

Issue 58, 28 June 2022

ISSN 1836-5698 (Print)
ISSN 1836-5779 (Online)

Australasian Journal of Herpetology



***Australasian Journal of Herpetology*®**

Issue 58, 28 June 2022.

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Dumped rubbish! Is a lack of oviposition sites a potential population limiting factor for southern Australian skinks?

LSIDURN:LSID:ZOOBANK.ORG:PUB:1DDF8585-2933-4AA9-809B-2721C50EB2A5

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Received 1 April 2022, Accepted 20 June 2022, Published 28 June 2022.

ABSTRACT

Fieldwork in eastern and southern central Victoria in January 2022 yielded oviposition sites in the skink *A. jackyhoserae* Hoser, 2012 (*sensu* Hoser, 2022) underneath human building materials waste and the like in areas with few other potential egg-laying sites.

The number of eggs in these communal laying sites was significantly higher than observed in congeners from mid to north New South Wales, implying a shortage of potential laying sites where these Victorian eggs were found.

This paper details three such sites and suggests that increases in numbers of this species in many areas, including on the urban/bush interface is directly correlated to the greater number of potential oviposition sites.

Keywords: Herpetology; skink; lizard; *Lampropholis*; *Allengreerus*; *delicata*; *jackyhoserae*; Victoria; oviposition; egg-laying.

INTRODUCTION

While conducting opportunistic fieldwork across Victoria in January 2020 (in between other work-related commitments, being wildlife displays or snake handling training education), I located a number of communal oviposition sites for the skink species *Allengreerus jackyhoserae* Hoser, 2012 (*sensu* Hoser 2022), previously treated as a form within the *Mococa delicata* De Vis, 1888 species complex, being better known as *Lampropholis delicata*. All were under man-made rubbish in areas lacking other potential egg-laying sites.

This paper gives a summary of these sites and makes comments on them.

MATERIALS AND METHODS

As already mentioned, the field work was opportunistic and done at various locations across central and eastern Victoria. This was typically either before or after doing reptile displays or snake handling training courses at various locations across the eastern half of Victoria and usually in areas near main roads which were investigated on the way to or from my home address in Melbourne, Victoria.

Reptiles and frogs observed were recorded and a summary of the three of the oviposition sites is given herein.

RESULTS – THE OVIPOSITION SITES

Site 1: The first site found at about 4 PM on 20 Jan 2022 was just south of the bridge of the Princes Highway crossing of the Toorloo Arm of Stony Creek, about 6 km north of Lakes Entrance on the Princes Highway, Gippsland, Victoria.

A roadside verge used as a parking space on the south-west side of the bridge had a pile of four pieces of dumped peg board in long grass at the edge of the car parking area (just gravel and dirt), being west of the road.

This peg board had been there for at least several months as evidenced by the fact that grass had grown through the edges and tended to hold it down to the ground when lifted.

This was lifted and underneath was at least 172 eggs from a small skink lizard.

Ten of these had been broken in the process of lifting the material and inside each were young specimens of *Allengreerus jackyhoserae* Hoser, 2012.

After taking photos of the site and eggs, the human building waste material was replaced as best as possible to ensure the survival of the remaining skink eggs.

The site had no canopy facing east, which was the direction of the roadside and verge, including the area where my car had been parked. The tree canopy on the west side of the site was dense. This meant that the site had good exposure to sun in the first half of the day, but none in the hotter second part of the day.

The positioning of the eggs under the lowest of the four pieces of wood and against dirt, gave the eggs a higher humidity and avoided the extreme heat that the outer boards would get. The lizards had in effect chosen the most thermally inert place in the pile, which otherwise was a heat sink due to the nature of the wood material.

The forest area nearby was dense, but there were few if any

fallen logs and no rocks. There were no other obvious oviposition sites. Noting that this species lays 4-8 eggs at a time as a rule, it is self-evident that a large number of lizards had utilized this site to lay eggs.

Site 2: The second site was 4 km east of Stratford, Gippsland, Victoria and found at 6 PM on 20 Jan 2022 (still well and truly daylight hours). This site was between the Princes Highway and the railway line immediately to the north side.

I had pulled over to lift some rubbish amongst the roadside vegetation. Under old carpet, carpet underlay or similar material I found a group of no less than 52 unhatched and 8 recently hatched eggs. Under this same material was also found 3 newly hatched *A. jackyhoserae* implying most or all the eggs were from that species.

This material was very decayed and much was embedded into the ground implying it had been there for some years.

The egg-laying site had a tree canopy to the south-side and faced a clearing and railway line immediately north, meaning it was directly exposed to the sun for most of the day, including the hottest part of the day.

In contrast to the previous oviposition site, the material covering the eggs was very thick and dense and heavy and again the eggs were laid between it and the dirt. Due to the mass of the carpet-type of material, its thermal inertia would have been significant and by way of comparison, far greater than the peg board the other lizard eggs were laid under.

Again, besides the thermal inertia of the egg-laying site, the nature of it was also that it was exposed to heat and yet avoided the impact of the worst heat on a hot day. That is the thick cloth-like material would tend to dissipate the heat.

The section where the eggs were found was otherwise well embedded and below the level of the surrounding ground.

Site 3: The third site was under a thick sheet of chipboard at an address in Donvale (outer east of Melbourne, Victoria) on 22 January 2022, when I attended to locate and catch a Tiger Snake as my work as the Melbourne Snake Catcher. It yielded 220 eggs unhatched. The only species of skink observed on the property was *A. jackyhoserae* (I saw about 10) implying most or all the eggs were from that species, but other small skinks do occur in the same suburb.

The sheet of chipboard being about 1 metre square was embedded on all sides by thick Wandering Jew *Tradescantia zebrina* hort. ex Bosse, with only the centre exposed to the sun or elements.

On three sides it was surrounded by dense vegetation and only clear on the easterly aspect which faced a lawn area and then the house, some distance away.

As for the first site above, the oviposition site here only got exposed to the sun in the first half of the day and avoided direct sunlight beyond about 12 noon.

DISCUSSION

The three examples given are some of many similar such cases seen over decades of searching for reptiles and frogs across Victoria, both when "relaxing" or when working to find venomous snakes as part of my snake catcher work.

While there are many potential reasons for the large number of females choosing to deposit eggs in a single site, the overall impression I get is that the main driver of this is simply a shortage of good sites. That is places eggs can be laid, where they are protected by being under hard cover and the thermal and humidity requirements needed for successful incubation are met.

In areas such as the first two sites in particular, the ground was generally devoid of anything under which to lay any eggs, save for the man-made rubbish deposited in the areas.

Therefore it comes as no surprise that the lizards chose to deposit their eggs at these exact locations.

This raises the issue of what happens if and when there is no human rubbish in these areas.

The obvious conclusion must be that in cases of oviposition site shortages, the few suitable sites, must be exploited by all or most lizards in the area, meaning greater numbers of eggs likely to be found in each.

This seems to reflect in as much as congeners from Sydney, where rocks on the ground are abundant, while laying eggs in communal sites, rarely seem to lay in the quantities seen in the two areas above (sites 1 and 2) where natural oviposition sites are either rare or absent.

Numbers of *A. jackyhoserae* and congeners are known to increase in areas of human habitation, including for example *A. ronhoseri* Hoser, 2009 which is extremely common on the edges of rural towns like Shepparton in northern Victoria, but less common in the surrounding agricultural areas that simply lack all forms of ground cover.

This may well be in part due to the greater number of potential oviposition sites.

With lack of oviposition sites potentially being a limiting factor on skink numbers in some areas, including perhaps the two localities in East Gippsland referred to above, it seems to be a certainty that man made rubbish, even if dumped against the laws of the State of Victoria, may in fact be aiding in the recruitment of young and the continuation of at least this skink species.

While *A. jackyhoserae* and most other members of the genus *Allengreerus* Hoser, 2009 are regarded as invasive species and not of conservation concern (Baker 1980, Chapple *et al.* 2016a, 2016b, Harris *et al.* 2020, Miller *et al.* 2017, Naimo *et al.* 2021), it is likely a shortage of oviposition sites also limits populations of other species of Australian lizard.

Therefore the illegal act of dumping rubbish in Australian bush and agricultural lands may be of benefit to the long-term survival of some of these species including those that may be threatened or endangered (Hoser, 1996).

Hoser (2005) suggested the creation of fake rocks to save the endangered Broad-headed Snake (*Hoplocephalus bungaroides*), which was later successfully adopted by the New South Wales government as a way to increase habitat for the species.

This may not be not dumped rubbish, but it is pretty much the same in as much as it is man-made habitat for potentially threatened species.

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CONFLICT OF INTEREST
 None.

Top images: Site one and eggs exposed after removal of boards.
Bottom Images: Site two eggs and where they were found.
All eggs appeared to be from *Allengreenerus jackyhoserae* Hoser, 2012.
Photos: Raymond Hoser



Hoser 2022 - Australasian Journal of Herpetology 58:3-5.

The inevitable further break up of the monotypic Australian skink genus *Saiphos* Gray, 1831.

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Received 17 March 2022, Accepted 4 June 2022, Published 28 June 2022.

ABSTRACT

Until now (2022), all but one pair of publishing authors have treated the skink genus *Saiphos* as monotypic for the species *Saiphos equalis* Gray, 1825.

Wells and Wellington (1985) formally described *Saiphos samueli* from the New England Tablelands region of New South Wales (NSW) as a new species based on differing reproductive mode (live bearing, rather than laying eggs), larger adult size and occupation of a very different environment to the nominate form.

The most recent field guides (e.g. Cogger 2014 as well as Wilson and Swan 2017) continue to treat *Saiphos* as monotypic.

This is in spite of the fact that Smith *et al.* (2001) provided a sound basis to recognize at least three species within the genus.

Following a review of the literature and inspection of *Saiphos* specimens from throughout their known distribution, this paper recognizes the two previously named forms, *Saiphos equalis* Gray, 1825 and *Saiphos samueli* Wells and Wellington, 1985 and names four further forms in the genus as species.

In total they are *Saiphos equalis* from Barrington Tops, south along the NSW coast and near ranges to about Nowra, NSW, *S. samueli* from the cooler parts of the New England region of NSW and far southern Queensland, *S. hoserae* sp. nov. from the north coast of New South Wales and far southern Queensland near the coast, *S. shanksi* sp. nov. from the Bunya Mountains and nearby hills in south-east Queensland, *S. wellsii* sp. nov. from the Kroombit Tops area in southern central coastal Queensland and *S. wellingtoni* sp. nov. from the Canarvon Range area in southern Queensland.

