

Two new species of True Cobra in the genus *Boulengeria* Dollo, 1886 from West Africa and South Africa (Serpentes: Elapidae).

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ABSTRACT

The African True Cobras, have been a source of newly described species in recent times.

Since 2000, three new species have been formally named. These are: *Spracklandus nubiae* (Wüster and Broadley, 2003), *Spracklandus ashei* (Wüster and Broadley, 2007) and *Uraeus senegalensis* (Trape, Chirio, Broadley and Wüster, 2009) all the result of division of widespread taxa.

This paper names a fourth and fifth new species from Africa. The first species is from the forested zone west of the Dahomey Gap. *Boulengeria jackyhoserae* sp. nov. is formally named according to the Zoological Code (Ride *et al.* 1999). It had been long confused with the morphologically similar and closely related species *Boulengeria melanoleuca* (Hallowell, 1857), (also more widely known as *Naja melanoleuca* Hallowell, 1857) from forested areas of central Africa east of the Dahomey gap.

Another species confused with *Boulengeria melanoleuca*, namely *B. adelynhoserae* sp. nov. from South Africa and immediately adjacent areas, is also formally described according to the Zoological Code.

The new species *Boulengeria jackyhoserae* sp. nov. is most readily separated from the species *Boulengeria melanoleuca* (Hallowell, 1857) in the field by obvious differences in labial and ventral markings, in particular those of the fore-body.

All three species are allopatric.

Keywords: Taxonomy; True Cobras, Africa, *Naja*, *Boulengeria*; *Spracklandus*; new species; *jackyhoserae*; Liberia; Sierra Leone, Ghana, Ivory Coast; Dahomey Gap; *adelynhoserae*; Kwazulu Natal; South Africa, Zimbabwe, Mozambique.

INTRODUCTION

The African True Cobras, remain a source of newly described species in recent times.

Since 2000, three new species have been formally described and named, namely *Spracklandus nubiae* (Wüster and Broadley, 2003), *Spracklandus ashei* (Wüster and Broadley, 2007) and *Uraeus senegalensis* Trape, Chirio, Broadley and Wüster, 2009 all the result of division of widespread taxa and the naming of well-known regionally distinct forms.

Also, well-known variants have also been resurrected from synonymy of better known species both in Africa and in terms of Asian Cobra taxa.

Hoser 2009, reclassified the African True Cobras at the generic level, dividing *Naja* as then known into four groups based on divergence times as indicated below, these being:

- 1 - Asian True Cobras (*Naja Laurenti*, 1768) 25 MYA (million years ago) (minimum 16 MYA);
- 2 - Spitting Cobras (*Spracklandus* Hoser, 2009) 23 MYA;
- 3 - African Non-spitting Cobras (*Wellsus* Hoser, 2009) 21 MYA;
- 4 - *Boulengerina* group (*Boulengerina* Dollo, 1886) 21 MYA.

Wellsus Hoser, 2009 is in fact a junior synonym for *Uraeus* Wagler, 1830 and so the latter name should be used for that group; as done within this paper.

Notwithstanding the last identified error in terms of the nomenclature of Hoser, 2009, the proposed classification of Hoser, 2009 remains the best fit model for the True Cobras and so is the basis of the higher-level nomenclature within this paper. This is especially when an attempt is made to have consistent genus-level classification across the Serpent genera. In 2009, while conducting fieldwork and inspections of collections in Africa, it became apparent that one or more regional variants of the Forest Cobra *Boulengeria melanoleuca* (Hallowell, 1857), (also more widely known as *Naja melanoleuca* Hallowell, 1857) came in a number of apparently regionally distinct colour phases.

The best known variants were the so-called brown phase from South Africa and nearby and the so-called black-phase, with distinct labial bands from the forested areas of West and Central Africa, the distribution centre of the species as (then) recognized.

Inspection of large numbers of preserved specimens, live specimens and photos of live specimens from all known parts of the range of the taxon identified as "*Naja melanoleuca* Hallowell, 1857" showed a most significant division being that between those west of the Dahomey Gap (being essentially within Togo and Benin) and the nominate form found east of there, both being so-called black or dark forms.

While there were a number of trend differences between the two dark coloured forms identified by myself, the most obvious and consistent differences between the two forms is the colouration of the upper labial scales and also the size and shape of some of the head shields.

