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Aspects of the ecology and behaviour of the thick-tailed bushbaby Galago crassicaudatus

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Appendix 6. A comparison of the vocalizations of G. crassicaudatus and G. senegalensis (in brackets) showing the situations in which they were heard and the responses which they evoked, in relation to their relative frequency of occurrence and the age and sex of the animals involved. (Data for G. senegalensis from Andersson (1969); Bearder (1969) and the present study.)

KEY: F = Frequent — Ad = Adult
O = Occasional — Juv = Juvenile
R = Rare — Inf = Infant

1. Calls Associated with Social Cohesion	Relative Frequency	Age & Sex of Animals Involved
CRY/(BARK)		
Situations		
In answer to other cries (barks) or incipient cries (barks)	F (F)	Ad ♂ (Ads)
Soon after leaving the sleeping place in the evening	O (R)	Ad ♂ (Ad ♂)
On leaving a food tree	O	Ad ♂
After separating from, or being rejoined by, a companion	O (R)	Ads (Ads)
Preceding or following a squabble or fight	O (O)	Ad ♂ (Ad ♂)
When a rival was nearby	O (O)	Ad ♂ (Ads)
Before moving directly towards the sleeping place in the morning	F	Ad ♂
When close to the sleeping place at dawn	O (O)	Ad ♂ (Ad ♂)
After investigating a nest site or at a particular spot within the home range	R (R)	Ad ♂ (Ad ♂)
During the period following births	(O)	(Ad ♀)
While moving from place to place	(O)	(Ads)

Calls Associated with Social Cohesion	Relative Frequency	Age & Sex of Animals Involved
Responses		
Looking up sharply and facing the direction of the cry (bark)	O (O)	Ads, Juvs (Ads, Juvs)
Ignoring cries (barks) from a distance, or even those closeby	F (F)	Juvs (Juvs)
Moving away from the caller	R (R)	Ads (Ads)
Moving towards the caller, sometimes with an abrupt change in direction	O (R)	Ad ♀, Juvs (Ad ♀, Juvs)
Answering with a cry (bark) or an incipient cry (bark)	F (F)	Ad ♂ (Ads)
BUZZ (No equivalent call in G.s.)		
Situations		
When an individual had been left behind by others of a group	F	Juvs
Prior to rejoining a group after a short period of separation	O	Ads, Juvs
When a bushbaby had moved ahead of its group, before being joined by its companions	R	Juvs
In answer to a buzz from a juvenile	R	Ad ♀
Responses		
Answering the caller with a buzz	R	Ad ♀
Waiting for the caller to arrive	O	Ad ♀, Juvs
Moving towards the caller	O	Ad ♀, Juvs
(HOOT) No equivalent call in G.c.		
Situations		
During non-aggressive chasing	(F)	(Ad ♂)
Prior to naso-nasal contact or allogrooming	(O)	(Ad ♂)
Preceding or following a bark during social interactions	(O)	(Ad ♂)

Calls Associated with Social Cohesion	Relative Frequency	Age & Sex of Animals Involved
Responses		
Answering with a bark	(0)	(Ad ♂)
CLUCK/(COO)		
Situations		
Prior to contact between mother and offspring	F (F)	Ad ♀ (Ad ♀)
By females moving with their infants	0 (0)	Ad ♀ (Ad ♀)
Responses		
Acceptance of the approaching adult	F (F)	Infs (Infs)
Uttering of clicks	0 (0)	Infs (Infs)
CLICK/(CLICK)		
Situations		
While an infant was being carried or when it was placed down awkwardly by its mother	F (F))	Infs (Infs)
When infants attempted to follow the mother	F (F)	Infs (Infs)
Initially when infants were left alone	0 (0)	Infs (Infs)
When individuals had apparently lost their companions	0 (R)	Juvs (Juvs)
Before making a jump	(R)	(Infs)
After falling to the ground	(R)	(Infs)
Responses		
Attraction of the mother	F (F)	Ad ♀ (Ad ♀)
Retrieval of the infants by the mother	0 (0)	Ad ♀ (Ad ♀)

Calls Associated with Social Cohesion	Relative Frequency	Age & Sex of Animals Involved
SQUEAK/(SQUEAK)		
Situations		
Young infants in distress	0 (0)	Infs (Infs)
Responses		
Attraction of the mother	0 (0)	Ad ♀ (Ad ♀)

