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Behavioural adaptations in South African Galagos

Harcourt, Caroline Susan

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(Snedecor and Cochran, 1967 p.27).

Three major clusters of behaviour, all orthogonal to each other, existed for G. crassicaudatus in summer. Cluster one contained travelling, moving, resting, allogrooming and autogrooming; cluster two of gum-foraging and gum-feeding with urine-washing not occurring in the same patches while cluster three was made up of insect-feeding and insect-foraging with allogrooming not occurring in these patches. Resting and autogrooming had a spatial correlation with insect-foraging which indicated that clusters one and three formed a 'loose' cluster and were probably close to each other in space. As there was no observed clumping of insect-feeding in winter in G. crassicaudatus it was excluded from the space correlation. A single, major cluster of activities was found which contained travelling, resting, auto- and allogrooming, gum-feeding, gum-foraging and urine-washing. However, within this cluster allogrooming had a low correlation with urine-washing and gum-feeding. Insect-foraging was not positively related to any activity but had a negative relationship with urine-washing.

Two major clusters of behaviour existed for G. senegalensis in summer. The first contained travelling, moving, resting, autogrooming, insect-feeding and insect-foraging while the second contained travelling, gum-feeding and gum-foraging. Neither allogrooming nor urine-washing was related to either of these clusters; the occurrence of these two behaviours in space was negatively related. Gum-feeding did occur in patches where insect-foraging and insect-feeding occurred but gum-foraging did not occur in the same patches.

In winter there were again two major clusters of activity for G. senegalensis. One consisted of travelling, autogrooming, allogrooming, gum-feeding and gum-foraging; the other contained moving, resting, autogrooming, insect-feeding and and insect-foraging. Urine-washing occurred in patches where gum-feeding and gum-foraging were found and tended not to occur where allogrooming, moving or insect-feeding were seen.

5.2.3 Height variation: Differences in the use of vertical space by the two species were examined using Kolmogorov-Smirnov tests. Signficant seasonal differences were found (G. senegalensis X^2 = 142,16, df = 2,<p 0,001; G. crassicaudatus X^2 = 316,31, df = 2, p<0,001). G. senegalensis had a more platykurtic distribution of height use in winter than in summer (Fig. 27). In G. crassicaudatus the distribution in summer is skewed towards more activity lower in the trees and it is more platykurtic than it is in winter (Fig. 27). A comparison between the two species in each season also showed significant differences in heights used (Summer X^2 = 67,69, df = 2, p<0,001; Winter X^2 = 238,35, df = 2, p<0,001). In summer G. senegalensis was spending less time near the ground than was G. crassicaudatus and vice versa in winter. The differences between the seasons and species were due mainly to changes in feeding and foraging behaviour; evidence for this is presented below.

The heights at which the bushbabies were foraging for and feeding on gum and insects were also analysed using

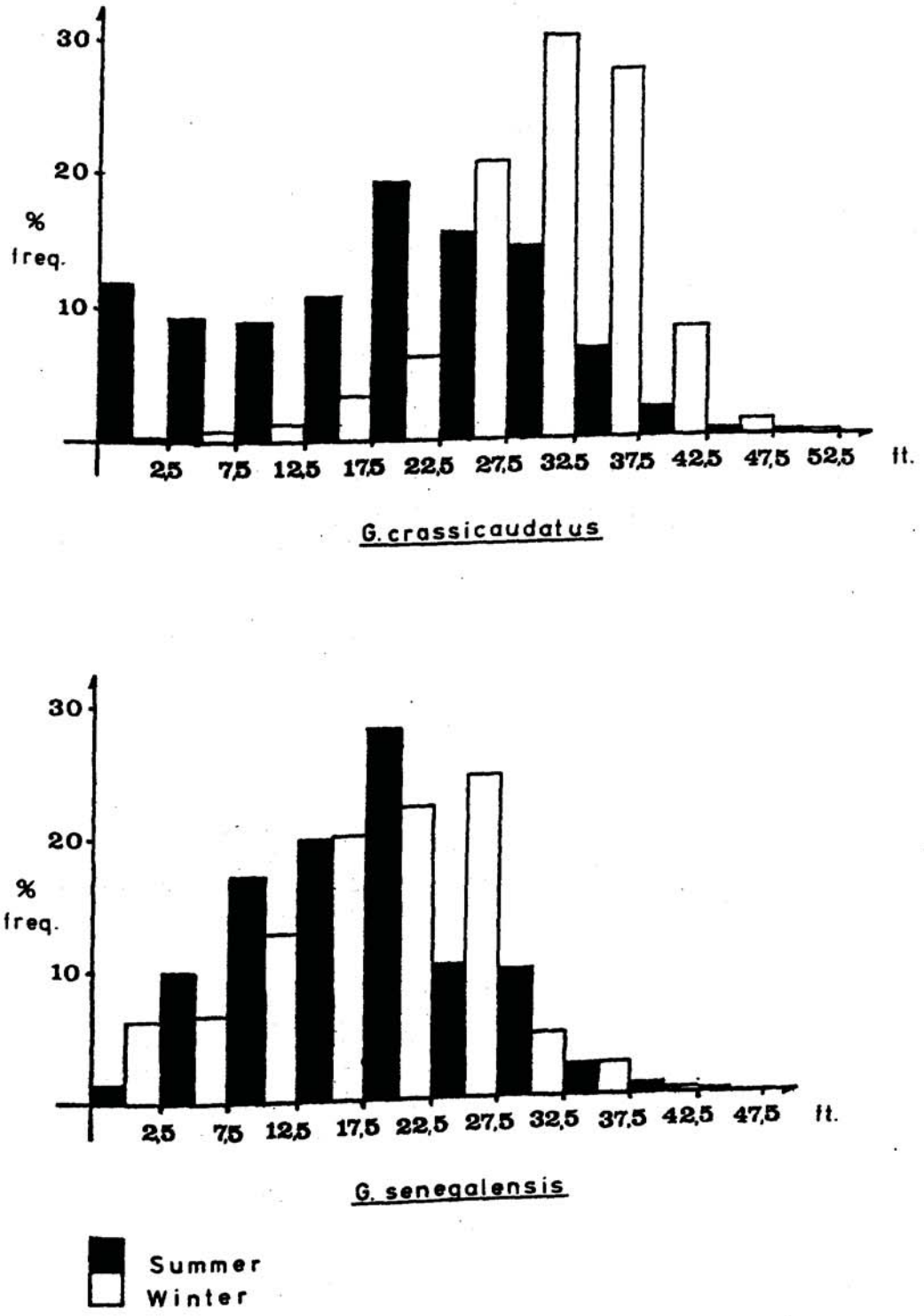

Figure 27. Seasonal differences in the time spent at different heights by the two species.

