STATUS AND FOOD HABITS OF JAPANESE SEROW

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ABSTRACT

Japanese serow (Capricornis crispus)once used to be an "animal of mystery", but recent studies have been revealing its ecology and other biological aspects. The distribution of this ungulate shows a good correspondence with that of the deciduous broad-leaved forest zone in the northern half of Japan except Kokkaido Island. This species is principally a forest dweller. It is territorial and forms small groups (three individuals at most). The population has been increasing since 1959 when the supervision of poaching was tightened, and recently the damage on plantations has become a social problem. Accordingly, culling was begun in central Japan in 1976. Rumen contents of 124 Japanese serows collected in the winter of 1979-1980 were analyzed by the point frame method. The analysis revealed that browse is the most important constituents (57.0%), and among them, Chamaecyparis obtusa, a planted conifer, contributed as much as 27.0% of the diet. Sasa spp., dwarf bamboos, were also important and accounted for 27.2%. Besides these, the following items were important in several samples: conifers such as Abies spp., Tsuga spp., Cryptomeria japonica, Pinus spp., Thujopsis dolabrata, evergreen broad leaves such as Ilex crenata and I. pedunculosa, sedges and ferns. Based on this analysis together with other studies, we considered Japanese serow to be a "browser".

INTRODUCTION

Food habit studies are a prerequisite for understanding the ecology of wildlife and for its management. Prior to the analysis of the rumen contents of Japanese serow (Capricornis crispus), we focused on the following two questions:

Firstly, we intended to examine whether the Japanese serow was a browser or a grazer. Recent studies on feeding ecology of ungulates (e.g. Bell 1971;

Jarman, 1974; Estes, 1974; Hanley, 1982) have found a general trend in their body size, habitat use, behavior and social organization. According to them, small ungulates living in dense forests, being territorial, forming small groups, are in terms of food habits browsers or concentrate selectors. On the other hand, larger ungulates living in open habitats, being non-territorial, forming larger groups are grazers or bulk and roughage eaters. This tendency was also confirmed by anatomical studies on digestive organs (Hofmann, 1968; 1973; Kay et al., 1980). Based on these syntheses, we can expect the Japanese serow to be a browser, because the information on this species support that it is a forest dweller, is territorial and principally solitary (Akasaka and Maruyama, 1977; Sakurai, 1981). The information on the food habits were, however, only qualitative (Akasaka and Maruyama, 1977; Suzuki et al., 1978), and some quantitative reports dealt with only small samples (Yamaguchi et al., 1974: Chiba and Yamaguchi, 1975; Miyao, 1976).

Secondly, we intended to examine the occurrence or contribution of dwarf bamboos in the dietary composition. These plants are unique in that they grow abundantly on the forest floors and that they are evergreen. Therefore, we can expect them to be important forages for the serow. However, the information to support this assumption is quite insufficient.

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GENERAL STATUS OF JAPANESE SEROW IN JAPAN

In the 1960's, no scientific information was available on the ecology of Japanese serow, and it used to be called "the animal of mystery". Scientific studies were begun in the 1970's and have been progressively revealing its ecology.

The distribution of the Japanese serow shows a good correspondence with that of deciduous broad-leaved forests in the cool temperate zone of northern Japan, except Kokkaido which is not inhabited by this ungulate (Fig. 1). This species can live even in the deep snow area, which is different from another ruminant - Sika deer (Cervus nippon). In Kyushu and Shikoku, the distribution is restricted to higher mountains. Japanese serows live solitarily, in pairs or in pair-offspring units. They are territorial and their home ranges seldom overlap (Akasaka and Maruyama, 1977; Sakurai, 1981).

The population of Japanese serow once decreased and in 1934 this species was designated as an endangered animal and has been legally protected. The supervision of illegal hunting was strictly tightened from 1959, and since then the population has been gradually recovering. On the other hand, for the last two decades many roads were constructed even into high mountains and natural forests were clear-cut for plantation on a large scale. As a result, the damage on planted trees, e.g., Chamaecyparis obtusa and Cryptomeria japonica, by Japanese serow became a social problem in the later 1970's. Following this situation, a population control was begun in central Japan in 1976. This control will be conducted in more localities in the future.

