Short Communications

A re-evaluation of the taxonomic status of *Xenocalamus bicolor concavorostralis* Hoffman, 1940 (Serpentes: Atractaspidinae)

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The taxonomic status of *Xenocalamus bicolor concavorostralis* Hoffman, 1940, represented only by the holotype collected near Bloemfontein in 1939, is re-evaluated. The holotype of *X. b. concavorostralis*, two specimens of *X. bicolor* recently collected within 11 km of the type locality of *X. b. concavorostralis* and a specimen from Barkly West were examined in detail. Hoffman's diagnostic characters for *X. b. concavorostralis* were found to be untenable, with all four specimens referable to *X. b. bicolor* Günther, 1868.

Die taksonomiese status van *Xenocalamus bicolor concavorostralis* Hoffman, 1940, verteenwoordig deur alleenlik die holotipe wat naby Bloemfontein in 1939 versamel is, word herevalueer. Die holotipe van *X. b. concavorostralis*, twee eksemplare van *X. bicolor* wat 11 km van die tipe-lokaliteit van *X. b. concavorostralis* versamel is, en 'n eksemplaar van Barkly-Wes is in detail bestudeer. Hoffman se diagnostiese kenmerke vir *X. b. concavorostralis* is onaanvaarbaar, en al vier eksemplare word beskou as *X. b. bicolor* Günther, 1868.

The African snake genus *Xenocalamus* Günther contains five species, namely *X. bicolor* Günther, *X. mechowii* FitzSimons, *X. michelli* Müller, *X. sabiensis* Broadley and *X. transvaalensis* Methuen. All species are nocturnal, fossorial, oviparous and feed mainly on amphisbaenians (Broadley 1971; 1983).

The genus *Xenocalamus* was founded by Günther in 1868, on a single specimen (*X. bicolor*) collected in Damaraland, Namibia (Broadley 1971; 1983). *X. b.* var. *lineatus* Roux, 1907 was found to differ sufficiently from typical *bicolor* to allow subspecific status (FitzSimons 1946). In 1915, Werner described *Micaëla pernasuta*, later placed in the genus *Xenocalamus* by Hewitt (1926) and treated as *X. b. pernasutus* by FitzSimons (1946; 1962) and Witte & Laurent (1947). *X. b. maculatus* was described by FitzSimons in 1932. Hoffman (1940) then described *X. b. concavorostralis* from a single specimen collected at Kelly's View near Bloemfontein in 1939. Hoffman (1940) noted that *concavorostralis* 'is closely allied to *bicolor*, but distinguished therefrom in the shape of the rostral and the length of the parietal suture'. FitzSimons (1946) later examined this specimen, noting that Hoffman's ventral count of 215 was incorrect and should have been 198. He also pointed out that Hoffman's text figures, one of which depicts a distinctly downward projecting rostral, were not accurate. FitzSimons (1946) nevertheless retained *concavorostralis* as a subspecies of *X. bicolor*, and described a new subspecies, *X. b. australis*. In 1954, Laurent described *X. b. machadoi* from Dundo, Angola. In his revision of the genus, Broadley (1971) retained the subspecies *australis* FitzSimons, *machadoi* Laurent and *lineatus* Roux, but placed *pernasutus* (Werner), *maculatus* FitzSimons and *concavorostralis* Hoffman in the synonomy of *X. bicolor bicolor*.

FitzSimons (1946; 1962) considered the occurrence of the Bloemfontein specimen to be somewhat inexplicable as it was collected so far south of the general range of the genus (see also Broadley 1983, map 45), and expressed the hope that further specimens would be collected from the area to confirm or refute its validity as a distinct form. Broadley (1971) did not examine the holotype of *X. b. concavorostralis*, but considered it representative of a peripheral population clinally linked to typical *bicolor* populations to the northwest. Despite De Waal's (1978) intensive survey of the reptiles of the Orange Free State, no additional specimens of *Xenocalamus* were collected. However, in February, 1983, a specimen of *X. b. bicolor* was collected on the farm Pniel Estate near Barkly West (2824 Cb) (Bates 1988a). This record bridges the gap between *X. b. bicolor* populations elsewhere in the northern Cape Province and the Bloemfontein population (2926Aa) (Figure 1). In December 1985, a second *X. b. bicolor* was collected near Bloemfontein, from a disused termitarium on the farm Cecilia, only 7 km from the type locality of *X. b. concavorostralis* (Kelly's View) (Lynch 1986a,b; Bates 1988b). In April, 1989, a third specimen was found in a drained pond at the Bloemfontein Zoo, 10,5 km from Kelly's View and 3 km from Cecilia. The latter specimen may have originated in soil taken from a quarry near Cecilia and used during building operations at the Bloemfontein Zoo, as it seems unlikely that it would have survived in such an actively utilized area.