Kolmogorov-Smirnov tests. Significant seasonal differences were found in the heights at which insects were taken (G. senegalensis $X^2 = 71,98$, df = 2, $p<0,001$; G. crassicaudatus $X^2 = 7,06$, df = 2, $p<0,05$). Differences between seasons in G. senegalensis were due to more time being spent on or near the ground in winter as well as to a peak of insect-feeding and insect-foraging occurring at twenty-five feet (Fig. 28). In summer G. crassicaudatus spent a lot of time foraging in and around dead Acacia trees and bushes that had been cut down the year before. Insect-foraging was greatly reduced in winter and what little occurred was mostly higher in the trees than it was in summer (Fig. 28). There were also significant differences between the species in the heights at which they were searching for and feeding on insects (Summer $X^2 = 82,79$, df = 2, $p<0,001$; Winter $X^2 = 12,77$, df = 2, $p<0,001$).

There was no significant difference in the heights at which G. senegalensis foraged for and fed on gum between the two seasons (Fig. 29) though there was for G. crassicaudatus (G. senegalensis $X^2 = 5,46$, df = 2, N.S.: G. crassicaudatus $X^2 = 15,52$, df = 2, $p<0,001$). The thick-tailed bushbaby used gum from all heights in summer whereas its use peaked at twenty-five feet in winter (Fig. 29). Species differences were found only in winter (Summer $X^2 = 3,48$, df = 2, N.S.; Winter $X^2 = 40,16$, df = 2, $p<0,001$). G. senegalensis was tending to forage and feed closer to the ground than G. crassicaudatus in winter.

In both seasons G. crassicaudatus was consistently travelling, resting and grooming five or ten feet higher in

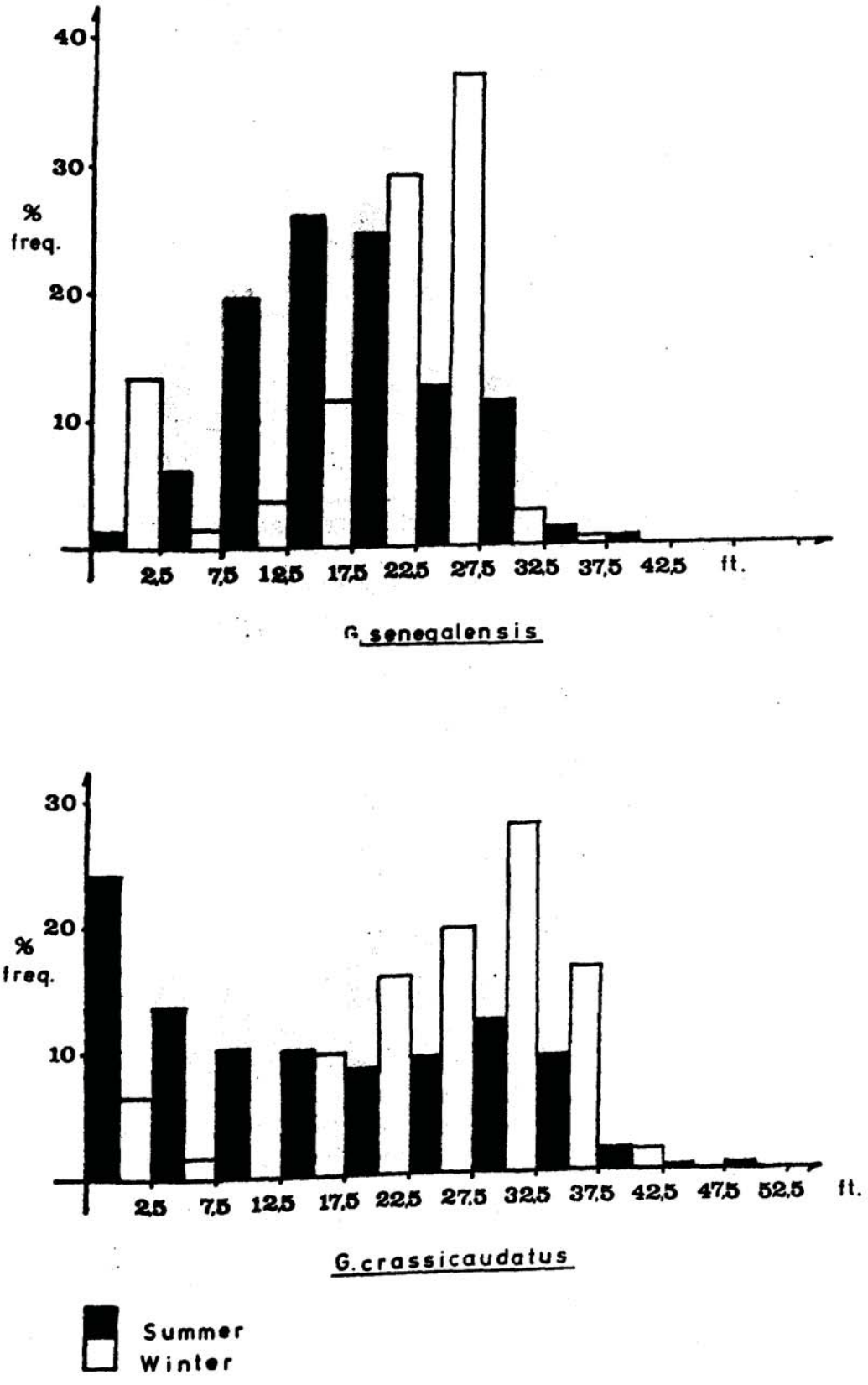

Figure 28. Seasonal differences in the time spent insect-foraging and insect-feeding at different heights by the two species.

