Expeditionary Ranging by a Japanese Macaque Troop in Hieizan

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Abstract A case of expeditionary ranging, ranging extensively out of the original home range, was observed in a Japanese macaque troop in Hieizan. Their original home range covered 499 ha, and during the one-month expedition, they ranged as far as 12 km from it. This troop did not suffer any demographic or environmental changes preceding the expedition. The distribution pattern of crops, distributed in thin, long patches along the edges of forest, and lack of adjacent troops seem to have facilitated the extensive expedition by this troop.

Keywords: expedition, ranging, philopatry, home range, Japanese macaque

Introduction

Female-bonded primate troops, including Japanese macaques, are philopatric (Pusey and Packer, 1987; Takahata et al., 1994). However, they change their home ranges during troop fission or severe food shortage (Sugiyama and Ohsawa, 1982) or in response to supra-annual variations in fruit availability (Hill and Agetsuma, 1995) or for unknown reasons (Takizawa et al., 1995). Here, we define “expedition” as ranging out of the home range of the past one year. Seasonal migration is excluded by this definition. After a troop makes an expedition, it may form a new home range (“range shift”, e.g., Sugiyama and Ohsawa, 1982) or may return to the original home range. We observed a case of an expedition by a Japanese macaque troop in Hieizan. This expedition was extraordinarily extensive (12 km) compared to the others reported (Ryozenyama: 3.5 km, Sugiyama and Ohsawa, 1982; Hakusan: 1–4 km, Takizawa et al., 1995) and we discuss why this urbanized troop ranged in such an unusual manner.

Study Sites and Subjects

The study subject, B troop, inhabited Mt. Hieizan (Fig. 1), which is surrounded by agricultural fields and the urban districts of Kyoto and Otsu City. Forested areas are mostly mountainous and other areas are mostly urban. Artificial coniferous forest
occupied 30.0% of their home range, and there was a large (> 300 ha) block of coniferous forest in the south of their home range (Hanya et al., 1997). There was no neighbouring troop, except for the A troop in the north. The members of this troop have been individually identified since 1992, and they were directly followed for 141 hours over 30 days during the one year before the expedition (November 1995-October 1996). Our five-year data, information from local inhabitants, and the official record on the distribution of crop-raiding by Japanese macaques, all agree that no monkey troop has been observed over the past several decades in the areas where the B troop ranged between October 26 and November 21, 1996. The area has a dense human population, so information from local inhabitants is reliable. Thus, it is certain that the expedition reported below was not our misjudgment of the normal range of this troop. They were quite habituated because they were provisioned by tourists and raided crops at the eastern foot of the mountain. The troop size fluctuated between 25 and 30 animals between 1992 and 1996 (Hanya et al., 1997) and numbered 28 in May 1996 (3 adult males, 9 adult females, 10 juveniles and 6 infants). Before the expedition, no change in membership occurred since the last infant was born in May 1996. While they made the expedition, we located them by direct observation for 25 hours over 13 days. We located them mainly by the information from local inhabitants. When we found them, we followed, checked the membership, and recorded their food ad libitum. We could locate them by information from inhabitants, but not by our direct observation, for 11 days.

Observations

The home range of the B troop during the one year before October 11, 1996 covered 499 ha (Fig. 1). They made an expedition during the period between October 26 and November 21, 1996, and after that, they have stayed in their original range. They ranged through forests during the expedition: they were always observed within 100 m of forested areas except on November 10, when they crossed the narrowest part of the urban area, 1.4 km in width, for less than one hour. They were found in agricultural fields or urban areas on all but three days. They often stayed in agricultural fields or urban areas for several hours (5.5 hours at most, Table 1). They ate crops such as persimmons, oranges, onions, pumpkins, and radishes in the fields or in gardens. We observed no mating behavior. On November 2, when they crossed the Meishin Expressway southward, one adult female and two juveniles were killed in a traffic accident. The distance between the southern limit of the original home range and the farthest (southernmost) point of the expedition was 12 km.

Discussion

We discuss this extensive expedition by dividing it into two stages. The first stage was when the B troop first crossed the block of coniferous forest which bordered
Expeditionary ranging by the B troop. Hieizan is surrounded by the urban area of Otsu City in the east, the Sakyo Ward of Kyoto City in the west, and the Yamashina Ward of Kyoto City in the south. When the troop was located at more than two places that were more than 500 m apart on one day, the places are indicated as separate points.
their original home range in the south (from October 22 to October 27). At this stage, their expedition did not differ from small-scale expeditions which have been reported for many other populations (Sugiyama and Ohsawa, 1982; Takizawa et al., 1995; Hill and Agetsuma, 1995). The second stage was when the expedition became extraordinarily extensive (after October 28), which has not been observed elsewhere.