Due to the fact that the key traits separates those specimens West of the Dahomey Gap from all others found across a wide swathe of western, central and even into southern Africa, it is apparent that the western specimens do in fact consist of an undescribed species-level taxon being more divergent and distinct than all the rest.

On this basis I herein describe the new taxon as a species according to the Zoological Code (Ride *et al.* 1999) below.

Specimens of *B. melanoleuca* from South Africa and adjacent parts of Zimbabwe and Mozambique also have consistent differences in general body colouration, ventral markings and labial markings to those from further north, as well as different habitat preferences.

While the latter may in part be due to local environmental conditions as opposed to any other difference in terms of the snakes themselves, the physical differences between the said snakes is significant, and also worthy of recognition at the species level.

Like the population from west of the Dahomey Gap, this South African form does not have an available name under the Zoological Code (Ride *et al.* 1999).

As a result, this taxon is also formally named below as a new species, named *B. adelynhoserae sp. nov.* in accordance with the Zoological Code.

I should also comment that both newly named species herein fit within the more popular definitions of a species as accepted in zoology at the present time (see comments on the subject by Wilkins (2003, 2007, 2009a, 2009b, 2010) and sources cited therein).

The published material relevant to *Boulengeria melanoleuca* (Hallowell, 1857) and the newly described taxa below (identified until now as the former species) is extensive and relevant material in terms of these two and similar True Cobra species include the following: Barnett (2001), Barnett and Emms (2003), Böhme *et al.* (2001), Boulenger (1896, 1906), Branch (1993), Broadley (1959, 1962, 1968, 1991), Broadley and Cotterill (2004), Burger *et al.* (2004), Capocaccia (1961), Chifundera (1990), Chirio and Ineich (2006), Cimatti (2005), Dobby and Vogel (2007), Fischer (1885), Gossmann *et al.* (2002), Haagner *et al.* (2000), Hallowell (1857), Hofer (2002), Hoogmoed (1980), Jackson (2008), Jackson and Blackburn (2007), Jackson *et al.* (2007), Jacobsen (2009), Jacobsen *et al.* (2010), Lanza (1990), Largen and Spawls (2010), Laurent (1955), Leaché *et al.* (2006), Loveridge (1929, 1936, 1956), Marias (2004), Marias and Jubbe (2010), Matschie (1893), Ota and Hikida (1987), Pauwels and David (2008), Pauwels and Vande Weghe (2008), Pauwels *et al.* (2002, 2007), Peters (1876), Rasmussen (1981), Rödel and Mahsberg (2000), Rödel *et al.* (1999), Schmidt (1923), Schmitz *et al.* (2000), Segniabeto *et al.* (2011), Spawls *et al.* (2001), Trape and Mane (2000, 2004, 2006), Trape and Roux-Esteve (1995), Trape *et al.* (2009), Trutnau (1984), Tyron (1979), Wüster and Broadley (2003, 2007), Wüster *et al.* (2007), Yeomas (2011) and material cited therein.

BOULENGERINA JACKYHOSERAЕ SP. NOV.

Holotype: A specimen at the American Museum of Natural History, in New York, USA, specimen number: AMNH Herpetology 104366, from Grand Gedeh, Liberia, Africa. The

American Museum of Natural History, in New York, USA is a government-owned facility that allows access to its specimens by scientists.

Paratypes:

Three specimens at the Museum of Comparative Zoology, Harvard, USA.

These are:

MCZ Herp R-51634 from 3 miles northeast of Suacoco, Gbanga, Liberia, Africa.

MCZ Herp R-51815 from Cuttington College, Suacoco, Liberia, Africa, and

MCZ Herp R-5709, from Cape Palmas, Liberia, Africa.

The Museum of Comparative Zoology, Harvard, USA is a facility that allows access to its specimens by scientists.

Diagnosis: Until now the species *Boulengeria jackyhoserae sp. nov.* would have been identified as a regional variant of the Forest Cobra *Boulengeria melanoleuca* (Hallowell, 1857), (also more widely known as *Naja melanoleuca* Hallowell, 1857) from West Africa in forested areas west of the Dahomey Gap, namely Ghana, Ivory Coast, Liberia and Sierra Leone.

Boulengeria jackyhoserae sp. nov. is most readily separated from the species *Boulengeria melanoleuca* (Hallowell, 1857) by obvious differences in upper (and lower) labial markings.

