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Behavioral variability in captive slow lorises, Nycticebus coucang (Lorisidae, primates)

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BEHAVIORAL VARIABILITY IN CAPTIVE SLOW LORISES, *NYCTICEBUS COUCANG* (LORISIDAE, PRIMATES)

A Thesis

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by

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This is a quantitative analysis of individual and sex-related variability in selected activities of captive slow lorises (Nyctivebus coucang).

The slow loris (Figure 1) is a nocturnal lorisid prosimian inhabiting tropical rainforests of Southeast Asia (Napier and Napier, 1967). Observations of this species in its natural habitat are limited to brief, incidental accounts (Buettner-Janusch, 1966; Elliot and Elliot, 1967; Napier and Napier, 1967; Medway, 1969; Fooden, 1971).

Previous reports on behavior of captive slow lorises have focused on social behavior (Horr, 1969; Ehrlich and Musicant, 1977; Chinn, 1980), the use of scent-marking in spatial orientation (Seitz, 1969), 24-hr activity rhythms in a natural day-night cycle (Tenaza et al., 1969) and influences of light and darkness on activity rhythms (Trent et al., 1977; Redman, 1979).

Tenaza et al. (1969) and Trent et al. (1977) reported that caged lorises sleep during the day and remain active throughout the night, with no marked temporal changes in frequency of any particular nocturnal activities. Redman (1979) discovered an endogenous activity rhythm of 22-23 hrs duration persisting in constant darkness.

With regard to social behavior, Ehrlich and Musicant (1977) noted strong mutual attraction and very little

Figure 1. A 3-month old male slow loris (Nycticebus coucang) conceived and born in Richard Tenaza's laboratory at the University of the Pacific. Adults weigh 1-2 kg. They are slow moving, nocturnal, arboreal omnivores.

agonistic behavior among slow lorises in groups consisting of one male and two females but mutual intolerance and fighting between adult males. Horr (1969) and Tenaza (pers. comm.) similarly observed that males caged together invariably fought. Horr (1969) also noted that, in the same situation, males did not attack females and females attacked neither males nor females. However, Tenaza (pers. comm.) has observed that males may suddenly become hostile towards females and inflict serious wounds upon them, even after they have been living peaceably together for up to two years. Chinn (1980) found a low incidence of agonistic behavior between the sexes, and little difference between male and female in other social activities.

Tenaza (pers. comm.), Redman (1979), and Chinn (1980), cited above, worked with the same lorises utilized in the present study.

METHODS AND MATERIALS

Subjects

The subjects of this study were four adult female and four adult male slow lorises. All were in the laboratory for at least six years prior to this study. Six were wild-caught (origin and ages unknown), the remaining two (Male #2 and Female #4) were born in captivity.

Housing and Diet

The lorises were housed in a laboratory at the University of the Pacific (Stockton, California) on a reversed day-night cycle. Room windows were blacked out with foil and a light-proof curtain. "Daylight" was provided by four eight-foot flourescent lights (GE-F96T12-CW) located approximately 1 m above the cage tops. An automatic timer turned the lights off at 0900 and on at 2100, resulting in a 12 hour night and a 12 hour day. Since lorises are relatively insensitive to red light (Horr, 1969), a bank of red lights was used to provide illumination during observation periods.

Room temperature varied from 22-27 C. During the summer months a small air conditioner was operated to maintain this temperature range. Fresh air also circulated continuously.

The lorises' diet consisted of Purina Monkey Chow, fresh fruits (bananas, grapes, oranges, pears and assorted

melons), cottage cheese, and/or ground beef. Live insects were provided on occasion. Lab water bottles were hung on cage sides. Food was placed daily in small bowls on the cage floor, always before the lights went off (0900) and hence before the lorises became active.

The room layout and cage positions are shown in Figure 2. The six cages were not visually or acoustically isolated from each other but physical contact between animals in adjacent cages was prevented by distance.

