A field study of two sympatric 'annual' lizards (genus *Ichnotropis*) in Rhodesia

D.G. Broadley
Umtali Museum, Zimbabwe Rhodesia

A fourteen-month marking/recapture study of the sympatric lacertids *Ichnotropis squamulosa* and *I. capensis* (Sauria:Lacertidae) was carried out at Zimunya township near Umtali. This confirmed that these lizards have staggered life cycles and that individuals rarely live for more than 12 months, thus reducing competition for food between similar-sized lizards of the two species.

S. Afr. J. Zool. 14: 133–138 (1979)

Die simpatriese akkedisse *Ichnotropis squamulosa* en *I. capensis* Sauria:Lacertidae) is vir 14 maande by die Zimunya dorpsgebied naby Umtali bestudeer deur middel van merk en hervangste. Die studie het bevestig dat hierdie akkedisse gespreide lewensiklusse het en dat individue selde vir meer as 12 maande lewe. Dus word kompetisie vir voedsel tussen akkedisse van twee spesies in naastenby dieselfde mate verminder.

S.-Afr. Tydskr. Dierk. 14: 133–138 (1979)

D.G. Broadley
Umtali Museum, Umtali, Zimbabwe Rhodesia

Accepted 30 March 1979

An analysis of snout-vent length against month of collection for Umtali Museum specimens of *Ichnotropis squamulosa* and *I. capensis* suggested that these are 'annual' lizards whose life cycles are staggered (Broadley 1967b). Additional material in the Transvaal Museum, examined by W.D. Haacke, confirmed this picture, except that in *I. squamulosa* there was a slight overlap of generations in October/November, whereas in *I. capensis* no hatchlings were recorded earlier than March and no adults later than February. Consequently there is minimal competition between similar sized individuals of the two sympatric species. Pianka (1971) has reported a similar separation of growth curves in sympatric *Meroles suborbitalis* and *Eremias lineoocellata* in the Kalahari (Pianka, Huey & Lawlor 1977, Fig 6). This type of resource-partitioning is relatively rare in reptiles (Schoener 1977) and it was desirable to confirm this hypothesis with a field study. This was launched in November 1973 and terminated in March 1975, a preliminary report being published while the project was in progress (Broadley 1974b).

Study area and Methods

A study area (Fig. 2) was selected in the Zimunya Township, on the eastern side of the main road to Melsetter, 20 km south of Umtali at an altitude of 1 100 m. The line of concrete markers at the edge of the road reserve was used as a base line, one being selected as 'peg 0' and a series of numbered stakes placed at 10 m intervals parallel to the main road. The effective depth of the study area was 60 m, as just beyond this point a steep bank falls away to the Murowa stream. The study area is sandveld with an ecotone of open miombo (*Brachystegia spiciformis*) woodland with small thorn (*Acacia tortilis*) bushes and *Dodonaea viscosa* shrubs. A *Kigelia africana* is the only large tree in the study area and its shade was avoided by all the lacertids. Grass cover is sparse, as the area is traversed by a cattle track and overgrazed. Annual rainfall is approximately 800 mm and mean maximum temperatures vary from 20 °C in July to 27,5 °C in October and January.

The study area was visited for a morning (approximately 08h30 to 12h30) at approximately monthly intervals, 14 visits being made in 17 months. Usually three people