Keywords: Taxonomy; nomenclature; Australia; Skink; lizard; Scincidae; Queensland; New South Wales; *Saiphos*; *equalis*; *samueli*; new species; *hoserae*; *shanksi*; *wellsii*; *wellingtoni*.

INTRODUCTION

The three-toed skink *Saiphos equalis* Gray, 1825 is a well-known species in eastern Australia. Common even in the most heavily urbanised parts of Sydney, Australia, Australia's largest city, the numbers of this species, normally native to rainforests and wet sclerophyll forests appear to have increased in inner suburbs. This is evidently because they have successfully adapted to urbanization and survived in gardens apparently free from some of the predators or competing species that are found in undisturbed bushland.

Until now (2022), all but one pair of publishing authors have treated the skink genus *Saiphos* as monotypic for the species *Saiphos equalis* Gray, 1825.

Wells and Wellington (1985) in a paper that named dozens of new species and genera, formally described *Saiphos samueli* from the New England Tablelands

region of New South Wales as a new species.

Their assessment was based on differing reproductive mode (live bearing, rather than laying eggs), larger adult size and occupation of a very different environment to the nominate form.

It also occurred north of the biogeographic barrier of the Hunter River Valley, a dry zone north of Sydney, New South Wales, from which the putative species may have been divided at some time in the past, allowing for allopatric speciation to occur.

The most recent field guides (e.g. Cogger 2014 or Wilson and Swan 2017) continue to treat *Saiphos* as monotypic.

This is in spite of the fact that Smith *et al.* (2001), with no connection to Wells and Wellington (1985) provided a sound basis to recognize at least three species within the genus.

Their paper found three obvious clades, being the egg layers with short incubation period from Sydney and nearby regions south of the Hunter Valley, extending south along the coast and eastern

ranges to about Nowra, New South Wales. A second clade including the live-bearers from the New England region of New South Wales and at least one more clade including egg layers with a long incubation term from the north coast of New South Wales.

With three putative species identified in the paper of Smith *et al.* (2001) it was deemed necessary to review the genus *Saiphos* from across the known range of the putative species to determine exactly how many species there were and also what names applied to the given populations.

Further to that, if any forms were unnamed, they should obviously be formally identified and named in accordance with the rules of the *International Code of Zoological Nomenclature* (Ride *et al.* 1999) as amended online since.

MATERIALS AND METHODS

Live specimens of putative *Saiphos equalis* Gray, 1825 and/or *Saiphos samueli* Wells and Wellington, 1985 from across their known distribution were inspected. This was over some decades and included field trips searching for and catching specimens from the entire known range of the genus, being from Nowra, New South Wales in the south to Krombit Tops, Queensland in the north, as well as as far west as the Canarvon National Park area in south-central Queensland and including areas around Brisbane, Sydney, the New England region and other intervening areas.

Also viewed were numerous photos including those with quality location data as well as museum specimens.

Further to this, all relevant literature with regards of the species, taxonomy and nomenclature was also reviewed.

This included Beltrán *et al.* (2020a, 2020b), Biazik *et al.* (2020), Chapple *et al.* (2011a, 2011b), Cogger (2014), Cogger *et al.* (1983), Couper *et al.* (2006), Dubois *et al.* (1988), Dubois (2014), Foster *et al.* (2020), Gray (1825, 1831), Greer *et al.* (2006), Hoser (1989), Hugi *et al.* (2012), Hutchinson *et al.* (2021), ICZN (1991, 2001, 2021), Johnson (2002), Laird *et al.* (2019), Longman (1915), Mo (2015), Murphy (1994), Parker *et al.* (2010), Reeder (2003), Ride *et al.* (1999), Smith *et al.* (2001), Stewart *et al.* (2010a, 2010b), Swan *et al.* (2017), Wells (2002, 2011), Wells and Wellington (1984, 1985), Wilson (2015), Wilson and Knowles (1988), Wilson and Swan (2010, 2017), Wu *et al.* (2009) and relevant sources cited therein.

RESULTS

The type form described by Gray in 1825 is clearly of the form that is common around Sydney in New South Wales.

It appears self-evident that the more primitive and basal stock for the genus are the specimens from the north coast of New South Wales and southern Queensland, including outlier populations such as Krombit Tops and Canarvon National Park as they have a smaller adult body size and also proportionately longer first and second toes on the front feet (Smith, 1996).

This situation is made even more stark as the most proximal other population to these are putative *S. sameuli* from the New England region of NSW and far southern Queensland, which is proportionately larger than type *S. equalis* from Sydney and environs.

Type *S. equalis* have a distribution that is almost entirely disjunct from the populations of other species found exclusively north of the Hunter River valley, is clearly evolving separately to them and clearly must be treated as a separate species.

In terms of those north of the Hunter Valley, the five distinct forms, being the highland form and the lowlands ones, are morphologically divergent (highlands is larger and lowlands are smaller) and with longer toes on the front feet in the lowlands forms.

With no evidence of mixing of the relevant populations, they appear to be of five more well-defined biologically distinct species and so I have no hesitation in recognizing each as a full species.

The name *Saiphos samueli* Wells and Wellington, 1985 is available for the highlands form and so it is formally resurrected from synonymy.

The lowlands form from the north coast of New South Wales and nearby far south-east Queensland is formally named herein as a new species being *Siaphos hoserae* sp. nov..

A divergent form from the Bunya Mountains and nearby hills in south-east Queensland is formally named *Saiphos shanksi* sp. nov..

An isolated and divergent population from Krombit Tops in Queensland formally named as a new and divergent species, being *Saiphos wellsi* sp. nov..

Another isolated and divergent species from the Canarvon National Park area in south-central Queensland is formally named as a divergent species *Saiphos wellingtoni* sp. nov..

Notable is that these divisions are similar to those seen in a formal division of the *Allengreerus delicata* (De Vis, 1888) complex subject of another paper published by myself in 2022, which also relied upon a phylogeny published by Chapple *et al.* (2011a).

That putative species has a near identical distribution in south-east Queensland and northern New South Wales and appears to have been fragmented by the same factors.

I note that while almost all prominent publishing herpetologists in Australia have steadfastly pretended that all *Saiphos* are of a single species, the biological reality has been harder to hide.

By way of example, the arch conservative Hal Cogger, wrote in Cogger (2014) of *Saiphos*:

"As here recognized, a monotypic endemic genus", clearly flagging the reality of an inevitable split of the putative species.

TAXONOMIC VANDALISM BY THE WOLFGANG WÜSTER GANG OF THIEVES

As part of their campaign to destroy the *International Code of Zoological Nomenclature* (Ride *et al.* 1999 as amended online since) (AKA The Code), the so-called Wolfgang Wüster gang of thieves have sought to suppress works of their rivals and then to later steal their kudos, by claiming to have newly discovered species named by others some years prior.

They have then engaged in taxonomic vandalism by renaming the species or genera and peddling their illegal names as valid in direct breach of the Code.

Their mantra is spelt out explicitly by Shine (1987) as first draft and expanded upon by Glen Shea in Shea (1987).

Despite being harshly condemned by the ICZN in ICZN (1991 and 2001), the Wolfgang Wüster gang of thieves rejigged their campaign against the Code with Kaiser (2012a, 2012b, 2013, 2014a, 2014b), Kaiser *et al.* (2013) and Rhodin *et al.* (2015).

These attempts to destroy the code are detailed by Dubois *et al.* (1988), Dubois (2014), Hoser (2007, 2009, 2012a, 2012b, 2013, 2015a-f, 2017, 2019a, 2019b), Wellington (2015) and Hawkeswood (2021) and the many sources cited therein.

Wolfgang Wüsters gang of thieves also control the website at: <https://reptile-database.reptarium.cz/>

which is under the control of Peter Uetz, who in reality is nothing more than a puppet of the evil, law-breaking Wolfgang Wüster.

Using this so-called database of all things taxonomy and nomenclature for reptiles, the gang has aggressively sought to sabotage and destabilize the taxonomy and nomenclature of herpetology, including this very genus (*Saiphos*), being why their campaign of destruction is mentioned here.

The campaign by this gang of fake scientists includes making the website at:

<https://reptile-database.reptarium.cz/>

into what they describe as a "list of available names" or "LAN", in a bastardisation of an ongoing project of the International Commission of Zoological Nomenclature (ICZN), to create such lists for all major groups of animals.

The site, is ostensibly run by one Peter Uetz as front man, who

in reality is nothing more than a puppet of the evil, law-breaking Wolfgang Wüster. Uetz has openly admitted to having censored out more than a thousand authors, publications and scientific names that are by people outside their own cohort (Uetz, 2022). After Uetz was lampooned within the herpetological community, including on countless Facebook threads, he publicly renounced his censorship and said he'd include the censored material immediately.

However the statement was a lie as his site continues to censor numerous authors, works and their ICZN valid names for reptile taxa.

Of course, most Uetz's censorship is not admitted in a rare burst of honesty as seen in Uetz (2022), but instead just done, with most viewers of the website deliberately made unaware that the censorship has gone on.

In the case of the genus *Saiphos* and the putatively monotypic species *P. equalis*, the Uetz site webpage is at: https://reptile-database.reptarium.cz/species?genus=Saiphos&species=equalis&search_param=%28%28genus%3D%27Saiphos%27%29%29

Significantly, it lists "all" previous synonyms and available names as:

"*Seps equalis* GRAY 1825: 202

Anguis lacertina GRAY 1831: 72 (nomen nudum)

Siaphos aequalis — GRAY 1839 (emendation)

Lygosoma (*Siaphos*) *aequale* — LONGMAN 1915: 34

Saiphos equalis — COGGER 1983: 183

Saiphos equalis — COGGER 2000: 572

Saiphos aequalis — GREER et al. 2006"

There is no mention of Wells and Wellington, 1985 or their name *Saiphos samueli* Wells and Wellington, 1985, even though they have been fully aware of it since at least 1987, noting that Uetz himself, as well as Wüster and the rest of the gang of thieves even petitioned the ICZN in relation to the works of Wells and Wellington as recently as 2015 in Rhodin *et al.* (2015).

The bibliography of references about the genus and species includes no less than 28 entires, alleged to be relevant to the taxonomy and nomenclature of the genus and species.

However almost all are barely relevant at all, most are not peer reviewed publications and some were merely mentioning the putative species in passing, such as part of an account of a fauna survey or similar.

One citation (Laird *et al.* 2019), not making any taxonomic changes or judgements on putative *Saiphos equalis* is actually published twice, being 2 of the 28 citations.

