

WINTER FOOD HABITS AND SEXUAL MONOMORPHISM IN JAPANESE SEROW

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Abstract: Rumen contents of Japanese serow (*Capricornis crispus*, N = 253) were obtained in central Japan during the winter of 1982-82. Botanical composition was similar for males and females, as predicted by their lack of sexual dimorphism. Male and female serow are similar in body size and length and shape of horns, though there are slight differences in their skeletons. Sexual dimorphism is greater in their northern-adapted relative, the mountain goat (*Oreamnos americanus*).

A recent project on Japanese serow (Fig. 1), once an "animal of mystery", has revealed many aspects of its biology, including reproduction, morphology, diseases, age-determination, food-habits, nutrition, genetics, population dynamics and management (Sugimura 1985). The authors reported food habits analyses in a previous paper (Takatsuki and Suzuki 1984). Serow is a browsing animal, at least in winter. Browse leaves formed as much as 57% of the diet; dwarf bamboos (*Sasa* spp.) were also important (27%). Food habits could be a factor determining the distribution of serow, which corresponds with that of deciduous broad-leaved forests.



Figure 1. A male Japanese serow in northern Japan (photo by R. Kishimoto)

Here we compare the food habits of males and females, based on a larger sample size. In ungulate species with a high degree of sexual dimorphism, differences in food habits can be a factor in habitat segregation (Geist, 1974a, b). However, Japanese serow appear to have little sexual dimorphism, and we can predict that this would be reflected in their food habits. The objective of this study was to compare the botanical composition of the rumen contents of male and female Japanese serow.

METHODS

A total of 253 rumen samples of Japanese serow (132 males and 121 females), excluding kids (0.5 year old), was collected from Nagano Prefecture, central Japan, during November 1982 - February 1983. About 500 ml of each contents were sampled and stored in ethyl alcohol (over 60%). Samples were washed through a 2-mm mesh screen, and residues were analyzed by the point-frame method (Leader-Williams et al. 1981). Plant fragments were uniformly spread over a laboratory dish with 5-mm grid, and the points covered by plant fragments were scored. Four hundred points were counted for each sample. Plant fragments were assigned to 6 forage categories: (I) browses, (a) conifers, (b) broad-leaved browses, (c) unidentified browses; (II) graminoids, (a) dwarf bamboos, (b) grasses, sedges and others; (III) others such as forbs, ferns, mushrooms and unidentified materials.

Forage availability may vary among winter months, depending on snow conditions (Takatsuki and Suzuki 1985), and therefore, data were partitioned by months.

RESULTS

In 1982-83, winter diets of Japanese serow (Table 1) were similar to those recorded in 1979-80 (Takatsuki and Suzuki 1984). "Browses", including coniferous and broad-leaved woody plants, were most important, occupying 50-70 percent of the diet. There were compensating relations between coniferous and broad-leaved woody plants; the former increased and the latter decreased through the sampling period. Among the browse species, the leaves of Chamaecyparis obtusa, a coniferous tree, were most important both in percent composition (around 15% in most cases) and in frequency of occurrence. Graminoids accounted for 20-30 percent in most cases, among which dwarf bamboos (Sasa spp.) were important (10-20%). Miscellaneous forages accounted for about 15 percent of the rumen contents except in February when they accounted for less than 10 percent. Major constituents in this category were ferns and mushrooms, but their occurrence was irregular.

No significant differences were recognized between males and females, for any food category or in any month (Table 1).

DISCUSSION

Since competition for limited resources is most intense within a species, it can be predicted to be adaptive for animals to segregate forage resources between males and females (Geist 1974a, b). Despite this prediction, there seem to be few studies of ungulates in which the food habits of males and females are compared, though there are some for species with well developed sexual dimorphism; red deer (Cervus elaphus, Ahlen 1965, Harper et al. 1967), Sika deer (Cervus nippon, Takatsuki 1980) and bighorn sheep (Ovis canadensis, Shank 1982).

Table 1. Percentage composition of rumen contents of Japanese serow.

Month	Nov.		Dec.		Jan.		Feb.	
	M	F	M	F	M	F	M	F
N	32	32	62	55	28	22	10	12
Browns	73.5	64.3	58.9	56.1	49.3	56.5	68.7	67.8
conifers	9.0	12.2	19.1	16.4	26.6	25.5	36.0	28.9
broad-leaves	63.2	50.1	36.9	37.2	21.4	28.6	29.6	35.6
unidentified	1.3	2.0	2.9	2.5	1.3	2.4	3.0	3.2
Graminoids	11.8	20.4	25.6	19.9	34.0	27.0	22.0	27.3
dwarf bamboos	7.6	14.2	16.4	12.6	24.9	20.4	13.4	16.6
others	4.2	6.2	9.2	7.3	9.1	6.7	8.6	10.7
Others ¹	14.8	15.3	15.5	24.0	16.7	16.5	9.4	4.9

¹Forbs, ferns, mushrooms and other unidentifiable materials.