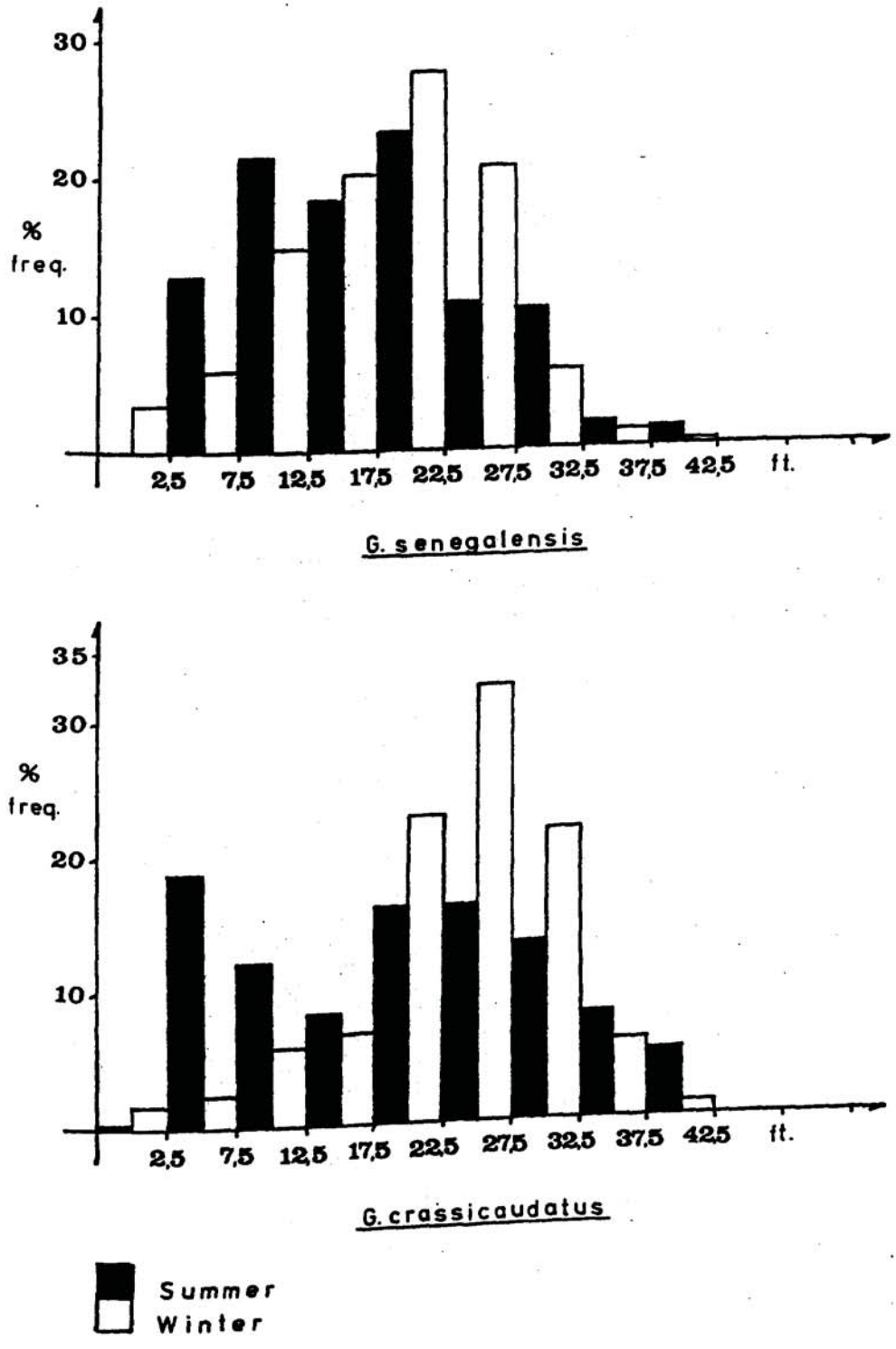

Figure 29. Seasonal differences in the time spent gum-foraging and gum-feeding at different heights by the two species.

the trees than *G. senegalensis*. There was, however, comparatively little seasonal difference in the heights at which any of these activities took place.

5.3. Discussion

The home range of *G. crassicaudatus* was approximately three times the size of the range used by *G. senegalensis*. It seemed that the prediction that the larger species would have the bigger home range (Clutton-Brock and Harvey, 1977; Milton and May, 1976) did hold true for the galagos. However, *G. crassicaudatus* spent almost all its time in only a third of its range while *G. senegalensis* did not have a similarly heavily used area within its home range. In contrast to an earlier study on the thick-tailed bushbaby (Bearder, 1975) the resource determining range use in this study was gum producing trees rather than sleeping trees. Sleeping sites outside the riverine strip were used fairly frequently and those within the strip were distributed along it rather than being clustered at a few places (see Fig. 31). There was no obvious reason why the female *G. crassicaudatus* did not confine her movements entirely to the riverine vegetation. It appeared, though, that a large number of bushbabies used the scrub area to the east of the strip so it may have been visited by the focal animal for social reasons. In addition the plant species in the scrub area were more varied and flowered at different times to those near the river. Their flowers would have attracted insects to them and they would, therefore, have been good food sources for

the bushbabies. Some of the fruits in this area may also have been used on occassions.

Both species, contrary to expectations (Clutton-Brock and Harvey, 1977), reduced the size of their home range in winter. This was almost certainly due to changes in the use of resources. G. crassicaudatus was taking very few insects so its movements were confined almost entirely to the gum trees near the river. Flowering trees were used as important insect sources by G. senegalensis in both seasons but their distribution was more limited in winter and this restricted the galagos' range.

The results of the spatial covariation of behaviours indicated that the galagos tended to use different areas in their range for each of their two resources. The recognition of different resource types, both in space and time, should mean that an animal can combine their use to provide an optimal diet. To obtain such a diet the animal has firstly to decide how long to stay in each patch type ('giving-up time') and secondly whether to move to the same or a different type of resource patch. These decisions will then influence the distribution of other behaviours.

Two different strategies of resource use were found in the present study. The galagos either devoted most of the time that they allocated to feeding behaviours to searching for and feeding on one particular resource (insects for both species in summer, gum for G. crassicaudatus in winter) or devoted their time to using both resources (G. senegalensis in winter). These strategies were linked to body size and environmental energy levels as discussed in chapter three.