Meanwhile the most important papers of Wells and Wellington (1984, 1985) or the critically important Smith *et al.* (2001), being the only publication to have a molecular analysis of the genus from most of its known range, making them the two most significant publications since the original description by Gray in 1825 are deliberately omitted from the Uetz page.

This is not just a matter of petty jealousy as would inevitably be alleged by the Wüster gang, but is in fact a serious and dangerous omission.

By faking that the New England form of *Saiphos* is not already formally named and that the name *Saiphos samueli* Wells and Wellington, 1985 is not only available, but validated by a molecular study as well as confirmed as valid in ICZN rulings of 1991, 2001 and 2021, Wüster and his puppet in the form of Peter Uetz are actively encouraging an act of taxonomic vandalism.

This is in the expectation that someone else may independently find that the New England *Saiphos* is a separate species to type *S. equalis*, check

<https://reptile-database.reptarium.cz/>

to see if there is any available name or synonym exists in their alleged complete "list of available names" and when finding none, renaming the same entity in the misguided belief it is an unnamed entity.

Of course, science then gets stuck with a destabilizing dual nomenclature for anything from a few days to a few decades, while other scientists have to sort out the mess created by Wüster and his puppet Peter Uetz.

There is also likely to be what Uetz himself described in 2022 as "collateral damage" (Uetz 2022) in the form of a budding herpetologist unhappy to see all their taxonomic work in discovering and naming a new species getting trashed, simply because two critically important earlier works were hidden from them.

Of course the recent historical record shows Wüster and his puppet in the form of Peter Uetz aggressively peddling the name they know to be an invalid junior synonym in preference of the valid ICZN name, because they happen to dislike the person who originally named the species.

Even as of 2022, we see reticulated pythons at:

<https://reptile-database.reptarium.cz/species?genus=Malayopython&species=reticulatus>

listed as "*Malayopython*", which everyone knows is an illegally coined junior synonym of *Broghammerus* Hoser, 2004, or at:

<https://reptile-database.reptarium.cz/species?genus=Leiopython&species=fredparkeri>

we have the iconic python *Leiopython hoseerae* Hoser, 2000, rebranded with the illegally coined name *Leiopython fredparkeri* Schleip, 2008, which is yet another abortion following their earlier claimed name of *Leiopython meridionalis* Schleip, 2014.

Serial criminal Wulf Schleip is a close friend of the notorious animal abuser Wolfgang Wüster who seeks self-gratification in stealing works from others and renaming the species they discovered earlier.

Via the Uetz website he then falsely claims to have made a "new discovery".

Worse still the scientific literature is permanently cluttered with another set of wholly unnecessary junior synonyms.

This effort and time wasted by scientists fixing the taxonomic and nomenclatural mess deliberately created by Wüster and his puppet Peter Uetz, is time that should be better spent on other things, including saving species facing extinction.

This is no abstract or hypothetical situation.

This egregious misconduct by Wüster, his puppet Peter Uetz and their cohort of thieves over the past 3 decades has already directly caused the extinction of a species of Australian Agamid *Tympanocryptis pinguicollis* (Mitchell, 1948) as detailed in Hoser (2019a, 2019b) and sources cited therein, as well as quite likely several species of snake and lizard from various Pacific islands.

INFORMATION RELEVANT TO THE FORMAL DESCRIPTIONS THAT FOLLOW

There is no conflict of interest in terms of this paper or the conclusions arrived at herein.

Several people including anonymous peer reviewers who revised the manuscript prior to publication are also thanked as are relevant staff at museums who made specimens and records available in line with international obligations.

In terms of the following formal descriptions, spellings should not be altered in any way for any purpose unless expressly and exclusively called for by the rules governing Zoological Nomenclature as administered by the International Commission of Zoological Nomenclature (ICZN).

This includes if gender assignment of suffixes seems incorrect, Latinisation is wrong, apparent spelling mistakes and so on (see Article 32.5.1 of the *International Code of Zoological Nomenclature*).

In the unlikely event two or more newly named taxa are deemed to be the same by a first reviser, then the name to be used and retained is that which first appears in this paper by way of page priority and as listed in the abstract keywords, or by way of date priority if this is possible.

Some material in descriptions for taxa may be repeated for other taxa in this paper and this is necessary to ensure each

fully complies with the provisions of the *International Code of Zoological Nomenclature* (fourth edition) (Ride *et al.* 1999) as amended online since.

Material downloaded from the internet and cited anywhere in this paper was downloaded and checked most recently as of 3 June 2022 (including if also viewed prior), unless otherwise stated and was accurate in terms of the content cited herein as of that date. Any online citations within this paper, including copied emails and the like, are not as a rule cited in the references part of this paper and have the same most recent viewing date as just given. Unless otherwise stated explicitly, colour and other descriptions apply to living adult specimens of generally good health, as seen by day, and not under any form of stress by means such as excessive cool, heat, dehydration, excessive ageing, abnormal skin or reaction to chemical or other input.

SVL or SV means snout-vent length, TL means tail length, tail measurements refer to original tails, max. size refers to maximum known, sometimes approximated up to the nearest 10 mm if number of measured specimens is below 10.

While numerous texts and references were consulted prior to publication of this paper, the criteria used to separate the relevant genera, subgenera, species or subspecies has already been spelt out and/or is done so within each formal description and does not rely on material within publications not explicitly cited herein.

SAIPHOS HOSERAE SP. NOV.

LSIDDurn:lsid:zoobank.org:act:485AF782-15D8-4B11-A291-A3E004B8B41A

Holotype: A preserved specimen at the Australian Museum, Sydney, New South Wales, Australia, specimen number R.146699 collected from Byron Bay Holiday Villages, 3.5 km north of the Byron Bay town centre, at Byron Bay, New South Wales, Australia, Latitude -28.63166 S., Longitude 153.58888 E. This government-owned facility allows access to its holdings.

Paratypes: 21 preserved specimens at the Australian Museum, Sydney, New South Wales, Australia, specimen numbers R.146710, R.146711, R.146712, R.146720, R.146721, R.151823, R.151824, R.151825, R.151826, R.151827, R.146832, R.146734, R.146735, R.146736, R.146737, R.146850, R.146751, R.146852, R.146853, R.146854 and R.146858 collected from Byron Bay Holiday Villages, 3.5 km north of the Byron Bay town centre, at Byron Bay, New South Wales, Australia, Latitude -28.63166 S., Longitude 153.58888 E.

Diagnosis: Until now, each of *Saiphos hoserae sp. nov.*, *S. shanksi sp. nov.*, *S. wellsi sp. nov.* and *S. wellingtoni sp. nov.* have been treated as divergent populations of the Three-toed Skink *Saiphos equalis* Gray, 1831, as has the species *S. samueli* Wells and Wellington, 1985 by all other publishing authors since the name was first published.

In the face of obvious morphological differences between populations and molecular evidence, including that of Smith *et al.* (2001), it is no longer tenable to treat all populations as a single species and hence the split as done herein.

This is especially noting the various relevant populations are also allopatric and clearly evolving as separate species.

Each of the six species within *Saiphos* Gray, 1831 are separated from one another by the following six unique suites of characters:

Siaphos equalis Gray, 1831, found from Barrington Tops, New South Wales, south along the coast and nearby ranges to about Nowra, New South Wales, is distinguished by having heavy black etching on or between the anterior scales of the upper surface of the head, grading to irregular spotting on the neck and body, this sometimes being absent. At the dorsolateral edge is a dark greyish-black stripe with a well-defined upper boundary and a lower boundary that fades quickly to whitish about half to three quarters of the way down the flank, making this line thick. On the side of the head the scales are generally greyish all over save for small white spots of specks in the centres of most scales, with scales on the side of the neck of similar form. Venter is yellow.

Average maximum adult snout-vent length is 70 cm.

S. samueli Wells and Wellington, 1985 from the cooler uplands and ranges of the New England region of New South Wales and far southern Queensland is distinguished by having a head of similar colour to the neck and body, this being a medium brown colour, which has dark spotting on the posterior part, these spots being more numerous anteriorly and sometimes coalescing. The dark stripe on the sides of the body extends all the way down the flank and without fading on the lower edge, forming a well-defined interface between it and the orangeish-yellow belly. The dorsum is spotted with tiny black dots forming barely distinct longitudinal lines, these being best defined towards the lateral edges.

Average maximum adult snout-vent length is 80 cm.

S. hoserae sp. nov. from the far north coast of New South Wales, extending from Coffs Harbour to the Queensland border and into south-east Queensland, with the north and south limits of distribution not exactly known is readily separated from the other species by having a light brown dorsum, distinctly greyish-brown head, with scales on the top etched with dark grey to black. The black dorsolateral stripe is thin, below which is most of the flank that is yellowish grey in colour, with the centre of each scale marked grey and the outer edges being yellowish.

Unlike the other species in the genus, the flank stripe does not extend most or all of the way along the tail. In this species it is thin at the anterior end of the tail and diffusing into the general greyish-brown tail colour. The sides of the head and neck posterior to the eye is a whitish-grey colour.

Venter is yellow, but with a slight orange tinge.

Average maximum adult snout-vent length is 65 mm.

Smith (1996) reported this taxon had proportionately longer first and second toes on the front feet.

S. shanksi sp. nov. from the Bunya Mountains and nearby hills as far south as near Dalby and as far north as Kingaroy, all in south-east Queensland is readily separated from the other species in the genus by having a dorsum that is defined by having about four thick, well-defined dark blackish longitudinal stripes with irregular edges, running along the dorsum.

Sides of head are black, except for a few upper labials which may have small amounts of white in the centre of each scale. Neck is also blackish in colour. The lateral stripe is moderately thick, extending between a third and half way down the flank. It grades gradually to dark grey on the lower boundary, with brown at the interface of the lower boundary of the lateral stripe, this being the colour along the midline of the flank. The top of the head is brown, heavily infused with black etchings and blotches on most scales.

Venter is yellow.

Average maximum adult snout-vent length is 65 mm.

S. wellsi sp. nov. from Kroombit Tops in Queensland is similar in most respects to *S. shanksi sp. nov.*, but separated from that species and the morphologically similar *S. wellingtoni sp. nov.* by having a dark brownish grey body, a head that on the upper surface is more dark grey than brown and indistinct irregular black markings also on the head of similar intensity both anterior and posterior to the eyes. The tail is also heavily peppered and marked with black, but forming stripes as seen in other species where this occurs.