One of the diagnostic traits of *B. melanoleuca* is a barring of the labials. In this taxon the side of the head is a light brown colour. At the rear of each of the upper labials, number 2 and further back, there is a well defined section of black pigment on each labial giving the distinct barred appearance. The anterior part of each labial is however immaculate in terms of the light colouration.

By contrast in *B. jackyhoserae sp. nov.* the pigment at the rear of each upper labial is a dark brownish black as opposed to black. More importantly, and diagnostic for this species, the lighter pigment anterior to this is not immaculate. Instead there is extensive and very obvious flecking or peppering of the lighter sections of the labials, sometimes presenting as blotches or obvious marks. The same applies to the lower labials, although to a lesser extent.

The fore-belly of *B. melanoleuca* is immaculate and yellowish for a number of subcaudals (usually about 18-20) before being broken with an immaculate black crossband across the belly. By contrast in *B. jackyhoserae sp. nov.* there is intense dark speckling commencing on the first ventrals and intensifying, so that by ventral number 10, the belly has the appearance of being a dusky grey colour.

In common with *B. melanoleuca* from east of the Dahomey Gap, *B. jackyhoserae sp. nov.* is a mainly blackish coloured snake in terms of overall dorsal colouration.

However in *B. melanoleuca* from east of the Dahomey Gap and elsewhere the tip of the snout is light in colour, or rarely with a small number of well-defined dark flecks. By contrast *B. jackyhoserae sp. nov.* has a completely dark upper head and snout, or rarely peppered with lighter flecks towards the sides.

In *B. jackyhoserae sp. nov.* the prefrontals, rostral and first upper labials are all dark or dominantly dark in colour. The reverse is the case for *B. melanoleuca*.

Ventral and subcaudal counts for both species are similar and cannot be reliably used to differentiate the two species taxa.

However the configuration of the upper labial scales between the two species are consistently different.

Because of differences in the third and fourth upper labials in the two taxa, the fourth one presents quite differently in each.

In *B. melanoleuca* the fourth upper labial is more-or-less triangular in shape, versus more-or-less square in *B. jackyhoserae sp. nov.* In *B. jackyhoserae sp. nov.* the seventh upper labial is usually broken into two, giving the species 8 supralabials, as opposed to 7 being the usual state in *B. melanoleuca*.

B. adelynhoserae sp. nov. (formerly classified as *B. melanoleuca* and formally described below) is most easily separated from the other two species by colouration of the labials and fore-body. To a large extent *B. adelynhoserae* sp. nov. lacks the labial barring seen in the other two species and dorsally is mainly brown in colour at the front half of the body, versus dark or black in the other two taxa.

B. jackyhoserae sp. nov., *B. adelynhoserae* sp. nov. (described below) and *B. melanoleuca* are diagnosed by the following suite of characters: 19-21 dorsal mid-body rows, 201-214 ventrals, single anal, 63-72 divided subcaudals. 7 or 8 upper labials (see above), with numbers 3 and 4 entering the orbit. One or two pre-oculars, 3 postoculars (rarely 2), 8 lower labials and variable temporals.

B. jackyhoserae sp. nov., *B. adelynhoserae* sp. nov. (described below) and *B. melanoleuca* are allopatric in distribution. *B. jackyhoserae* sp. nov. is found in the forested zone west of the Dahomey Gap, from Ghana, west and into Sierra Leone. *B. melanoleuca* is found East of the Dahomey Gap, including at least some of the forested areas within the Dahomey Gap, in an area stretching from Togo and Benin, east, through central Africa, including the main forested areas and as far east as Tanzania, extending south as far as Angola in the west. *B. adelynhoserae* sp. nov. is confined to a region including north-east South Africa and nearby parts of Zimbabwe and Mozambique.

Distribution: *B. jackyhoserae* sp. nov. is found in West Africa in forested areas west of the Dahomey Gap, including Ghana, Ivory Coast, Liberia and Sierra Leone.

Etymology: Named in honour of my younger daughter, Jacky Hoser, aged 12 as of 2013, for her immense efforts and work towards wildlife conservation and education in the first 12 years of her life, including volunteering to take bites from dozens of surgically de-venomized snakes (venomoids) to shatter the deliberate lies of a number of animal haters, who were falsely claiming that these snakes had regenerated venom (see for example Coghlan 2008 or Jenkins 2012) and disseminating an added lie that "dry bites", as in a bite from a venomous snake that does not inject venom are common in venomous snakes.