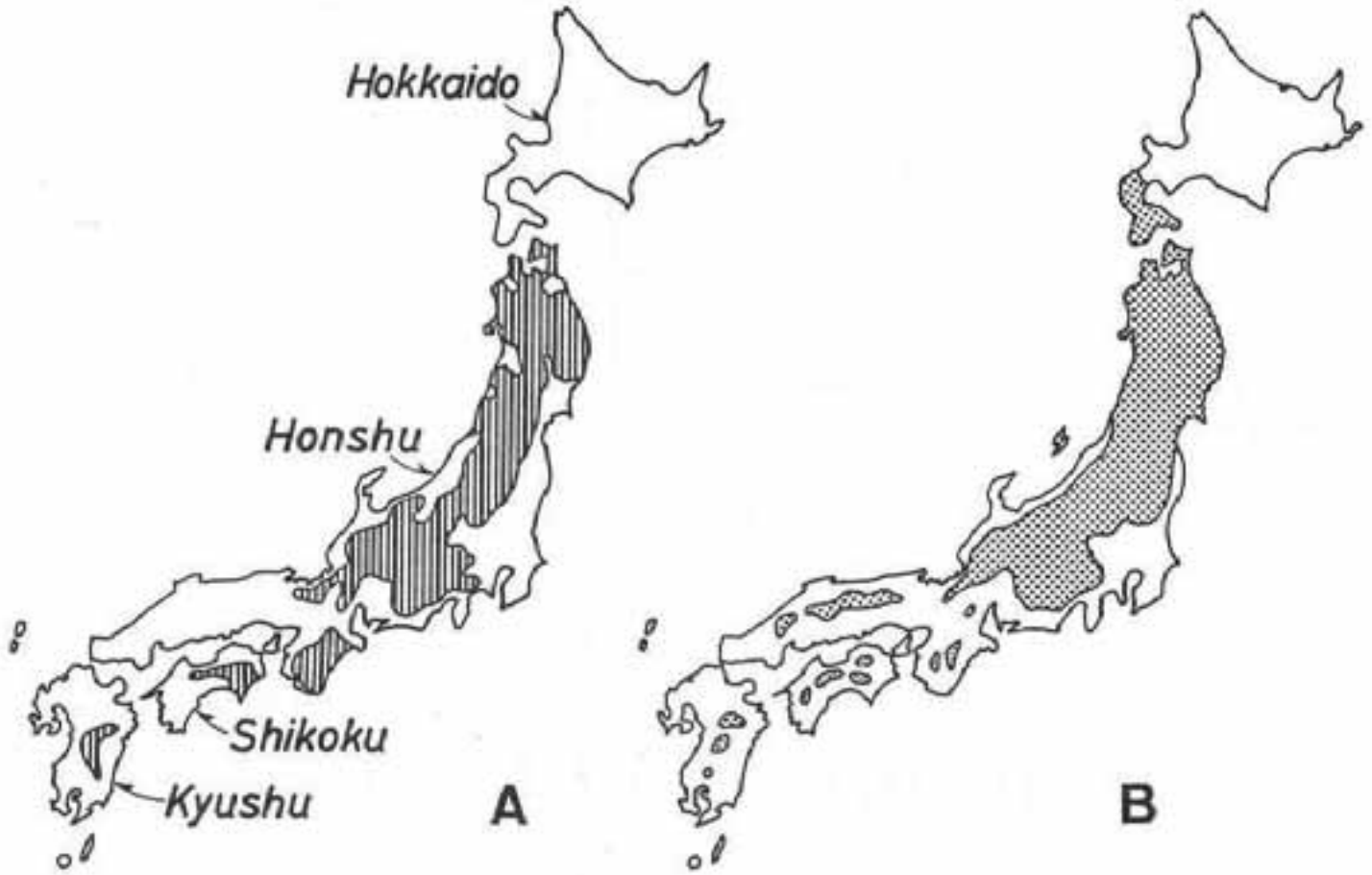

Fig. 1. Distributions of Japanese serow (A) and deciduous broad-leaved forest (B). After Furubayashi et al. (1979) and Yoshioka (1973).