How they affect all other behaviours is considered below.

When a single resource was used there were two different ways in which other behaviours were linked to feeding and foraging behaviours. For G. senegalensis in summer and G. crassicaudatus in winter many other behaviours besides feeding and foraging occurred in the same patch as the main resource. The less intensively used resource was not correlated with the occurrence of any behaviour other than feeding and foraging on that resource. A different pattern of relationships was found for G. crassicaudatus in summer. Travelling, moving, resting, allogrooming and autogrooming tended to occur together but the areas in which these types of behaviour were found were only loosely linked to the most intensively used resource patches.

The occurrence of other activities in the same areas as feeding and foraging could be simply a function of the length of time spent in the feeding areas. As in the model presented in the chapter on the use of time (chapter 4) the occurrence of a behaviour is seen to be dependent on the length of time since it was last emitted (McFarland, 1976). For both G. crassicaudatus in winter and G. senegalensis in summer over 20% of the time was spent on feeding and foraging, using gum and insects respectively. As expected from a semi-Markov chain model (Ross-Ashby, 1956) there was a high correlation of non-feeding behaviour with the areas where long periods of time were spent using the food resources. However, although G. crassicaudatus used a single resource for long periods of time in summer a strong correlation between feeding on that resource and non-feeding behaviour

was not found. This can be explained in two ways, both of which involve constraints on the occurrence of non-feeding activities in the main resource patch.

The first constraint is the need to avoid predators. G. crassicaudatus spent nearly a quarter of its foraging time on or near the ground and it would move up into a tree before allogrooming, autogrooming or resting. It is probable that the animal was more vulnerable to predation on the ground so non-feeding behaviour occurred in safer areas. The distribution of the main food resource is the constraint used in the second explanation. A comparison of the sizes of arthropod used by the two species in summer showed that the larger bushbaby selected larger arthropods (Chapter 3). It would be expected that large arthropods would be encountered less frequently than small ones. An inverse relationship has been demonstrated between prey encounter rate and giving-up time (Krebs, Ryan and Charnov, 1974) and therefore G. crassicaudatus, which will be encountering prey less frequently than G. senegalensis, would be expected to spend longer in a patch than does the smaller bushbaby. The short giving-up time in G. senegalensis would be associated with frequent changes of patch thus feeding and foraging behaviour would be more randomly distributed. The lower values of $s^2/\bar{x}$ for insect-feeding and insect-foraging in G. senegalensis than in G. crassicaudatus confirmed that insects were less clumped for the former species. The insect patches used by G. crassicaudatus were smaller than those used by G. senegalensis so the former species would have to exploit its resource patches more efficiently and would have devoted much

more of its time in a patch to feeding and foraging rather than to any other sort of behaviour. A combination of the two factors, predator avoidance and resource distribution, probably explained why feeding activities were only loosely associated with other types of behaviour in G. crassicaudatus even though it was using only one resource in summer.

When both insects and gum were important contributors to the diet, as for G. senegalensis in winter, each resource had a number of non-feeding activities associated with it. Resting, autogrooming and moving tended to be found in the insect-foraging and insect-feeding patches while travelling, autogrooming and allogrooming occurred in the gum patches. To a certain extent a semi-Markov chain model, in which the probability of non-feeding behaviour occurring in the resource patches is purely a function of the time spent in them, does explain the spatial covariation of activities found in G. senegalensis in winter. However, in this case the type of resource used appeared to be having an effect on which types of behaviour occurred with it. The slower, more cryptic behaviour tended to be found in the insect patches while allogrooming was rarely if ever found in them. Rapid movements and the presence of a second animal are both likely to frighten away the prey before it can be caught. A hierarchical model (Dawkins, 1976) in which the decision to use a particular resource then determines the probability of the occurrence of other behaviours, is possibly a more appropriate model to explain the covariation of behaviours when more than one food resource is used.

The importance of food resources in determining not only

where the galagos foraged and fed in horizontal space but also in vertical space was demonstrated by the seasonal changes in feeding heights which clearly responded to the availability of gum and insects.

Though the lesser bushbaby is almost certainly more liable to predation while on the ground the decrease in insects available in winter meant it had to exploit all areas where they might be found, including the ground. The increase in insect feeding at twenty-five feet was due to the use of big Acacia mellifera trees which were flowering during the winter and attracting a lot of insects, and hence the bush-babies, to them.

G. crassicaudatus relied to a great extent on gum in winter. The peak of feeding on it at twenty-five feet was due to the restricted number of big trees with large gum patches at that height being used regularly throughout the observation period in winter. The lesser bushbaby may well have been able to use smaller gum spots than G. crassicaudatus and, therefore, found no difference in its availability or distribution between seasons.

As there was little seasonal difference in the heights at which travelling, resting and grooming took place within the species but there was a difference of five or ten feet between the species it is possible that the height differences were due solely to habitat differences. The trees at Louis Trichardt were generally slightly taller than those at Mosdene. However, the small size of G. senegalensis and its method of locomotion (vertical clinging and leaping) may well have contributed to the differences because the lesser

bushbaby could use small saplings, particularly when travelling, that would not be suitable for use by G. crassicaudatus.

It appears then that for both the species in this study the use of space, including vertical space, depended to a large extent on the density and distribution of food resources. Which resources were used depended on the body weight of the animal and the environmental energy levels, hence the differences found between the species and seasons. The choice of resource then affected the spatial occurence of non-feeding behaviour though no single explanation could account for the patterns of covariation found.

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6. SOCIAL ORGANISATION

6.1 Introduction

Early attempts to examine the social organisation of primates placed all the nocturnal species in a single grade (Crook and Gartlan, 1966; Crook, 1970; Eisenberg, Muckenhirn and Rudran, 1972; Jolly, 1972). They are generally characterised as solitary, insectivorous, forest-living and territorial species (Crook and Gartlan, 1966). More recently four distinct types of social organisation have been recorded in nocturnal prosimians (Charles-Dominique, 1978) and even within each of these there are both inter- and intraspecific differences. Though the notion of a single grade of social structure for all the nocturnal primates is evidently too simple there are a number of generalisations that can be made for the nocturnal prosimians:

1) adult females have small territories,
2) adult males have larger territories overlapping those of one or more females,
3) both sexes signal the boundaries of their territories by urine marks or vocalisations or both,
4) both usually exclude same-sex conspecifics though daughters may share their mothers' territories and
5) during active periods the animals are most often solitary but they congregate during the day to sleep.

