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*Journal of Arid Environments* (1990) 18, 67-73

## Spatial usage of a desert environment by baboons (*Papio ursinus*)

Conrad Brain\*†

Accepted 3 February 1989

Three separate periods of observation totalling 1504 h were carried out on the baboons (*Papio ursinus*) resident in the Central Namib desert environment of the Kuiseb River canyon. The three troops resident in the canyon occupy highly linear ranges that overlap at the extremities. Troop interactions occur when troops are forced into close proximity as resources fail. The spatial separation of food resources and water has resulted in one of the troops spending up to 11 days in food-rich areas without drinking. This adaptation has numerous advantages, such as decreasing mean daily travel by 41% and reducing the chance of troop interactions. Individual's rank in the troop determines the order but not the quantity of resource acquisition. Tactics employed by low ranking individuals frequently result in their more successful utilization of available resources in this desert environment.

### Introduction

Baboons resident in the central Namib desert environment of the Kuiseb river canyon are faced with a daily predicament of efficient resource utilization due to the spatial distribution of food patches and water sources. The pressures of this cost-benefit situation are central to the highlighting of social status and troop interactions in an environment where access to drinking water is, for most of the year, limited to a single individual being able to drink at a time.

The Kuiseb baboons were studied by Hamilton and colleagues during 1972 and 1973 (Hamilton, 1985, 1986; Hamilton & Tilson, 1982; Hamilton *et al.*, 1976, 1978). Recent studies by the author have consisted of three periods of observation; 12 December 1986 to 21 January 1987, 4 June 1987 to 3 July 1987 and 9 December 1987 to 3 January 1988, periods during which continuous contact was maintained with the baboon troop. These studies were augmented by regular demographic observations carried out by staff members of the Desert Ecological Research Unit (DERU) during the intervening periods. The purpose here is to document the activities pertaining to the spatial use of a desert environment during a one-year period.

### Study area and methods

The baboon troop studied occupy the most southerly area of the Kuiseb river along a 25 km stretch where the canyon crosses the central Namib desert, approximately 150 km south-east of Walvis Bay, S.W.A., 24°S 15°E. The highly linear habitat occupied by the baboons runs in an east-west direction just upstream from where the dry river bed makes a

\*Desert Ecological Research Unit, S.W.A./Namibia.

†Correspondence to: Conrad Brain, 38 King Street, Irene, 1675, Republic of South Africa.



Figure 1. Adult male, Newman, sits in the excavation in the dry river bed which was dug to get water about 1.3 m below the surface.

north-west curve on its way to the Atlantic ocean. For the entire occupied stretch an alluvial floodplain within the Kuiseb canyon supports a dense riparian forest dominated by *Acacia albida* and *Acacia erioloba* trees. Large clumps of *Salvadora persica* cover much of the floodplain between the acacias with ten widely spaced fig trees (*Ficus sycomorus*) occurring against the canyon walls.

Two water sources, a seep in a crack against a vertical cliff and an excavated seep in the river sand 7.6 km further upstream were utilized by the baboons, both of which allowed for only one individual at a time to drink (Fig. 1).

The abandoned Hottentot village of Homeb, 19.1 km upriver from Gobabeb was designated km 0.0. Specific landmarks within the baboons' range were identified and designated by the notation 'km' preceding the distance into the home range, and distances between locations by the notation 'km' placed after the distance mentioned. Observations were made mainly from a Land-Rover and to a lesser extent from positions against the canyon walls. Subjects were not provisioned and there was no attempt to interact with them.

