动物学报 52(Supplement): 298–300, 2006
Acta Zoologica Sinica

S17-2 The social unit and habitat of the Sichuan jay (*Perisoreus internigrans*) in Zhuoni, Gansu, China

JING Yu[1], FANG Yun[1], Dan STRICKLAND[2], SUN Yue-Hua[1*]
1. Institute of Zoology, Chinese Academy of Sciences, 25 Beisihuan Rd., Haidian, Beijing 100 080, China; *sunyuehua@sina.com
2. Algonquin Provincial Park, Box 219, Whitney, Ontario P0A 1H0, Canada

Abstract The Sichuan jay (*Perisoreus internigrans*) is a rare Chinese endemic found in coniferous forests on the Qinghai-Xizang (Tibet) plateau. In 2000–2001, we undertook a preliminary investigation on its ecology and behavior at Zhuoni, Gansu, China. Eighteen birds were banded and most were measured; mean body mass was 103.4 g for 16 birds. Home range size in the spring breeding period was estimated at 0.53 km^2 (n=4). In the pre-breeding season, the birds were observed in groups 3 to 5 (mean = 3.8). Vegetation analysis of breeding habitat estimated an average tree density of 4.86 ± 4.09 conifers/ha and 1.72 ± 3.99 deciduous trees/ha, indicative of open wooded habitat where the cut rate of conifer trees was 28.1%.

Key words Sichuan Jay (*Perisoreus internigrans*), Habitat, Social unit

1 Introduction

The Sichuan jay (*Perisoreus internigrans*) is a reclusive Chinese endemic of the Qinghai-Xizang (Tibet) plateau. The few available reports indicate that this rarely seen bird occurs in montane coniferous forest in south Gansu, west Sichuan, east Tibet and southeast Qinghai provinces (Sun et al., 2001). Since its discovery in Sichuan by Thayer and Bangs in 1912, its status and ecology have received no attention at all. Nothing was known of its nesting, and all that Madge and Burn (1994) could add in their monograph of the Corvidae was that it is "skulking and unobtrusive". Its listing as a "globally threatened species" (Collar et al., 1994) subsequently led, in 2000–2001, to a preliminary investigation of its status at Zhuoni, Gansu Province, one of the 14 locations where it is known to occur. This study site lies at the northernmost limit of its known range.

2 Materials and methods

2.1 Study area

Our main study area is Zhuoni county, Gansu, central China (34°27'35", 103°25'94"), at an altitude of 3 000–3 600 m. Local meteorological data shows yearly mean air temperature ranging between –25°C to 28°C. Patchy coniferous forest, with dominant trees of fir (*Abies fargesii*) and spruce (*Picea asperata*) mixed with rhododendron (*Rhododendron* spp.), occurs on northward slopes. Rhododendrons constitute over 90% of broad-leaved trees in the forest patches. Shrub and grassland occurs on insolated southern slopes. From 1958 to 1995, this area had been selective logged and the overall timber production was reported as 39 m^3/ha (Bailongjiang Forestry Administration, 1995).

2.2 Field methods

Field techniques used successfully for assessing the status of the related gray (*Prisoreus canadensis*) and Siberian (*P. infaustus*) jays were employed. Lard was nailed on branches or stems to attract the birds, and the sites videocameraed to provide preliminary information of group size. Potter traps baited with lard were then used to capture birds. After basic measurements were taken, trapped birds were radio-tagged with 3.8 g mounts on the base of central rectrices, and tracked by radio telemetry integrated with a GPS receiver. Group home ranges were calculated by the Minimum Convex Polygon method using location data from more than 25 workdays.

10 m × 10 m vegetation samples were taken from the breeding habitat of one nesting pair; and 35 sample plots were scattered randomly through foraging home ranges. The number of coniferous and deciduous trees present, canopy cover, grass cover, shrub cover and moss cover were all recorded; very small trees with a DBH (diameter-at-breast-height) of less than 3 cm were counted as shrubs. To evaluate the effects of deforestation, the cut rate of the forest was calculated by the equation:

$$\text{Cut rate} = \frac{\text{Base Area of Cut Stems}}{\text{Base Area of (Spring + Fir + Cypress + Cut Stems)}}$$

Sample plots outside or at the edge of the forest patches were manually abandoned in computation of the cut rate.