S. wellingtoni sp. nov. from the Canarvan National Park and hills immediately south of there in inland southern Queensland is similar in most respects to *S. shanksi sp. nov.*, but separated from that species and the morphologically similar *S. wellsi sp. nov.* by having a light to medium brown body, black etched scales on top of the head that are otherwise brown in colour, a tail that has numerous tiny dots at the anterior end, tending to form one or more longitudinal stripes and prominent white spots on the labials and other scales on the side of the head and neck, which are otherwise grey in colour. The dark stripe on the flank fades immediately, but gradually, after the upper boundary to

the whitish-grey lower surface, which is consistently whitish-grey from about half-way down the flank.

The six preceding species, forming the entirety of the genus *Saiphos* Gray, 1831 are separated from all other Australian skinks by the following suite of characters:

Limbs tridactyle, with short and unequal digits; the hindlimb is about 10% of the snout-vent length, all limbs being widely separated when adpressed. Ear opening is hidden and is only indicated by a depression. Supranasals absent; nasals undivided; prefrontals absent although the enlarged first supraciliary could be treated as a small prefrontal; parietal shields are in contact behind the interparietal; frontoparietals paired, distinct from the interparietal; four supraoculars; postmental in contact with two infralabials on each side; a series of suboculars between the labials and the eye. Usually six supralabials. Lower eyelid is scaly and movable. 18-20 midbody scale rows (modified from Cogger 2014).

Saiphos equalis is depicted in life in Hoser (1989), page 106, middle, as well as in Cogger (2014) on page 677 and online at: <https://www.inaturalist.org/observations/19373517>

and

<https://www.inaturalist.org/observations/55767936>

Saiphos samueli Wells and Wellington, 1985 is depicted in life online at:

<https://www.inaturalist.org/observations/31211620>

Saiphos hoserae sp. nov. is depicted in life online at:

<https://www.inaturalist.org/observations/96923085>

and

<https://www.inaturalist.org/observations/110645595>

and

<https://www.inaturalist.org/observations/27462>

Distribution: *S. hoserae* sp. nov. occurs on the far north coast of New South Wales, extending from Coffs Harbour to the Queensland border and into south-east Queensland, with the north and south limits of distribution not exactly known

Etymology: *S. hoserae* sp. nov. is named in honour of my mother, Katrina Joan Hoser, of Lane Cove, New South Wales, Australia in recognition of her monumental contributions to herpetology over some decades.

SAIPHOS SHANKSI SP. NOV.

LSIDDurn:lsid:zoobank.org:act:14521B72-41F8-4FB3-906D-EE4F4E4B931B

Holotype: A preserved specimen at the Queensland Museum, Brisbane, Queensland, Australia, specimen number J59248 collected from Lower Koondaii, Bunya Mountains National Park, Queensland, Australia, Latitude -26.885556 S., Longitude 151.554722 E.

This government-owned facility allows access to its holdings.

Paratype: Two preserved specimens at the Queensland Museum, Brisbane, Queensland, Australia, specimen numbers J2310 and J2311 collected from Bell, near Dalby, Queensland, Australia, Latitude -26.933333 S., Longitude 151.45 E.

Diagnosis: Until now, each of *Saiphos shanksi* sp. nov., *S. hoserae* sp. nov., *S. wellsi* sp. nov. and *S. wellingtoni* sp. nov. have been treated as divergent populations of the Three-toed Skink *Saiphos equalis* Gray, 1831, as has the species *S. samueli* Wells and Wellington, 1985 by all other publishing authors since the name was first published.

In the face of obvious morphological differences between populations and molecular evidence, including that of Smith *et al.* (2001), it is no longer tenable to treat all populations as a single species and hence the split as done herein.

This is especially noting the various relevant populations are also allopatric and clearly evolving as separate species.

Each of the six species within *Saiphos* Gray, 1831 are separated from one another by the following six unique suites of characters: *Saiphos equalis* Gray, 1831, found from Barrington Tops, New

South Wales, south along the coast and nearby ranges to about Nowra, New South Wales, is distinguished by having heavy black etching on or between the anterior scales of the upper surface of the head, grading to irregular spotting on the neck and body, this sometimes being absent. At the dorsolateral edge is a dark greyish-black stripe with a well-defined upper boundary and a lower boundary that fades quickly to whitish about half to three quarters of the way down the flank, making this line thick. On the side of the head the scales are generally greyish all over save for small white spots of specks in the centres of most scales, with scales on the side of the neck of similar form. Venter is yellow.

Average maximum adult snout-vent length is 70 cm.

S. samueli Wells and Wellington, 1985 from the cooler uplands and ranges of the New England region of New South Wales and far southern Queensland is distinguished by having a head of similar colour to the neck and body, this being a medium brown colour, which has dark spotting on the posterior part, these spots being more numerous anteriorly and sometimes coalescing. The dark stripe on the sides of the body extends all the way down the flank and without fading on the lower edge, forming a well-defined interface between it and the orangeish-yellow belly. The dorsum is spotted with tiny black dots forming barely distinct longitudinal lines, these being best defined towards the lateral edges.

Average maximum adult snout-vent length is 80 cm.

S. hoserae sp. nov. from the far north coast of New South Wales, extending from Coffs Harbour to the Queensland border and into south-east Queensland, with the north and south limits of distribution not exactly known is readily separated from the other species by having a light brown dorsum, distinctly greyish-brown head, with scales on the top etched with dark grey to black. The black dorsolateral stripe is thin, below which is most of the flank that is yellowish grey in colour, with the centre of each scale marked grey and the outer edges being yellowish.

Unlike the other species in the genus, the flank stripe does not extend most or all of the way along the tail. In this species it is thin at the anterior end of the tail and diffusing into the general greyish-brown tail colour. The sides of the head and neck posterior to the eye is a whitish-grey colour.

Venter is yellow, but with a slight orange tinge.

Average maximum adult snout-vent length is 65 mm.

Smith (1996) reported this taxon had proportionately longer first and second toes on the front feet.

S. shanksi sp. nov. from the Bunya Mountains and nearby hills as far south as near Dalby and as far north as Kingaroy, all in south-east Queensland is readily separated from the other species in the genus by having a dorsum that is defined by having about four thick, well-defined dark blackish longitudinal stripes with irregular edges, running along the dorsum.

Sides of head are black, except for a few upper labials which may have small amounts of white in the centre of each scale. Neck is also blackish in colour. The lateral stripe is moderately thick, extending between a third and half way down the flank. It grades gradually to dark grey on the lower boundary, with brown at the interface of the lower boundary of the lateral stripe, this being the colour along the midline of the flank. The top of the head is brown, heavily infused with black etchings and blotches on most scales.

Venter is yellow.

Average maximum adult snout-vent length is 65 mm.

S. wellsi sp. nov. from Kroombit Tops in Queensland is similar in most respects to *S. shanksi* sp. nov., but separated from that species and the morphologically similar *S. wellingtoni* sp. nov. by having a dark brownish grey body, a head that on the upper surface is more dark grey than brown and indistinct irregular black markings also on the head of similar intensity both anterior and posterior to the eyes. The tail is also heavily peppered and marked with black, but forming stripes as seen in other species where this occurs.

S. wellingtoni sp. nov. from the Canarvan National Park and hills immediately south of there in inland southern Queensland is similar in most respects to *S. shanksi* sp. nov., but separated from that species and the morphologically similar *S. wellisi* sp. nov. by having a light to medium brown body, black etched scales on top of the head that are otherwise brown in colour, a tail that has numerous tiny dots at the anterior end, tending to form one or more longitudinal stripes and prominent white spots on the labials and other scales on the side of the head and neck, which are otherwise grey in colour. The dark stripe on the flank fades immediately, but gradually, after the upper boundary to the whitish-grey lower surface, which is consistently whitish-grey from about half-way down the flank.

The six preceding species, forming the entirety of the genus *Saiphos* Gray, 1831 are separated from all other Australian skinks by the following suite of characters:

Limbs tridactyle, with short and unequal digits; the hindlimb is about 10% of the snout-vent length, all limbs being widely separated when adpressed. Ear opening is hidden and is only indicated by a depression. Supranasals absent; nasals undivided; prefrontals absent although the enlarged first supraciliary could be treated as a small prefrontal; parietal shields are in contact behind the interparietal; frontoparietals paired, distinct from the interparietal; four supraoculars; postmental in contact with two infralabials on each side; a series of suboculars between the labials and the eye. Usually six supralabials. Lower eyelid is scaly and movable. 18-20 midbody scale rows (modified from Cogger 2014).

Saiphos equalis is depicted in life in Hoser (1989), page 106, middle, as well as in Cogger (2014) on page 677 and online at: <https://www.inaturalist.org/observations/19373517>

and <https://www.inaturalist.org/observations/55767936>

Saiphos samueli Wells and Wellington, 1985 is depicted in life online at:

<https://www.inaturalist.org/observations/31211620>

Saiphos hoseerae sp. nov. is depicted in life online at:

<https://www.inaturalist.org/observations/96923085>

and

<https://www.inaturalist.org/observations/110645595>

and

<https://www.inaturalist.org/observations/27462>

Distribution: *S. shanksi* sp. nov. occurs in the Bunya Mountains and nearby hills as far south as near Dalby and as far north as Kingaroy, all in south-east Queensland, Australia.

Etymology: *S. shanksi* sp. nov. is named in honour of an Australian comedian Jordan Shanks, trading as "FriendlyJordies" in recognition of the great personal risks he has taken in attempting to expose corrupt and dishonest Australian politicians via his humorous online presentations that have got a cult following in 2022.

His website is at:

<https://www.friendlyjordies.com>

He has online accounts at:

<https://www.facebook.com/friendlyjordies>

and

<https://twitter.com/friendlyjordies>

and

<https://www.instagram.com/friendlyjordies/>

and

<https://www.youtube.com/channel/UC2-i3KuYoODXsM99Z3-Gm0A>

and

<https://www.youtube.com/channel/UCaoxFlhy4oGz3EvkTGhWvka>

SAIPHOS WELLSI SP. NOV.

LSIDurn:lsid:zoobank.org:act:E011188E-DA97-4530-97D8-1EDCEFCEDC16

Holotype: A preserved specimen at the Queensland Museum, Brisbane, Queensland, Australia, specimen number J32325 collected from Kroombit Tops, west of Gladstone, Queensland, Australia, Latitude -24.366667 S., Longitude 150.983333 E.

This government-owned facility allows access to its holdings.

Paratype: Five preserved specimens at the Queensland Museum, Brisbane, Queensland, Australia, specimen numbers J40130, J40131, J40132, J42165 and J54872 all collected from Kroombit Tops, west of Gladstone, Queensland, Australia, Latitude -24.366667 S., Longitude 150.983333 E.

