

## Some aspects of ecology and behaviour of *Homopus* sp. from southwestern Namibia (Testudines: Cryptodira: Testudinidae)

Bemerkungen zur Ökologie und zum Verhalten von *Homopus* sp.  
im südwestlichen Namibia  
(Testudines: Cryptodira: Testudinidae)

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### KURZFASSUNG

Im südwestlichen Namibia kommt *Homopus* sp. im Bereich von anstehendem verwitterten Granit vor, dessen Spalten und Risse er zum Zweck der Thermoregulation und Verteidigung aufsucht. Die Öffnungen der als Zufluchtsort gewählten Spalten und Risse sind hauptsächlich nach Westen ausgerichtet. Die Ortswechsel der Tiere sind kleinräumig, ihre Aktionsräume unter einem Hektar groß. Flechten sind Teil der natürlichen Nahrung der Schildkröten.

### ABSTRACT

*Homopus* sp. is associated with weathered granite outcrops in southwestern Namibia where it uses cracks and crevices for thermoregulation purposes and defence. The orientation of cracks and crevices selected as retreat are mainly westward facing. Movement is limited and activity ranges are less than 1 ha in size. Lichens are included in the diet of free ranging tortoises.

### KEY WORDS

Reptilia: Testudines: Cryptodira: Testudinidae: *Homopus* sp.; ecology, physiology, thermoregulation, behaviour, activity range, habitat use, Africa, Namibia

### INTRODUCTION

Namibia has the second largest tortoise fauna (6 species and 5 of the 11 recognised genera of recent Testudinidae) in the world, after South Africa, with tortoises being the reptile family of greatest national concern (GRIFFIN 1998). The Nama Padloper *Homopus* sp. is classified as endemic to southern Africa and is restricted to southern Namibia (BOYCOTT & BOURQUIN 2000; BRANCH 1998) where it occurs southwards from the Tiras Mountains (SCHLEICHER and VISSER pers. comm.) throughout the mountainous region around Aus down to the Huns Mountains adjacent the Orange River (BRANCH 1998). According to GRIFFIN (2003) it may also occur in the adjacent Richtersveld in South Africa although this has not yet been verified. Its international status is classified as: CITES Appendix II, Insufficiently known and Vulnerable and in Namibia its conservation status is classified

as: Endemic & Intermediate and Protected Game (Specially Protected) (GRIFFIN 2003).

This small tortoise has a reddish-brown carapace, which is flattened and flexible, a structural design assisting it to enter narrow cracks and also making it difficult to extract when wedged into fissures. Very little is known about this species as it has only recently been rediscovered after originally been incorrectly described as *Homopus bergeri* from what was later to be determined as a *Psammobates tentorius verroxii* SMITH, 1839 individual and currently waiting to be formally described (BRANCH 1989, 1992).

Very little is known about the ecology of Namibian tortoises in general and the elusive *Homopus* sp. in particular. This present paper deals with some aspects of the ecology and behaviour of *Homopus* sp. as observed in Namibia.

## STUDY AREA AND METHODS

The southern Namib Desert falls within the northernmost extension of the Succulent Karoo Biome of southern Africa with over 600 plant species present of which 10% are restricted to the area (BURKE 2003). The general vegetation type in the vicinity of Aus is classified as Desert and Succulent Steppe (GIESS 1971) dominated by *Mesembryanthemum* species. The environment is harsh with average rainfall varying between 50-100 mm p. a., mainly during winter months, and the average maximum and minimum temperatures range between 24-26 °C and 6-8 °C (MENDELSON et al. 2002; VAN DER MERWE 1983). Rainfall is highly unpredictable (annual average of 10-20 days with rain expected) and variable (60-70% average deviation of the annual average expected) in the Aus area (VAN DER MERWE 1983). The dominant rock type in the area is classified as Namaqua Metamorphic Complex, between 1400-1050 million years old with resultant shallow coarse-textured lithic leptosol soils (MENDELSON et al. 2002).