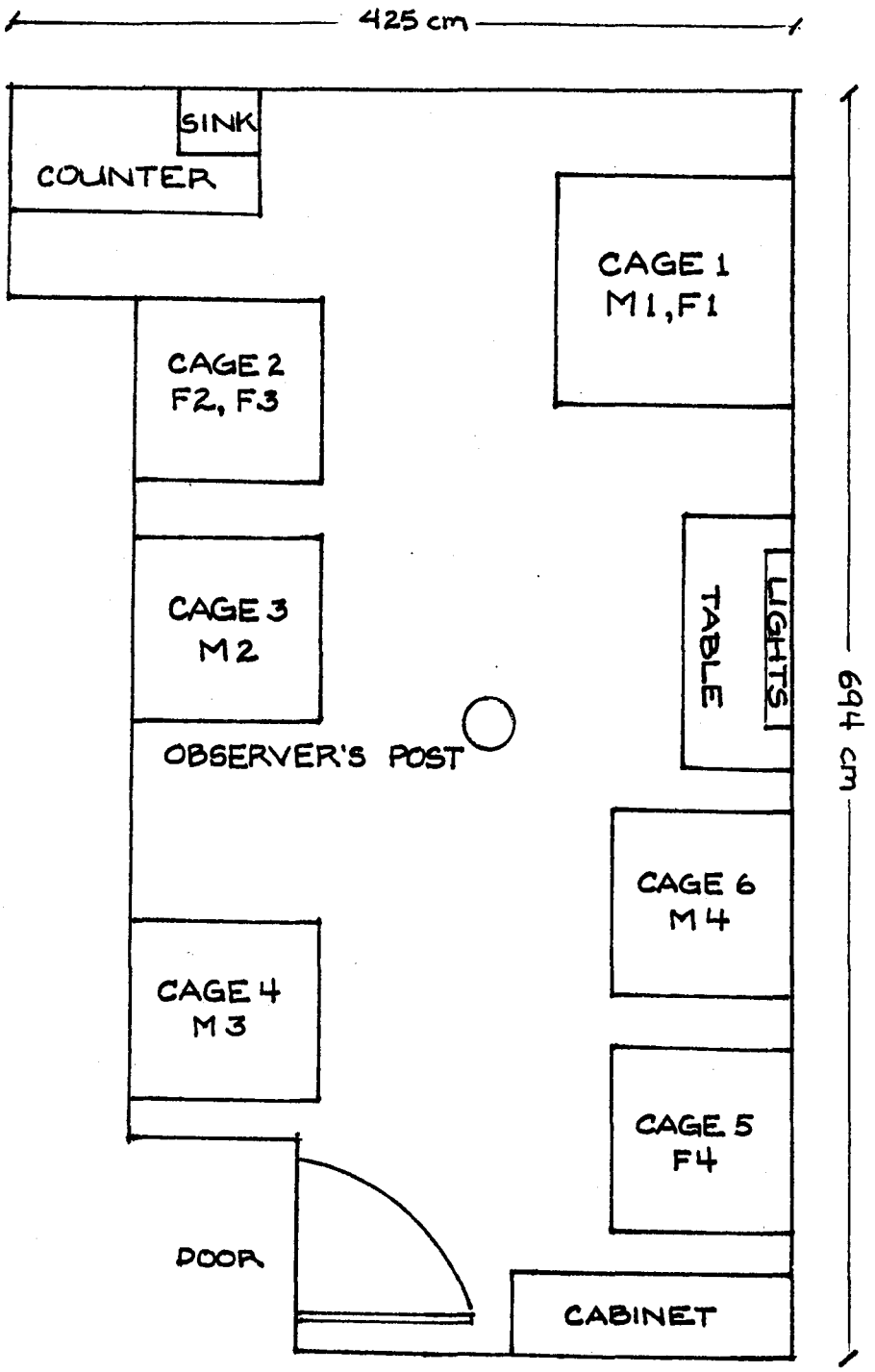
Observation methods

The study was divided into an initial 8-week observational phase followed by a 6-week quantification phase. During the initial phase I constructed a behavior taxonomy and habituated the animals to my presence. Figures 3 and 4 show the activities, individual and social, selected for quantification. The last two weeks of the initial phase were devoted to trial data collection to thoroughly familiarize myself with data recording procedures.

Data reported herein were collected from 20 July to 2 September. Most data were collected in blocks of five consecutive days; however, three blocks of only three days duration were also employed due to excessive disturbance in adjacent rooms.