Diagnosis: Until now, each of *Saiphos wellisi* sp. nov., *S. hoseerae* sp. nov., *S. shanksi* sp. nov. and *S. wellingtoni* sp. nov. have been treated as divergent populations of the Three-toed Skink *Saiphos equalis* Gray, 1831, as has the species *S. samueli* Wells and Wellington, 1985 by all other publishing authors since the name was first published.

In the face of obvious morphological differences between populations and molecular evidence, including that of Smith *et al.* (2001), it is no longer tenable to treat all populations as a single species and hence the split as done herein.

This is especially noting the various relevant populations are also allopatric and clearly evolving as separate species.

Each of the six species within *Saiphos* Gray, 1831 are separated from one another by the following six unique suites of characters:

Saiphos equalis Gray, 1831, found from Barrington Tops, New South Wales, south along the coast and nearby ranges to about Nowra, New South Wales, is distinguished by having heavy black etching on or between the anterior scales of the upper surface of the head, grading to irregular spotting on the neck and body, this sometimes being absent. At the dorsolateral edge is a dark greyish-black stripe with a well-defined upper boundary and a lower boundary that fades quickly to whitish about half to three quarters of the way down the flank, making this line thick. On the side of the head the scales are generally greyish all over save for small white spots of specks in the centres of most scales, with scales on the side of the neck of similar form. Venter is yellow.

Average maximum adult snout-vent length is 70 cm.

S. samueli Wells and Wellington, 1985 from the cooler uplands and ranges of the New England region of New South Wales and far southern Queensland is distinguished by having a head of similar colour to the neck and body, this being a medium brown colour, which has dark spotting on the posterior part, these spots being more numerous anteriorly and sometimes coalescing. The dark stripe on the sides of the body extends all the way down the flank and without fading on the lower edge, forming a well-defined interface between it and the orangeish-yellow belly. The dorsum is spotted with tiny black dots forming barely distinct longitudinal lines, these being best defined towards the lateral edges.

Average maximum adult snout-vent length is 80 cm.

S. hoseerae sp. nov. from the far north coast of New South Wales, extending from Coffs Harbour to the Queensland border and into south-east Queensland, with the north and south limits of distribution not exactly known is readily separated from the other species by having a light brown dorsum, distinctly greyish-brown head, with scales on the top etched with dark grey to black. The black dorsolateral stripe is thin, below which is most of the flank that is yellowish grey in colour, with the centre of each scale marked grey and the outer edges being yellowish.

Unlike the other species in the genus, the flank stripe does not extend most or all of the way along the tail. In this species it is thin at the anterior end of the tail and diffusing into the general greyish-brown tail colour. The sides of the head and neck posterior to the eye is a whitish-grey colour.

Venter is yellow, but with a slight orange tinge.

Average maximum adult snout-vent length is 65 mm.

Smith (1996) reported this taxon had proportionately longer first and second toes on the front feet.

S. shanksi sp. nov. from the Bunya Mountains and nearby hills as far south as near Dalby and as far north as Kingaroy, all in south-east Queensland is readily separated from the other species in the genus by having a dorsum that is defined by having about four thick, well-defined dark blackish longitudinal stripes with irregular edges, running along the dorsum.

Sides of head are black, except for a few upper labials which may have small amounts of white in the centre of each scale. Neck is also blackish in colour. The lateral stripe is moderately thick, extending between a third and half way down the flank. It grades gradually to dark grey on the lower boundary, with brown at the interface of the lower boundary of the lateral stripe, this being the colour along the midline of the flank. The top of the head is brown, heavily infused with black etchings and blotches on most scales. Venter is yellow.

Average maximum adult snout-vent length is 65 mm.

S. wellsi sp. nov. from Kroombit Tops in Queensland is similar in most respects to *S. shanksi* sp. nov., but separated from that species and the morphologically similar *S. wellingtoni* sp. nov. by having a dark brownish grey body, a head that on the upper surface is more dark grey than brown and indistinct irregular black markings also on the head of similar intensity both anterior and posterior to the eyes. The tail is also heavily peppered and marked with black, but forming stripes as seen in other species where this occurs.

S. wellingtoni sp. nov. from the Canarvan National Park and hills immediately south of there in inland southern Queensland is similar in most respects to *S. shanksi* sp. nov., but separated from that species and the morphologically similar *S. wellsi* sp. nov. by having a light to medium brown body, black etched scales on top of the head that are otherwise brown in colour, a tail that has numerous tiny dots at the anterior end, tending to form one or more longitudinal stripes and prominent white spots on the labials and other scales on the side of the head and neck, which are otherwise grey in colour. The dark stripe on the flank fades immediately, but gradually, after the upper boundary to the whitish-grey lower surface, which is consistently whitish-grey from about half-way down the flank.

The six preceding species, forming the entirety of the genus *Saiphos* Gray, 1831 are separated from all other Australian skinks by the following suite of characters:

Limbs tridactyle, with short and unequal digits; the hindlimb is about 10% of the snout-vent length, all limbs being widely separated when adpressed. Ear opening is hidden and is only indicated by a depression. Supranasals absent; nasals undivided; prefrontals absent although the enlarged first supraciliary could be treated as a small prefrontal; parietal shields are in contact behind the interparietal; frontoparietals paired, distinct from the interparietal; four supraoculars; postmental in contact with two infralabials on each side; a series of suboculars between the labials and the eye. Usually six supralabials. Lower eyelid is scaly and movable. 18-20 midbody scale rows (modified from Cogger 2014).

Saiphos equalis is depicted in life in Hoser (1989), page 106, middle, as well as in Cogger (2014) on page 677 and online at: <https://www.inaturalist.org/observations/19373517>

and

<https://www.inaturalist.org/observations/55767936>

Saiphos samueli Wells and Wellington, 1985 is depicted in life online at:

<https://www.inaturalist.org/observations/31211620>

Saiphos hoserae sp. nov. is depicted in life online at:

<https://www.inaturalist.org/observations/96923085>

and

<https://www.inaturalist.org/observations/110645595>

and

<https://www.inaturalist.org/observations/27462>

Distribution: *S. wellsi* sp. nov. appears to be a range-restricted endemic, confined to the wetter parts of Kroombit Tops, Queensland, Australia. On this basis it should immediately be formally listed by state and federal governments as vulnerable as well as being monitored on a regular basis to confirm population stability.

Refer also to the relevant comments in Hoser (1989, 1991, 1993, 1996, 2007, 2019a, 2019b).

Etymology: *S. wellsi* sp. nov. is named in honour of Australian herpetologist, Richard Wells, recently of Lismore, New South Wales, Australia, in recognition for his services to herpetology and zoology globally, including his strong advocacy against taxonomic vandalism as practiced by Welsh criminal Wolfgang Wüster and his gang of thieves as detailed by Cogger (2014), Hoser (2007, 2009, 2012a, 2012c, 2013, 2015a-f, 2017, 2019a, 2019b), Hawkeswood (2021), ICZN (1991, 2001, 2021) and sources cited therein.

Besides the association of Richard Wells with the exact area this species occurs, it is also noted that along with his colleague, Cliff Ross Wellington, they formally named another species in this complex, namely *S. samueli* Wells and Wellington, 1985 since shown by Smith *et al.* (2001) using molecular techniques to be a valid species-level taxon.

Richard Wells is also by far the largest ever benefactor with respect of collecting and donating reptiles to the Australian Museum in Sydney, having donated many thousands of specimens to their priceless research collection spanning full-time work over many decades.

He has received few if any accolades for this achievement.

SAIPHOS WELLINGTONI SP. NOV.

LSIDurn:lsid:zoobank.org:act:5FA1ED2B-66F8-44BC-A117-293C6A01A5CE

Holotype: A preserved specimen at the Queensland Museum, Brisbane, Queensland, Australia, specimen number J76305 collected from "Oakwells", west of Injune, just north of Mount Hutton, on the Great Dividing Range, on the steep upper slopes of Main Top, Queensland, Australia, Latitude -25.4505 S., Longitude 148.1629 E., at 840 m ASL (capture details taken from Johnson 2002).

This government-owned facility allows access to its holdings.

Paratype: Two preserved specimens at the Queensland Museum, Brisbane, Queensland, Australia, specimen numbers J82956 and J82957 collected from about 20 km west of Injune on the north facing slope of Mount Hutton, Queensland, Australia, Latitude -25.858056 S., Longitude 148.359167 E.

Diagnosis: Until now, each of *Saiphos wellingtoni* sp. nov., *S. hoserae* sp. nov., *S. shanksi* sp. nov. and *S. wellsi* sp. nov. have been treated as divergent populations of the Three-toed Skink *Saiphos equalis* Gray, 1831, as has the species *S. samueli* Wells and Wellington, 1985 by all other publishing authors since the name was first published.

In the face of obvious morphological differences between populations and molecular evidence, including that of Smith *et al.* (2001), it is no longer tenable to treat all populations as a single species and hence the split as done herein.

This is especially noting the various relevant populations are also allopatric and clearly evolving as separate species.

Each of the six species within *Saiphos* Gray, 1831 are separated from one another by the following six unique suites of characters:

Siaphos equalis Gray, 1831, found from Barrington Tops, New South Wales, south along the coast and nearby ranges to about Nowra, New South Wales, is distinguished by having heavy black etching on or between the anterior scales of the upper surface of the head, grading to irregular spotting on the neck and body, this sometimes being absent. At the dorsolateral edge is a dark greyish-black stripe with a well-defined upper boundary and a lower boundary that fades quickly to whitish about half to three quarters of the way down the flank, making this line thick. On the side of the head the scales are generally greyish all over save for

small white spots of specks in the centres of most scales, with scales on the side of the neck of similar form. Venter is yellow. Average maximum adult snout-vent length is 70 cm.

S. samueli Wells and Wellington, 1985 from the cooler uplands and ranges of the New England region of New South Wales and far southern Queensland is distinguished by having a head of similar colour to the neck and body, this being a medium brown colour, which has dark spotting on the posterior part, these spots being more numerous anteriorly and sometimes coalescing. The dark stripe on the sides of the body extends all the way down the flank and without fading on the lower edge, forming a well-defined interface between it and the orangeish-yellow belly. The dorsum is spotted with tiny black dots forming barely distinct longitudinal lines, these being best defined towards the lateral edges.

Average maximum adult snout-vent length is 80 cm.