In terms of the latter lie, a number of people have believed the judgments of Coghlan and Jenkins, as widely posted by Wolfgang Wüster and other truth haters, subsequently failed to get treatment for venomous snake bites and died as a result. For case details see Hoser (2013).

As it happens, it was Jacky's older sister, Adelyn, who in 2011 was videotaped taking bites from the said snakes in a public display at a shopping mall, the video being made by ourselves to shatter the obvious deliberate lie peddled by the animal hating truth haters.

Contrary to news reports, I can state as a matter of fact that my daughter Adelyn was not killed as reported on Melbourne radio (in 2013) from the venomoid snake bites. Contrary to news reports and material on a Wikipedia hate page edited by Wolfgang Wüster and others, Adelyn was not put in a coma as a result of the venomoid bites (Wüster *et al.* 2013).

In fact as would be expected, nothing happened.

Contrary to material on the Wikipedia hate page edited by Wolfgang Wüster and others, Adelyn was not in any way subject to trauma and suffering from the bites, bearing in mind that in her previous 12 years of life, she had been bitten by non-venomous reptiles many times and knew the pain was insignificant.

However I do note that Adelyn and Jacky were both traumatized after being unlawfully arrested at gunpoint twice in a week in August 2011 at the behest of corrupt Victorian Wildlife Officers in an attack strongly supported and endorsed by truth haters Wolfgang Wüster and Mark O'Shea (both of the UK) as posted on their Facebook blogs.

This included an illegal arrest of each young girl at gunpoint on

one occasion in their own home and another when both were frogmarched out of their classrooms at school in front of the other similarly traumatized children.

BOULENGERINA ADELYNHOSERAЕ SP. NOV.

Holotype: Specimen number 50938 at the United States National Museum (USNM), Washington DC, United States of America, collected from Ubombo, 'in the dry berth of the Umsundusi River' at KwaZulu Natal, South Africa. The United States National Museum (USNM), Washington DC, United States of America is a government-owned facility that allows access to its specimens by scientists for study purposes.

Paratype: Specimen number 50939 at the United States National Museum (USNM), Washington DC, United States of America, collected from Ubombo, 'in the dry berth of the Umsundusi River' at KwaZulu Natal, South Africa. The United States National Museum (USNM), Washington DC, United States of America is a government-owned facility that allows access to its specimens by scientists for study purposes.

Diagnosis: The taxon *B. adelynhoserae* sp. nov. would as a matter of course have been diagnosed as *B. melanoleuca* until now. It is most easily separated from both *B. melanoleuca* and *B. jackyhoserae* sp. nov. by colouration, including the fact that there is reduced dark pigment on the top of the head, neck and fore-body, giving the snake a brownish colouration for the dorsal fore-body.

As a rule, specimens also lack the distinct labial bars running from the upper lip into the eye or top of the head, as seen in *B. melanoleuca* and *B. jackyhoserae* sp. nov..

In some young specimens, the dark posterior (bar) of the fourth supralabial is markedly thicker than all others (which are effectively indistinct, in contrast to that in the other two species) and this one creates a thick line running to the bottom of the eye from the jawline in contrast to the other dark posterior sections (if present) and which are markedly thinner and do not reach the eye.

In *B. melanoleuca* and *B. jackyhoserae* sp. nov. the dark posterior parts of each supralabial beyond number two are of similar thickness to one another, or at least with two or more of the middle ones having dark areas of similar thickness and at least two or more dark strips entering the orbit or dark markings on the head.

In *B. adelynhoserae* sp. nov. the fore-body is light to medium brown with numerous dark flecks, intensifying as one moves posteriorly, so that the rear end of the snake is effectively reversed, being near black with just a few lighter brown flecks. In contrast to both *B. melanoleuca* and *B. jackyhoserae* sp. nov. there is no black pigment on the top of the head in front of the eye and these are the only other taxa likely to be confused with this newly named species.

In common with *B. jackyhoserae* sp. nov. the anterior ventrals of *B. adelynhoserae* sp. nov. have distinct peppering on the scales, but in this species the belly remains a brownish yellowish colour for most of its length, as opposed to being dark in colour a short distance from the beginning of the neck as seen in *B. jackyhoserae* sp. nov..

B. jackyhoserae sp. nov. (described above), *B. adelynhoserae* sp. nov. (described here) and *B. melanoleuca* are diagnosed by the following suite of characters: 19-21 dorsal mid-body rows, 201-214 ventrals, single anal, 63-72 divided subcaudals. 7 or 8 upper labials (see above), with numbers 3 and 4 entering the orbit. One or two pre-oculars, 3 postoculars (rarely 2), 8 lower labials and variable temporals.