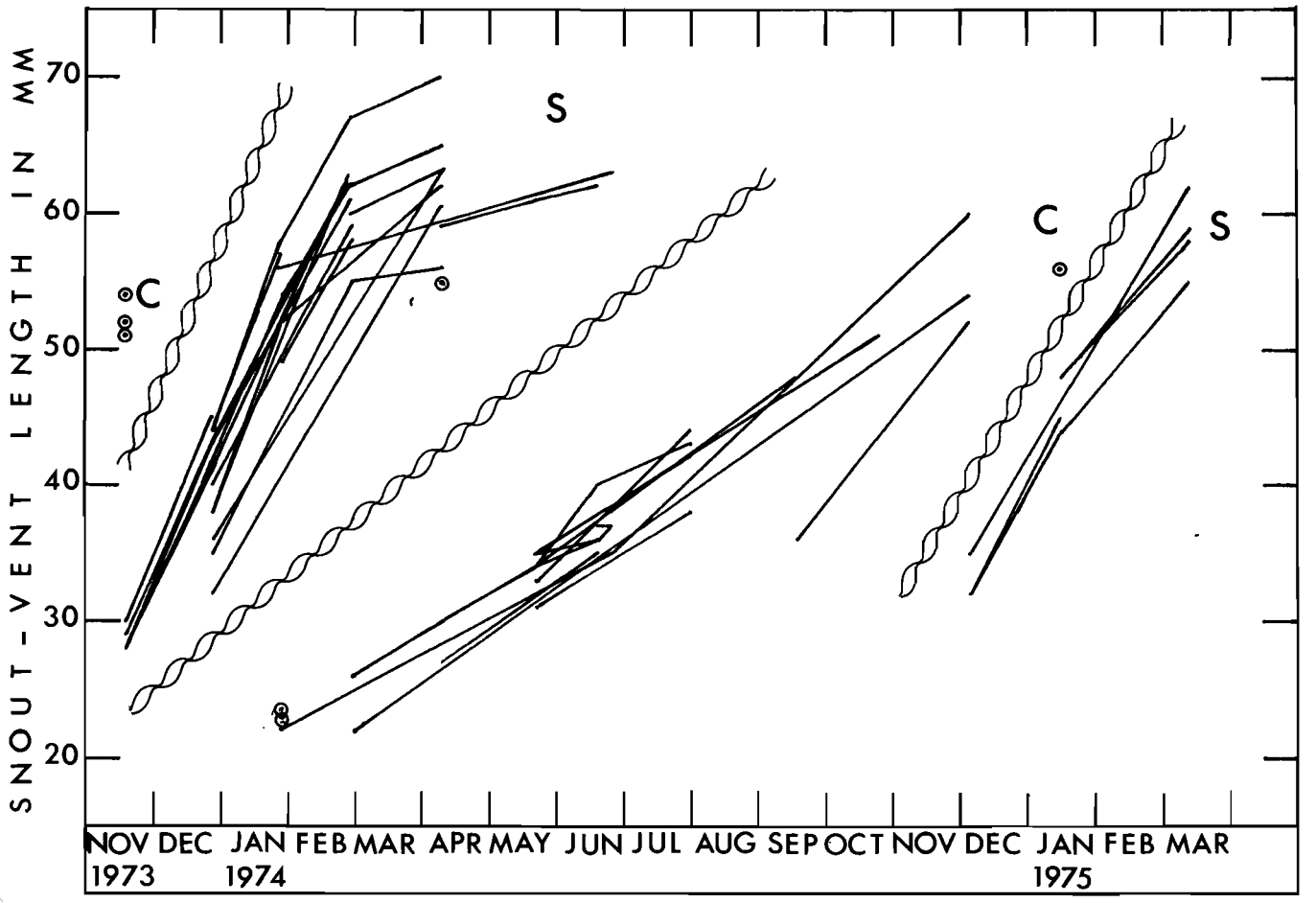

Fig. 1 Records of growth of marked *Ichnotropis* on the Zimunya study area. 'S' = *I. squamulosa;* 'C' and points enclosed in circles = *I. capensis.*

combed the 6000 m² area, collaborating to capture by hand any lizard sighted. Lizards were marked by toe-clipping (Broadley 1974a), measured with a white-face ruler and (if there had been no delay between capture and processing) the cloacal temperature was recorded with a Wesco rapid equilibrium thermometer. Males were identified by the presence of a penial swelling at the base of the tail, plus a black chin and throat in *I. squamulosa* and a vermilion lateral band in *I. capensis.*

Adults of both *Ichnotropis* species retired to burrows which were usually among the roots of *Acacia* bushes, sometimes forming networks occupied by several individuals. Juveniles of both species usually took shelter in smaller holes made by insects, sometimes they hid beneath the few loose stones found on the study area.