Six tortoises (4 males, 2 females) were located by scouring the area around Aus where they are known to occur and fitted

with radio transmitters each weighing 6 g. A receiver and hand held antennae, using predetermined frequencies, were used to locate the individuals after being tagged. A Global Positioning System (GPS) was used to plot the various positions and the activity range data was calculated by using the Minimum Convex Polygon (MCP) option in the animal movement analysis ArcView® extension. Lying-up-places – i.e. rock crevices were measured with a 5 m tape measure. Callipers and spring balance were used to gather morphological data. The radio telemetry equipment used included a TR-4 receiver, directional antenna and CHP-2P transmitters (weighing 6 grams) supplied by Telonics Telemetry-Electronic Consultants (Mesa, Arizona, USA). A frequency band of between 151-152 MHz was used.

Research was conducted between July 2003 and November 2005 in the Aus area using radio telemetry for easy location of these usually inconspicuous tortoises. Data on the habitat use, movement and activity range size were collected and interpreted using Microsoft® Excel and ArcView® GIS software.

## RESULTS

Nama Padloper tortoises are mainly associated with granite outcrops (pegmatite) in the Aus area where the animals predominantly selected rock cracks and crevices (75% of 44 observations) as lying-up-places (Fig 1). When using bush as lying-up-places (18%), thorny species such as *Lycium* sp. were favoured (63%).

Orientation of the openings/entrances of the rock cracks and crevices used by 5 male and 2 female tortoises was mainly in a westerly (SW to N – 72%) direction (Fig. 2).

The following measurements (cm) were taken for mean height, depth and width of rock cracks and crevices selected as lying-up-places by 5 male and 2 female Nama Padlopers (minimum – mean±SD – maximum, n): height (4 – 9.6±5.2 – 30, 30), depth (6 – 37.7±26.9 – 100, 30) and width (5 – 20.1±17.8 – 90, 29), respectively.

Female tortoises tended to select smaller (i.e. more inaccessible) rock cracks and crevices as lying-up-places than male tortoises (female: height 7.5±2.8 cm, depth 25.1±10.2 cm, width 15.7±7.9 cm, n = 13; male: height 11.2±6.1 cm, depth 47.4±31.8 cm, width 22.7±21.5 cm, n = 17).

The mean straight carapace length and body mass were 88±5.2 mm and 91±13.8 g for male (n = 6) and 98±1.4 mm and 155±7.1 g for female (n = 2) tortoises, respectively (Table 1).

Movement events were randomly determined (i.e. differences in lying-up-places as determined per site visit) between June 2003 to November 2005. Forty four movement events were determined for five individuals during this period (Table 1).

Movement between lying-up-places varied between the sexes with females (n =

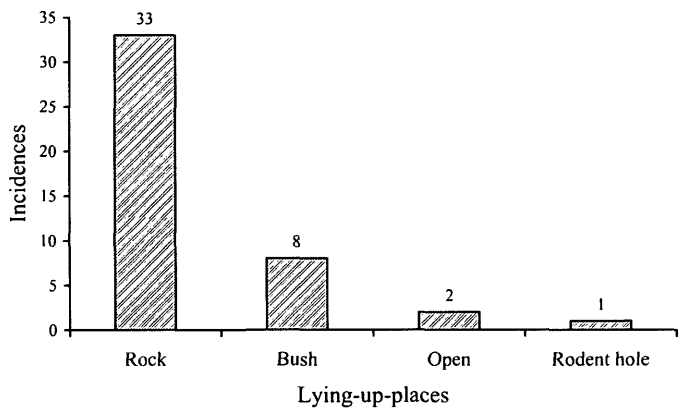


Fig. 1: Lying-up-places as determined from 44 observations of 3 male and 2 female Nama Padloper tortoises in southwestern Namibia.

Abb. 1: Verteilung der Ruheplätze auf Felshöhlen (Rock), unter Buschwerk (Bush), in ungedeckter Lage (Open) und in einem Nagerbau (Rodent hole) aufgrund von 44 Beobachtungen an 3 Männchen und 2 Weibchen von *Homopus* sp. im südwestlichen Namibia.

2) moving on average  $21 \pm 24.8$  m (range: 1-90 m) and males ( $n = 4$ ) moving on average  $50 \pm 57.9$  m (range: 10-210 m). Male ( $n = 2$ ) and female ( $n = 2$ ) tortoises had an average activity range of 0.74 ha and 0.17 ha, respectively (Table 1).