The first three generalisations apply to a variety of other

mammalian orders and appear to be conservative features of mammalian social structure.

The social organisation of the two species in the present study can be considered in terms of two major variables; social structure, measured by the overlap between individual ranges and 2) sociality, measured by the number and type of interactions during the night and by the size and composition of sleeping groups.

The social structure of G. senegalensis has recently been studied in detail (Bearder and Martin, 1979). It was found that adult male bushbabies were either 'Central A' or 'Central B' animals. The former dominated or displaced all other galagos and showed territorial behaviour towards neighbouring high-ranking males. The latter were non-territorial males which were mutually intolerant during social encounters and displaced one another within a linear dominance hierarchy. They were submissive to 'Central A' males at all times. 'Central A' males had smaller ranges than 'Central B' males and the ranges of the females were smaller than either of these. Females had territories varying between those that were almost entirely separate from others and those that were nearly congruous; in the latter case the females involved were members of kin groups.

There has not been a similarly detailed study of the social organisation of G. crassicaudatus. Two other authors, working at Wallacedale, have commented on the social structure of the thick-tailed bushbaby. Clark (1978) suggested that this species lived in 'neighbourhoods' of loosely bonded animals, with their home ranges highly over-

trapping. Females had smaller ranges than males and related females could share a territory. Katsir (1979) divided adult males into 'residents' and 'vagrants'. The resident males dominated all other males in their control area. He, too, found that males had large territories overlapping the smaller ones held by females. He suggested that females who shared a territory did so at different times and that they had different core areas.

Bearder (1969) found that G. senegalensis foraged alone for 70% of the night. The size of sleeping groups of this species varied from one to seven animals; in all reports the larger groups were less common (Bearder, 1969; Haddow and Ellice, 1964; Sauer and Sauer, 1963). Bearder (1975) reported that G. crassicaudatus in the Northern Transvaal foraged alone for a only 29% of their time. As many as nine of these bushbabies have been seen sleeping together (Haddow and Ellice, 1964) though, again, smaller groups were found more frequently (Bearder, 1975; Jolly, 1966a).

Data from trapping, sleeping site position and partners, as well as from direct observation, have been used in the present study in an attempt to examine and compare the social organisation G. senegalensis and G. crassicaudatus. Changes in organisation within the two species between summer and winter were also recorded.

The definitions of an adult in each species are given in appendices 3 and 4.

6.2 Results

6.2.1 Social Structure of G. senegalensis: An initial

estimate of the ranges of individual bushbabies was obtained by repeated trapping at twelve sites in the study area (Fig. 30). Twenty-four galagos were trapped between March 1977 and September 1978. Seven were adult females, five adult males and the rest juveniles or infants.

The focal female, Lydia, was caught in five traps (Numbers 4, 5, 6, 7 and 10 on Fig. 30), all in the western half of the study area. She was never seen much further to the south-east than trap 4 though her range did extend to the west and north beyond the trapping area (Fig. 30). Two other adult females were caught in this region. One of these, Trudi, had been trapped and ear-marked at the site in 1975 (E. A. Armstrong, pers. comm.). She was an adult at that time and it is probable that she was Lydia's mother. Prior to her disappearance in July 1977 she was caught in traps 4, 6 and 7 and was regularly seen in Lydia's range. She slept with Lydia on occasions and interacted with her during the night. The other female, Carmen, was caught twice in trap 6 but never interacted with Lydia in any way. When released from the trap she moved off into the south-west into an area in which Lydia was never found. A female offspring of Lydia's, Katrina, grew up in her mother's range and was still present as a young adult at the age of eleven months.

Three adult females were trapped to the southeast of the area used by Lydia. At the beginning of the study one female, Jenny, was seen in that area and was caught in traps 1, 3 and 8. She was last seen in July 1977 at which time she was with one of her offspring. a juvenile female, Kali. This female and her twin sister, Lisa, were both seen and trapped in the