2. Calls Associated with 'Anxiety' and 'Alarm' Situations	Relative Frequency	Age & Sex of Animals Involved
SNIFF (No equivalent call in G.s.)		
Situations		
Towards the observer	R	Ad ♀
Towards a resting wood owl	R	Juvs
Responses		
Staring at the object of interest	R	Ad ♀, Juvs
(SNEEZE) No equivalent call in G.c.		
Situations		
When approaching the observer, a conspecific or a strange object	(F)	(Ads, Juvs)
Constantly or sporadically while foraging	(F)	(Ads, Juvs)
Following any sudden disturbance	(F)	(Ads, Juvs)
On landing after a jump	(0)	(Ads, Juvs)
During social interactions	(F)	(Ads, Juvs)

Calls Associated with 'Anxiety' and 'Alarm' Situations	Relative Frequency	Age & Sex of Animals Involved
Responses		
Sneezes from others closeby	(F)	(Ads, Juvs)
Jumping away from a novel object	(F)	(Ads, Juvs)
KNOCK/(SHIVERING-STUTTER)		
Situations		
At the initial approach or proximity of the observer or a minor potential predator (cat or genet)	F (0)	Ads, Juvs, Infs (Ads, Juvs)
Following any disturbance when in a vulnerable position, e.g. when attempting to descend to the ground	0 (0)	Ads, Juvs, Infs (Ads, Juvs)
With other 'anxiety/alarm' calls during and following bouts of more intense agitation	0 (0)	Ads, Juvs, Infs (Ads, Juvs)
During and after agonistic social interactions	0 (0)	Ads, Juvs, Infs (Ads, Juvs)
When trapped or disturbed during the daytime	R (R)	Ads, Juvs, Infs (Ads, Juvs)
At the time of mating or actually accompanying coitus	0 (F)	Ad ♂ (Ad ♂)
Responses		
Staring at the object which induced the call	F (F)	Ads, Juvs, Infs (Ads, Juvs)
A startle reaction of jumping or climbing away quickly	0 (0)	Ads, Juvs (Ads, Juvs)
Simultaneous calling	0 (0)	Ads, Juvs (Ads, Juvs)
Remaining still	0 (0)	Ads, Juvs (Ads, Juvs)
CREAK/(GERWHIT, CLUCK)		
Situations		
Following disturbance by the observer	0 (0)	Ads, Juvs (Ads, Juvs)

Calls Associated with 'Anxiety' and 'Alarm' Situations	Relative Frequency	Age & Sex of Animals Involved
During mildly agonistic social interactions	0 (0)	Ads, Juvs (Ads, Juvs)
Preceding or following high intensity alarm situations	0 (0)	Ads, Juvs (Ads, Juvs)
Responses - Unknown		
SQUAWK/(WHISTLES & VARIANTS)		
Situations		
When disturbed by the movements of a large potential predator (observer, bushpigs, dogs or jackals)	F (F)	Ads, Juvs (Ads, Juvs)
Towards sleeping vervet monkeys	R	Ad ♂
During aggressive agonistic encounters	0 (0)	Ads, Juvs (Ads, Juvs)
Following a major change in the environment (tree felling or the presence of a strange object)	0 (0)	Ads, Juvs (Ads, Juvs)
Before making a long jump or crossing an open space	(0)	(Ads, Juvs)
Responses		
Remaining still and staring	F (0)	Ads, Juvs (Ads, Juvs)
Joining in with a squawk (whistle) or whistled-yap (yap)	0 (0)	Ads, Juvs (Ads, Juvs)
Continuing activity undisturbed after a brief pause	0 (0)	Ads, Juvs (Ads, Juvs)
Looking up at a call from a distance	0	Ads, Juvs
WHISTLED-YAP/(YAP) WHISTLE/(YAP-ALARM)		
Situations		
In the presence of a potential predator (cat, eagle owl, genet)	0 (F)	Ads, Juvs (Ads, Juvs)

Calls Associated with 'Anxiety' and 'Alarm' Situations	Relative Frequency	Age & Sex of Animals Involved
Following sudden movements or a major disturbance by the observer	O (O)	Ads, Juvs (Ads, Juvs)
During and following aggressive agonistic encounters	R (F)	Ads, Juvs (Ads, Juvs)
In response to unfamiliar objects	O (O)	Ads, Juvs (Ads, Juvs)
Responses		
Calling in unison	O (O)	Ads, Juvs (Ads, Juvs)
Looking towards the call from a distance	O (R)	Ads, Juvs (Ads, Juvs)
CHIRP/(WUFF, WAIL)		
Situations		
Towards a snake	R	Ad ♂
Towards an owl	(R)	(Ad ♀)
Responses - Unknown		
CHATTER/(CAW)		
Situations		
Accompanying bouts of whistled-yaps (yaps) and rarely squawks (whistles)	O (R)	Ads (Ad ♂)
Responses		
Remaining inactive	O (O)	Ads, Juvs (Ads, Juvs)
MOANS/(EXPLOSIVE - COUGH)		
Situations		
When close to the observer, a potential predator (snake or genet) or a strange object (photographic equipment)	F (F)	Ads, Juvs (Ads, Juvs)