B. jackyhoserae sp. nov. (described above), *B. adelynhoserae* sp. nov. (described here) and *B. melanoleuca* are allopatric in distribution. *B. jackyhoserae* sp. nov. is found in the forested zone west of the Dahomey Gap, from Ghana, west and into Sierra Leone. *B. melanoleuca* is found East of the Dahomey Gap, including at least some of the forested areas within the Dahomey Gap, in an area stretching from Togo and Benin, east,

through central Africa, including the main forested areas and as far east as Tanzania, extending south as far as Angola in the west. *B. adelynhoserae* sp. nov. is confined to a region including north-east South Africa and nearby parts of Zimbabwe and Mozambique.

Comment: A number of internet sites identify the taxon *B. adelynhoserae* sp. nov. erroneously as *Naja melanoleuca subfulva*, including for example the following url:

<http://www.venomstreet.com/Naja%20melanoleuca%20subfulva.htm> (Ciuros 2013).

This is not the case. The taxon "*subfulva*" (Laurent, 1955) refers to a different animal with a type locality of Lwiro, Kivu, Zaire (in fact a variant of the same form as holotype *B. melanoleuca*). All other taxon names synonymised with *Naja melanoleuca*, do in fact refer to the main population of the species and so were not available for either species named within this paper.

I note that a large number of websites, including <http://www.venomdoc.com> (Fry et al. 2009) do provide erroneous information in this regard in terms of alleged species and subspecies relevant to *B. melanoleuca* and appropriate available names.

Distribution: *B. adelynhoserae* sp. nov. is confined to far north-eastern South Africa, near the coast (KwaZulu Natal) and adjacent parts of Mozambique and Zimbabwe, in two main population areas. In turn these appear to be isolated from the main population centre further north for the species *B. melanoleuca*.

Etymology: Named in honour of my eldest daughter, Adelyn Hoser, aged 14 as of mid 2013. See also for the etymology of *B. jackyhoserae* sp. nov. above.