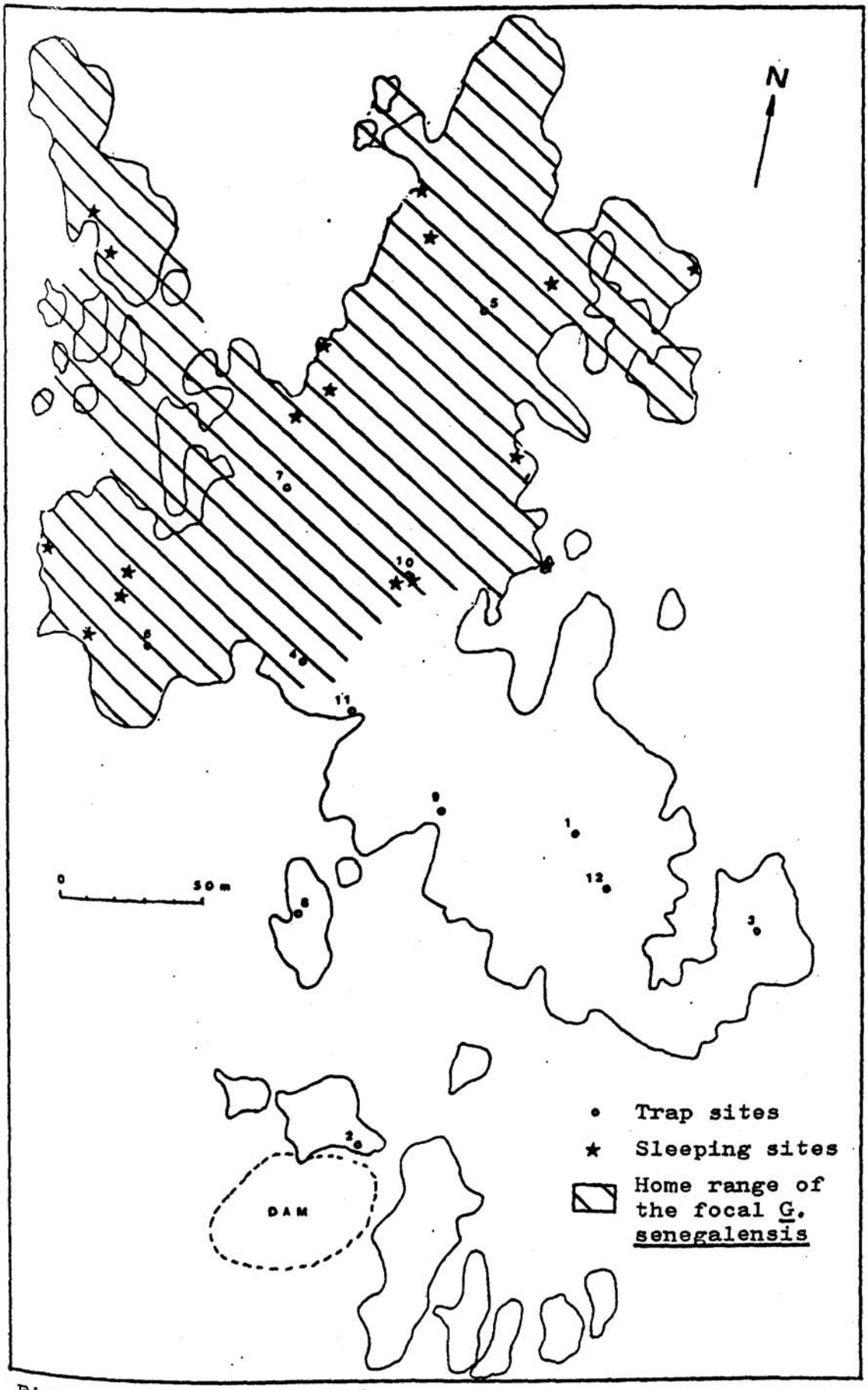

Figure 30. Diagram showing home range and sleeping sites of the focal G. senegalensis and all trap sites.

eastern area until the end of the study. They usually slept together and their sleeping sites were never in the range used by Lydia. Each of these two, though, was once caught outside their normal range; Kali in trap 2 and Lisa in trap 10. They both gave birth in October 1977 but only one of their offspring, a female named Emma, remained with them. She was still one of their frequent sleeping partners at the age of eleven months.

The seventh adult female found in the site was caught only in trap 2. She was often seen near the dam (Fig. 30) but never in the main, T-shaped study area.

From these facts it appeared that the study site and its immediate surroundings contained four territories as far as the females were concerned. Each territory was used exclusively by one female or by two or more related females. Brief forays by the occupier of one territory into a neighbouring one did occur on rare occasions.

Data on the ranges of males were not collected systematically but the trapping results gave some idea of their social structure. Only two (Titus and Sula) of the five adult males caught at the site were present throughout the whole study, though all of them, except Titus, had been present and were marked in 1975 (E. A. Armstrong, pers. comm.). The male, Titus, was caught in traps 1, 5, 8 and 10, he was seen interacting with Lydia during the night, sleeping with her and sleeping with Kali and Lisa. Sula was caught in traps 2, 5, 6 and 10. He was seen interacting with the focal female, though not as frequently as was Titus, but he never slept with her. The other three adult males were never seen

interacting with Lydia. Of these three Oberon was caught in traps 1, 7 and 8; Philip in traps 1 and 5 and Jeremy in traps 6 and 8. The adult males were never found together but both Titus and Sula did associate with males of up to a year old. The observations on the males found in the study site all fit into the model of social structure proposed by Bearder and Martin (1979). The males had larger territories than the females and there was very little interaction between the males though their ranges may have overlapped to a considerable extent. Forays by adult males not permanently resident in the area (e.g. Oberon, Philip and Jeremy) did occur. In the case of these three males they are possibly "Central A" males from neighbouring territories making "pre-reproductive" (Bearder and Martin, 1979) migrations into the main study area.

6.2.2 Social Structure of G. crassicaudatus: Forty-one thick-tailed bushbabies were trapped at thirteen sites in the strip of riverine forest at Wallacedale (Fig. 31) between March 1977 and June 1978. Seven of these were adult females, six were adult males and the rest juveniles or infants.

The focal female, Diana, was caught in traps 2, 3, 5, 6, 7, 8, 10 and 11 (Fig. 31). Five other adult females (Grey, Jessica, Katie, Maria and Tip) were caught in one or more of these traps. However, only Tip was consistently found in Diana's range. Diana and Tip slept together on occasions and interacted during the the night. Tip was an older animal than Diana and was thought to be her mother (A. B. Clark, pers. comm.). Grey was once found with Diana but was normally seen

and trapped to the north of Diana's range. She was regularly caught in traps 11 and 12 and once in trap 9. Katie and Jessica, who were known to be mother and daughter, shared an area to the south of Diana's and were never seen interacting with her. They were caught in trap 2 on a number of occasions, whereas Diana was caught there only once, and they were frequently caught in trap 1. Maria was a 1975 offspring of Diana's who was caught in traps 1 and 3 as an adult evidently having shifted her range away from that of her mother. No interactions between this female and any other were seen and she was not found often enough for it to be certain where she spent most of her time but it was thought that she was in the eastern area more frequently than in the riverine strip. The seventh female, Mandy, was caught only in trap 13, to the north of Diana's range.

Animals were trapped in only a limited area at this site but a detailed picture of the range of the focal animal could be worked at from sleeping site data and direct observation (Fig. 31). Both Grey and Tip were radio tracked for a time which enabled further details of their ranges to be collected. As with G. senegalensis the site was divided up into territories used exclusively by one female or by related females.