Calls Associated with 'Anxiety' and 'Alarm' Situations	Relative Frequency	Age & Sex of Animals Involved
When disturbed in a vulnerable position e.g. when feeding low down in a tree or when moving from one tree to another	F (F)	Ads, Juvs (Ads, Juvs)
During social interactions involving chasing, grappling and allogrooming	F (F)	Ads, Juvs (Ads, Juvs)
At the approach of a conspecific following a period of separation	0 (F)	Ads, Juvs (Ads, Juvs)
When approaching an adult female	0	Ad ♂
Responses		
Staring at the potential danger	F	Ads, Juvs
Moving away from the potential danger	0	Ads, Juvs
Approaching the caller	0 (F)	Ads, Juvs (Ads, Juvs)
(SOB) No equivalent call in G.c.		
Situations		
By a subordinate bushbaby during aggressive interactions	(0)	(Ad ♀, Juvs)
Responses - Unknown		
3. Calls Associated with Agonistic Contact Situations		
HACK (No equivalent call in G.s.)		
Situations		
On being disturbed by the noise of a camera when photographed in a vulnerable position	R	Ad. ♀, Juvs
When swooped upon by an owl	R	Juvs
During social interactions (play-fighting)	0	Juvs
Responses		
Avoidance of potential danger or social partner	0	Juvs

Calls Associated with Agonistic Contact Situations (continued)	Relative Frequency	Age & Sex of Animals Involved
(GRUNT) No equivalent call in G.c.		
Situations		
At the approach of a threatening stimulus when the animal is cornered	(R)	(Ads, Juvs, Infs)
From a nest hole at the approach of another animal	(R)	(Infs)
Responses - Unknown		
SPIT/(SPIT, SPIT-GRUNT)		
Situations		
At the approach of, or when chased by a conspecific	F (F)	Ads. Juvs. Infs (Ads, Juvs, Infs)
During contact situations: play, allogrooming, fighting and prior to sleeping together	F (F)	Ads, Juvs (Ads, Juvs)
When confronted at close quarters by another species	R	Ads, Juvs
During squabbles at a small food supply (gum lick)	R	Juvs
On being handled by the observer	O (O)	Ads, Juvs (Ads, Juvs)
Responses		
Avoiding contact	F (F)	Ads, Juvs (Ads, Juvs)
Approaching more cautiously	O (O)	Ads, Juvs (Ads, Juvs)
SCREAM/(SCREAM, FIGHTING CHATTER)		
Situations		
During fighting or aggressive chasing	O (O)	Ads, Juvs (Ads, Juvs)
When held by a superior	R (R)	Ad ♀ (Ad ♀)

Calls Associated with Agonistic Contact Situations (continued)	Relative Frequency	Age & Sex of Animals involved
Responses		
Moving away from the caller	0 (0)	Ads (Ads)
YELL (No equivalent call in G.s.)		
Situations		
When in the grip of a predator	R	Ads, Juvs
Responses		
'Anxiety'/'Alarm' calls given	R	Ads, Juvs
(RASP) No equivalent call in G.c.		
Situations		
In aggressive situations by a female with infants	(R)	(Ad ♀)
By a subordinate during chasing and fighting	(R)	(Ad ♀)
Responses - Unknown		

Appendix 7 The organization of field observations

Effective observation of bushbabies with red light necessitates a close approach which, after an initial period of wariness, the animals will tolerate with no further signs of disturbance. Postures and movements of the subject(s) can be seen throughout most of each observation period, but intervals during which they are obscured are inevitable. Quantitative data derived from these observations can, at best, give only a general picture of the inter-relationships between activites. During each period, events and sequences of behaviour shown by a single individual were recorded on a notepad with reference to the time of night at which they were observed. The behaviour of companions or other animals was recorded in relation to that of the subject, but in less detail. Notes on vocalizations were made at all times, irrespective of whether or not the caller could be seen.