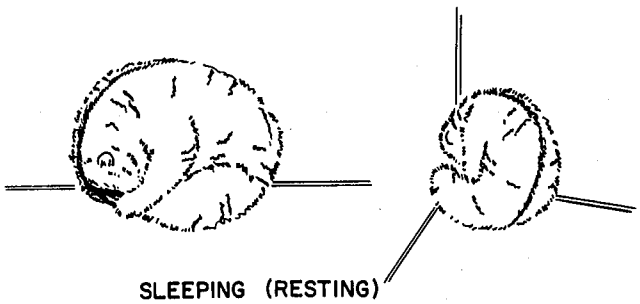
Sampling periods were of one hour duration. Two 1-hour periods were sampled each sampling day with a 30 minute break between them. The first period started between 0900-0930,

WINDOWS EXTEND ACROSS ENTIRE WALL,
FROM A HEIGHT OF 238 cm TO CEILING.



CAGE 1 BASE : 121 cm × 121 cm HEIGHT : 198 cm
CAGES 2-6 BASE : 92 cm × 92 cm HEIGHT : 167 cm

SITTING (AWAKE)

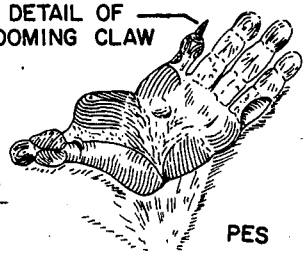


SLEEPING (RESTING)

ORAL SELF-GROOMING

SCRATCHING

DETAIL OF GROOMING CLAW



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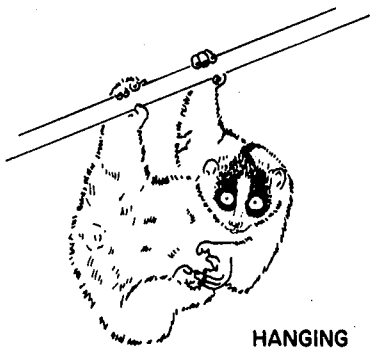
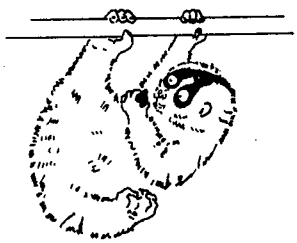
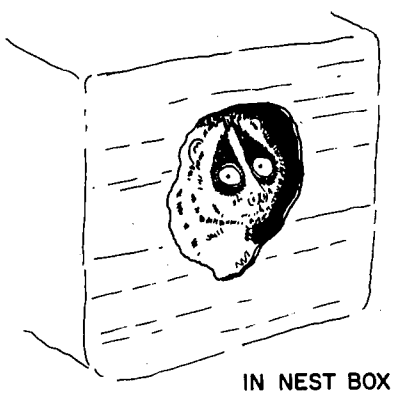