### Observations

#### Demographic changes

The troop studied represents the lower troop as described by Hamilton (1985). From 1972 to 1979 the total number of individuals varied from 35 in 1972 to 33 in 1979 (Hamilton, 1985). Table 1 shows the deaths of all four infants born during the period December 1986 to December 1987. Between 1979 and 1987 the troop was reduced by 52% with, at this time, no individuals between the ages of 18 months and 6 years. All troop members, except the year-old female, suffered from raw and frequently bleeding lesions affecting the outer ear (Hamilton *et al.*, 1976). The aetiology of this condition is thus far undetermined. The immigration of two adult males seen in December 1987 appeared to coincide with the rise to alpha status of the previous shadow male, Xhabbo. The previous top ranking male, Fork Tail, badly damaged his left hind limb (incident was not observed) during that socially unsettled time. Both immigrants had affected ears with evidence of infection still present. One of the new males appeared to act as a shadow male and adopted the position of second ranking male. Although ranking of the rest of the males was not accurately

**Table 1.** Demographic changes during the period December 1986 to December 1987

	Adult male	Adult female	Infants
December 1986	6	7	2
Births	—	—	+4
Deaths	—	—	-4
Male immigrants	2	—	—
Male emigrants/ Disappearances	1	—	—
December 1987	7	7	2

determined by January 1988, the other new immigrant appeared to be one of the lowest ranking adult males.

#### Movements

During the first observation period (December 1986 and January 1987), and in June 1987 a linear home range of 13 km was used by the troop. This range stretched from a point 8 km upriver from Homeb to the only water source utilized by the baboons at that time located at km 21 (Fig. 2a). As can be seen from Fig. 2a, the main feeding sites were located in the downriver limits of the range where the baboons spent the majority of their time. Here foraging focused almost exclusively upon ripe *Salvadora persica* berries which occurred in abundance in both December and June 1987. These berries have a 69% moisture content (Hamilton *et al.*, 1978).

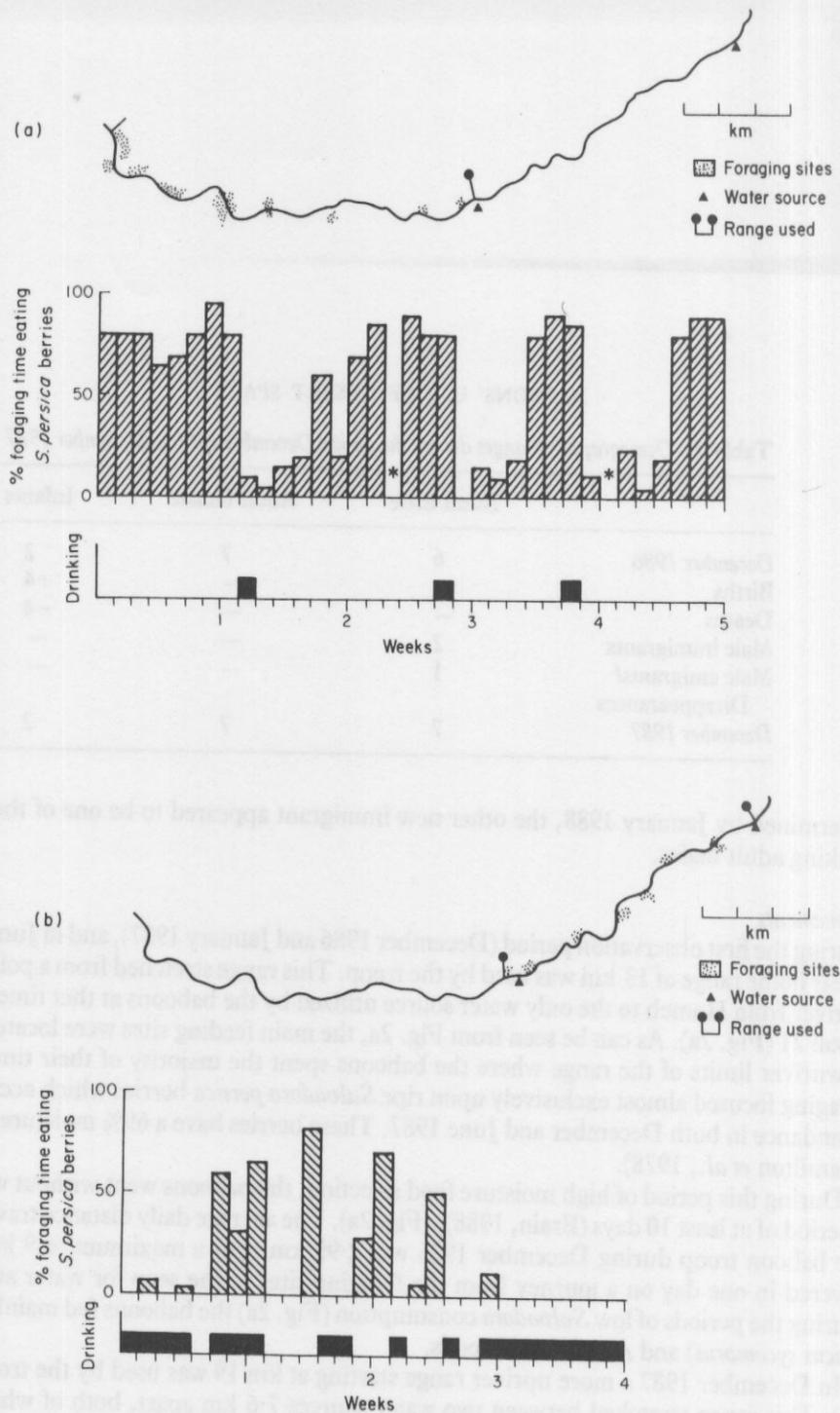
During this period of high moisture food selection, the baboons went without water for a period of at least 10 days (Brain, 1988), (Fig. 2a). The average daily distance travelled by the baboon troop during December 1986 was 2.99 km with a maximum of 9 km being covered in one day on a journey from the foraging sites to the seep for water at km 21. During the periods of low *Salvadora* consumption (Fig. 2a) the baboons fed mainly on figs (*Ficus sycamoros*) and *Acacia albida* pods.

