

RESEARCH ARTICLE

Discovery of Miller's Grizzled Langur (*Presbytis hosei canicrus*) in Wehea Forest Confirms the Continued Existence and Extends Known Geographical Range of an Endangered PrimateSTANISLAV LHOTA^{1,2}, BRENT LOKEN^{3,4*}, STEPHANIE SPEHAR⁵, ERIC FELL⁵, ALEXANDR POSPĚCH⁶, AND NUNUK KASYANTO⁷¹Department of Zoology, Faculty of Science, University of South Bohemia, České Budějovice, Czech Republic²Ústí nad Labem Zoo, Ústí nad Labem, Czech Republic³School of Resource and Environmental Management, Simon Fraser University, Burnaby, British Columbia, Canada⁴Ethical Expeditions, Gig Harbor, Washington⁵Anthropology Department, University of Wisconsin Oshkosh, Oshkosh, Wisconsin⁶Wolf Springs Reserve, White Carpathians, Vyskovec, Czech Republic⁷Badan Pengelola Hutan Lindung Wehea, Sangatta, Kalimantan Timur, Indonesia

Miller's Grizzled Langur (*Presbytis hosei canicrus*) is one of the least known and rarest primates in Borneo. With a limited geographic range along the central coast of East Kalimantan and the highly degraded Kutai National Park, its former stronghold, this subspecies is now extremely rare and has been listed as one of the world's 25 most endangered primates. From June 6 to August 2, 2011, we carried out both direct observation and camera trap surveys at two mineral springs (sepan) in the Wehea Forest, East Kutai district, East Kalimantan. *Presbytis hosei canicrus* was observed at the large sepan on 3 of 6 observation days and at the small sepan on 2 of 3 observation days with up to 11 individuals observed in a single day at a single site. Camera traps recorded a per day capture rate of 0.72 at the small sepan and 0.25 at the large sepan and a per photo capture rate of 0.50 and 0.005, respectively. These data suggest relatively frequent occurrence of *P. h. canicrus* at the sepan, but the langurs are rarely encountered elsewhere in the Wehea Forest. The discovery of *P. h. canicrus* in the Wehea Forest confirms the continued existence of this endangered primate and is the first solid evidence demonstrating that its geographic range extends further inland than previously thought. It is not known whether the population of *P. h. canicrus* within Wehea Forest is large and stable enough to be considered viable, but it is likely part of a larger population that may possibly occur across surrounding protected forests and logging concessions. Surveying this potentially large population, and securing its protection, should be a priority measure for ensuring the continued existence of *P. h. canicrus*. *Am. J. Primatol.* 74:193–198, 2012. © 2012 Wiley Periodicals, Inc.

Key words: *Presbytis hosei canicrus*; East Kalimantan; camera trap; survey; sepan; Wehea Forest

INTRODUCTION

Miller's Grizzled Langur (*Presbytis hosei canicrus*), also known as Miller's Grizzled Surili, is one of the rarest primates in Borneo. Until recently, it was known only from two areas along the central coast of East Kalimantan province, Indonesia: Sangkulirang Peninsula (Mt Talisayang and Karangan River) and Kutai National Park [Payne et al., 1985]. Rodman [1978] calculated the population density of *P. h. canicrus* in the Mentoko study area of Kutai National Park as 20.4 individuals/km², which is relatively high for a *Presbytis* langur species in Borneo. To our knowledge, this has been the only attempt to estimate the population density for *P. h. canicrus*. In 1982–83, a prolonged El Niño and resulting drought prompted catastrophic forest fires that burned most of Kutai National Park, including Men-

toko. The langur was observed in Kutai after the fire [Suzuki, 1984] but the park experienced several additional fires, human encroachment and continued forest degradation in following years. By the

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end of 1998, only about 5% of the primary forest in Kutai National Park remained, and much of the secondary forest has been used for agriculture, mining, and industry [Dennis & Colfer, 2006]. No comparable data on the status of *P. h. canicrus* in the Sangkulirang Peninsula was available at that time, but forest degradation and land conversion were also widespread in this area, in addition to hunting pressure [Setiawan et al., 2009].