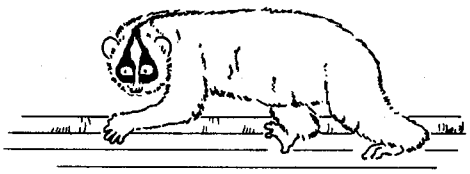
HANGING



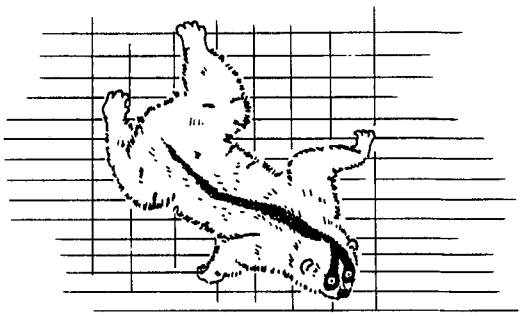
HANGING AND EATING



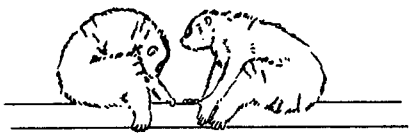
IN NEST BOX



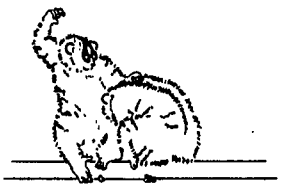
WALKING



CLIMBING

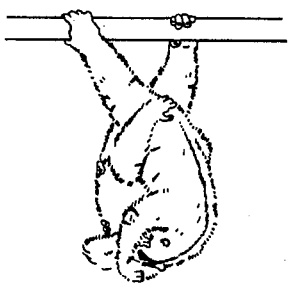


SOLICITING GROOMING

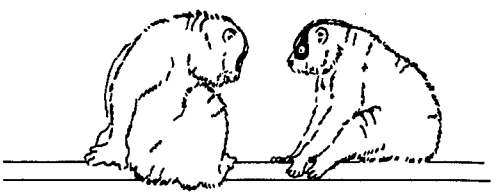


ALLOGROOMING

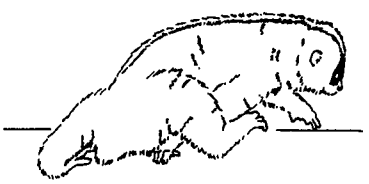
ALLOGROOMING



PLAY-FIGHTING



SITTING IN PROXIMITY



PERINEAL RUBBING

the second between 1030-1100. The entire session was always over by 1200 hrs. local clock time. This morning session was chosen over a split morning/afternoon session for convenience to the observer and because prior studies on the slow loris (Horr, 1969; Tenaza et al., 1969) including the present subjects (Redman, 1979), showed the greatest variety of activities during this time period. After this 2.5 hour period the activities of self-grooming, sleeping and locomotion predominated.

A scan-sampling method (Altmann, 1974) was used in conjunction with a Casio PW-80 "Pocket Watch" electronic calculator with a beeping intervalometer. The intervalometer was set to beep at 10 sec. intervals. At each beep I would tally the activity of one animal, then shift my attention to the next and await the next beep to tally its activity. After each animal was tallied (a total of 80 sec.) I had a 40 sec. break to jot down relevant comments before the next round began. A new round of tallying was started every 2 min. Thus each animal's activities were tallied once every 2 min. for a cumulative count of 60 tallies per individual on each sampling day. Total tallies for the study were 1,620 per subject.

Quantiative data so collected were analyzed with the University of the Pacific's Burroughs 6700 computer and the following SPSS sub-routines: Condescriptive, Students t-test (with F-test for equality of within variance), Mann-Whitney

U test, Kruskall-Wallis one-way analysis of variance (Nie et al., 1975; Hull and Nie, 1979).

RESULTS

Results of this study are summarized in Tables 1-3. Males were observed sitting, self-grooming, moving (walking and climbing) and urine marking more than females (Table 1). Females were observed hanging from cage sides, perches or roof more than males (Table 1).

Although on the average males were observed staring and engaging in investigative behavior more than females, and females were in sleeping or resting positions more than males, these apparent differences between the sexes are spurious because they are outweighed by individual variability (Table 2). The activity "Stare" could be of differing durations, ranging from a brief glance to a prolonged look, it is the latter that is predominent in this study due to the sampling method.

Activities which did not show statistically significant differences between males and females were, "Eating" ($\overline{X}$ = 7.0, SD = 4.4, range 3.3-10.6 and $\overline{X}$ = 7.4, SD = 5.6, range 4.7-13.8, respectively, p = 0.792), "In Nest Box" ($\overline{X}$ = 8.7, SD = 11.2, range 1.3-21.1 and $\overline{X}$ = 13.7, SD = 15.2, range 3.3-33.2, respectively, p = 0.084) and "Perineal Rubbing" ($\overline{X}$ = 1.7, SD = 2.2, range 0.6-3.8 and $\overline{X}$ = 1.2, SD = 1.5, range 0.4-3.0, respectively, p = 0.191).

Two females caged together spent less time close to each other and engaged in much less social activity than did a male and female caged together (Table 3). This male-female pair also tended to synchronize some of their activities more so than the males and females when compared as groups (i.e., "In Next Box," $p = 0.8457$, Locomotion, $p = 0.4977$ and "Perineal Rubbing," $p = 0.6844$).

Self-grooming was of two types: (1) scratching with the modified nail on the second digit of the rear foot ("grooming claw") and (2) oral grooming using the dental comb and tongue. I could not reliably distinguish between the use of the tongue and the use of the dental comb while oral grooming. Males groomed themselves more than females (Table 1). Although individual variability and a small sample size, precluded reliable statistical analysis based on sex, males as a group had a greater tally than females for scratching. No differences were found between the sexes for oral self-grooming.