In December 1987 a more upriver range starting at km 19 was used by the troop (Fig. 2b). This range stretched between two water sources 7.6 km apart, both of which were utilized by the baboons. Drinking occurred regularly and *S. persica* foraging was intermittent on the few bushes still having berries (Fig. 2b). The *Salvadora* bushes used in the previous December bore little or no berries. An average daily distance of 5.06 km was travelled during this period with a maximum daily distance of 16 km.

On two occasions in both January and December 1987 shortly after sunrise, the troop was seen to move up the steep south side of the canyon and proceed directly to a foraging site 2 km into the dunes (Fig. 3). The main feeding activity was centred around obtaining the insect larvae and other invertebrates occurring in galls on the desert grasses *Stipagrostis sabolicola* and *Stipagrostis namaquensis* (Brain, 1988). Spider excavations are also a feature of dune excursions, with 69 attempts noted on one particular excursion, the majority of which were for *Leucorchestris* species. This led to a 72% success rate in obtaining the spiders, based on observations of the baboons digging out a spider and eating it.

#### Water

Water availability is the primary determinant of the location of sleeping sites, daily movements and range limits (Hamilton, 1986; Hall, 1962; Stoltz & Saayman, 1970). The Kuiseb baboons periodically overcome this limitation by demonstrating a partial independence of drinking water (Brain, 1988). During these periods baboons are able to stay for prolonged periods at foraging sites at least 8 km from the nearest water, selecting a single high moisture content food. The relatively small current size of the troop allowed for maximum individual usage of this food without rapid depletion of the available ripe *Salvadora* berries. The occasional excursions to the drinking seep at km 21 (Fig. 2a) were



**Figure 2(a,b).** Diagram illustrating aspects of home range used in December 1986 (a) and December 1987 (b). The map is of the stretch of river used ( $23^{\circ} 30'S:15^{\circ} 00'E-23^{\circ} 30'S:15^{\circ} 30'E$ ; flow direction from right to left), while the histogram shows levels of *Salvadora* foraging. Drinking frequency is shown by shaded blocks. Foraging times were not recorded on those days where an asterisk appears.