Brandon-Jones et al. [2004] were among the first to express concerns that *P. h. canicrus* might have gone extinct. In 2006, the subspecies was listed as one of the 25 most threatened primates [Mittermeier et al., 2006], which significantly increased interest in this primate. In 2008, Arif Setiawan and his colleagues conducted the first focused survey across the known geographical range of *P. h. canicrus*, including both Kutai National Park and Sangkulirang Peninsula [Setiawan et al., 2009]. The team did not find evidence for the continued existence of the langur in Kutai National Park. The only solid evidence of the survival of *P. h. canicrus* was a single group of five individuals found in a patch of mangrove forest, surrounded by palm oil plantations, on the banks of the Baai River, Sangkulirang Peninsula. Local people recently confirmed this single group no longer exists in the area [Setiawan, pers. comm., August 2011]. In 2010, *P. h. canicrus* individuals were sighted, and regularly heard, by Anne Russon and her colleagues in Kutai National Park, near the original Mentoko research site. In 2011, these langurs were not seen or heard despite ongoing research activities at the field station [Russon, pers. comm., August 2011].

P. h. canicrus may still survive both in Kutai National Park and Sangkulirang Peninsula but populations are likely to be small and fragmented, decreasing its long-term viability. *Presbytis hosei canicrus* is currently classified as Endangered according to IUCN Red List criteria; however, Nijman et al. [2008] noted the subspecies may be reclassified once more data on its distribution becomes available.

In this paper, we present evidence that *P. h. canicrus* does indeed occur in the forests of central East Kalimantan, west of its known geographic range. We recorded the presence of *P. h. canicrus* at two mineral springs (sepan) in the Wehea Forest, East Kutai district, East Kalimantan. We provide preliminary observations on these two langur groups and argue for more research on the status, ecology, and distribution of this endangered primate.

METHODS

Study Site

This research was conducted in the Wehea Forest (01°32'46"N, 116°46'43"E) in East Kutai District,

East Kalimantan, Indonesia. Wehea contains 38,000 ha of mostly undisturbed forest bordered by large tracts of primary and secondary forests classified as logging concessions. Approximately 30% of Wehea has been selectively logged, with the last activity taking place in approximately 1996. Wehea is classified as a logging concession but paperwork has been submitted to change Wehea's status to a Protection Forest (Hutan Lindung). The site has varied topography, containing multiple ridges, ravines, and runoff streams with elevations varying from 250 m in the east to 1,750 m in the west. Wehea Forest is characterized by lowland dipterocarp and montane forests with average rainfall amounting to 3,000 mm per annum and temperatures ranging from 24°C to 35°C. A dry season typically runs from June to September and the rainy season is from November to February. At least nine species of nonhuman primates have been previously reported from the site: the Bornean orangutan (*Pongo pygmaeus*), Bornean gibbon (*Hylobates muelleri*), maroon langur (*Presbytis rubicunda*), white-fronted langur (*Presbytis frontata*), silvered langur (*Trachypithecus cristatus*), short-tailed macaque (*Macaca nemestrina*), long-tailed macaque (*Macaca fascicularis*), slow loris (*Nycticebus coucang*), and the Western tarsier (*Tarsius banancus*).

DATA COLLECTION

Presbytis hosei canicrus groups were observed at two sepan in Wehea Forest (Fig. 1) located a distance of 4.2 km apart, during June–July 2011. In both cases, the data were collected in two ways: (1) direct observation and photographing and (2) use of camera traps. Direct observations and photographs were collected by observers concealed in blinds. On days where direct observations were conducted, observers spent 8–10 hr in the blind watching the sepan. When the langur arrived at the sepan the observer noted the size and composition of the group and photographed all individuals for the purposes of identification. Camera trap data were acquired by battery-powered motion-triggered cameras that had been positioned strategically around the sepan.