In order to avoid misinterpretation of the animals' activity patterns and movements, at least some observations were made at all times of the night. It proved impractical and unrewarding, however, to work in the middle of the night when the animals were least active (see section 9,2, page 30). The majority of observations were divided almost equally between the four hours after sunset and the four hours before sunrise. Since bushbabies were often followed away from their sleeping places, and later followed back to the same sleeping places before dawn, it was often possible to estimate the direction and distance of their travel during the middle part of the night with a reasonable degree of certainty.

Almost two thirds of the total hours of direct observation were restricted to the known individuals of an isolated population in a small part of the main study area (see section 2.3, page 9). Furthermore, a large proportion of this period (295 hours) was spent watching members of a maternal group, which moved together, and the remainder (116 hours) following an adult

male with which they associated on occasions. Data from these individually recognisible animals provide the backbone of the study, with additional results from marked and unmarked bushbabies in other areas. Except where it has been stated otherwise, however, quantitative data used in the text are drawn from the total of all observations in each of the study areas.

Behaviours were recorded in terms of events, each of which was terminated by the start of a new activity (urine washing; scratching; stretching), or in terms of bouts of more or less uninterrupted performance of a particular behaviour (vocalizing; feeding; grooming). Events and bouts were interrelated descriptively in terms of their consequences with respect to the environment (approaching a feeding place; grooming a partner). More precise descriptions of motor patterns, postures and signals were attempted at such times as the conditions of observation allowed. These were supplimented, as far as possible, by flash photography and tape recordings of vocalizations (see sections 2.5 and 2.6, page 12). The duration of each activity could be calculated, if necessary, from the time record which accompanied it. At the end of each night the shorthand record was transcribed and elaborated to include relevant background information (weather conditions; the state of the moon). Movements were then plotted onto a map of the study site to show the distribution of fixed points (sleeping sites; food trees; resting places) and the routes of travel.

In order to extract specific information from the sequential record, behaviours were classified according to broadly functional categories, corresponding to the section or subsection heading of the thesis. Data were assigned to one or more such headings by noting an appropriate symbol in the margin opposite. Thus a series of symbols denoting, for example, range movements (mve.), locomotion (lo.), feeding (fd.) and grooming (gm.) were listed opposite parts of a descriptive passage which included these activities. At the end of the study all field notes were regrouped under each of the headings by transcribing the information found opposite the appropriate symbols.

The end result was two sets of field notes, one showing a succession of events throughout the study period and the other showing the same data grouped, either in full or in tabular form, according to the titles under which it would eventually be described or illustrated. Both records were used where applicable in the final analysis.

Appendix 8. Some examples of data analysis for specific aspects of the study.

1. The Calculation of Population Densities (section 8, page 25)

Two methods were employed to give an indication of population density depending on the nature of the vegetation in different study areas. Where the animals were confined to narrow tracts of riverine forest or open woodland (North Eastern Transvaal, Eastern Rhodesia), their eyes could be picked out with the headband torch without difficulty. Several nights were devoted to reconnaisance of each study locality, during which the vegetation was scanned from as many angles as possible. The number and position of bushbaby sightings was noted and repetition avoided on the return journey. The number of individuals observed on successive nights remained more or less constant and the highest figure was thus taken to represent the total number of animals present in the area covered. As the vegetation occupied by bushbabies differed from the surrounding habitat, it was possible to measure the area of all suitable bush included in the reconnaisance and divide this by the total population to give an average population density per km^2.

The chances of seeing all members of a population in the sub-tropical forests of Zululand were negligible and an alternative method of estimation was adopted. Forest paths were followed on several consecutive nights to give an average figure for the number of animals likely to be spotted on each night. The length of the transect was then multiplied by the effective scanning distance of the torch beam on either side of the pathway. This indicated the total area in which the bushbabies were observed and hence their approximate population density.

2. An Estimation of the Relative Use of Different Foodstuffs During the Year (section 10, page 34)

All observations of feeding in the main study area were considered together. Each record consisted of feeding on a single item in one place at one time.

In this way a bout of licking at a source of gum was taken as being equivalent to eating a single fruit or insect and recorded separately from a renewed bout of licking, at the same or a different place, or the consumption of a second fruit or insect. While this did not show the amount of food material ingested, it provided some indication of the relative importance of different food types and their varied use from one season to the next.

3. The Proportional Representation of Behaviours Observed on the Ground (section 11.4, page 61)

Activities on the ground were expressed on a presence or absence basis in relation to the total number of periods when bushbabies were observed to descend throughout the study. The results which are enumerated in the text give an indication of the likelihood with which each type of behaviour (walking; running; standing etc.) will be shown by a bushbaby on the ground, although this may vary from one area to another.

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