The following lizards were marked between 19 November 1973 and 12 March 1975: *Ichnotropis squamulosa* 56; *Ichnotropis capensis* 43; *Nucras taeniolata ornata* 5, and *Agama hispida armata* 32.

None of the *Nucras* was recaptured and the data derived from the *Agama* recaptures will be included in a subsequent paper covering a similar study on *Agama atricollis* at Umtali. Other lizards occasionally encountered on the study area were the skinks *Mabuya v. varia; M. s. striata* and *Panaspis* (*Afroablepharus*) *wahlbergii.*

Samples of the Zimunya populations of the two *Ichnotropis* species were deposited in the Umtali Museum. Data for all *Ichnotropis* that were recaptured at least once are shown in Tables 1 & 2. Growth curves for these specimens are shown in Fig. 1. The life cycles of the two species on the Zimunya study area unfolded as follows:

19 November 1973: Three adult *I. capensis* were caught: the only apparent survivor of this generation to be encountered subsequently was ♀ No. 20, which was taken on 10 April 1974. Six hatchling *I. squamulosa* (snout-vent length 28–30 mm) were marked. The minimum s.v.l. for this species is 24 mm (numerous November specimens; a single October hatchling in the Transvaal Museum).

28 December 1973: Twenty-four *I. squamulosa* (s.v.l. 32–45 mm) were captured.

29 January 1974: Nine *I. squamulosa* (s.v.l. 47–58 mm) and four hatchling *I. capensis* (s.v.l. 22–23,5 mm) were caught. The minimum s.v.l. recorded for the latter species is 22 mm, but hatchlings had not previously been recorded earlier than March (Broadley 1967b).

28 February 1974: Fourteen *I. squamulosa* (s.v.l. ♂♂ 55–63; ♀♀ 59–67) and six *I. capensis* (s.v.l. 22–26 mm) were captured, in addition to two hatchling (s.v.l. 30–33 mm) *Nucras taeniolata ornata.*

10 April 1974: Twelve *I. squamulosa* (s.v.l. ♂♂ 56–63; ♀♀ 60–70), nine *I. capensis* (s.v.l. ♀ 55 mm; juvs 26–30 mm) and a hatchling *Nucras t. ornata* taken.

21 May 1974: One ♂ *I. squamulosa* (s.v.l. 61 mm) and eleven *I. capensis* (s.v.l. 31–36 mm) were caught.

18 June 1974: One ♂ *I. squamulosa* (s.v.l. 62 mm) and five *I. capensis* (s.v.l. 35–40 mm) were captured.

25 June 1974: One ♂ *I. squamulosa* (s.v.l. 63 mm) and six *I. capensis* (s.v.l. 35–38 mm) taken.

30 July 1974: Five ♂ *I. capensis* (s.v.l. 38–44 mm) were captured.

Table 1 Records of marked specimens of *Ichnotropis squamulosa* which were subsequently recaptured