METHODS

A hundred and twenty-four samples of rumen contents of Japanese serow were collected from animals shot for population control from Gifu and Nagano Prefectures, central Japan (Fig. 2) from December, 1979 to early April, 1980.

Rumen contents of about 500 ml were sampled and stored in ethyl alcohol (over 60%). These rumen contents were washed through a 2.0 mm mesh screen, and residues were analyzed by the point frame method (Leader-Williams et al., 1981; Chamrad and Box, 1964). Plant fragments were spread uniformly over a laboratory dish with grid of 5 mm interval, and the points covered by the fragments were scored for each category. Up to 400 points were counted for each sample. Plant fragments were identified to genus and species if possible, otherwise, they were assigned to forage categories listed below.

I. Browses
   - Conifers
   - Broad-leaves
   - Unidentified browses

II. Graminoids
   - Dwarf bamboos
   - Grasses, sedges and others

III. Others
   - Forbs, ferns and unidentified materials

RESULTS

GENERAL TREND

Table 1 shows the results of rumen contents analysis. In terms of forage classes (browses, graminoids and others), "browses" were the most important constituents to make up as much as 57.0%. Among them, coniferous leaves accounted for 31.4%. "Graminoids" occupied about one third of the total and "others" occupied only a small portion.

Table 1. Composition of rumen contents (N = 124).

Item	Mean	±	S. E. (%)
Browses	57.0	±	25.6
Conifers	32.8	±	17.4
Chamaecyparis obtusa	27.0	±	18.1
Broad-leaves	20.8	±	18.4
Undentified browses	3.5	±	5.3
Graminoids	35.5	±	25.7
Dwarf bamboos	27.2	±	24.5
Grasses, sedges & othes	8.3	±	14.6
Others	7.5	±	13.7

Fig. 2. Location map of sampling sites.

MAJOR FORAGE PLANTS

Chamaecyparis obtusa was the most important constituent as a single species to account for as much as 27.0% (Table 1). This species is one of the native conifers of this area, but its supply as a forage for the Japanese serow has been increasing because of the enlargements of the plantation areas in this species' habitat. It was ascertained by the present analysis that Chamaecyparis obtusa was eaten by the serow and that the proportion in the diet was substantial.

Other coniferous trees were important in several samples. Twenty-four samples contained conifers other than Chamaecyparis obtusa for more than 10%; Abies spp. in 7 samples, Thujopsis dolabrata in 6 samples, Cryptomeria japonica in 5 samples, Tsuga spp. in 2 samples, Pinus spp. in 2 samples and unidentified conifers in 1 sample. Table 2 shows the mean values and frequencies of these species. It is noteworthy that though the mean values were small, if occurring the proportion (x/F in Table 2) were usually larger. It suggests that these trees do not occur constantly in the serow's habitat, but if they are found by the serow, they are eaten in considerable amounts.

Table 2. Mean value and frequency of coniferous species found in rumen contents (N = 124).

	Mean value $\bar{X}$	Frequency F	$\sum \bar{X}/F$
Chamaecyparis obtusa	27.0	124	27.0
Abies spp. & Tsuga spp.	2.8	35	9.8
Pinus spp.	0.8	21	4.4
Thujopsis dolabrata	1.1	16	8.1
Cryptomeria japonica	1.3	14	11.5

Dwarf bamboos made up 27.2% of the dietary composition. This forage category contains several Sasa spp. including Sasa kurilensis and S. palamata and possibly Sasamorpha borealis. These results support our second assumption that dwarf bamboos will be important in the diet of the serow.