Three adult males (Boy, Curly and Joel) were caught in Diana's range and were seen interacting with her. Only one of these, Boy, ever slept with her and that occurred only in the mating season. Boy and Joel were both radio tracked for a short time. They both ranged and slept over a much greater distance than did the focal female. Adult males were never

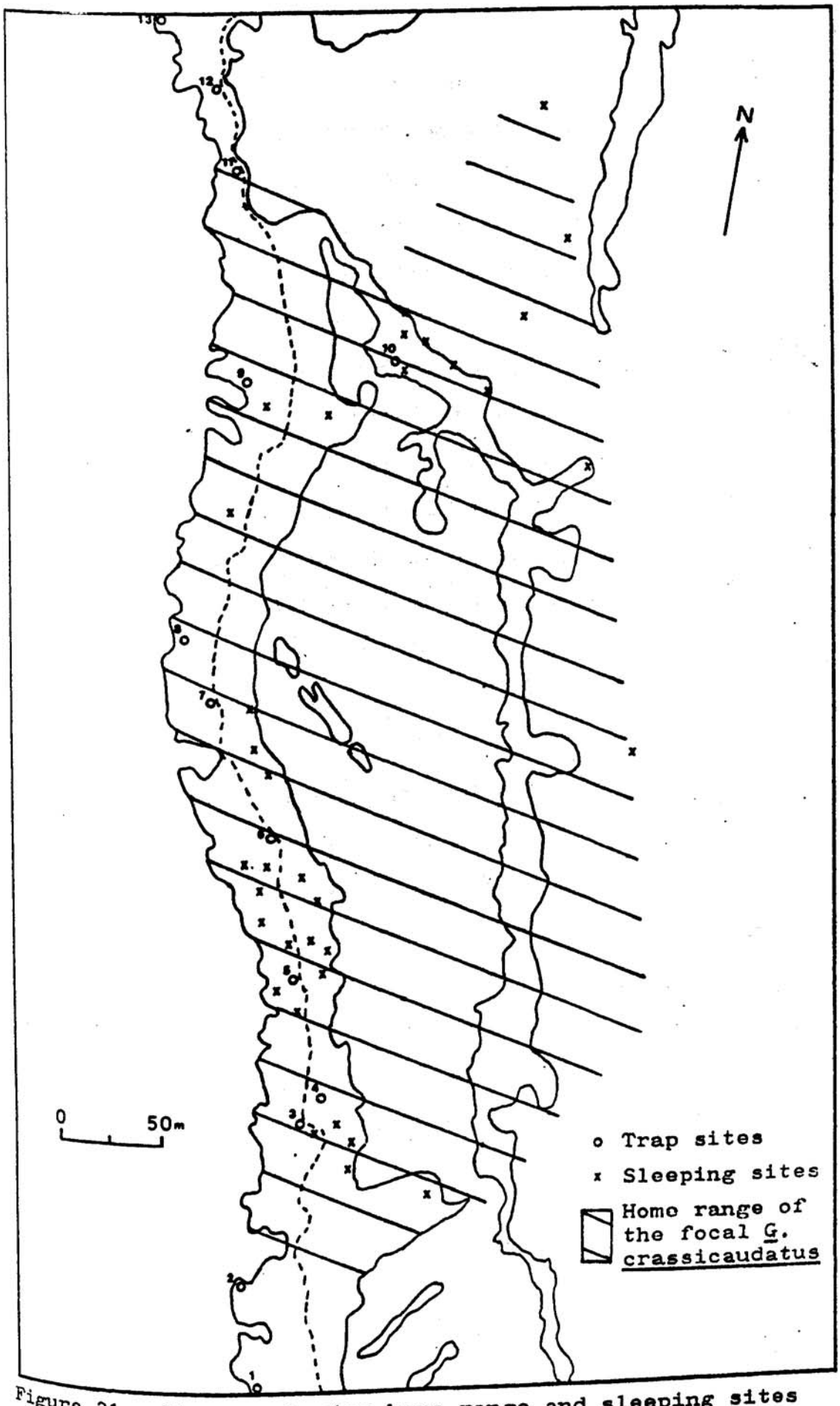

Figure 31. Diagram showing home range and sleeping sites of the focal G. crassicaudatus and all trap sites.

found sleeping together though they did sleep with sub-adult and juvenile males and were found with the younger males (and females) during the night. Joel and Boy were found together during the night on some occasions but Boy appeared to be the dominant animal during these interactions. He was also both older and heavier than Joel.

Of the other three adult males, Puck was regularly caught and seen to the south of Diana's range in the area shared by Katie and Jessica. He was about the same age and weight as Boy. The second male, number 21, was lighter and probably younger than Puck. He was found in Puck's area twice at the beginning of the study and then disappeared. The third male, Paul, was another of Diana's 1975 offspring and he appeared to have moved from her area into an area to the north of her range as he was seen and caught no further south than the area around trap 13 once he had reached adulthood.

The social structure of the males of this species appears to be very similar to that of G. senegalensis. Boy was apparantly the 'Central A' male in Diana and Tip's ranges and probably in Grey's area as well. Joel appeared to be a 'Central B' male in Boy's range. Puck was probably the 'Central A' male in the area to the south of Diana's range. Within this system it is possible that some of the adult males (probably the younger ones) trapped at the site were 'vagrants', animals that had left their birthplace and were looking for new areas to settle.

6.2.3 Sociality of G. senegalensis: Two measures of sociality of the focal female of both species were recorded in

each season: 1) time in contact with other galagos, which included resting with, allogrooming, chasing or being near (in the same tree) another bushbaby, 2) the size of sleeping groups. All partners were identified whenever possible.

In summer the focal bushbaby, Lydia, was in contact with other galagos for 9,9% of the total observation time, this included allogrooming for 1,2% of the time and chasing or being chased for 0,7% of the time. Her partners in the bouts of allogrooming were the adult female Trudi, Lydia's female infant Katrina and a young male named Tocolosh. On three occasions the second animal was not identified. Katrina was the only bushbaby to be groomed more than twice during the total observation period, 85% of the allogrooming was with her. Titus, Katrina, Tocolosh and a juvenile male, Tatu, were the only identified galagos seen in close contact with Lydia during the night. On only one occasion was she seen with more than one other bushbaby during the night and then she was with two unidentified animals. Ten chases were recorded, once with Titus chasing her, twice with Tocolosh chasing her and the rest with unidentified animals some chasing her and others being chased.

In winter Lydia was with other galagos for only 3,8% of the total observation time, allogrooming occupied 0,3% and chases 1,9% of this time. Titus was groomed on several occasions while Katrina, now aged ten to eleven months, and Tocolosh, were each groomed once. Contact during the night, not involving allogrooming, was made with these three animals, with David, who was a young male, and with Sula. Twenty-five chases were recorded. Lydia was chased by Titus and Sula on

five and two occasions respectively, she chased Katrina twice and either chased or was chased by the young males Tocolosh and David four times by each. Her partner in the other five chases was not identified. Table 4 gives a comparison of the summer and winter data on these aspects of sociality.