3 Results

3.1 Measurements

Over the duration of the study, 18 birds were banded, and 8 radio-tracked for more than 50 workdays. Table 1 gives measurements of selected birds. As sex and age could not be distinguished, these classes are combined.

3.2 Group size and home range

In March and April at the beginning of breeding, group size varied from 3 to 5 birds, with a mean of 3.8 (n = 5). In October 2000, one group of 7 individuals was recorded. Estimated home range in April–May was 0.53 km^2 (n = 4).

3.3 Breeding habitat

Jays spent much of their time in dense forest patches, especially in April–May during breeding. More than 95% of daylight hours were spent there then. The one nest found in Zhuoni was in a forest patch which had been logged only once. Principal vegetation characteristics are given in Table 2. Table 3 details the base areas of the conifers and the cut rates for conifer forest.

4 Discussion

Our results show that group size in the Sichuan jay during the breeding season averages 3.8 individuals, with extra-pair birds present. Groups of such size are found also in its congeners, the gray and Siberian jays. As delayed dispersal and offspring retention, associated with cooperative breeding, are well known in these last two species (Strickland et al., 1993; Ekman et al., 1994), it seems likely that the Sichuan jay is a cooperative breeder too. Even so, the social role of extra-pair birds in the groups is still unclear and may vary within the genus. The body mass of the Sichuan jay (mean 103.4 g) is considerably greater than in the gray jay (62–82 g) and Siberian jay (68–90 g) (Madge and Burn, 1994).

Our data indicate that the breeding habitat of the Sichuan jay is restricted to montane coniferous forest, as had already been suggested by earlier records (Cheng, 1987; Cheng et al., 1965, 1998; Madge and Burn, 1994). The denser parts of the forest are favored in breeding season, suggesting that concealment might be important at that stage. At our study site, we recorded birds in forest with a maximal cut rate of 28.1%, much lower than the 62.6% reported by Sun et al. (2001) for the area generally. This suggests that a culling rate of any more than a quarter of primary, old growth forest is likely to affect breeding. Further work is needed to determine the "threshold" of habitat disturbance to breeding habitat that the jay can withstand.

Acknowledgements This project is supported by the National Natural Science Foundation of China (39870103). We thank Mr. Lu Zeng-Xiang and Mr. Liu Sheng-Lun, officials of Taohe Forestry Bureau, and Mr. Cheng Xiao-Gang and his staffs in Kache Forest Farm, for their great help. We also appreciate the diverse and valuable advice of

Table 1 Measurements of the Sichuan jay at Zhuoni, Gansu, 2000–2001

	Body mass (g)	Length (mm)	Wing (mm)	Tail (mm)	Tarsus (mm)	Alula (mm)	Culmen (mm)
n	16	12	10	9	11	10	13
Range	92–110	280–295	160–165	150–165	40–43	17–22	22–25
Mean	103.4	288.8	162.4	153.7	41.4	19.4	23.3

Table 2 10 × 10 m vegetation sampling of the breeding habitat of the Sichuan Jay (n = 35)

	Factors					
	Coniferous forest	Deciduous forest	Canopy cover	Shrub cover	Grass cover	Moss cover
	trees (n)	trees (n)	(0–1)	(0–1)	(0–1)	(0–1)
Range	0–15	0–16	0–0.9	0–0.85	0.1–0.95	0.1–0.96
Mean ± *SD*	4.86 ± 4.09	1.72 ± 3.99	0.39 ± 0.30	0.24 ± 0.25	0.30 ± 0.30	0.49 ± 0.40

Table 3 Mean base area of coniferous forest, conifer components and the estimated forest cut rate
From 10 × 10 m vegetation sampling of breeding habitat (n = 22 plots)

	Coniferous components				
	Spruce	Fir	Cypress	Total living conifers	Cut stems
Base area (cm^2/100 m^2)	111.9	2432.4	2.4	2546.4	993.1
Number of trees in 100 m^2	0.20	7.33	0.20	7.73	2.4
Component percentage (%)	2.6	94.8	2.6	100	
Forest cut rate (%)			28.1		

Prof. H.B. Willam, Dr. T.A. Waite, and Prof. J. Ekman.

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