TRIANGULAR ORDINATION

Each sample is plotted in the triangular diagram according to its composition (Fig. 3). Most plots concentrate on and around the line connecting browses (B) and graminoids (G). According to the distributional patterns, the plots are categorized into the following types.

1) Browse Type

Many points are concentrated in the corner B (browses). Of the 47 samples, 32 samples were occupied by Chamaecyparis obtusa for more than 25%. Other important species were Abies spp., Cryptomeria japonica and other evergreen broad-leaved trees.

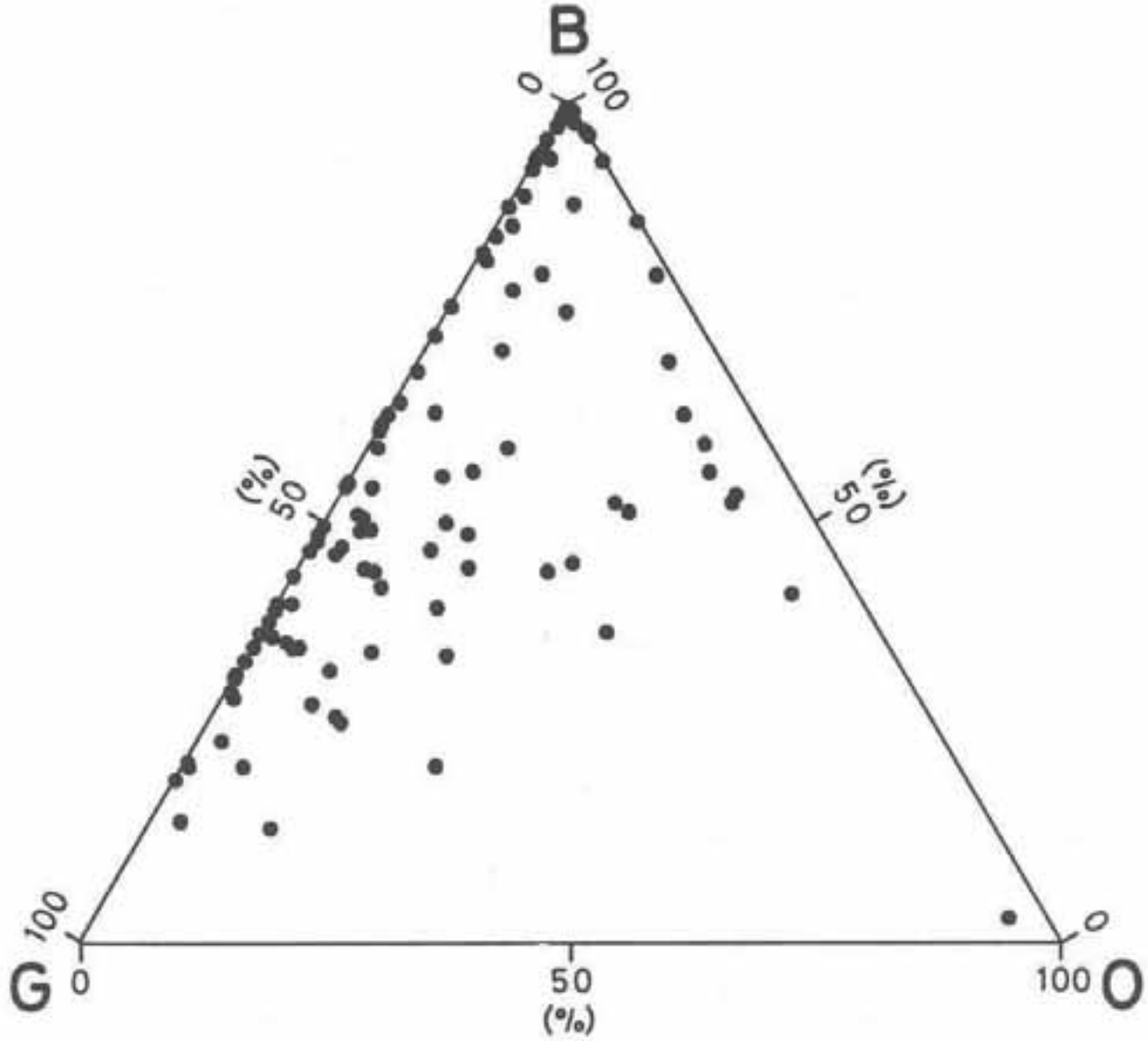

Fig. 3. Triangular ordination of rumen contents. B: Browses, G: Graminoids, O: Others

ii) Browse-Graminoid Type

Another concentration is recognized around the central part of the line BG, which means in these samples browses and graminoids were codominant. Forty (32.3%) samples belong to this type. Among them, the combination of dwarf bamboos and Chamaecyparis obtusa was most frequently found. Other important constituents were Tsuga spp., Cryptomeria japonica, Pinus parvi-flora and Abies spp.

iii) Graminoid Type

Graminoids were predominant in 29 samples (23.4%), and most of them were dominated by dwarf bamboos.

iv) Other Types

Only eight samples were not categorized into these types. The main compositions were as follows.

No. 14: Chamaecyparis obtusa: 30.5%, ferns: 25.8%, Thujopsis dolabrata : 10.5%.
No. 20: evergreen broad-leaves: 40.8%, ferns: 36.3%.
No. 31: ferns: 31.3%, deciduous broad-leaves: 20.5%, dwarf bamboos: 16.0%.
No. 69: ferns: 68.0%, Chamaecyparis obtusa: 23.5%.
No. 81: ferns: 35.3%, Chamaecyparis obtusa: 28.0%.
No.105: ferns: 93.0%.
No.114: ferns: 42.0%, deciduous broad-leaves: 19.8%, Thujopsis dolabrata: 19.3%.
No.328-2: Chamaecyparis obtusa: 44.1%, Shortia sp. (Diapensiaceae, evergreen forb: 31.3%.

DISCUSSION