A lack of intersexual differences in food habits of Japanese serow can be attributed to their physiological and morphological similarities. There are no physiological studies comparing male and female serow, and there are no significant intersexual differences in their external measurements (Table 2).

Table 2. External measurements of Japanese serow and mountain goats.

	Japanese serow ¹			Mountain goat		
	Male	Female	M/F	Male	Female	M/F
Body weight (kg)	35.2	37.7	0.93	79.5 69.9 75.7	61.3 53.1 49.0	1.30 ² 1.32 ³ 1.54 ⁴
Body length (cm)	78.0	79.9	0.98		No data	
Horn length (cm)	15.0	14.9	1.01	23.2 23.6	22.8 21.1	1.02 ⁵ 1.12 ⁴
Horn spread (cm)		No data		15.9	14.8	1.08 ⁵

¹Sugimura (1985), 10 of each sex, ²Klein (1953), ³Brandborg (1955),
⁴Richardson (1971), ⁵Hibbs (1966).

Among 99 measurements from serow skulls, vertebral columns, and thoracic and pelvic limbs, there were only 13 differences between the sexes (Sugano et al. 1982, Tsuchimoto et al. 1982). Males were larger than females in 5 of the measurements and smaller in 8, but these differences were small, none more than 1.2 cm. Thus it is very difficult to distinguish the sexes especially in the field, without checking the primary sexual characteristics, even for well-experienced observers (Kishimoto, personal communication).

Further evidence of sexual monomorphism, relating more directly to food habits, has been recognized in the serow's tooth wear (Miura 1985). There were no significant differences between sexes in degree of tooth wear, which is in contrast to some cervid species such as mule deer (*Odocoileus hemionus*, Erickson et al. 1970), elk (*Cervus elaphus*, Flook 1970) and caribou (*Rangifer tarandus*, Miller 1974).

Sexual monomorphism in Japanese serow becomes more apparent when serow are compared to their northern-adapted relative, the mountain goat. Though this species is considered less sexually dimorphic than the mountain sheep (*Ovis* spp. Geist 1974b; 213), differences between sexes are apparent (Table 2). Body weight differences between sexes are greater in mountain goats, where the male/female ratios are 1.3 to 1.5 while this ratio is 0.9 in Japanese serow. Intersexual differences in horn length are slight in mountain goats, but Hibbs (1966) has recognized that the horns of males are more massive and continuously curved backward. These comparisons suggest that the mountain goat has increased in sexual dimorphism through recent evolution. We need comparable studies on the food habits of mountain goats, focused on comparing the sexes.

Other differences between serow and mountain goats occur with their habitats and social behavior. Japanese serow inhabit forests and are territorial, living in groups of 1-3 individuals (Akasaka and Maruyama 1977, Sakurai 1981). In contrast, mountain goats inhabit cliffs and more open habitats; they are not territorial and form larger groups of 3-6 to even 60 individuals (Hibbs 1966, Richardson 1971, Chadwick 1977, Adams and Bailey 1980, J. A. Bailey personal communication). These differences may relate to food habits, and should be reconsidered from the socio-ecological standpoint (Geist, 1974a, b).

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QUESTIONS AND ANSWERS

Dale Reed, Colorado: Are you familiar with the controversy, or is there any controversy concerning the population of Japanese serow and forestry products?

Seiki Takatsuki: Yes, there is a very serious problem, they eat most of the trees planted.

Reed: Do you have an idea for a solution to this problem?

Takatsuki: Well, its hard to answer. I am just a biologist. The agency is beginning to control the populations, but they have no plans to hunt the animals, but there is a movement to use some repellent or plastic net around on the young saplings.

Joseph Hamr, Ontario: I was wondering if there is any information on the movements of the animals in the course of the year?

Takatsuki: Well, they are basically solitary, but mother/kid units are common. They are territorial against the same sex. Male are territorial against males only, and a territorial male and female are overt. They do not migrate, they just move several kilometers up and down depending on snow conditions. We have no information on the composition of groups over five individuals. Most of them occur in groups of two and three. A group is usually composed of a male and female pair during the rut, and later a group of three includes the newborn kid.