The holotype of *X. b. concavorostralis* and the three new specimens listed above, in the collection of the National Museum, Bloemfontein, have been examined to re-evaluate the taxonomic status of *X. b. concavorostralis* Hoffman and investigate variation in specimens from the southernmost part of the subspecies' range.

The four specimens were examined and compared with descriptions of *X. b. concavorostralis* (Hoffman 1940; FitzSimons 1946; 1962) and *X. b. bicolor* (Broadley 1971; 1983). Colour patterns, ventral counts (using the method of Dowling 1951) and snout-vent length / midbody diameter ratios were compared with those of three specimens from the northern Cape Province examined by Broadley (1971) (see Table 1). The following measurements were taken on all specimens using vernier calipers (0,02 mm): head length (from tip of rostral to posterior border of parietals), greatest width of head, parietal length (greatest length on right side measured in a straight line), and third lower labial length (as a mean of left and right sides), whereas the following were measured using an optic micrometer (0,1mm): rostral length and posterior width (dorsally), length of parietal suture and length of scale postceding parietal suture (median nuchal scale). These measurements were used to calculate ratios relevant in comparing head shield proportions (*cf.* FitzSimons 1946; 1962).

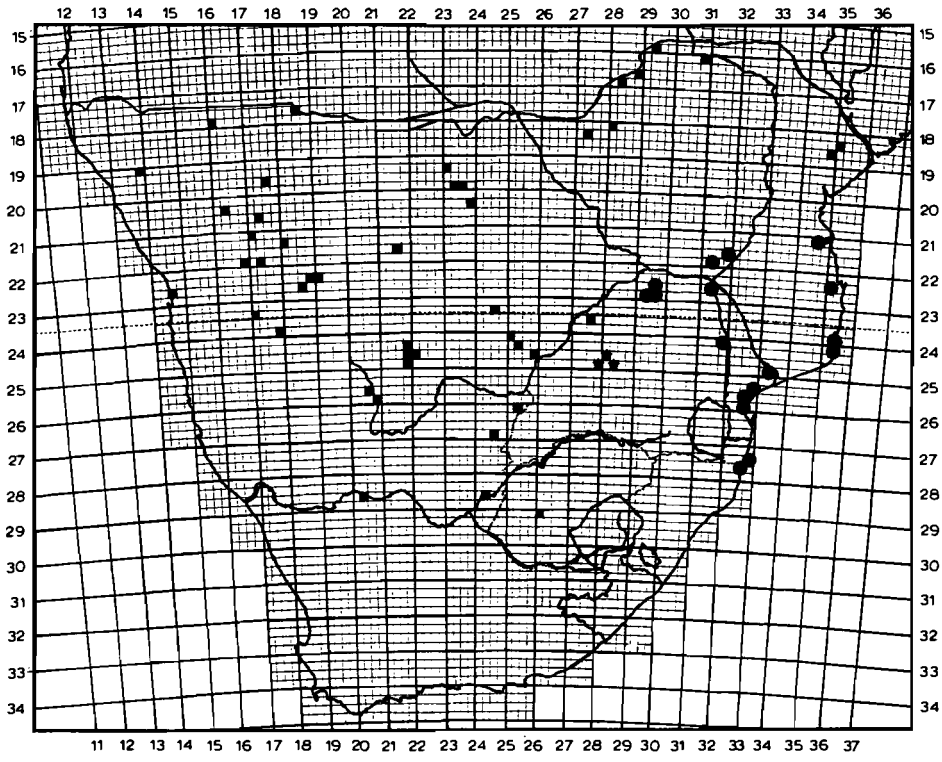

Figure 1 Distribution of the quill-snouted snake, *Xenocalamus bicolor* in southern Africa (Broadley 1983; Auerbach 1987; Bates 1988a,b). ■ *X. b. bicolor;* ● *X. b. lineatus;* ★ *X. b. australis.*

Table 1 Data on *X. b. bicolor* from the northern Cape Province and Orange Free State (specimens examined are in bold print; *l* = length)

Locality	Museum catalogue number	Sex	Ventrals (Dowling)	Subcaudals	SVL + tail *l* = total *l* (mm)	Total *l* / tail *l*	SVL/midbody diameter ratio	SVL/ head *l*
Kelly's View, Bloemfontein	NMB A.2077	male	197	29	341 + 47 = 388	8,26	34*	31,6
Cecilia, Bloemfontein	NMB R5318	male	199	30	409 + 46 = 455	9,89	59	41,7
Bloemfontein Zoo	NMB R5904	male	191	27	456 + 48,5 = 504,5	10,4	53	41,8
Mareetsane	NMSR 1171	male	204				49	
Pniel Estate, Barkly West	NMB R5063	female	217	24/25	391 + 31 = 422	13,6	65	40,5
Zoet Vlei	AM 6770	female	228				50	
Aughrabies Falls	TM 36059	female	239				61	

* Determined as 36 by FitzSimons (1946).