A large overlap in activity ranges was determined ( $H6 \cap H2 = 0.0336$  ha,  $H6 \cap$

$H4 = 0.004$  ha, and  $H7 \cap H6 = 0.1606$  ha) especially between sexes.

Only one observation of foraging was made over a period of two years of regular visits to the study site when a male tortoise was observed feeding on unidentified black lichen.

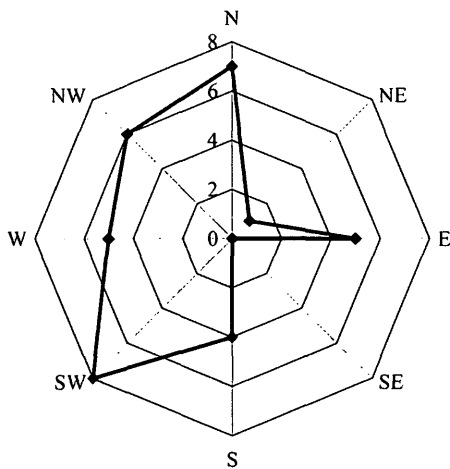


Fig. 2: Orientation of the entrance of rock cracks and crevices used by 5 male and 2 female Nama Padloper tortoises from southwestern Namibia (36 observations).

Abb. 2: Ausrichtung der Öffnungen von Felsspalten, die von 5 Männchen und 2 Weibchen von *Homopus* sp. im südwestlichen Namibia als Ruheplatz verwendet wurden. (36 Beobachtungen). Verteilung auf die Himmelsrichtungen. E - Ost.

Table 1: Data recorded for eight *Homopus* sp. individuals located in the Aus area in southwestern Namibia. SCL - Straight Carapace Length, BM - Body Mass.

Tab. 1: Meßdaten zu acht Exemplaren von *Homopus* sp. aus dem Gebiet von Aus, südwestliches Namibia. SCL - Karapaxlänge (Stockmaß), BM - Körpermasse.

ID	Sex	SCL (mm)	BM (g)	Lying-up-places		Observation Period	Moving Average (m)	Activity Range (ha)
				Number of observations	Number of different places			
				Anzahl Beob- achtungen	Ruheplätze Anz. verschied- ener Plätze	Beob- achtungs- periode	Mittlere Entfer- nung zwischen Ruheplätzen (m)	Aktivitäts- gebiet (ha)
H2	♀	97	150	9	9	18/1–14/4/2004	12.3	0.0336
H3	♂	88	80	--	--	--	--	--
H4	♂	83	70	5	4	12/4/2004–13/1/2005	55	0.4097
H5	♂	91	100	11	11	3/12/2004–2/11/2005	24.5	--
H6	♂	83	100	9	9	22/3–2/11/2005	66.7	1.0722
H7	♀	99	160	10	10	22/3–2/11/2005	28.6	0.3137
H8	♂	86	92	--	--	--	--	--
H9	♂	97	106	--	--	--	--	--

DISCUSSION

The Nama Padloper is a small morphologically adapted crevice dwelling tortoise typically selecting inaccessible rock crevices associated with pegmatite (granite) outcrops in the Aus area. These inaccessible crevices serve as protection as indicated when attempting to extract individuals from such crevices. They typically increase their size by inhaling and subsequently expanding their flexible carapace and raising their hind legs thus effectively wedging themselves into the fissures. These crevices also serve as thermoregulation havens when negotiating the extremely harsh environment. Straight carapace length for males and females is similar to that indicated by SCHLEICHER & LOEHR (2001) although free ranging males were slightly heavier (91 g vs. 66 g). This could however be ascribed to different age of individuals and small sample size.

These tortoises spend very little time outside and away from shelter and only seem to move to locate a new lying-up-place. They are typically active during the early morning in the Aus area although this is not a daily occurrence. According to SCHLEICHER & LOEHR (2001) they have a bimodal activity pattern (morning and late afternoon) under seminatural captive conditions (outdoor enclosure). The harsh envi-

ronment – i.e. low and unpredictable rainfall and extreme seasonal temperature variations – probably account for this tortoises’ general inactiveness.