The larger sepan (approximately 1,000 m²) consists of mixed terrain (grass, rock, gravel, mud, and water pools) with only a few small trees occurring within its borders and a small stream flowing through the site. Direct observations at the larger sepan were done using a small (2.5 × 1.2 × 1.5 m³) wooden blind with 12 cm tall window slits for observation. The blind was constructed several years earlier, and therefore animals were habituated to the structure. Data were collected from July 3 to 10, 2011; direct observations were conducted during 6 days of this study period, and camera trapping was done for all 8 days of this study period. Camera trap data were obtained using two Bushnell Trophy Cam camera traps, which were positioned on two trees

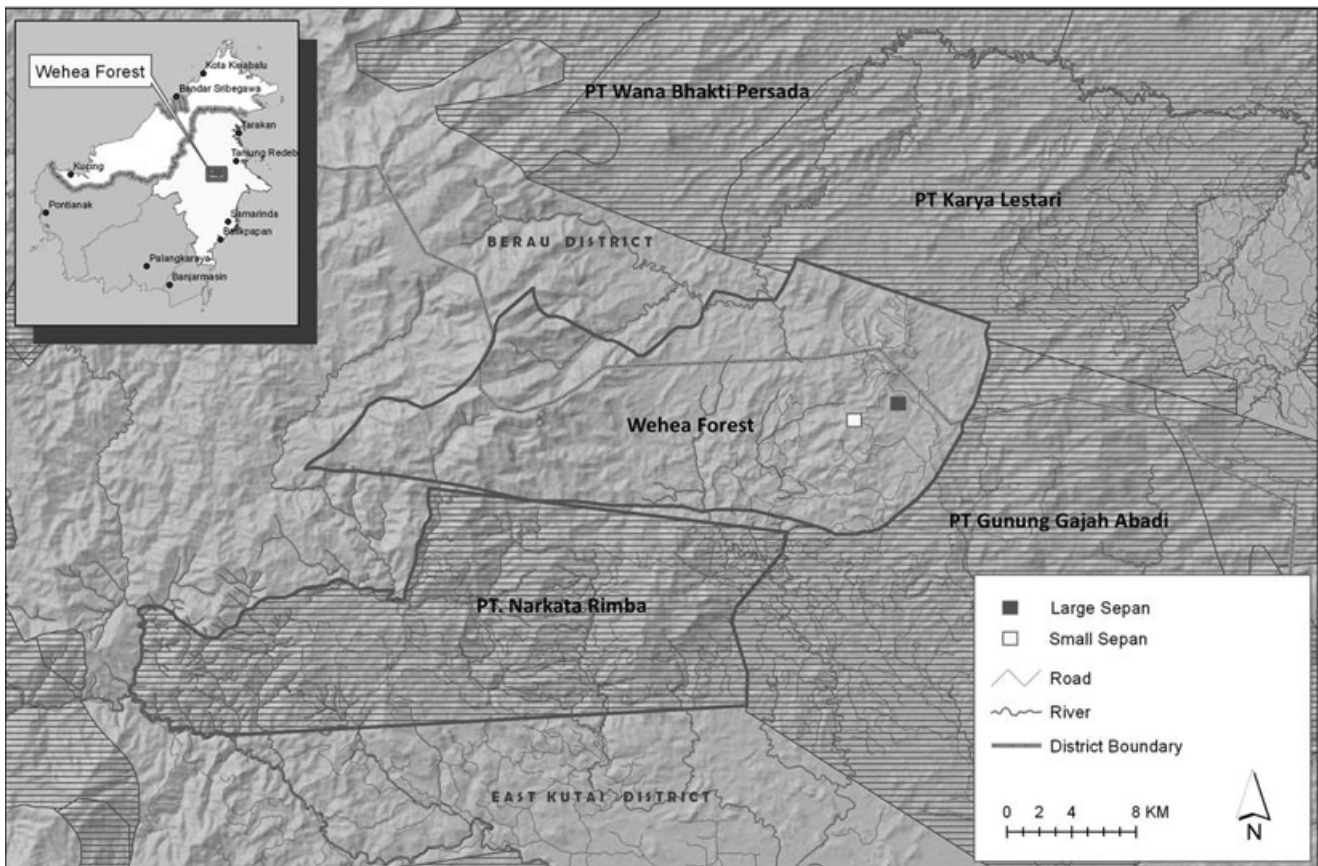


Fig. 1. Location of sepan in Wehea Forest where Miller's Grizzled Langur (*P. h. canicrus*) was observed from June 6–August 2, 2011. Inset shows location of Wehea Forest on the island of Borneo.

along the perimeter of the sepan at a height of approximately 80 cm. Both camera traps were set to take three photos per trigger.