Urine marking, observed in conjunction with perineal rubbing is defined here as touching the urethral opening against a surface and releasing drops of urine on it in regular or irregular patterns (drops, swabs or streaks). Urine marking was only tallied when the animal was moving and there was evidence of urine being deposited. This probably resulted in the freuqency of urine marking being underestimated. However, males urine marked more than females (Table 1) and males near female(s) marked the most in proportion to locomotion.

Table 1. Individual activities that differed significantly between the sexes. Self-grooming occurred with sitting and hanging, urine marking with locomotion; hence these activities are not independent of one another. Probabilities were obtained with the Mann-Whitney U test using data on caged slow lorises with a sampling period of 27 days.

	Daily frequency of occurrence in samples:						
	Males			Females			2-tailed p
	$\bar{X}$	Range	S.D.	$\bar{X}$	Range	S.D.	less than
Sitting (awake)	25.9	15.5-35.1	10.5	13.9	5.5-23.1	9.6	.001
Hanging from sides of cages	2.1	0.3-5.0	2.4	6.7	1.3-17.7	7.4	.001
Locomotion (walking or climbing)	17.6	7.8-30.2	10.8	13.4	8.5-22.1	7.7	.01
Self-grooming	12.0	6.6-24.4	9.3	8.1	4.3-14.4	5.8	.01
Urine marking	1.5	0.9-3.1	1.6	0.7	0.2-1.5	1.1	.001

Table 2. Activities in which individual variability outweighed apparent sex differences. In each case, comparing males and females using either the Student's t-test or the Mann-Whitney U test yields statistically significant but spurious differences between the sexes at levels of p = 0.001. Data were obtained on caged slow lorises, collected twice a day for a 27-day period. The F-test was used to analyze between group variability, at 0.05 level of significance.

	Frequency of occurrence per daily sample:					
	Males			Females		
Activities	$\bar{X}$	Range	S.D.	$\bar{X}$	Range	S.D.
Sleeping/ Resting	1.3	0-4.4	4.4	8.3	0-16.2	11.4
Staring	7.4	1.3-17.6	7.2	2.4	1.1-3.6	2.7
Investigative behavior	2.8	0.3-7.2	3.1	1.1	0.6-2.2	1.5

Table 3. Social activities and inter-individual distance of a male and female loris caged together compared with two female slow lorises caged together. Probabilities were obtained with the Mann-Whitney U test using data collected twice a day over a 27 day sampling period.

	Frequency of occurrence per daily sample		
	Male-Female Pair	Female-Female Pair	2-tailed p less than
Activity	$\bar{X}$ (S.D.)	$\bar{X}$ (S.D.)	.0001
Play-fighting	3.8 (4.1)	0.0 (0.0)	.0001
Allogrooming	2.3 (1.8)	0.01 (0.4)	.0001
Grooming solicitation	1.1 (1.1)	0.02 (0.1)	.0001
Proximity*	14.2 (6.6)	1.1 (2.5)	.0001

*Estimated inter-individual distance 25 cm or less.

DISCUSSION

Tenaza et al. (1969) examined some of the same activities which were studied here. In both studies it was found that sitting was the most common non-sleeping activity for both sexes, males engaged in more locomotion than females and, on the average, females had a greater frequency of sleeping and resting than the males did. However, considerable individual variability among females makes it impossible to conclude generally that females sleep or rest more than males (Table 2).

Self-grooming was a prevalent maintenance activity for both sexes (Table 1), as reported in prior studies (Horr, 1969; Ehrlich and Musicant, 1977). Tenaza et al. (1969) found that females groomed themselves 57% more than males did, whereas in the present study, almost the reverse was ture, i.e., males groomed themselves 45% more than females. Although I observed a statistically significant difference between the sexes in self-grooming, individual variability might still outweigh any sex difference (Table 1).

Eating was the most common activity accompanying hanging, especially among females. Ellefson (1967) and Horr (1969) have suggested that hanging beneath branches while eating is an adaptation alleviating the problem of having to maintain

balance while manipulating food. This same interpretation could apply to other activities for which free limbs are required, e.g., self and social grooming, play-fighting and infant care.

Ehrlich and Musicant (1977) considered staring by slow lorises to be a threat, as it is in higher primates (Andrew, 1963; Oppenheimer, 1976; Gautier and Gautier, 1976; Van Hooff, 1967). However, as Oppenheimer (1976) notes, prolonged staring is also a generalized sign of attention that can be associated with non-aggressive motivations. In my observations, most staring did not appear to be aggressively motivated.

