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Winter Daytime Activity Budgets of Asiatic Ibex *Capra sibirica* in Tomur National Nature Reserve of Xinjiang, China

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Abstract.- Asiatic Ibex, *Capra sibirica*, is distributed only in the mountains of central Asia, and is a threatened species in China. Although the ecology of the *C. ibex* and *C. walliae* [*C. Nubiana waliae*] have been well studied in Europe and Africa, little information is available on the species of Asiatic ibex in Asia. Since knowledge of the time activity budget can provide useful information for ibex conservation and management, we studied the daytime activity budgets of the Asiatic ibex in Tomur National Nature Reserve (TNNR) of Xinjiang, China. The results showed that both female and male ibex spent most of their time feeding: females spent significantly more time feeding than males (Kruskal-Wallis tests, χ^2=4.935, d.f.=1, P=0.026), while males spent significantly more time standing than females (Kruskal-Wallis tests, χ^2=7.676, d.f.=1, P=0.006). In addition, the Asiatic ibex showed two distinct activity peaks during the day when they were most activity: early morning from 7:00 to 8:30 and around sunset from 15:30 to 19:30.

Key words: Activity budget, Asiatic ibex, *Capra sibirica*, behavior rhythm.

INTRODUCTION

The Asiatic ibex, *Capra sibirica*, is distributed only in the mountains of central Asia (Schaller, 1977), and is a threatened species in China. It is classified as a Category I Protected Wild Animal Species under the Wild Animal Protection Law in China, and listed as "Endangered" in the China Red Data Book of Endangered Animals (Wang, 1998). Although the ecology of the *C. ibex* and *C. walliae* [*C. Nubiana waliae*] have been well studied in Europe and Africa (Acevedo and Cassinello, 2009; Aublet *et al*., 2009; Grotan *et al*., 2008; Massolo *et al*., 2008; Saether *et al*., 2007; Wakefield *et al*., 2008), little information is available on the species of Asiatic ibex in central Asia. Some work has been done on the Asiatic ibex in its southeastern distribution range in the northwestern Himalaya Mountains of India (Schaller, 1977; Fox *et al*., 1992), but information of the Asiatic ibex in China is still very limited. The daytime activity budget plays a major role in determining an animal's adaptations to seasonal and diurnal variations in environmental factors. Knowledge of the time activity budget can therefore provide useful information on the survival strategy it is adopting, and help in ibex conservation and management. For sexually dimorphic ungulates, gender may also influence the daytime activity budgets. So we studied the daytime activity budgets of the Asiatic ibex in northwestern China, and also compared the time budgets between males and females.

MATERIALS AND METHODS

Study area

This study was conducted in Tomur National Nature Reserve in the Tianshan Mountains of northwestern China (80°07'-80°52' E, 41°40'-42°02' N). The nature reserve is located on the southern flank of the Tianshan Mountains and encompasses about 3 000 km^2 of rugged ridges and narrow valleys, with an elevation of 2 000-7 000 m. The reserve provides habitat for many protected animals, such as the Asiatic ibex, argali sheep (*Ovis ammon*), snow leopards (*Uncia uncia*), wolves (*Canis lupus*), and red foxes (*Vulpes vulpes*) (Xu *et al*., 2007; Sun, 1985).

Behavioral observation

Behavioral observations were made using the

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group scan sampling method (Bateson and Martin, 2005) during the autumn of 2005 (September to December). The observations were conducted during the daytime from 07:00 to 19:30 h. We randomly selected groups of ibex using binoculars, and then used a telescope to observe their behavior. The ibex were classified into males, females, and lambs. Their activities were recorded while scanning animal groups at 10-min intervals. The activities were classified into 5 categories: feeding, standing, moving, bedding, and other behaviors. Feeding was defined as biting, chewing, grazing, or swallowing food. Standing was defined as standing still, standing alert, or standing ruminating. Bedding was defined as sternal recumbence, with or without rumination, and includes sleeping with eyes closed. Moving was defined as traveling and walking. And other behaviors were defined as all other activities not included in the above categories, such as grooming, defecating and lactating (Li and Jiang, 2008; Shi *et al*., 2003; Zhang, 2000).

Statistical analyses

The percentages of each behavioral category (feeding, bedding, moving, standing, and other behaviors) were calculated for each behavioral sample. Because the data was not normal, we used Kruskal-Wallis tests to determine sexual differences in each behavioral category. All significant levels were set at P=0.05. Data were analyzed using the SPSS 13.0 statistical package.

RESULTS

A total of 193 ibex were observed over a period of 64 days, from Oct 21st to Dec 24th in 2005. In total, we documented 47 behavioral sessions which equaled 4 638 minutes of observations.

Observational results indicated that both female and male ibex spent most of their time feeding. In addition, female ibex spent significantly more time feeding than males (Kruskal-Wallis tests, χ^2=4.935, d.f.=1, P=0.026), while males spent significantly more time standing than females (Kruskal-Wallis tests, χ^2=7.676, d.f.=1, P=0.006). There were no significant differences in moving, bedding, and other behaviors between female and male ibex (Table I).

Table I.- Different activity time budgets between the female and male Asiatic Ibex *Capra sibirica* in Tomur National Nature Reserve of Xingjiang, China. (* stand for significantly different).