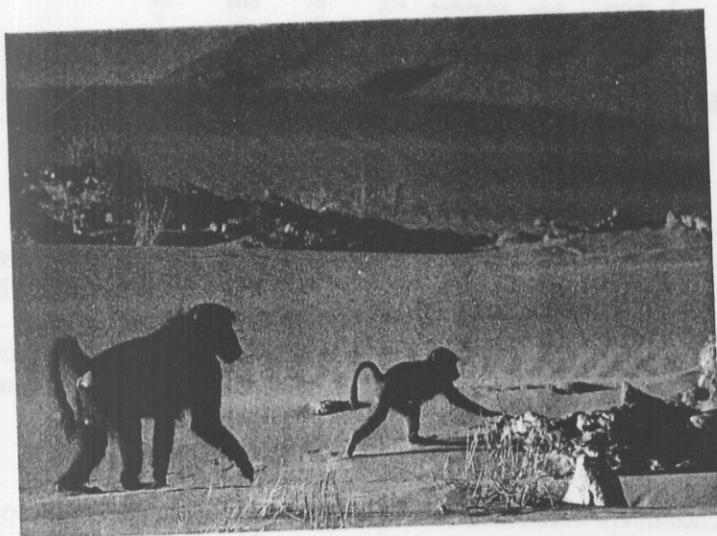


Figure 3. Adult male, Fork Tail, and one-year-old male, Smudge, in the dunes on their way back to the Kuiseb River. Note the deformed ear of Fork Tail and Smudge demonstrating the initial signs of the disease.

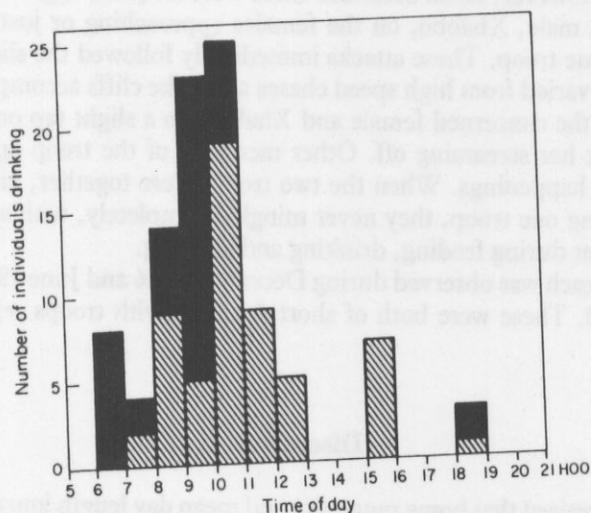
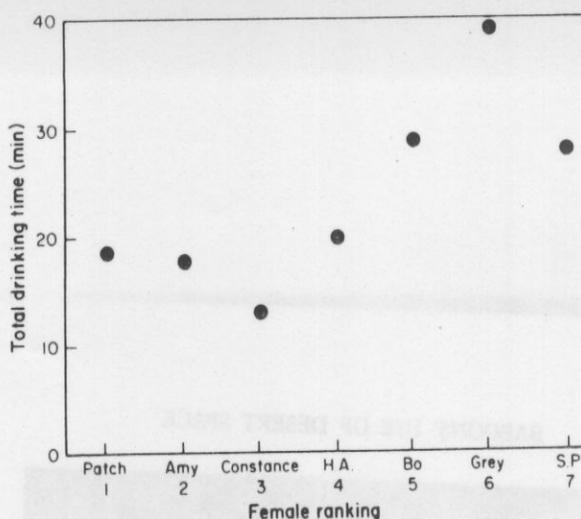


Figure 4. Time of day when drinking occurred as recorded for 11 drinking sessions. ■, males; ▨, females.

characterized by the short periods of between 5 and 1 days spent in the area of the seep before returning to the feeding sites.