S. hoserae sp. nov. from the far north coast of New South Wales, extending from Coffs Harbour to the Queensland border and into south-east Queensland, with the north and south limits of distribution not exactly known is readily separated from the other species by having a light brown dorsum, distinctly greyish-brown head, with scales on the top etched with dark grey to black. The black dorsolateral stripe is thin, below which is most of the flank that is yellowish grey in colour, with the centre of each scale marked grey and the outer edges being yellowish.

Unlike the other species in the genus, the flank stripe does not extend most or all of the way along the tail. In this species it is thin at the anterior end of the tail and diffusing into the general greyish-brown tail colour. The sides of the head and neck posterior to the eye is a whitish-grey colour.

Venter is yellow, but with a slight orange tinge.

Average maximum adult snout-vent length is 65 mm.

Smith (1996) reported this taxon had proportionately longer first and second toes on the front feet.

S. shanksi sp. nov. from the Bunya Mountains and nearby hills as far south as near Dalby and as far north as Kingaroy, all in south-east Queensland is readily separated from the other species in the genus by having a dorsum that is defined by having about four thick, well-defined dark blackish longitudinal stripes (with irregular edges, running along the dorsum).

Sides of head are black, except for a few upper labials which may have small amounts of white in the centre of each scale. Neck is also blackish in colour. The lateral stripe is moderately thick, extending between a third and half way down the flank. It grades gradually to dark grey on the lower boundary, with brown at the interface of the lower boundary of the lateral stripe, this being the colour along the midline of the flank. The top of the head is brown, heavily infused with black etchings and blotches on most scales.

Venter is yellow.

Average maximum adult snout-vent length is 65 mm.

S. wellsi sp. nov. from Kroombit Tops in Queensland is similar in most respects to *S. shanksi* sp. nov., but separated from that species and the morphologically similar *S. wellingtoni* sp. nov. by having a dark brownish grey body, a head that on the upper surface is more dark grey than brown and indistinct irregular black markings also on the head of similar intensity both anterior and posterior to the eyes. The tail is also heavily peppered and marked with black, but forming stripes as seen in other species where this occurs.

S. wellingtoni sp. nov. from the Canarvan National Park and hills immediately south of there in inland southern Queensland is similar in most respects to *S. shanksi* sp. nov., but separated from that species and the morphologically similar *S. wellsi* sp. nov. by having a light to medium brown body, black etched scales on top of the head that are otherwise brown in colour, a tail that has numerous tiny dots at the anterior end, tending to form one or more longitudinal stripes and prominent white spots on the labials and other scales on the side of the head and neck,

which are otherwise grey in colour. The dark stripe on the flank fades immediately, but gradually, after the upper boundary to the whitish-grey lower surface, which is consistently whitish-grey from about half-way down the flank.

The six preceding species, forming the entirety of the genus *Saiphos* Gray, 1831 are separated from all other Australian skinks by the following suite of characters:

Limbs tridactyle, with short and unequal digits; the hindlimb is about 10% of the snout-vent length, all limbs being widely separated when adpressed. Ear opening is hidden and is only indicated by a depression. Supranasals absent; nasals undivided; prefrontals absent although the enlarged first supraciliary could be treated as a small prefrontal; parietal shields are in contact behind the interparietal; frontoparietals paired, distinct from the interparietal; four supraoculars; postmental in contact with two infralabials on each side; a series of suboculars between the labials and the eye. Usually six supralabials. Lower eyelid is scaly and movable. 18-20 midbody scale rows (modified from Cogger 2014).

Saiphos equalis is depicted in life in Hoser (1989), page 106, middle, as well as in Cogger (2014) on page 677 and online at: <https://www.inaturalist.org/observations/19373517>

and

<https://www.inaturalist.org/observations/55767936>

Saiphos samueli Wells and Wellington, 1985 is depicted in life online at:

<https://www.inaturalist.org/observations/31211620>

Saiphos hoserae sp. nov. is depicted in life online at:

<https://www.inaturalist.org/observations/96923085>

and

<https://www.inaturalist.org/observations/110645595>

and

<https://www.inaturalist.org/observations/27462>

Distribution: *S. wellingtoni* sp. nov. appears to be a range-restricted endemic, confined to the wetter parts of Canarvan National Park and hills immediately south of there in inland southern Queensland Australia. On this basis it should immediately be formally listed by state and federal governments as vulnerable, and then monitored on a regular basis to confirm population stability.

Refer also to the relevant comments in Hoser (1989, 1991, 1993, 1996, 2007, 2019a, 2019b).

Etymology: The new species *A. rosswellingtoni* sp. nov. is named in honour of Cliff Ross Wellington of Ramornie, northern New South Wales, Australia in recognition of his many contributions to Australian herpetology, that go well beyond two publications he is a well-known co-author of, namely Wells and Wellington (1984 and 1985).

He has also taken a strong stand against the tyranny of taxonomic vandalism as practiced by Welsh criminal Wolfgang Wüster and his gang of thieves as detailed by Cogger (2014), Hoser (2007, 2009, 2012a, 2012c, 2013, 2015a-f, 2017, 2019a, 2019b), Hawkeswood (2021), ICZN (1991, 2001, 2021) and sources cited therein.

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CONFLICTS OF INTEREST - NONE.**Cite this paper as:**

Hoser, R. T. 2022. The inevitable further break up of the monotypic Australian skink genus *Saiphos* Gray, 1831. *Australasian Journal of Herpetology* 58:6-15.

A new species of skink lizard *Calyptotis* De Vis, 1886 from Queensland, Australia (Reptilia: Squamata: Scincidae).

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Received 2 April 2022, Accepted 12 May 2022, Published 28 June 2022.

ABSTRACT

During a number of field trips to Queensland over a 30 year period, including when living there for a six month stint, morphologically divergent lizards previously identified as putative *Calyptotis lepidorostrum* Greer, 1983 from near Mackay in Queensland were inspected and appeared to be of a different species.

This population appears to have been separated from the main population of *C. lepidorostrum* to the south, by a coastal biogeographical break known as St. Lawrence Gap, just north of Rockhampton in Queensland. Species in the *Lampropholis delicata* (De Vis, 1888) species group were also split by this barrier and were found to be divergent by more than 2.5 MYA (Chapple *et al.* 2011), implying a similar break for the species *Calyptotis lepidorostrum*.

Combining reproductive isolation, ancient divergence and consistent morphological differences, this northern population is formally named *Calyptotis greerae* sp. nov. in recognition of wildlife conservation icon Germaine Greer.

A divergent form of *Calyptotis scutirostrum* (Peters, 1873) from the Bunya Mountains, Queensland, is also formally named as a new subspecies, *C. scutirostrum bunyaensis* subsp. nov..

Keywords: Taxonomy; nomenclature; Australia; Queensland; *Calyptotis*; *lepidorostrum*; Eungella; Crediton; new species; *greerae*; new subspecies; Bunya Mountains; *bunyaensis*.

INTRODUCTION

Commencing 1972 and ongoing, I have made numerous trips across most parts of Queensland and northern New South Wales (Australia) collecting and studying reptiles and frogs specifically, as well as various other wildlife.

Included in this has been a number of collections of sometimes locally common skinks in the genus *Calyptotis* De Vis, 1886 from Queensland and northern New South Wales.

Greer (1983) resurrected the genus *Calyptotis* De Vis, 1886 from the synonymy of *Sphenomorphus* Fitzinger, 1983 for the single species formally named as *Lygosoma scutirostrum* Peters, 1873 (later described by De Vis in 1886 as "*Calyptotis flaviventer*").

He then formally described four other species in the same genus, being, *Calyptotis lepidorostrum* Greer, 1983, *Calyptotis ruficauda* Greer, 1983, *Calyptotis temporalis* Greer, 1983 and *Calyptotis thornonensis* Greer, 1983.

All occur in wetter habitats north of the Hunter Valley in New South Wales, along the coast to the northern wet tropics in North Queensland.

Within this broad area, each species is parapatric to one another, or so it appears, and are distributed along a discrete section of coast and nearby ranges, with the five described forms as follows (from south to north) (taken from Greer 1983):

C. ruficauda Greer, 1983 is restricted to the lowlands of the

central north coast of New South Wales in the area between Brinerville and Moonee Beach in the north and Barrington Guest House and Bulahdelah in the south.

C. scutirostrum (Peters, 1873) is found from an area just northwest of Dorrigo, New South Wales in the south to an area just south of Gympie in south-eastern Queensland and inland to include the Bunya Mountains and the highlands south south-west of Stanthorpe in southern Queensland.

C. lepidorostrum Greer, 1983 is found from the Conondale and Blackall Ranges in south-east Queensland, north to the vicinity of Mackay and Eungella National Park. In the south, the range of this taxon abuts or interdigitates the range of *C. scutirostrum*, while in the north the range of this putative taxon appears to be surrounded by populations of *C. temporalis* Greer, 1983 (see below), which also appear to occupy a large area across the coastal biogeographical break known as St. Lawrence Gap, just north of Rockhampton in Queensland.

C. temporalis Greer, 1983 is found in various locations between Rockhampton in the South and Proserpine in the north, including east of Mackay, Queensland.

C. thornonensis Greer, 1983, still (as of 2022) is only known from Thornton Peak in the northern wet tropics of far north Queensland.

In both fieldwork and inspection of dead specimens after the fact,

I became aware of significant divergence between specimens of putative taxa in various locations, particularly with regard to the isolated northern population of *C. lepidorostrum*, a putative taxon with a type locality of Bulburin State Forest, in South East Queensland, being south of the St. Lawrence Gap.

With this in mind and no known synonym names available for the northern population of *C. lepidorostrum* it was decided to audit the entire genus as conceived by Greer, 1983 and all other publishing authors since, to see if the northern population of *C. lepidorostrum* or any other within the genus warranted taxonomic recognition and at what level.

MATERIALS AND METHODS

Specimens from across the ranges of all relevant putative taxa were inspected.

This included live specimens, dead specimens (mainly those in the Qld Museum inspected during a visit in 2002) and photos with good locality data.

A review of the literature relevant to these species and others affected by the same biogeographical features, including any relevant molecular studies was also conducted, as was a review of past climate and vegetation in the relevant part of Australia.

Literature relevant to the five putative species being audited and the taxonomic conclusions ultimately made, included Chapple *et al.* (2011), Cogger (2014), Cogger *et al.* (1983), Daly and Hoyer (2016), De Vis (1886), Greer (1979, 1983), Hoser (2009), Hutchinson *et al.* (2021), Longman (1916), Müller (1880), O'Shaughnessy (1874), Peters (1874), Pyron *et al.* (2013), Reeder (2003), Ride *et al.* (1999), Singhal *et al.* (2018), Skinner *et al.* (2013), Wells (2002, 2010), Wells and Wellington (1984, 1985) and sources cited therein.