The smaller sepan (approx. 250 m²) was situated beside a small river, on rocky terrain and contained a small amount of low vegetation. Direct observations of *P. h. canicrus* were conducted at this site for 3 days between June 25–29, 2011, and were done from small temporary blinds. The first blind was constructed a few days before observation data were collected but was later moved to a more convenient location. There was no habituation period. The single observer was virtually invisible to the animals, although the animals may have noted his presence by subtle auditory cues. Camera trapping was done for 58 days between June 6 and August 2, 2011, using two Reconyx HC 500 camera traps. Camera traps were placed on two trees, located along the perimeter of the smaller sepan, at a height of 40 to 60 cm. Both traps were set to take three photos per trigger, with the trigger delay varying from 0 to 1 sec. Camera trapping and direct observations were conducted during the same study period and largely overlapped.

Camera traps in both sepan recorded only animals observed on the ground in the proximity of the

spring itself, while direct observations recorded animals observed on the ground as well as those that could be viewed in trees from the blinds. For that reason, group counts are based primarily on observational data when available. However, observations of group counts and composition were validated by inspections of the camera trap photographs as well as photographs taken during the observations by the observers at both sepan. From photographs, we closely inspected the morphology of genitalia, nipples, and individual differences in coloration to confirm the age/sex categories of the individual animals and to minimize the risk of double counting the same individuals. The maximum group counts from the camera trap photographs also were taken into consideration in estimating group size.

All research conducted was in compliance with *American Journal of Primatology* guidelines for the ethical treatment of nonhuman primates, was approved by the Ethical Commission of the Faculty of Science of University of South Bohemia for Treatment of Laboratory Animals, and adhered to Indonesian legislation. Research permits were approved by the Indonesian Ministry of Research and Technology (RISTEK).

ANALYSIS

We analyzed our observational and camera trap data in order to determine how often *P. h. canicrus* visited each of the sepan, and how frequently they visited the sepan relative to other animals. The per day capture rate was calculated as the total number of days the langur was captured by camera traps in each sepan divided by the total number of camera trap days at each location. The frequency of visits to the sepan by the langurs was calculated as the per photo capture rate: the number of *P. h. canicrus* camera trap photos divided by the total camera trap photos. The average number of individuals per photo was calculated by counting the number of *P. h. canicrus* individuals in each capture event (three pictures per trigger) divided by the total number of capture events. Presence rate was used to add some behavioral information and to standardize differences in length of observation days, and was calculated by dividing the total time when *P. h. canicrus* was present at the sepan by the total time when the observer was present.

The number of individuals present at the sepan was calculated from the direct observation data for each observation day. These counts may be but need not be identical to the size of the entire group.

RESULTS

Tables I and II provide the respective summary data on the direct observations and camera trapping of *P. h. canicrus* and other primates at both sepan.

At the large sepan, *P. h. canicrus* was observed on 3 of 6 days. On July 3, three individuals were counted, including two adult females, and one adult or subadult langur of unknown sex. On July 9, 11 individuals were counted, including one adult male, three adult females with infants, one adult female without an infant, two adults of unknown sex, and one large juvenile or subadult of unknown sex. On July 10, only two individuals were observed, one subadult of unknown sex and one large juvenile or subadult of unknown sex. Both of these langurs were observed alone, as the second langur appeared at the sepan 52 minutes after the first individual went out of sight.

The camera trapping data from the large sepan occurred simultaneously to and is largely redundant with respect to the observational data. However, on July 4, one langur was photocaptured but not observed, and on July 10, two individuals were observed at the sepan but none was photocaptured. Both data sets are included for comparison and methodological consideration.