The use of the upriver range in December 1987 was associated with low levels of irregular *Salvadora* feeding and regular drinking (Fig. 2b). The results of 11 recorded drinking sessions, six of them at the excavated seep and five at the crack in the vertical face are shown in Figs 4 and 5. On five of the 11 sessions the lowest ranking female, SP, was the first to arrive at the water, while Bad-ears, the lowest ranking male reached water first on another three occasions. Because the excavated seep required digging out each time as a result of zebra trampling, the low ranking individuals were not able to drink before the rest of the troop arrived and were consequently supplanted. However, at the seep in the crack of the vertical cliff they were able to drink before the rest of the troop arrived. Two other tactics used by the low ranking females to obtain water were to wait for the troop to move off from the drinking site and then drink or slip in quickly when some other disturbance



**Figure 5.** Total drinking times of females recorded on 11 drinking sessions. The ranking of females is on the X axis.

left the water site vacant for a short while. These tactics appeared to pay off as demonstrated in Fig. 5. Low ranking males did not appear to use any particular method of getting water other than supplanting females at the water, and consequently it was the high ranking females who were mostly supplanted by the males (Fig. 5).

On 2 days in late December 1987, large flocks of white butterflies, mainly *Belenois aurota* and *Catopsilia florella*, accumulated at the waterholes. The baboons' foraging focused on the butterflies for these 2 days with little other foraging occurring.

#### *Inter-troop interactions*

Four inter-troop encounters were observed in December 1987 between the troop under investigation and a neighbouring troop, the middle troop, whose home range is adjacent to the study troop. These encounters occurred between km 21 and km 28.6 and, in contrast to Hamilton's observations (1986) where there was considerable aggression, these were characterized by mutual tolerance with the two troops operating as an apparent single unit for up to 3 days. However, on all occasions there were frequent aggressive attacks by the lower troop alpha male, Xhabbo, on the females approaching or just past full oestrus swelling in the same troop. These attacks immediately followed the slightest straying of these females and varied from high speed chases along the cliffs accompanied by barking and screaming of the concerned female and Xhabbo, to a slight tap on the rump of the female which sent her screaming off. Other members of the troop apparently paid no attention to these happenings. When the two troops were together, giving the outward appearance of being one troop, they never mingled completely, with a slight separation particularly evident during feeding, drinking and sleeping.

One encounter each was observed during December 1986 and June 1987, both between km 18 and km 20. These were both of short duration with troops separating within 6 hours.

#### **Discussion**

Altman (1970) surmised that home range size and mean day length journeys depend upon those vital resources with the most sparse and most restricted distribution. This has been the case with previous Southern African baboon studies where Hall (1962), Stoltz &

Saayman (1970) and Hamilton *et al.* (1982) noted restricted resources placed a lower limit on range size. Furthermore, previous studies have noted no fixed pattern of home range utilization, whether it involved progression, selection of preferred food until its exhaustion necessitated taking of the next preferred food or that one water hole was used in preference to another. Although the only water source used by the Kuiseb troop in December 1986 undoubtedly determined the lower limit of the range size used, their partial drinking water independence enabled the troop to concentrate on a small area for long periods. More time could therefore be allocated to activities in those areas of the range where the possibility of net positive gain were greatest.

The advantages of this adaptation become clearer when compared to the more upriver range used in December 1987; water sources are no longer the primary determinant for day ranges or sleeping cliffs. The mean daily distance travelled was 41% lower than at other periods, and periods of home range overlap with the middle troop's range are reduced with a corresponding drop in the number of interactions. Whether these actions promote the advancement of the group as a whole or are only favouring individual interests will be one of the objectives of further study.

I am grateful to Dr Mary Seely for her encouragement and logistic support during the study period: Ekart Pfeiffer provided invaluable support while Prof. Bill Hamilton's advice and suggestions were most valuable during the field periods, and his comments on the manuscript were gratefully accepted. Dr Ginny Watson's suggestions and help in preparing the manuscript are kindly acknowledged.

This study could not have been possible without the enormous support from my parents and their generosity is exceeded only by my appreciation.

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