Philopatric female-bonded troops make small-scale expeditions in response to demographic or environmental changes, such as troop fission (Takizawa et al., 1995) or termination of provisioning (Sugiyama and Ohsawa, 1982). Even in the absence of these severe changes, they make expeditions in search of specific food or water (Hill and Agetsuma, 1995; Jolly and Pride, 1999). However, there is no evidence that B troop suffered demographic or environmental changes before the expedition. No increase in troop size or habitat alterations had occurred for the past five years. They depended on tourists' handouts and crops at the eastern foot of Mt. Hieizan before the expedition, and the availability of these artificial foods did not seem to have changed. The number of tourists and the local government’s or inhabitants’ policy against crop-raiding did not change before the expedition. There is a possibility that fruit production in this year was worse than usual. However, more than 50% of monkeys’ feces (in terms of dry weight) contained seeds one month before the expedition (Hanya et al., 1997), which may suggest fruit availability was not so bad before the expedition. No wild dog, which is a possible predator of monkeys, was detected before or during the expedition. Social factors did not seem to be important. Because the B troop had rarely encountered the A troop for several months before the expedition, they were not “swept” away by the A troop. No non-troop male was observed and no age/sex class led the ranging before or during the expedition, thus the possibility that they were seeking mates is not supported. We consider that the factors which made B troop leave the original home range initially were subtle or non-existent and remain to be established. There have been reports of small-scale expeditions

Table 1. Utilization of agricultural fields or other urban areas by the B troop during the expedition

<table>
<thead>
<tr>
<th>Date</th>
<th>Observation time (hour)</th>
<th>Time spent in agricultural fields or other urban areas (hour)</th>
</tr>
</thead>
<tbody>
<tr>
<td>November 1</td>
<td>2</td>
<td>1.5</td>
</tr>
<tr>
<td>November 5</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>November 7</td>
<td>2.5</td>
<td>2.5</td>
</tr>
<tr>
<td>November 8</td>
<td>3.5</td>
<td>2.5</td>
</tr>
<tr>
<td>November 13</td>
<td>6.5</td>
<td>1</td>
</tr>
<tr>
<td>November 16</td>
<td>5.5</td>
<td>5.5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>22</strong></td>
<td><strong>14</strong></td>
</tr>
</tbody>
</table>

Only the observations which lasted more than one hour were shown.
by philopatric macaque troops, which were not related to any apparent environmental or demographic factors (Sugiyama, 1971; Takizawa et al., 1995).

Once B troop left the original home range, why did they range so extensively, reaching as far as 12 km from the original home range? We consider the reason was that they ranged in search of crops and the distribution pattern of crops and lack of adjacent troops were important factors in the extensiveness of this expedition. The monkeys seemed to eat a large amount of crops during the expedition: the monkeys appeared in agricultural fields or urban areas almost every day, stayed there for a long time and raided crops in fields or gardens. For monkeys, the crops were distributed in thin, long patches along the edges of forest because the troop almost always stayed close to forests even when they used fields or gardens. This distribution pattern is likely to have facilitated B troop’s extensive expedition because they were able to use new crop patches. This is contrary to the small-scale expedition by Yakushima macaques that utilized clumped patches of *Myrica rubra* in the natural forest (Hill and Agetsuma, 1995). The lack of adjacent troops in the south may also have facilitated the extensive expedition. In Hakusan, where many small-scale expeditions were observed, few troops ranged beyond those of adjacent troops (Takizawa et al., 1995). Jolly and Pride (1999) also pointed out the importance of inter-troop relations in explaining the long-term stability of the home ranges of ring-tailed lemur troops. However, the constraints of neighbouring troops may be smaller for larger troops because large troops are often observed to invade the ranges of small troops in Yakushima (e.g., Hill and Agetsuma, 1995).

Why have there been few reports of extensive expeditions from other Japanese macaque study sites? Or, why has it not been reported in Hieizan before this case occurred? In case of B troop, we consider the reason was that they “accidentally” (or for unknown reasons) reached the new agricultural fields in autumn. If B troop’s initial (small-scale) expedition had been into different directions or in a different season where or when the availability of crops was low, they would not have found new agricultural fields and would not have made such an extensive expedition. In addition to these stochastic reasons, we consider that extensive expeditions are limited for other populations by adjacent troops (continuously-distributed troops) or by isolated distribution of forest (isolated troops). The ecology of Japanese macaques which rely on crops or tourists’ handouts has largely gone unreported. These “urbanized” monkeys may offer us the chances to discover the extent of this species’ behavioral flexibility, which may include extensive expeditions or fission-fusion social systems (Fukuda, 1989).

The reason they came back to the original home range remains uncertain. Possible reasons may be that expeditionary areas were too dangerous because of the large motorways or too fragmental in the distribution of forested areas.
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References


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