Snout-vent length (SVL) / midbody diameter ratio was first used by FitzSimons (1946) to separate subspecies of *X. bicolor*. However, Broadley (1971) stated that geographical variation in this 'slenderness ratio' is obscured by individual variation owing to contents of the digestive tract, developing ova, general condition of the specimen and probably also shrinkage following preservation. To determine whether or not a recent meal was the cause of the seemingly atypically robust form of *X. b. concavorostris*, incisions were made through the belly and the gut examined. SVL / midbody diameter ratio is determined on preserved specimens and the girth of snakes may be exaggerated if an excess of fixative was injected into the body cavity prior to preservation. The Barkly West specimen was somewhat emaciated before being injected with fixative, possibly resulting in a smaller girth than normal and therefore a slightly larger SVL / midbody diameter ratio.

To determine the sex of specimens, incisions were made

through the belly and examined for the presence of testes or ovaries. The holotype of *X. b. concavorostralis* (NMB A.2077) is a male (with an everted hemipenis), as are the Cecilia (NMB R5318) and Bloemfontein Zoo (NMB R5904) specimens, whereas the Barkly West snake (NMB R5063) is a female.

Examination of the holotype of *X. b. concavorostralis* was generally consistent with FitzSimons's (1946; 1962) description. Hoffman's (1940) description and illustration of the rostral of *concavorostralis* as being very hooked in profile is erroneous, as pointed out by FitzSimons (1946). The three Bloemfontein snakes have very slightly hooked rostrals, whereas that of the Barkly West specimen is straight in profile. The holotype of *X. b. concavorostralis* differs from the other specimens in having a long head relative to SVL and a far more robust body (Table 1). The head was slightly wider than the neck in all specimens. Examination of the gut of *concavorostralis* showed it to be undistended with a little sand present in the hindgut only. The robust appearance of *concavorostralis* may be the result of injection of an excessive quantity of fixative.

All specimens had six upper and five lower labials, except for the Barkly West specimen, which had only four lower labials on the right side. The third and fourth upper labials enter the orbit, but only the fourth enters the orbit on the left side in the Barkly West specimen. Dorsal scales are in 17 rows. Median dorsal scales are as broad as long over middle of back anteriorly (*cf.* FitzSimons 1946; 1962). Variation in number of ventrals and subcaudals, size, total length / tail length ratio, SVL / midbody diameter ratio and SVL / head length ratio is shown in Table 1. The three Bloemfontein snakes are all males with similar low ventral and subcaudal counts, but the SVL / midbody diameter ratio ranged from 34–59. There was little variation in head shield proportions, with the greatest variation being in length of parietal suture relative to length of median nuchal scale (parietal suture / median nuchal scale length ratio: NMB A2077 = 0,61; NMB R5318 = 0,52; NMB R5904 = 0,90; NMB R5063 = 0,64).

Broadley (1971; 1983) described four basic colour patterns in populations of *X. b. bicolor*. The type of *concavorostralis* and three Cape Province specimens are described as 'reticulate', where the dorsum is brown or grey, each scale with a pale border and outer three or four scale rows and ventrum white. The type of *concavorostralis* is grey dorsally, has light-edged dorsal scales, three pale lateral scale rows (scales of first — most dorsal — row are dark above, pale below, all rows with occasional dark blotches) and has a white ventrum with very occasional small dark blotches. The Barkly West specimen is similar, but has a chocolate brown dorsum and four pale lateral scale rows (upper half of top row is dark). The latter two specimens therefore have the 'reticulate' pattern. The other two Bloemfontein snakes have a grey-black dorsum with less easily discernable pale edges to the dorsal scales, three pale lateral scale rows (top scales dark dorsally, second row with more blotching than third) and ventrum with numerous dark blotches. These two specimens are close to the 'bicolor' pattern described by Broadley (1971; 1983) (uniform black above, outer 1–3 scale rows and ventrum white, sometimes with dark blotches or infuscation). All specimens had pale grey head shields (*cf.* Broadley 1971: 677).

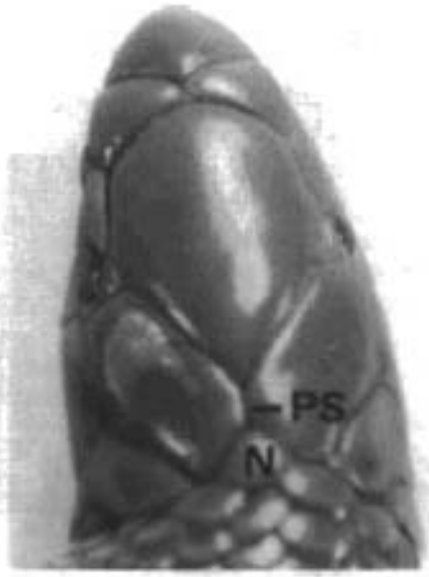

Figure 2 Dorsal view of the head of the holotype of *Xenocalamus bicolor concavorostralis* Hoffman. Note that the parietal suture (PS) is shorter in length than the median nuchal scale (N).