Table 4. Type and frequency of nocturnal social contact in G. senegalensis measured as a percentage of total observation time in each season.

	ALLOGROOMING	CHASING	OTHER	TOTAL SOCIAL CONTACT
SUMMER	1,2	0,7	8,0	9,9
WINTER	0,3	1,9	1,7	3,8

Sleeping group size varied between the seasons (X^2=12,21, df = 4, p<0,05) with a higher percentage of smaller groups being found in winter. To avoid bias by such things as relative ease of finding larger groups, especially in winter when there was considerable leaf fall, data were used only from the collared female (Table 5). This also applied for G. crassicaudatus (Table 7).

Table 5. Sleeping group size in G. senegalensis measured as a percentage of the number of sites found in each season.

Number of galagos in sleeping site	1	2	3	4	5	
SUMMER	22,7	31,8	31,8	4,5	9,0	N=22
WINTER	38,0	32,0	16,0	14,0	-	N=50

In summer five different galagos were seen sleeping with Lydia. These were Trudi (once) Titus (three times), Tocolosh (once), Tatu (three times) and Katrina (nine times). Identifying all the bushbabies at a sleeping site was quite often

not possible, usually because the visibility was poor rath than because the animals were unknown. In winter three different animals, either separately or together in all combinations, slept with Lydia. They were the adult male Titus (fifteen times), the young male David (eight times) and the young female Katrina (thirteen times).

6.2.4 Sociality of G. crassicaudatus: In summer the focal female, Diana, was in contact with other galagos for 58,5% of the total observation time. This included 2% of the time spent allogrooming and 0,1% spent in chases. Her most frequent grooming partners were her two three-month old twins, Ace and Tana; 56% of the time spent allogrooming was with them. Other partners were the adult males Joel and Curly, the adult female Tip, her male offspring of 1976 Nicky and one of Tip's 1976 offspring, Ken. She was in groups of up to six galagos during the night (Table 6). All the bushbabies in these groups were those Diana was seen with in the bouts of allogrooming. Two brief chases were seen; Diana chased Tip once and Joel chased Diana.

In winter Diana was with other galagos for 40,7% of the observation time; allogrooming made up 3,2% of this time and there were no chases seen. Diana's 1977 offspring were still her most frequent grooming partners, occupying 57,3% of the time that she spent allogrooming. Other grooming partners were Joel and Boy, Nicky and Tim (the latter being another of Tip's 1976 offspring), and two younger males, Jeff and Rusty, which were born in 1977 to Tip and Maria respectively. Groups of up to five galagos were seen together at night in this

season (Table 6). The bushbabies found in these groups were all those seen allogrooming with Diana but also included the adult female Grey who was once seen resting in the same tree as Diana.

Table 6. Sizes of G. crassicaudatus groups found at night, measured as a percentage of total observation time in each season.

Group Size	2	3	4	5	6
SUMMER	15,1	39,1	3,2	0,9	0,2
WINTER	21,4	17,0	1,8	0,4	-

A significant difference was found in groups sizes between the seasons (X^2 = 8,86, df = 3, p 0,05). The groups tended to be smaller in winter.

A difference was also found in the size of sleeping groups between seasons (X^2 = 19,73, df = 2, p<0,001, Table 7). For this test, group sizes of one animal, two and three animals and more than four animals were used.

Table 7. Sleeping group size in G. crassicaudatus measured as percentage of the number of sites found in each season.

Number of galagos in sleeping site	1	2	3	4	5	6	
SUMMER	25,0	-	62,5	-	-	12,5	N=16
WINTER	52,5	15,2	30,4	2,1	-	-	N=48

Diana was almost always with both of her infants in summer. She occasionally slept alone and twice slept with Tip and both sets of twins. In winter her sleeping partners were her offspring, now six to seven months old, either together or separately; Tip and Boy. She was in oestrus on the two

occasions that she slept with Boy.

6.3 Discussion

There was obviously a great degree of similarity between the social structure of G. senegalensis and that of G. crassicaudatus. The females of each species ranged in an area that was used exclusively by one female or by two or more related females. The males had larger ranges that overlapped those of a number of females. The ranging patterns of the males was more complex than that of the females but the social system of "Central A" and "Central B" males described by Bearder and Martin (1979) seemed to apply to both species in this study. This model is not very different from the 'general galago type' of social organisation proposed by Charles-Dominique (1978) but he did not have male ranges overlapping to any great extent. It has to be realised, though, that, in addition to the adult, established animals, there will be a fairly high number of bushbabies growing up in the study areas each year and that these will stay in their natal range for varying lengths of time.

Though the social structure of the two species appeared to be very similar there was a striking difference in their sociality. Differences were found between the species and within each species between the seasons. In addition, there appeared to be differences between the populations of the two species used in the present study and those used by Bearder (1969, 1975).

G. senegalensis was alone for 94,5% of the night whereas G. crassicaudatus was alone for only 50,4% of the night (these

figures combine those for summer and winter for each species). The major cause of the difference between them was the length of time that the offspring remained with the mother. The period of gestation and immaturity, also longevity, lengthen as body size increases (Wilson, 1975). With an adult female G. crassicaudatus having a body weight eight times or more that of a G. senegalensis female, the time taken to reach adulthood in the former species is much longer than for the latter. G. senegalensis infants are weaned when they are about sixty days old (Doyle, 1979) and, even during this time, contact between mother and infant is minimal with the young galagos being "parked" during the night and suckled only during the day. G. crassicaudatus infants take twice as long to be weaned (Doyle, 1979). They are often carried around at night rather than being "parked" and they remain in close contact with their mother for a year or more. Related to the differences in body size are dietary differences with G. senegalensis tending to be more insectivorous than G. crassicaudatus. As a result the smaller species is more likely to adopt a solitary foraging technique than the larger.

Seasonal variation in the time each species was in contact with other bushbabies could be caused by a number of factors. There are no infants present in winter which reduces the amount of social contact in both species, but to a much greater extent in G. crassicaudatus. The lesser bushbaby had to spend longer feeding and foraging in winter than in summer thereby reducing the length of time available for social activities from which the benefit gained is presumably less than that gained by continuing the search for