No.	Sex	Date	Snout-vent length	Tail length	Cloacal temp. (°)	Remarks
1	J	19 November 1973	30	37 + X	—	Capture sites 3 m apart
	J	28 December 1973	45	65 + 5	30	
2	J	19 November 1973	28	50	—	Capture sites within a 15 m diameter
	J	28 December 1973	43	84	—	
	♂	28 February 1974	61	57 + X	34,5	
3	J	19 November 1973	29	28 + X	—	Capture sites within a 22 m diameter
	J	28 December 1973	43	50 + 14	30	
	♀	28 February 1974	63	77 + 28	34	
5	J	19 November 1973	28	27 + X		Same capture site
	J	28 December 1973		10 + X		
8	J	28 December 1973	43	42 + 18	30	Capture sites 34 m apart
	♀	28 February 1974	63	106	33	
10	J	28 December 1973	44	80	34	Capture sites within a 20 m diameter
	♀	29 January 1974	58	110	36	
	♀	28 February 1974	67	24 + X	34	
	♀	10 April 1974	70	25 + 9	31	Gravid
12	J	28 November 1973	32	54		Capture sites 13 m apart
	♀	10 April 1974	60	43 + X	31	
13	J	28 November 1973	36	62	30	Capture sites 47 m apart
	♂	10 April 1974	63	51 + 50	34	
14	J	28 November 1973	44	69	31	Capture sites 12 m apart
	♀	29 January 1974	57	105	36	
16	J	28 December 1973	41	73	29	Capture sites 7 m apart
	♀	28 February 1974	63	108	34	
17	J	28 December 1973	41	50 + 14	29	Capture sites within a 28 m diameter
	♀	29 January 1974	54	64 + 27	35	
	♀	28 February 1974	62	101	33	
	♀	10 April 1974	65	59 + X	32	Accidentally killed
19	J	28 February 1973	38	70	29	Capture sites within a 45 m diameter
	♂	29 January 1974	52	64 + X	37	
	♂	10 April 1974	62	65 + 41	33	
23	J	28 December 1973	40	69	30	Capture sites 7 m apart
	♀	28 February 1974	59	78 + 22	34	
24	J	28 December 1973	35	64	30	Capture sites within a 32 m diameter
	♂	28 February 1974	55	117	32,5	
	♂	10 April 1974	56	124	28	
28	♂	29 February 1974	49	49 + 31	36	Capture sites 44 m apart
	♂	28 February 1974	58	104	32	
31	♂	29 January 1974	56	43 + X	38	Capture sites 20 m apart
	♂	25 June 1974	63	29 + 57	32	
33	♂	28 February 1974	60	28 + X	34	Same capture site
	♂	10 April 1974	63	31 + 37	25	
40	♂	10 April 1974	59	28 + 105	32	Capture sites within a 45 m diameter
	♂	21 May 1974	61	30 + 11	—	
	♂	18 June 1974	62	29 + 29	33	
47	J	5 December 1974	32	52	32	Capture sites 44 m apart
	♀	15 January 1975	45	82	—	
48	J	5 December 1974	35	58	32	Capture sites 9 m apart
	♀	12 March 1975	62	110	33	
49	J	5 December 1974	32	57	33	Capture sites within a 45 m diameter
	♂	15 January 1975	44	83	39,5	
	♂	12 March 1975	55	107	34,5	
52	♀	15 January 1975	48	85	—	Capture sites 13 m apart
	♀	12 March 1975	59	110	31	
56	♂	15 January 1975	48	94	36	Capture sites 23 m apart
	♂	12 March 1975	58	—	32	
70	J	28 December 1973	38	41 + X	28	(No. 7) marked 70 in error
	♂	28 February 1974	63	137	34	Capture sites 14 m apart

Table 2 Records of marked specimens of *Ichnotropis capensis* which were subsequently recaptured

No.	Sex	Date	Snout-vent length	Tail length	Cloacal temp. (°)	Remarks
7	J	28 February 1974	26	50	—	Capture sites within a 11 m diameter
	J	10 April 1974	30	62	—	
	J	21 May 1974	34	71	—	
10	J	28 February 1974	22	39	—	Capture sites 20 m apart
	♀	5 December 1974	54	99	28	
15	J	10 April 1974	27	12 + 4	—	Gravid
	J	18 June 1974	35	19 + 33	28	Capture sites 13 m apart
21	J	21 May 1974	35	78	—	Capture sites 30 m apart
	♂	24 October 1974	51	123	36	
23	J	21 May 1974	33	71	—	Capture sites 90 m apart
	♂	30 July 1974	44	97	32	
24	J	21 May 1974	31	48 + X	—	Capture sites 3 m apart
	♂	30 July 1974	38	67 + 4	32,5	
25	J	31 May 1974	35	61 + X	—	Beneath same stone
	♀	18 July 1974	36	67 + X	31	
26	J	21 May 1974	34	78	—	Capture sites within a 3 m diameter
	♂	18 June 1974	40	90	29	
	♂	30 July 1974	43	102	32,5	
28	J	21 May 1974	34	44 + 19	—	Capture sites 21 m apart
	♀	17 September 1974	48	43 + X	34,5	
29	J	21 May 1974	34	54 + 4/7	—	Tail forked
	♂	18 June 1974	36	61 + 5/8	30	Tail forked
	♂	25 June 1974	37	51 + X	31	Capture sites within a 11 m diameter
30	J	21 May 1974	35	51 + X	—	Capture sites 1 m apart
	♂	30 July 1974	42	53 + 15	33	
31	J	18 June 1974	37	81	32	Capture sites 2 m apart
	J	25 June 1974	37	83	32	
36	J	17 September 1974	36	55 + 26	34	Capture sites 17 m apart
	♂	5 December 1974	52	67 + 30	30,5	
70	J	29 January 1974	22	29 + X	—	Capture sites within a 100 m diameter
	♀	25 June 1974	35	34 + X	25	
	♀	5 December 1974	60	56 + 35	28,5	Spent