A total of 1,279 photographs were taken from the large sepan during 8 camera trap days. The per photo capture rate was very low, 0.005, which is much less than for other mammals at this sepan, notably the sambar deer. During the 8-day study, *P. h. canicrus* was photocaptured only on July 3 and July 4 and only one langur was captured in each photograph. The per day capture rate is relatively high, 0.25, showing that the langurs visited the sepan frequently but did not spend very much time in its immediate proximity.

At the small sepan, *P. h. canicrus* was observed on 2 of 3 observation days. On June 27, we observed four animals, including one adult male, one adult female with infant, and one subadult animal of unknown sex. On June 29, three animals were observed, including one adult male, one adult female, and one subadult animal of unknown sex. Inspection of photographs indicates the group observed on June 29 was most likely the same individuals observed on June 27, although the infant was not seen on June 29.

A total of 8,184 photographs were taken from the small sepan during 58 camera trap days. With a per photo capture rate of 0.50 and a per day capture rate of 0.72, *P. h. canicrus* was the most frequently photocaptured mammal at the smaller sepan. The average number of individuals per photo was 2.30; the maximum number of seven individuals from camera trap photos was more than the maximum number of langurs directly observed at the small sepan.

Other primates directly observed or photographed by camera traps at both sepan included the Bornean orangutan (*P. pygmaeus*), maroon langur (*P. rubicunda*), and short-tailed macaque (*M. nemestrina*). The per day capture rate for other primates at the small sepan was less than that for *P. h. canicrus*, although at the large sepan, the per day capture rate for other primates was equal to or greater than that for *P. h. canicrus*.

TABLE I. Direct Observation of Miller's Grizzled Langurs (*P. h. canicrus*) and Other Primates at Sepans in Wehea Forest in June–July, 2011.

Location	Days <i>P. h. canicrus</i> observed (total days spent at sepan)	Hours <i>P. h. canicrus</i> present (total observation hours)	Average no. of individuals observed (min, max)	<i>P. h. canicrus</i> presence rate	<i>P. h. canicrus</i> per day capture rate	Other primates (per day capture rate)
Small sepan	2 (3)	5.83 (28)	3.5 (3, 4)	0.21	0.67	<i>M. nemestrina</i> (0.33)
Large sepan	3 (6)	1.6 (56)	5.3 (2, 11)	0.03	0.50	<i>P. pygmaeus</i> (0.50) <i>P. rubicunda</i> (1.00)

TABLE II. Camera Trapping Results for Miller's Grizzled Langur (*P. h. canicrus*) and Other Primates at Sepans in Wehea Forest From June 6–Aug 2, 2011

Location	Total no. of <i>P. h. canicrus</i> photos (total camera trap photos)	Days <i>P. h. canicrus</i> visited sepan (total camera trap days)	Average no. of individuals/photo (min, max)	<i>P. h. canicrus</i> per photo capture rate	<i>P. h. canicrus</i> per day capture rate	Other primates (per day capture rate)
Small sepan	4,124 (8,184)	42 (58)	2.30 (1, 7)	0.50	0.72	<i>P. pygmaeus</i> (0.05) <i>P. rubicunda</i> (0.29) <i>M. nemestrina</i> (0.02)
Large sepan	6 (1,279)	2 (8)	1.0 (1, 1)	0.005	0.25	<i>P. pygmaeus</i> (0.25) <i>P. rubicunda</i> (0.50)

DISCUSSION

Discovery of Miller's Grizzled Langur (*P. h. canicrus*) in the Wehea Forest confirms the continued existence of this endangered primate and is the first solid evidence demonstrating that its geographic range extends further inland than previously thought. As this subspecies (which should perhaps be elevated to the species level [Meijaard & Groves, 2004]) appears to be on the brink of extinction within its previously known geographic range, finding new populations and expanding the known distribution of *P. h. canicrus* is of utmost importance for determining the conservation status and securing the future of this endangered primate.