REFERENCES CITED

- Barnett, L. K. 2001. The herpetofauna of Abuko Nature Reserve, the Gambia. *Herpetological Bulletin* (77):5-1.
- Barnett, L. K. and Emms, C. 2005. Common reptiles of The Gambia. Rare Repro, Hailsham, East Sussex:24 pp.
- Böhme, W., Rödel, M., Brede, C. and Wagner, P. 2011. The reptiles (Testudines, Squamata, Crocodylia) of the forested southeast of the République Guinea (Guinée forestière), with a country-wide checklist. *Bonn zoological Bulletin* 60(1):35-61.
- Boulenger, G. A. 1896. *Catalogue of the snakes in the British Museum, Vol. 3. London* (Taylor and Francis):xiv+727 pp.
- Boulenger, G. A. 1906. Report on the reptiles collected by the late L. Fea in West Africa. *Ann. Mus. civ. Stor. Nat. Genova* (3)2:196-216.
- Branch, W. R. 1993. *A Photographic Guide to Snakes and Other Reptiles of Southern Africa*. Cape Town: Struik Publishers:144 S.
- Broadley, D. G. 1959. The herpetology of Southern Rhodesia. Part I: The snakes. *Bull. Mus. Comp. Zool. Harvard* 120(1):1-100.
- Broadley, D. G. 1962. On some reptile collections from the North-Western and North-Eastern Districts of Southern Rhodesia 1958-1961, with descriptions of four new lizards. *Occ. Pap. Nat. Mus. South. Rhodesia* 26(B):787-843.
- Broadley, D. G. 1968. A review of the African cobras of the genus *Naja* (Serpentes: Elapinae). *Arnoldia* (Rhodesia) (ser. 3) 29:1-14.
- Broadley, D. G. 1991. The Herpetofauna of Northern Mwinilunga Distr., Northw. Zambia. *Arnoldia Zimbabwe* 9(37):519-538.
- Broadley, D. G., Doria, C. T. and Wigge, J. 2003. *Snakes of Zambia. An Atlas and Field Guide*. Edition Chimaira, Frankfurt:280 pp.
- Broadley, D. G. and Cotterill, F. P. D. 2004. The reptiles of southeast Katanga, an overlooked 'hot spot'. *African Journal of Herpetology* 53(1):35-61.
- Burger, M., Branch, W. R. and Channing, A. 2004. Amphibians and Reptiles of Monts Doudou, Gabon: Species Turnover Along an Elevational Gradient. *California Academy of Sciences Memoir* 28:145-186.
- Capocaccia, L. 1961. Contributo allo studio dei serpenti delle isole del Golfo di Guinea. *Ann. Mus. civ. Stor. nat. Genova*, 72:285-309.
- Chifundera, K. 1990. Snakes of Zaire and their bites. *Afr. Stud. Monogr.* (Kyoto) 10(3):137-157.
- Chirio, L. and Ineich, I. 2006. Biogeography of the reptiles of the Central African Republic. *African Journal of Herpetology* 55(1):23-59.
- Ciuros, R. 2013. Venom street *Naja m. subfulva*. Url at: <http://www.venomstreet.com/Naja%20melanoleuca%20subfulva.htm> downloaded on 4 March 2013.
- Coghlan, A. 2008. Judgement: Hoser v Department of Sustainability and Environment (Occupational and Business Regulation) [2008] VCAT 2035 (30 September 2008).
- Cimatti, E. 2005. Zanzibar - Zala Zoological Park. *Reptilia* (GB) (39):62-68.
- Dobiey, M. and Vogel, G. 2007. *Venomous Snakes of Africa/ Giftschlangen Afrikas*. Terralog 15, Edition Chimaira, Frankfurt am Main:150 pp.
- Fischer, J. G. 1885. Ichthyologische und herpetologische Bemerkungen. V. Herpetologische Bemerkungen. *Jahrb. Hamburg. Wiss. Anst.* 2:82-121.
- Fry, B. G. 2009. Cobra's. Website posts from 2009 at: <http://www.venomdoc.com/forums/viewtopic.php?p=26572&sid=72c44ae01d91c2a652fc9a29f4e1a433> downloaded on 4 March 2013.
- Gossmann, V., Lötters, S., Obame, F. and Böhme, W. 2002. Zur Herpetofauna Gabuns. Teil II: Kommentierte Artenliste der gefundenen Reptilien, Bemerkungen zur Artenvielfalt. *Herpetofauna* 24(136):19-33.
- Haagner, G. V., Branch, W. R. and Haagner, A. J. F. 2000. Notes on a collection of reptiles from Zambia and adjacent areas of the Democratic Republic of the Congo. *Annals of the Eastern Cape Museum* 1:1-25.
- Hallowell, E. 1857. Notes of a collection of reptiles from the Gaboon country, West Africa, recently presented to the Academy of Natural Sciences of Philadelphia, by Dr. Herny A. Ford. *Proc. Acad. Nat. Sci. Philadelphia* 9:48-72.
- Hofer, D. 2002. *The São Tomé and Príncipe Handbook*. D. Hofer Verlag, Bern:152 pp.
- Hoogmoed, M. S. 1980. Herpetologische waarnemingen in Ghana. *Lacerta* 38(9):88-95.
- Hoser, R. T. 2009. A reclassification of the True Cobras; species formerly referred to the genera *Naja*, *Boulengerina* and *Paranaja*. *Australasian Journal of Herpetology* 7:1-15.
- Hoser, R. T. 2013. The science of herpetology is built on evidence, ethics, quality publications and strict compliance with the rules of nomenclature. *Australasian Journal of Herpetology* 18:2-79.
- Jackson, K. 2008. *Mean and lowly things: Snakes, Science, and Survival in the Congo*. Harvard University Press:336 pp.
- Jackson, K. and Blackburn, D. C. 2007. The amphibians and reptiles of Nouabale-Ndoki National Park, Republic of Congo (Brazzaville). *Salamandra* 43(3):149-164.
- Jackson, K., Zassi-Boulou, A., Mavoungou, L. and Pangou, S. 2007. Amphibians and Reptiles of the LacTélé Community Reserve, Likouala Region, Republic of Congo (Brazzaville). *Herp. Cons. Biol.* 2(2):75-86.
- Jacobsen, N. H. G. 2009. A contribution to the herpetofauna of the Passendro Area, Central African Republic. *Afr. Herp News* (47):2-20.
- Jacobsen, N. H. G., Pietersen, E. W. and Pietersen, D. W. 2010. A preliminary herpetological survey of the Vilanculos Coastal Wildlife Sanctuary on the San Sebastian Peninsula, Vilankulo, Mozambique. *Herpetology Notes* 3:181-193.