17 September 1974: Six *I. capensis* (s.v.l. ♂♂ 36–48; ♀♀ 48–49 mm) and a pair of *Nucras taeniolata ornata* (s.v.l. ♂ 55; ♀ 77 mm) were caught.

24 October 1974: Two ♂ *I. capensis* (s.v.l. 44–51 mm) were taken.

5 December 1974: Three *I. capensis* (s.v.l. ♂ 52; ♀♀ 54–60 mm) and nine hatchling *I. squamulosa* (s.v.l. 30–36 mm) were captured.

15 January 1975: One ♀ *I. capensis* (s.v.l. 56 mm) and nine *I. squamulosa* (s.v.l. ♂♂ 44–48; ♀♀ 44–49 mm) were caught.

12 March 1975: Four *I. squamulosa* (s.v.l. ♂♂ 55–58; ♀♀ 59–62 mm) were taken.

Pianka (1971) suggested that *I. squamulosa* normally uses the 'sit and wait strategy' to obtain its prey. On the Zimunya study area, adults of both *Ichnotropis* species showed flexible foraging behaviour, but the juveniles usually exhibited the 'widely foraging strategy' in order to locate the termites on which they largely feed. When alarmed, both species usually take refuge in burrows beneath thorn bushes and their home ranges are apparently centred on these.

Capture sites for those lizards which were recaptured at least twice are mapped in Fig. 2. Distances between capture sites for all recaptured lizards are listed in Tables 1 & 2. The average distances between points of capture were as follows: *I. squamulosa* ♂♂ 23,8 m (range 0–47 m); ♀♀ 16,4 m (range 7–44 m). *I. capensis* ♂♂ 21,4 m (range 1–90 m); ♀♀ 27,0 m (range 0–67 m).

Cloacal temperatures of active lizards show considerable variation, but the mode is approximately 30 °C for juveniles and 34 °C for adults of both species. On the study area it was observed that all the lacertids disappeared down their holes when a cloud passed in front of the sun.

The diet of the two species of *Ichnotropis* was checked by the examination of stomach contents of 312 *I. squamulosa* and 116 *I. capensis* mainly drawn from Botswana and Rhodesia. This indicated that juveniles of both species feed mainly on termites, supplemented by other small insects and spiders. Adults of both species also included large numbers of termites in their diet, but the relatively large harvester termites (*Hodotermes*) were more frequently taken; among the other insects eaten, grasshoppers were most important, particularly with regard to *I. squamulosa*. Apparently sympatric juvenile and adult *Ichnotropis* may feed on different genera of termites: two samples from the Zimunya study area that were identified provided the following data:

6 February 1972: *I. squamulosa* UM 27971 (♀ s.v.l. 44 mm) contained *Hodotermes mossambicus* six workers; *Odontotermes* sp. 12 workers (also a cicada, a grasshopper