Tortoises select crevices as lying-up-place mainly with westerly (SW to N) facing openings. The main rocky features in the study area have an east-west orientation with most of the potential lying-up-places (i.e. crevices) thus being either north or south facing (pers. obs) consequently influencing lying-up-place site selection. The dominant winds in the area are the notorious, usually cold, southerly (65% frequency) winds (MENDELSON et al. 2002) probably affecting crevice selection. Pegmatite outcrops are probably selected due to the suitable cracks and crevices associated with this weathered granite formation. Another possibility could be the associated lichens growing on the pegmatite formations in the area and which are included in the diet. Other geological formations in the area yielded no *Homopus* individuals indicating a preference for the well-weathered pegmatite.

Very little can be said regarding the diet of these tortoises as foraging was only observed on one occasion when a male was seen feeding on an unidentified black lichen. Except for BRANCH (1989) and SCHLEICHER

(2004) who suggest possible food plants, not confirmed, from the Kowiesberg area close to Lüderitz, no dietary data could be located in the literature. In captivity they fed readily on a variety of plants not naturally available *in situ* (SCHLEICHER & LOEHR 2001; SCHLEICHER 2004). Lichens included in the diet of the Nama Padloper should be investigated further.

Sharing of lying-up-places was noticed on three occasions when males (two males on one occasion) shared the retreat of one female. This behaviour has also been noticed under captive conditions (SCHLEICHER & LOEHR 2001).

The movement of tortoises was determined in a straight line between lying-up-places and are not necessarily the actual distances moved. The activity range of these tortoises is extremely small (< 1 ha) and associated with a specific geological feature (pegmatite). Males have a larger average activity range (0.74 ha) than females (0.17 ha) and move further between lying-up-places possibly indicating that they actively search for mates. Small activity ranges, limited movement, limited suitable lying-up-places and shared retreats including male-male assemblages (SCHLEICHER & LOEHR 2001) suggest that *Homopus* does not actively defend a territory or activity range. A total of seven tortoises (5 males and 2 females) were located in an area approximately 9.3 ha in size indicating high densities in suitable habitat. Small activity ranges and a specific habitat selection could result in the species becoming locally extinct especially as a result of unscrupulous collectors.

During the study period a partially covered egg, presumably that of *Homopus* although *Psammobates tentorius verroxii* also occur in the area, was located on the south side of a large boulder. On 11 April 2004 a recently hatched juvenile *Homopus* (5 g – body mass, 32.5 mm – straight carapace length) was located under a *Mesembryanthemum* shrub close to its uncovered egg remains. This differs from the average hatchling mass and straight carapace length of  $11 \pm 1.46$  g ( $n = 18$ ) and  $36.2 \pm 2.97$  mm ( $n = 18$ ) as documented under captive conditions (SCHLEICHER & LOEHR 2001). On 23 May 2004 this juvenile was still in the same location, but subsequent searches revealed no trace of it. According to SCHLEICHER & LOEHR (2001) all but one of 24 clutches observed in captivity were buried and most (67%) associated with rocky overhangs and hollows. Few inferences can be made of free ranging *Homopus* hatchling size and hatching success due to the paucity of data. Potential predators in the area include Yellow mongoose (*Cynictis penicillata*), Baboon (*Papio ursinus*), Rock monitors (*Varanus albigularis*) and a variety of avian predators, all of which could affect the survival rate of young *Homopus*. Mongooses are known to excavate *P. t. verroxii* eggs in the Helmeringhausen (approximately 50 km from the study site) area (CUNNINGHAM et al. 2004). BRANCH (1989) also mentions Black backed jackal (*Canis mesomelas*), Brown hyena (*Hyaena brunnea*) and crows (both Pied [*Corvus albus*] and Black [*Corvus capensis*] crows occur in the area) as potential predators.

Threats to *Homopus* in the Aus area include its relatively small habitat, high specialization, overgrazing by cattle, desertification (SCHLEICHER 2004) and localised habitat destruction due to construction of a new railway line between Aus and Lüderitz as well as illegal collecting, a disturbing recent phenomenon (SWIEGERS pers. comm.). Overturned rocks and evidence of wilful habitat destruction is evident around Aus necessitating stricter law enforcement or formal localised protection, something also suggested by BRANCH et al. (1995).

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