- Jenkins, P. 2012. Judgement: Hoser v The Department of Sustainability and Environment (Occupational and Business Regulation) [2012] VCAT 264 (9 March 2012).
- Lanza, B. 1990. Amphibians and reptiles of the Somali Democratic Republic: check list and biogeography. *Biogeographia*, 14:407-465.
- Largen, M. J. and Spawls, S. 2010. *Amphibians and Reptiles of Ethiopia and Eritrea*. Edition Chimaira, Frankfurt:694 pp.
- Laurent, R. F. 1955. Diagnoses préliminaires des quelques Serpents venimeux. *Rev. Zool. Bot. Afr.*, 51:127-139.
- Leaché, A. D., Rödel, M. O., Linkem, C. W., Diaz, R. E., Hillers, A. and Fujita, M. K. 2006. Biodiversity in a forest island: reptiles and amphibians of the Togo Hills, Kyabobo National Park, Ghana Amphibian and Reptile Conservation 4(1):22-45.
- Loveridge, A. 1929. East African reptiles and amphibians in the United States National Museum. *Bull. US Natl. Mus.* (151):1-135.
- Loveridge, A. 1936. African reptiles and amphibians in the Field Museum of Natural History. *Zool. Ser. Field Mus. Nat. Hist., Chicago*, 22(1):1-122.
- Loveridge, A. 1956. On snakes collected in the Anglo-Egyptian Sudan by J.S. Owen, Esq. *Sudan Notes Rec.* 36:37-56.
- Marias, J. 2004. *A Complete Guide to Snakes of Southern Africa*. South Africa: Struik Publishers:312 pp.
- Marias, J. and Jubbe, W. 2010. *Naja melanoleuca* (Hallowell, 1857) *Afr. Herp News* (52):24-25.
- Matschie, M. 1893. Mitth. *Deutsch. Schutzgeb.*, 6:214.
- Ota, H. and Hikida, T. 1987. On a small collection of lizards and snakes from Cameroon, West Africa. *African Study Monographs* 8(2):111-123.
- Pauwels, O. S. G. and David, P. 2008. Miscellanea Herpetologica Gabonica I. *Hamadryad* 32 (1):13-18.
- Pauwels, O. S. G. and Vande Weghe, J. P. 2008. *Les reptiles du Gabon*. Smithsonian Institution, Washington:272 pp.
- Pauwels, O. S. G., Kamdem Toham, A. and Chimsuncharat, C. 2002. Recherches sur l'herpétofaune du Massif du Chaillu, Gabon. *Bull. Inst. Roy. Sci. Nat. Belgique (Biologie)* 72:47-57.
- Pauwels, O. S. G., Albert, J. L., Vande Weghe, G. and Gramentz, D. 2007. Neue Reptiliennachweise von Franceville, Südost-Gabun. *Elaphe* 15(3):63-66.
- Peters, W. C. H. 1876. Eine zweite Mittheilung über die von Hrn. Professor Dr. R. Buchholz in Westafrika gesammelten Amphibien. *Monatsber. Königl. Akad. Wiss. Berlin* 1876 (Februar):117-123.
- Rasmussen, J. B. 1981. The snakes from the rainforest of the Usambara Mountains, Tanzania: a checklist and key. *Salamandra* 17(3/4):173-188.
- Ride, W. D. L. (ed.) *et al.* (on behalf of the International Commission on Zoological Nomenclature) 1999. *International code of Zoological Nomenclature*. The Natural History Museum, Cromwell Road, London, SW7 5BD, UK (also commonly cited as "ICZN 1999").
- Rödel, M. O. and Mahsberg, D. 2000. Vorläufige Liste der Schlangen des Tai-Nationalparks/Elfenbeinküste und angrenzender Gebiete. *Salamandra* 36(1):25-38.
- Rödel, M. O., Kouadio, K. and Mahsberg, D. 1999. Die Schlangenfauuna des Comoé-Nationalparks, Elfenbeinküste: Ergänzungen und Ausblick. *Salamandra* 35(3):165-180.
- Schmidt, K. P. 1923. Contributions to the herpetology of the Belgian Congo based on the collection of the American Museum Congo Expedition, 1909-1915. Part II. Snakes, with field notes by Herbert Lang and James P. Chapin. *Bull. Amer. Mus. nat. Hist.* 49(1):1-146.