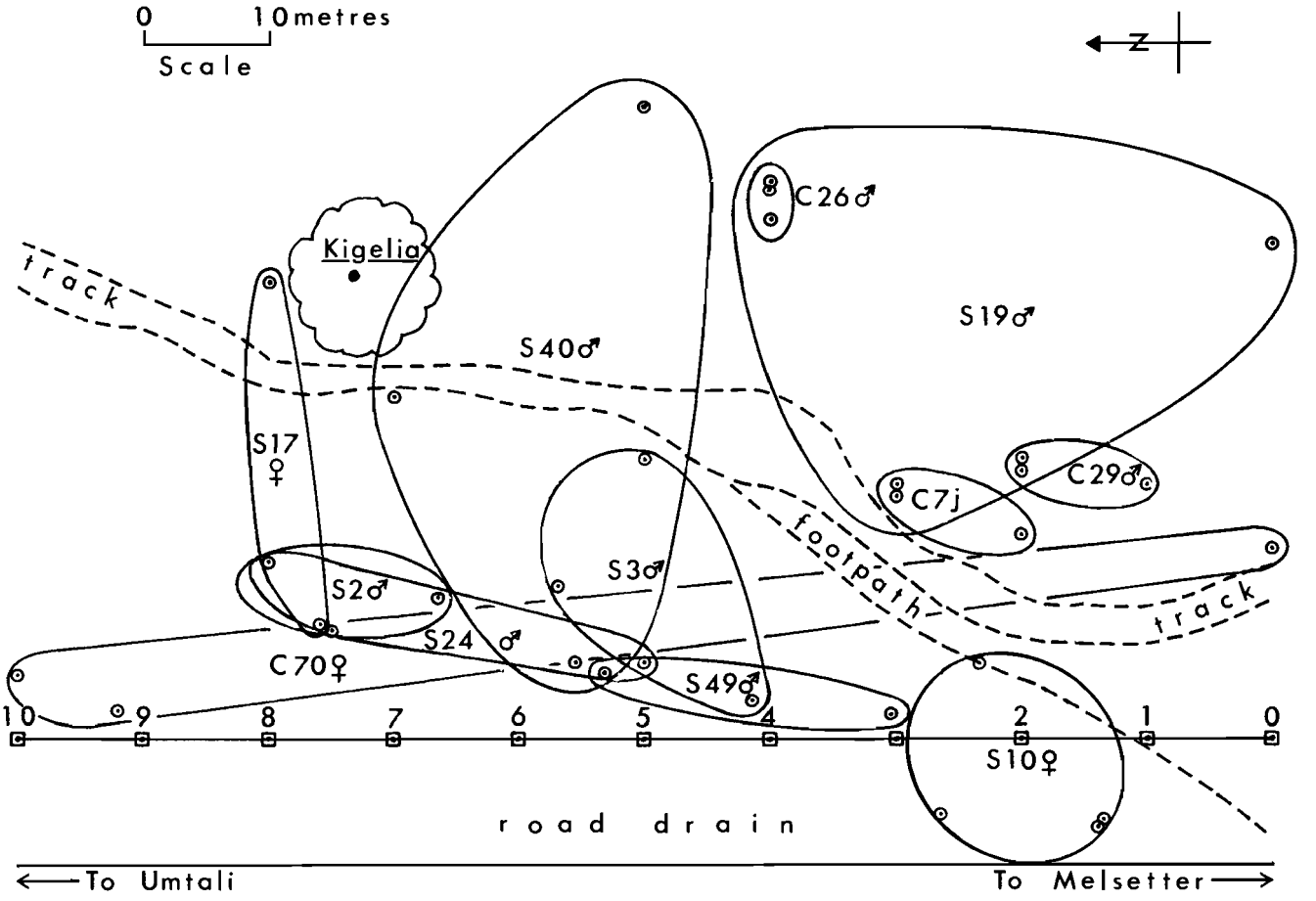

Fig. 2 Map of Zimunya study area showing capture sites for lizards recaptured at least twice. Circles indicate lizard capture sites, squares indicate reference pegs along the base line. Solid black lines enclose capture sites for individual lizards, indicated by numbers with the prefix 'S' = *I. squamulosa* and 'C' = *I. capensis*.

and an ant). *I. capensis* UM 27975 (juv. s.v.l. 24 mm) contained *Pseudacanthotermes miliaris* 20 soldiers/workers.