RESULTS

Putative *C. lepidorostrum* from the Eungella and Crediton areas west of Mackay in Queensland were morphologically divergent from those found south of the gap in distribution that coincided with the coastal biogeographical break known as the St. Lawrence Gap, just north of Rockhampton in Queensland.

Within the gap of distribution for putative *C. lepidorostrum* were populations of *C. temporalis* implying that species played a role in separating the two populations of putative *C. lepidorostrum*, which in turn implied that the formation of the St. Lawrence Gap barrier also had something to do with the split and its dating.

In the absence of molecular data on the two populations of putative *C. lepidorostrum*, I looked for alternative evidence to date the split between the two populations.

In their study of putative *Lampropholis delicata* (De Vis, 1888), Chapple *et al.* (2011) found that populations in this species group were also split by the St. Lawrence Gap barrier more than 2.5 MYA.

With *L. delicata sensu lato* being less habitat specific than species within *Calyptotis*, one can only conclude that 2.5 MYA is a minimum divergence time the two populations of putative *C. lepidorostrum*.

Combining reproductive isolation, ancient divergence and consistent morphological differences, this northern population is formally named according to the rules of the *International Code of Zoological Nomenclature* (Ride *et al.* 1999, as amended online since) as *Calyptotis greerae* sp. nov. in recognition of Australian wildlife conservation icon Germaine Greer.

Putative *Calyptotis scutirostrum* (Peters, 1873) from the Bunya Mountains, Queensland were also identified by Greer as being divergent, including with regards to greater average size of adult females.

This population appears to be physically isolated from others of the same taxon nearer the coast, but in the absence of any dated divergence or means to date the barrier between extant populations, I am loathe to formally name the new taxon at the species level.

Therefore it is formally named herein as new subspecies, being,

C. scutirostrum bunyaensis subsp. nov. with reference to where it occurs.

Referring also to the species "*Lampropholis colossus* Ingram, 1991" endemic to the Bunya Mountains, Queensland, treated herein as properly placed in the genus *Allengreer* Hoser, 2009, it appears to be a divergent form of putative *A. delicata* (De Vis, 1888), which happened to be in an unnamed species-level clade of the taxon, based on the phylogeny of Chapple *et al.* (2011). 4 groups within that unnamed clade all appeared to diverge from one another about 2 MYA and in turn from other named clades at least 3.5 MYA.

The claim of by Wilson (2015) of *A. colossus* that it is "*Status uncertain; possibly outlying pop. of L. delicata*" while more-or-less correct at the time, can be amended to read that it is a valid species, allied to *A. delicata*, but divergent by some millions of years.

Based on the above, *C. scutirostrum bunyaensis* subsp. nov. may be too conservative a placement and formal species-level recognition may be appropriate at a future date.

NOTES IN TERMS OF THE FOLLOWING FORMAL DESCRIPTIONS

There is no conflict of interest in terms of this paper or the conclusions arrived at herein.

Several people including anonymous peer reviewers who revised the manuscript prior to publication are also thanked as are relevant staff at museums who made specimens and records available in line with international obligations (in this case Jeanette Covacevich and Patrick Couper, for the Queensland Museum, Brisbane, Australia, Ken Aplin at the Australian National Wildlife Collection in Canberra, ACT, Australia as well as Allen Greer and Ross Sadlier for the Australian Museum, Sydney, Australia).

In terms of the following formal descriptions, spellings should not be altered in any way for any purpose unless expressly and exclusively called for by the rules governing Zoological Nomenclature as administered by the International Commission of Zoological Nomenclature (ICZN), (see Article 32.5.1 of the *International Code of Zoological Nomenclature*, Ride *et al.* 1999). This includes if Latinisation is wrong, apparent spelling mistakes and so on.

Any online citations within this paper, including copied emails and the like, are not as a rule cited in the references part of this paper and have the same most recent viewing and checking date of 6 May 2022 (at which time they were still online as cited).

Unless otherwise stated explicitly, colour and other descriptions apply to living adult specimens of generally good health, as seen by day and not under any form of stress by means such as excessive cool, heat, dehydration, excessive ageing, abnormal skin or reaction to chemical or other input

While numerous texts and references were consulted prior to publication of this paper, the criteria used to separate the relevant genera, subgenera, species or subspecies has already been spelt out and/or is done so within each formal description and does not rely on material within publications not explicitly cited herein.

CALYPTOTIS GREERAE SP. NOV.

LSIDurn:lsid:zoobank.org:act:5A2F942E-BCF2-4EE3-A4EA-FEA580491EBC

Holotype: A preserved adult specimen in the Queensland Museum, Brisbane, Queensland, Australia, specimen number J32735 collected from Crediton, Queensland, Australia, Latitude -21.216667 S., Longitude 148.566667 E.

This government-owned facility allows access to its holdings.

Paratypes: The following 21 specimens in the Queensland Museum, Brisbane, Queensland, Australia, specimen numbers J 32653-32655, 32671, 32673, 32707-32716, 32721-32722, 32734, 32736-32738 all collected from Crediton, Queensland, Australia, Latitude -21.216667 S., Longitude 148.566667 E, and a preserved specimen at the Australian Museum, Sydney, New

South Wales, Australia, specimen number R 59244, collected from the Eungella Area, Queensland, Australia.

Diagnosis: Until now, *Calyptotis greerae* sp. nov. has been treated as a northern population of *C. lepidorostrum* Greer, 1983, which it would otherwise key as using the key in Greer (1983).

Live adult specimens of *Calyptotis greerae* sp. nov. are readily separated from *C. lepidorostrum* by the following suite of characters:

1/ Black on the anterior tips of some of the scales are expanded to form three continuous and unbroken jagged edged lines running down the back, versus black on scale tips not expanded, thereby forming three lines of dots running down the back (in *C. lepidorostrum*);

2/ There are no obvious white flecks on the flanks, or if present, only on the upper part of the anterior flank, versus obvious white flecks on the flanks, or rarely an excess of white marbling on the flanks (in *C. lepidorostrum*);

3/ Half or most of the upper surfaces of the anterior limbs are dark or with mainly dark mottling, versus mainly light and with scattered dark flecks (in *C. lepidorostrum*).

Both *Calyptotis greerae* sp. nov. and *C. lepidorostrum* are separated from the other five species in the genus by the following unique suite of characters:

External ear indicated by a shallow auditory meatus (meaning in this case a conical depression) and a scaleless tympanum; head and body relatively deep; postorbital bone present; prefrontals present (from Greer, 1983).

Calyptotis De Vis, 1886 are separated from all other Australian skinks by the following suite of characters: palatal rami of pterygoids roughly triangular in shape (narrow anteriorly and broad posteriorly) and separated to varying degrees by posteriorly extending processes from posteromedial corners; phalanges in fourth toe of manus four; postmental in contact with only one infralabial; loreal single; and fourth supralabial subocular; small adult size (maximum SVL 59 mm or less); low number

of longitudinal scale rows at midbody (19-24); and bright coral pink to red colour on the ventral surfaces of the posterior part of the body and the tail (modified from Greer, 1983).

Calyptotis lepidorostrum, with a type locality of Bulburin State Forest, in South East Queensland, being south of the St. Lawrence Gap, is herein confined to the region south of this biogeographical barrier (being situated just north of Rockhampton, Queensland).

C. greerae sp. nov. is found north of here, currently only known from the vicinity of the where the type and paratype specimens come from, being the hills west of Mackay, Queensland.

Calyptotis lepidorostrum is depicted in life in Cogger (2014) on page 422 at bottom and Wilson (2015), page 96 bottom and online at:

<https://www.wesreadphotography.com/calyptotis/lepidorostrum>

and <https://www.inaturalist.org/observations/105389941>

and <https://www.inaturalist.org/observations/66688232>

C. greerae sp. nov. is depicted online at:

<https://arod.com.au/arod/reptilia/Squamata/Scincidae/Calyptotis/lepidorostrum>

and <https://cqclandcarenetwork.org.au/wildlife/cone-eared-calyptotis/>

and <https://www.flickr.com/photos/smacdonald/6409493009>

Distribution: *C. greerae* sp. nov. is found north of the St. Lawrence Gap, biogeographical barrier (being situated just north of Rockhampton, Queensland), but currently is only definitively known from the Eungella/Crediton hills, west of Mackay, Queensland.

Specimens from Mount Abbott, west of Bowen, Queensland

(north of the type localities) are also referred to this newly named species.

Calyptotis lepidorostrum, with a type locality of Bulburin State Forest, in South East Queensland, being south of the St. Lawrence Gap, is herein confined to the region south of this biogeographical barrier (being situated just north of Rockhampton, Queensland). It is found from Rockhampton, south to the Gold Coast hinterland hills.

Etymology: *C. greerae* sp. nov. is named in honour of Germaine Greer, born in Melbourne, Australia on 29 January 1939, in recognition of her contribution to wildlife conservation. This is best known in terms of when she correctly pointed out that the death of the late Steve Irwin was a direct consequence of his non-stop acts of animal abuse and cruelty for television audiences in his taxpayer funded mocked-up "reality TV" shows (Greer 2006).

Greer correctly pointed out that it was inevitable that Steve Irwin's non-stop assault of innocuous animals would eventually lead to one or more of them fighting back and with potentially fatal consequences.

Steve Irwin was a police-protected criminal and law-breaker who made millions of dollars for his family business, including via hand outs from governments for sham charities he operated, government funded TV appearances and the like.

His widow, Teri Irwin has publicly admitted that their zoo business only survived as a result of government largesse.

Steve Irwin aggressively campaigned against wildlife conservation groups for many years in return for cash hand outs from governments, government departments and businesses involved in habitat destruction.

This included his active support for the construction of the \$2 billion Traveston dam across the Mary River, that if built may well have caused the extinction of the Mary River Turtle *Elusor macrurus* Cann and Legler, 1994, being a species endemic to this drainage.

In return for this support for the project, Irwin and/or his business got yet more massive government hand-outs and gifts hidden in the form of highly paid government advertising contracts and non-prosecution for a number of serious criminal, wildlife and animal cruelty offences.

CALYPTOTIS SCUTIROSTRUM BUNYAENSIS SUBSP. NOV.
LSIDurn:lsid:zoobank.org:act:17B83265-C3C3-4215-B9DC-EE9C8A8E23B8

Holotype: A preserved specimen at the Queensland Museum, Brisbane, Queensland, Australia, specimen number QM J12188 collected from Marlaybrook, Bunya Mountains National Park, Queensland, Australia, Latitude -26.883333 S., Longitude 151.616667 E.

