Animal matter was found in all 3 seasons. Insects were present in all samples. Ants were found in scats collected in spring and summer, and the wasp (*Vespa xanthoptera*) in spring and fall. Animal matter was the most common during summer (Table 2).

Minerals—Mineral substances were found in the summer and fall (Table 2). It was most abundant during summer and was apparently derived from the nest material of ant colonies.

Observations of Feeding

Variations in the seasonal food habits of Japanese black bears as suggested by direct observations and indirect signs of feeding are summarized in Table 3.

Bears were observed on 8 occasions foraging on buds of beeches during spring. In addition, new leaves, stems, and shoots of *Symplocarpus*, *Cirsium*, *Urtica*, and *Angelica* were eaten.

Ant nests were destroyed by bears most often during summer, and berries of Japanese cluster cherry and several species of *Rubus* were also observed as being consumed during this season.

Table 4. Annual fluctuation of numbers of the trees on which "enza" had been formed by Japanese black bears in fall.

Trees	Years					All years
	1973	1974	1975	1976	1977	
<i>Fagus crenata</i>	30	0	0	4	0	34
<i>Quercus mongolica</i>	6	0	16	0	2	24
<i>Quercus serrata</i>	1	82	4	0	1	88
<i>Castanea crenata</i>	0	24	25	0	18	67
<i>Prunus grayana</i>	0	3	12	0	6	21
<i>Evodiopanax innovans</i>	0	4	0	0	0	4
<i>Sorbus alnifolia</i>	0	1	0	0	0	1
<i>Cornus kousa</i>	0	1	0	0	0	1
Total	37	115	57	4	27	240

Signs of feeding activity by bears during fall were mainly associated with eating fruits. Typically such signs consisted of structures (colloquially known as "enza") resembling bird nests hanging from the trees. These were formed by twigs and branches broken during feeding activities.

The species of trees on which "enza" were found were the nut-bearing species such as beech, Mongolian oak, and Japanese white oak, and those producing berries including Japanese cluster cherry, *Sorbus alnifolia*, *Evodiopanax innovans* and dogwood. No other indirect signs of feeding were found during fall.

The number of trees on which we found new "enza" in fall were 37 trees in 1973, 115 trees in 1974, 57 trees in 1975, 4 trees in 1976, and 27 trees in 1977. The species of trees with newly formed "enza" in fall changed annually; beech, Mongolian oak, and Japanese white oak in 1973, Japanese white oak and Japanese chestnut, Japanese cluster cherry, *Evodiopanax innovans*, *Sorbus alnifolia* and *Cornus cousa* in 1974, Japanese chestnut, Mongolian oak, Japanese cluster cherry, and Japanese white oak in 1975, beech in 1976, and Japanese chestnut, Japanese cluster cherry, Mongolian oak, and Japanese white oak in 1977 (Table 4). In 1976, although beeches had the richest crops of this study period, few broken branches of beech trees were found. The animals fed on the fallen beechnuts without forming "enza". These annual fluctuations in trees on which the "enza" had been formed in fall, seemed correlated with variations in crop production. Unfortunately we have no precise data on annual mast production to verify this relationship.

Japanese black bears studied at the Neo Nishitani Valley have been considered to have omnivorous food habits, but in the present investigation bears were found to be almost exclusively vegetarian, with the exception that remains of ants (*Formica* sp.) were conspicuous in the summer diet.

Plant materials eaten varied with the seasons. Foods during spring consisted of fallen acorns from the crop of the previous fall, and new sprouts and shoots of herbs and woody plants; foods in summer included ants, wasps and other insects, berries, and kernels of *Prunus grayana*; foods in fall included acorns and nuts of several species of *Fagaceae*.

Other studies have suggested carnivory by this species; for example, on hares (*Lepus brachyurus*) and Japanese serow (*Capricornis crispus*) in Nagano Prefecture (Takada 1979), and on sika deer (*Cervus nippon*) in Tochigi Prefecture (Nozaki et al. 1982). No instances of predation or feeding on carcasses were recorded in the present study.

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