As is likely true for remnant populations in Kutai National Park and Sangkulirang Peninsula, our study suggests that the population density of *P. h. canicrus* in Wehea Forest is very low. The high frequency of sightings at the sepans does not necessarily suggest a high abundance of the langurs. The sepans appear to contain key resources for primates and other wildlife within the forest and may be used disproportionately compared to other habitats. Unpublished observations at the large sepan suggest it has been used regularly by *P. h. canicrus* for many years. Rustam [in press] camera trapped the langurs at the large sepan in 2008, and Gabriella Fredriksson [pers. comm.] observed, photographed, and video recorded one group at the large sepan in August 2010. No long-term data yet exist for the small sepan, which was discovered only recently.

At present, the two sepans in Wehea Forest are the only locations where *P. h. canicrus* has been observed regularly. Sepans should therefore be considered priority spots for further survey of these langurs in Wehea and other forests within their potential geographical range. Furthermore, the tendency of the langurs to remain in the trees surrounding both sepans for extended periods of time and high frequency of visits makes it possible to collect data on the behavior and ecology of this cryptic primate. Preliminary results from this study indicate possible differences in the use of the two sepans by *P. h. canicrus*, including both the frequency and length of visits and the number of group members that descend

to the ground and approach the sepan. This is indicated by differences in the presence rate, per photo capture rate and the average number of individuals per photo. However, this also may be partially explained by the large difference in camera trapping effort between the two sepans and the placement of camera traps. Results also indicate possible differences in the frequency of use of the two sepans by *P. h. canicrus* and other primates. Further investigation on the potential differences in the use of the two sepans by *P. h. canicrus* and frequency of use by other primates may shed light on the ecology and behavior of this little known primate and make future surveys more efficient.

No other sepans have been located in Wehea Forest so far, and only one other sighting of *P. h. canicrus* outside of the two sepans has been confirmed since 2004. This sighting, by Larissa Salaki [pers. comm.] in 2011, was of at least two adults and one infant. The langurs have not been sighted on any other occasions despite an intensive study on the ecology and behavior of sympatric Maroon Langurs that began in 2009 and is still ongoing. Ex-hunters have indicated numerous sepans exist in Wehea, making search for additional sepans in Wehea a priority.

Although our study has extended the current geographical range for *P. h. canicrus*, we emphasize this does not ensure the survival of this subspecies. Loss of habitat and hunting pressure are the two greatest challenges facing the survival of *P. h. canicrus*. However, efforts to protect the Wehea Forest have substantial buy-in from the local community. In 2004, the Wehea Dayak declared the Wehea Forest, "protected land" under customary "adat" law, prohibiting the cutting of trees, starting of fires, and harvesting of plants and animals from the forest. The site is currently co-managed by the local Wehea Dayak community and the Wehea Management Body, a multi-stakeholder governing body consisting of the regional East Kutai government, NGO's, private companies, and universities, and the forest is patrolled by a team of Wehea Dayak rangers.

It is not known whether the population of *P. h. canicrus* within Wehea Forest is large and stable enough to be considered viable. But Wehea Forest is

still contiguous with other large forested areas along its borders. Some of these forests have protected status, but others are exploited as logging concessions for selective timber extraction. Together with the Wehea Forest, they represent a continuous area of at least 180,000 ha of suitable primate habitat, and very likely accommodate a viable population of *P. h. canicrus* (as well as other threatened primate and wildlife species). If logging is sustainably managed, hunting kept under control, and further expansion of palm oil plantations into the abandoned logging concessions halted, this forest block could provide hope for the long-term survival of *P. h. canicrus*. These forests should be considered a priority area for future surveys for the subspecies.

Discovery of a potentially viable population of *P. h. canicrus* in and around Wehea Forest should not undermine efforts to protect the subspecies in its formerly known geographic range. Although very rare, *P. h. canicrus* still appears to persist in its former stronghold of Kutai National Park, the only area where this langur was reported to occur at relatively high densities [Rodman, 1978]. Although these populations no longer exist at high densities, primarily due to the great fires of 1982–83 and 1997–98, the carrying capacity of burned forest in Kutai National Park may increase if forests are allowed or encouraged to regenerate. The possible recovery of *P. h. canicrus* in Kutai National Park should therefore be monitored and the status of the remaining population in the Sangkulirang Peninsula should be validated through thorough surveys before abandoning these potentially viable conservation causes.

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