- Schmitz, A., Euskirchen, O. and Böhme, W. 2000. Zur Herpetofauna einer montanen Regenwaldregion in SW-Kamerun (Mt. Kupe und Bakossi-Gergland). III. Einige bemerkenswerte Vertreter der Familien Lacertidae, Scincidae, Varanidae, Elapidae und Viperidae. *Herpetofauna* 22(124):16-27.
- Segniagbeto, G. H., Trape, J. F., David, P., Ohler, A., Dubois, A. and Gliho, I. A. 2011. The snake fauna of Togo: systematics, distribution and biogeography, with remarks on selected taxonomic problems. *Zoosystema* 33 (3): 325-360.
- Spawls, S., Howell, K., Drewes, R. C. and Ashe, J. 2001. *A field guide to the reptiles of East Africa*. Academic Press:543 pp.
- Trape, J. -F. and Mane, Y. 2000. Les serpents des environs de Dielmo (Sine-Saloum, Sénégal). *Bull. Soc. Herp. France* 95:19-35.
- Trape, J. -F. and Mane, Y. 2004. Les serpents des environs de Bandafassi (Sénégal oriental). *Bull. Soc. Herp. France* 109:5-34.
- Trape, J. -F. and Mane, Y. 2006. Guide des serpents d'Afrique occidentale. Savane et désert. IRD Editions, Paris:226 pp.
- Trape, J. -F. and Roux-Esteve, R. 1995. Les serpents du Congo: liste commentée et clé de détermination. *Journal of African Zoology* 109(1):31-50.
- Trape, J. F., Chirio, L., Broadley, D. G. and Wüster, W. 2009. Phylogeography and systematic revision of the Egyptian cobra (Serpentes: Elapidae: *Naja haje*) species complex, with the description of a new species from West Africa. *Zootaxa* 2236:1-25.
- Trutnau, L. 1984. Erfahrungen bei der Pflege und Nachzucht von zwei afrikanischen Naja-Arten: der Schwarzweißen Hutschlange *Naja melanoleuca* Hallowell, 1857 und der Kapkobra *Naja nivea* (Linnaeus, 1758). *Herpetofauna* 6(31):15-26.
- Tryon, B. W. 1979. Reproduction in Captive Forest Cobras, *Naja melanoleuca* (Serpentes: Elapidae). *Journal of Herpetology* 13(4):499-504.
- Wilkins, J. S. 2003. How to be a chaste species pluralist-realist: The origins of species modes and the Synapomorphic Species Concept. *Biology and Philosophy* 18:621-638.
- Wilkins, J. S. 2007. The Concept and Causes of Microbial Species. *Studies in History and Philosophy of the Life Sciences. History and Philosophy of the Life Sciences*, 28:389-408.
- Wilkins, J. S. 2009. *Species: a history of the idea, Species and Systematics*. Berkeley: University of California Press.
- Wilkins, J. S. 2009. *Defining species: a sourcebook from antiquity to today, American University Studies. V, Philosophy*. New York: Peter Lang.
- Wilkins, J. S. 2010. What is a species? Essences and generation. *Theory in Biosciences*, 129:141-148.
- Wüster, W. and Broadley, D. G. 2003. A new species of spitting cobra (*Naja*) from north-eastern Africa (Serpentes: Elapidae). *Journal of Zoology* 259:345-359.
- Wüster, W. and Broadley, D. G. 2007. Get an eyeful of this: a new species of giant spitting cobra from eastern and north-eastern Africa (Squamata: Serpentes: Elapidae: *Naja*). *Zootaxa* 1532:51-68.
- Wüster, W., Crookes, S., Ineich, I., Mané, Y., Pook, C. E. and Trape, J. F. 2007. The phylogeny of cobras inferred from mitochondrial DNA sequences: Evolution of venom spitting and the phylogeography of the African spitting cobras (Serpentes: Elapidae: *Naja nigricollis* complex). *Molecular Phylogenetics and Evolution* 45:437-453.
- Wüster *et al.* 2013. Raymond Hoser. Webpage at: http://en.wikipedia.org/wiki/Raymond_Hoser downloaded on 12 February 2013.
- Yeomas, L. 2011. Die Schwarzweiße Kobra, *Naja melanoleuca*. Teil 1. Reptilia (Münster) 16 (89):35-38.

CONFLICT OF INTEREST

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