Hoffman (1940) distinguished *X. b. concavorostralis* from typical *bicolor* on account of the rostral shape (hooked) and length of the parietal suture (distinctly shorter than scale behind) (Figure 2). Examination of the type of *concavorostralis* indicated that FitzSimons' (1946; 1962) diagram of the head is more accurate, the rostral being only slightly hooked in profile. The length of the median nuchal scale relative to length of the parietal suture (parietal suture / median nuchal scale length ratio) showed much variation among the four specimens examined (0,52–0,90), indicating that this character is too variable for use as a diagnostic feature.

Broadley (1971: 678) noted that *X. b. bicolor* includes some very diverse populations, but that none seem to warrant subspecific status. Broadley (1971) categorized these populations into six geographical groups based on colour morphs, ventral counts and SVL / midbody diameter ratios, although much variation in these characters occurs throughout the range of *X. b. bicolor*.

Broadley's (1971) suggestion of a clinal increase in ventral counts from east to west is supported by the material examined here, but SVL / midbody diameter ratio showed much variation (34–65). The two colour patterns 'reticulate' and 'bicolor' identified in the four specimens examined indicates that this character also varies in the southern part of the subspecies' range. The type of *X. b. concavorostralis* differs from other *X. b. bicolor* in that it has a more robust form, and has a distinctly longer head (relative to SVL) than the other three specimens examined (i.e. SVL / head length ratio = 31,6; compared to 41,7; 41,8 and 40,5). Numerous affinities between the holotype of *X. b. concavorostralis* and the other three specimens from the southernmost part of the species' range do, however, support Broadley's (1971) decision to place *X. b. concavorostralis* in the synonomy of *X. b. bicolor*.

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The distribution of *Bufo poweri* in southern Africa

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Bufo poweri is shown to be distinguishable from *B. garmani* on the basis of different male advertisement calls. A survey of published and unpublished sonagrams, and data summarizing sonagrams of calls, was used to determine the geographic ranges of the two species. *B. garmani* is found in the north and east, and *B. poweri* in the south and west of Africa. Further fieldwork is required at the boundary between the two species.

Bufo poweri kan van *B. garmani* onderskei word op grond van die verskil in hul manlike advertensieroepe. 'n Opname van gepubliseerde en ongepubliseerde sonagramme, en data wat sonagramme opsom, is gebruik om die geografiese verspeiding van die twee spesies te bepaal. *B. garmani* kom in die noorde en ooste voor, en *B. poweri* in die suide en weste van Afrika. Verdere veldwerk word benodig by die grens tussen die twee spesies.

The cosmopolitan genus *Bufo* has been divided into a number of species groups (Frost 1985). The *Bufo regularis* species group is African and, along with other species of the *regularis* complex, is remarkable for its chromosome number of 2n = 20, while all other species of *Bufo* examined have 22 chromosomes (Bogart 1968). The *regularis* species group presently consists of *B. brauni, B. garmani, B. gutturalis, B. kisoloensis, B. poweri, B. rangeri,* and *B. regularis* (Frost 1985).

Bufo garmani was described from Somalia (Meek 1897), while the morphologically similar *B. poweri* was described from Kimberley (Hewitt 1935). A long-standing problem has been to determine the status of *B. poweri*, based on preserved material. These two species are so similar in body proportions and colour pattern, characters often used to identify toads, that previous workers have been unable to separate them reliably. It is not surprising that until 1972 *B. garmani* and *B. poweri* were regarded as one species, *Bufo garmani* (Poynton 1964a; Tandy & Keith 1972). However, Tandy subsequently regarded them as distinct, largely on the basis of different advertisement calls (Tandy 1972; Tandy, Bogart, Largen & Feener 1982; Largen, Tandy & Tandy 1978). The call of *B. poweri* was described by Tandy *et al.* (1982), and that of *B. garmani* from Kenya by Largen *et al.* (1978). Most later workers have retained only the name *B. garmani* for southern African material (Passmore & Carruthers 1979; Poynton & Broadley 1988; Lambiris 1989).

The problem of how many species comprised '*B. garmani*' and their distribution, was investigated by analysing available advertisement calls. Although the members of the *regularis* species group are morphologically very similar, each species possesses a distinct call (Poynton 1964a: 11). Advertisement calls of male frogs have been demonstrated