Activity patterns	Proportion of the time spent by females (Mean±SE)	Proportion of the time spent by males (Mean±SE)	Different activity time budgets between the sex compared by Kruskal-Wallis tests
Feeding	0.53±0.24	0.44±0.29	χ^2=4.935, d.f.=1, P=0.026*
Standing	0.15±0.17	0.25±0.28	χ^2=7.676, d.f.=1, P=0.006*
Moving	0.14±0.11	0.13±0.11	χ^2=0.149, d.f.=1, P=0.700
Resting	0.16±0.23	0.15±0.25	χ^2=0.618, d.f.=1, P=0.432
Others	0.01±0.03	0.01±0.04	χ^2=1.086, d.f.=1, P=0.297

Asiatic ibex showed two distinct activity peaks during the day: early morning (7:00-8:30) and around sunset (15:30-19:30) (Fig. 1). During the activity peaks, ibex spent most of their time feeding and moving, and at midday there was a period of inactivity, when most ibex spent their time resting (Fig. 2).

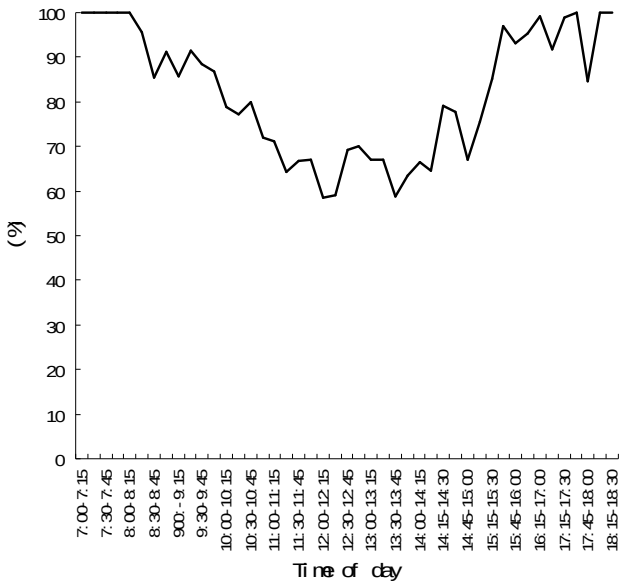

Fig. 1. Daytime activity pattern of Asiatic ibex during October-December 2005 in Tomur National Nature Reserve of Xinjiang, China.

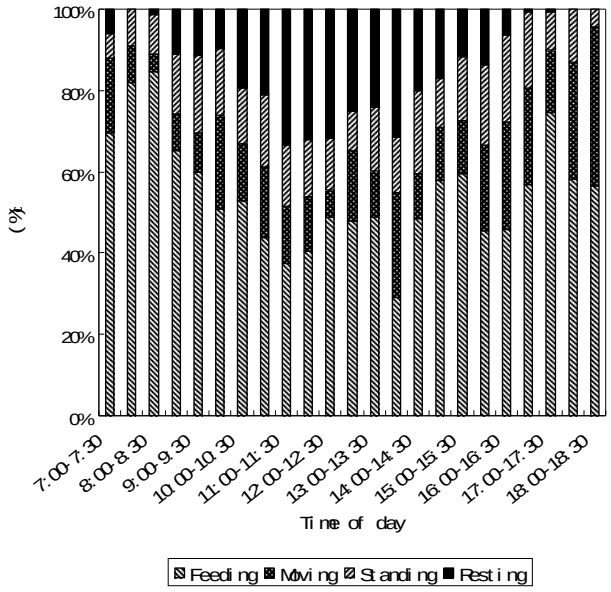

Fig. 2. Diurnal activity budgets of Asiatic ibex during October-December 2005 in Tomur National Nature Reserve of Xingjiang, China.

DISCUSSION

These results indicated that the Asiatic ibex's daytime activity budget had bimodal peaks of foraging, a pattern that is common in other temperate-environment ruminant species. Bimodal foraging peaks have been reported for red deer (*Cervus elaphus*) (Clutton-Brock, 1982), Chinese water deer (*Hydropotes inermis*) (Zhang, 2000), feral goats (*Capra hircus*) (Shi *et al*., 2003), mouflon (*Ovis musimon*) (Moncorps *et al*.,1997), elk (*Cervus elaphus nelsoni*) (Green and Bear, 1990), and for some African ungulates (Jarman and Jarman, 1973; Roberts and Dunbar, 1991). Also, the Asiatic ibex in the northwestern Himalaya Mountains of India showed the same bimodal peaks of foraging, with the morning peak during 7:00 to 9:00, and the sunset peak around 17:00 (Fox *et al*., 1992). These bimodal peaks of foraging reflect the animals' adaptation to their environment. If the environment changed, such as after a big snowfall, the daytime activity budget would change accordingly: the ibex in the northwestern Himalaya Mountains of India spent more time feeding after heavy snows, even during midday (Fox *et al*., 1992).

The results also indicated that gender had an effect on the activity budget. The female ibex spent more time feeding, while the males spent more time standing. These results are consistent with previous studies of Przewalski's gazelle (*Procapra przewalskii*) (Li *et al*., 2008), feral goats (Shi *et al*., 2003), and Tibetan gazelle (*Procapra picticaudata*) (Li and Jiang, 2008), although this differentiation was not found in Chinese water deer (Zhang, 2000). One possible explanation for this gender difference in activity budgets may be due to body size digestive constraints, since females are smaller, with less digestive capacity than males. The smaller females would compensate for their lower digestive output by feeding longer, while males, with larger body size and higher metabolic rate, would have more time for standing, moving, bedding, and other behaviors (Ruckstuhl, 1998; Ruckstuhl and Neuhaus, 2002).

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