10 April 1974: *I. squamulosa* UM 30006 (♀ s.v.l. 63 mm) contained *Ancistrotermes latinotus* 30 soldiers/workers (also grasshoppers and a spider). *I. capensis* UM 30007 (juv. s.v.l. 30 mm) contained *Pseudacanthotermes miliaris* 30 soldiers/workers; *Odontotermes* sp. 200 soldiers/workers.

The only vertebrate prey found in an *Ichnotropis* stomach was a juvenile *Panaspis wahlbergii* in a ♀ *I. capensis* from the Gonarezhou National Park, so it is doubtful whether there is any predation by adult *Ichnotropis* on juveniles of the sympatric species.

Conclusions

The data obtained from the Zimunya field study confirm that there is a temporal separation by size in sympatric *Ichnotropis squamulosa* and *I. capensis*, apart from occasional adults that survive into their second year. However the limited data available for the somewhat larger species *Ichnotropis grandiceps* (Broadley 1967a), which is sympatric with both *I. squamulosa* and *I. capensis* at its type locality on the Botswana/Caprivi border, suggests that this is not an 'annual' species, for the type series consists of two adult ♂♂ with snout-vent lengths 65–70 mm and a juvenile (s.v.l. 41 mm), all collected on 30 May. Four more specimens, collected during the first half of April, have snout-vent lengths ranging from 38,2 to 64,8 mm (Haacke 1970).

Body temperatures for active *Ichnotropis* are lower than those published for other African lacertids. Stebbins (1961) studied three sympatric species at Twee Rivieren in the Kalahari Gemsbok National Park and obtained the following mean temperatures: *Eremias namaquensis* 38,5 °C; *E. lineoocellata* 38,4 °C; *Meroles suborbitalis* 38,8 °C. Brain (1962) recorded a mean body temperature of 35 °C for *Meroles cuneirostris* in the Namib Desert.

In the arid areas of southwestern Africa many species of lacertids are sympatric and investigation of their life cycles may reveal other interesting ways in which the available resources may be shared.

Acknowledgements

I am grateful to Ms G.M. Watson who recorded most of the data in the field and examined the stomach contents of nearly 450 *Ichnotropis*, and to Messrs C. Masango and N. Mangezi who assisted in stalking and catching lacertids. I am indebted to Mr B.L. Mitchell of the Department of Research and Specialist Services, Salisbury, for the identification of termites from lizard stomachs. Ms M. Clift typed the manuscript.

References

BRAIN, C.K. 1962. Observations on the temperature tolerance of lizards in the central Namib Desert, South West Africa. *Cimbebasia* Old Series (4): 1-5.

BROADLEY, D.G. 1967a. A new species of *Ichnotropis* (Sauria:Lacertidae) from the Botswana-Caprivi border. *Arnoldia Rhod.* 3 (24): 1-5.

BROADLEY, D.G. 1967b. The life cycles of two sympatric species of *Ichnotropis* (Sauria:Lacertidae). *Zool. Afr.* 3: 1-2.

BROADLEY, D.G. 1974a. Marking/recapture studies on lizards at Umtali. *Rhod. Sci. News* 8 (10): 307-309.

BROADLEY, D.G. 1974b. Field studies on 'annual lizards' of the genus *Ichnotropis*. *Rhod. Sci. News* 8 (10): 309.

HAACKE, W.D. 1970. New herpetological records from South West Africa. *Ann. Transv. Mus.* 26: 277-283.

PIANKA, E.R. 1971. Lizard species density in the Kalahari Desert. *Ecology* 52: 1024-1029.

PIANKA, E.R. HUEY, R.B. and LAWLOR, L.R. 1977. Niche segregation in desert lizards. In: Analysis of ecological systems, eds. Horn, D.J., Mitchell, R. & Stairs, G.R. Ohio State University, Columbus.

SCHOENER, T.W. 1977. Competition and the niche. Ch. 7. In *Biology of the Reptilia*, ed. Gans, C., Academic Press, London.

STEBBINS, R.C. 1961. Body temperature studies in South African lizards. *Koedoe* 4: 54-67.