The distribution of the Japanese serow mostly corresponds to that of deciduous broad-leaved forests (Fig. 1). In these areas, the seasonal changes in climate and plant phenology are sharp and clear. Most plants are dormant in winter, and therefore this is the critical season for the wildlife living there. This is the reason why the rumen contents of Japanese serow in central Japan contained many evergreen plants including Chamaecyparis obtusa and other coniferous trees, dwarf bamboos, Ilex spp., sedges and ferns.

The results of this analysis indicate that browse was the most important constituent in the winter diet of Japanese serow in central Japan. Among the browse, Chamaecyparis obtusa and other native conifers were important, which suggests that the serow potentially has the food habits to utilize them. Before our analysis, Yamaguchi and Takahashi (1979) synthesized the information on the food habits of Japanese serow. They listed 15 kinds of conifers and 19 kinds of evergreen broad-leaved browse species, and pointed out that they were important forage plants especially in winter. The present results together with other fragmental information support our first assumption that the Japanese serow is a browser. They also support the indication by Schaller (1977, p.287) that Capricornis spp. are selective in food habits among the

subfamily Caprinae, and also support the generality of the socio-ecological theory proposed by Bell (1977), Jarman (1974) and Estes (1974).

Our second assumption was the importance of dwarf bamboos in the diet of Japanese serow. The results of this analysis showed that they contributed as much as 27.2%, which verified our expectation. Dwarf bamboos grow densely on forest floors in the cool temperate zone of northern Japan. This type of forest, for example Fagus crenata forest, is one of the most characteristic vegetation types of Japan. It is true that the contribution of dwarf bamboos was large in the diet, but since their availability as forage is also substantial, we cannot conclude that they are preferred by Japanese serow. Much is left to study on the interrelations between dwarf bamboos and Japanese serow.

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