Lorisids possess much simpler facial musculature than that employed by higher primates for intricate expressions (Andrew, 1963). The bold contrast between shiny eyes, dark eye rings and a light stripe between the eyes makes the slow loris face a potentially powerful visual signal (Horr, 1969). These facial contrasts are highly conspicuous, even in very dim light. Although staring occurred more frequently in certain males (those caged next to females), individual variability was high and this possible difference between the sexes cannot be reliably evaluated without further data (Table 2).

It has been suggested that urine marking by slow lorises functions in individual recognition, monitoring of female estrus cycles, and territorial boundary marking (Horr, 1969;

Seitz, 1969; Epple, 1976). Urine marking in the lorisids is by direct contact of the urethra opening with a surface ("rhytmic micturation" of Ilse, 1955 and "perineal rubbing" of Tenaza et al., 1969). Another method known as "urine washing" (Boulenger, 1936; Hill, 1938) occurs most frequently in the galagines and rarely in the lorisids (Charles-Dominique, 1977a, 1977b; Ehrlich, 1970; Hill, 1938) except in Loris (Ilse, 1955). Urine washing was not observed in this study nor in prior studies of the slow loris except for those studies mentioned above (Horr, 1969; Tenaza et al., 1969; Ehrlich and Musicant, 1977; Chinn, 1980). This difference in the method of urine marking between most of the lorisids and galagines has not been adequately explained although hypotheses abound (Charles-Dominique, 1977b).

Seitz (1969) suggested that frequency of urine marking in captive slow lorises is directly proportional to locomotor activity. In the present study, urine marking did vary more or less directly with activity in females but not in the males, where proximity to females also appears to be a factor.

Play-fighting and allogrooming were the most common social activities of the male-female pair (Table 3). The two females caged together tended to avoid one another and they engaged in much less social activity than the male-female pair. Whether this difference is due to individual variability or to sexual composition of these pairs is

impossible to say based on just these two dyads. Horr (1969) noted that mutual grooming was restricted to male-female combinations, but Tenaza (pers. comm.) observed affiliative behavior between two sibling female slow lorises. As pointed out by Ehrlich and Musicant (1977), play between adults makes slow lorises unusal among primates.

Trent et al. (1977) noted that their adolescent lorises spent considerable time on the cage floors. In the present study males spent 55% and females 41% of the total observation time on the floor. Since their food dishes and nest boxes were on the floor, the "terrestrial" behavior observed in this study is probably a product of captivity.

Ehrlich and Musicant (1976) found considerable individuality in learning performance of slow lorises. This is in accordance with the high degree of individual variability in most activities documented in the present study. It would seem, based on these observations and those on other prosimii (e.g. Roberts, 1971; Tandy, 1974), that behavioral individuality among prosimians may approach that of the anthropoids (cf. Mitchell, 1979). Slater (1980) hypothesized that such individuality might, among other things, form a personality profile that could aid in individual recognition. Whatever the importance of individual and sex-related variability in its activities, the slow loris demonstrates a high degree of both.

Due to this high degree of individuality, care must be used when analyzing and interpreting data based on few subjects. The activities in Table 2 all differed significantly between the sexes when evaluated only by the Mann-Whitney U test. However, when between-group variability was examined among individuals of each sex (F-test), one or two "outriders" made the conclusions obtained with the Mann-Whitney invalid. Due to the small number of individuals in each sex, it is not known to what extent these "outriders" are typical or atypical.

SUMMARY

Selected individual and social activities of eight captive slow lorises were tallied twice a day for 27 days using a scan sampling technique. High individual variability occurred in both sexes for all activities that were quantified. Statistically significant differences between males and females were found for stationary postures, locomotion, self-grooming and urine marking. Staring and object investigation were more frequent in males as a group and sleeping or resting were more frequent in females as a group, but these differences could not be reliably attributed to sex due to high differences in group variability. Eating, perineal rubbing and time spent in nest boxes did not differ significantly between the sexes. A male and a female caged together spent more time close to one another and also engaged in significantly more play-fighting, allogrooming and grooming solicitation than two females caged together.

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