This government-owned facility allows access to its holdings.

Paratypes: 1/ Eight preserved specimens at the Australian Museum, Sydney, New South Wales, Australia, specimen numbers R 17702-17707, 21279 and 26148 all collected from Marlaybrook, Bunya Mountains National Park, Queensland, Australia, Latitude -26.883333 S., Longitude 151.616667 E.

2/ Two preserved specimens at the Queensland Museum, Brisbane, Queensland, Australia, specimen numbers J12189 and J23932 both collected from Marlaybrook, Bunya Mountains National Park, Queensland, Australia, Latitude -26.883333 S., Longitude 151.616667 E.

Diagnosis: The subspecies *Calyptotis scutirostrum bunyaensis* subsp. nov. is confined to the Bunya Mountains and the immediate surrounds. Nominate *Calyptotis scutirostrum scutirostrum* (Peters, 1873) occupies the rest of the range of this species throughout its known distribution in south-east Queensland and nearby north-east New South Wales.

In more detail, *C. scutirostrum* (Peters, 1873) is found from an area just northwest of Dorrigo, New South Wales to an area just south of Gympie in south-eastern Queensland and inland to include the Bunya Mountains and the highlands south south-west

of Stanthorpe in southern Queensland.

Nominate *C. scutirostrum* and *C. scutirostrum bunyaensis* subsp. nov. are separated as follows:

C. scutirostrum have distinctive white or yellowish barring on the upper labials. In *C. scutirostrum bunyaensis* subsp. nov. this barring is reduced to become tiny white spots only.

C. scutirostrum have distinctive rows of white spots or marbling along the upper flanks, whereas in *C. scutirostrum bunyaensis* subsp. nov. only the top row is distinctive, with all lower areas having the spotting being diffuse to the point of being like peppering instead.

Greer (1983) also noted:

"In addition to the sexual dimorphism in size, there is also some geographic variation that is interesting. The animals in the Bunya Mountains, for example, seem to reach a larger size than animals from elsewhere. This is evidenced by the fact that out of 261 specimens from throughout the range of *C. scutirostrum* exclusive of the Bunya Mountains, only one (AM R 57553 from Wilson's Peak, SE Queensland) attained a SVL of 54 mm, whereas seven of the 17 specimens from the Bunya Mountains measured 54-59 mm SVL."

Both *C. scutirostrum scutirostrum* (Peters, 1873) and the subspecies *C. scutirostrum bunyaensis* subsp. nov. can be separated from all other members of the genus *Calyptotis* De Vis, 1886 are separated from the other six species in the genus (including *Calyptotis greerae* sp. nov. as formally described in this paper) by the following unique suite of characters:

External ear indicated by a shallow auditory meatus (meaning in this case a conical depression) and a scaleless tympanum; head and body relatively deep; postorbital bone present; prefrontals present (from Greer, 1983).

Calyptotis De Vis, 1886 are separated from all other Australian skinks by the following suite of characters: palatal rami of pterygoids roughly triangular in shape (narrow anteriorly and broad posteriorly) and separated to varying degrees by posteriorly extending processes from posteromedial corners; phalanges in fourth toe of manus four; postmental in contact with only one infralabial; loreal single; and fourth supralabial subocular; small adult size (maximum SVL 59 mm or less); low number

of longitudinal scale rows at midbody (19-24); and bright coral pink to red colour on the ventral surfaces of the posterior part of the body and the tail (modified from Greer, 1983).

Photos of *C. scutirostrum bunyaensis* subsp. nov. in life can be found online at:

<https://www.inaturalist.org/observations/106904031>

and

<https://www.inaturalist.org/observations/84192936>

and

<https://www.inaturalist.org/observations/49299330>

Photos of *C. scutirostrum scutirostrum* (Peters, 1873) in life can be seen in Cogger (2014) on page 424 bottom and Wilson (2015) on page 96 bottom right and online at:

<https://www.inaturalist.org/observations/34903190>

Chapple *et al.* (2011) found a divergence of about 2 MYA for putative "*Lampropholis delicata*" from Bunya Mountains in terms of their nearest relatives from the Conondale National Park, Queensland, being about 120 km straight line distance away. While there are populations of the same putative species from intermediate ranges, these appear morphologically most similar to those from further east, indicating the Bunya Ranges as a zone of isolation for both putative "*Lampropholis delicata*" and *C. scutirostrum*.

While 2 MYA and breeding isolation is normally deemed species-level divergence, I have taken the conservative step here and formally described this new taxon as a subspecies.

Elevation to full species may be appropriate following a wide sampling of the genetics of the relevant taxa.

Distribution: *C. scutirostrum bunyaensis* subsp. nov. is believed to be endemic to the Bunya Mountains in south-east Queensland, Australia and immediately adjacent foothills, being restricted here by drier areas away from the hills, either by way of habitat constraints or competing species.

Etymology: *C. scutirostrum bunyaensis* subsp. nov. is named in reflection of where it occurs and the type locality, being in the area of the Bunya Mountains, South-east Queensland, Australia.

Conservation: *C. scutirostrum bunyaensis* subsp. nov. is not believed to be under any existential threat, however the relevant comments of Hoser (1989, 1991, 1993, 1996, 2007, 2019a, 2019b apply).

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CONFLICT OF INTEREST

None.

Cite this paper as:

Hoser, R. T. 2022. A new species of skink lizard *Calyptotis De Vis*, 1886 from Queensland, Australia (Reptilia: Squamata: Scincidae). *Australasian Journal of Herpetology* 58:16-20.

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Hiding in plain sight! Three new species of Slug Eater snakes (Serpentes: Colubroidea: *Duberria* Fitzinger, 1826) from South Africa.

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Received 1 May 2022, Accepted 20 May 2022, Published 28 June 2022.

ABSTRACT

Following from extensive fieldwork in South Africa in 2009, a detailed assessment of Slug Eater Snakes was performed across the range for all putative species within the genus *Duberria* Fitzinger, 1826, to assess the species-level taxonomy.

Based on molecular and morphological studies as well as disjunct distributions, the following taxa were recognized as full species *Duberria abyssinica* (Boulenger, 1894); *D. atriventris* (Sternfeld, 1912); *D. basilewskyi* (Skelton-Bourgeois, 1961); *D. lutrix* (Linnaeus, 1758) (type for genus); *D. rhodesiana* (Broadley, 1958); *D. shirana* (Boulenger, 1894); *D. variegata* (Peters, 1854).

D. lutrix sensu lato, (with a type locality of "Cape of Good Hope") long recognized as a potential species complex (e.g. Branch 2002, 2003), distributed almost entirely within South Africa was more recently found to consist of at least four potential species by Kulenkampff *et al.* (2019), with divergences from one another of between 1.23 and 3.42 MYA.

Examination of specimens within each identified clade yielded consistent morphological differences. As a result, this paper formally names the three unnamed forms from east of the Bedford Gap as new species in accordance with the rules of the *International Code of Zoological Nomenclature* (Ride *et al.* 1999 as amended online since, via ICZN 2012).

While none of these species appears to be threatened, this situation may change suddenly in the wake of unknown factors, pest species or pathogens including as noted by Hoser (1991, 2019a, 2019b).

Keywords: Snakes; South Africa; Limpopo; Sabie; Port St. Johns; Bedford Gap; Slug eaters; *Duberria*; *abyssinica*; *atriventris*; *lutrix*; *basilewskyi*; *currylindahli*; *rhodesiana*; *shirana*; *variegata*; new species; *hoserae*; *woolfi*; *edwardsi*.

INTRODUCTION

In 2009, I engaged in fieldwork across South Africa, including the making of a TV documentary about South African reptiles. Most of the edited film work was stolen in an illegal armed raid on our Australian facility on 17 August 2011, as was most of the photos, field notes and the like created in 2009.

Notwithstanding this, when collecting snakes and also seeing others in collections, photos and the like, it rapidly became obvious that there was significant regional variation in the common species known as the Slug Eater, or *Duberria lutrix* (Linnaeus, 1758).

This variation in the putative species occurred across well known biogeographical breaks in the faunal elements of Western and Eastern Cape and led to further investigations of putative *Duberria lutrix*.

The taxonomic history of the genus *Duberria* Fitzinger, 1826 was that most forms were formally described as subspecies of the well-known *D. lutrix* (with a type locality of Cape of Good Hope,

South Africa), which is also the first described and type species for the genus, some of which have since been synonymised with either *D. lutrix*, or other named subspecies.

Exceptional to this were *Homalosoma shiranum* Boulenger, 1894 and *Homalosoma variegatum* Peters, 1854, since transferred to the genus *Duberria* and mainly recognized as full species ever since.

With the status of populations of South African *D. lutrix* in question, as well as those elsewhere in Africa, it became prudent to inspect all putative taxa within the genus *Duberria* to see which species were valid, which needed to be synonymised, which taxa could be treated as subspecies and which if any taxa remained unnamed.

Parallel studies of snakes in the genus *Duberria* also assisted in answering relevant questions, enabling a proper genus-wide revision to be undertaken.

A stop on taxonomic studies and publications by myself with respect of the genus *Duberria* occurred after Bill Branch of South

Africa made it known in late 2009 that he intended naming one or more unnamed forms from east of the Bedford Gap in South Africa.

He had allegedly commenced working on the genus and relevant taxa in 2007 and so I deferred most further inquiries in favour of Branch.

I note that Branch's claim to be working on naming a species of *Duberria* in 2009 followed on from a major paper I had published on the African Cobras earlier that year (Hoser, 2009), which himself and best friend Don Broadley took exception to as it apparently breached a hegemony the two men had over herpetological publications on African reptiles.

That paper assigned spitting cobras to the newly named genus *Spracklandus* Hoser, 2019.

In the first instance, Branch and Broadley with good friends, Bryan Fry and Wolfgang Wüster claimed my science was rubbish and that spitting Cobras were perfectly placed within *Naja Laurenti*, 1768 (see for example Fry 2009, Wüster 2009a, 2009b).

Broadley and close friends Wolfgang Wüster and Van Wallach decided to overwrite the genus *Spracklandus* Hoser, 2019, with their own genus name *Afronaja*, Wallach, Wüster and Broadley, 2009, justifying their illegal action with a false claim that *Australasian Journal of Herpetology* was not published in accordance with the *International Code of Zoological Nomenclature* (Ride *et al.* 1999).

The lies by these men were exposed in Hoser (2012a) and again in Hoser (2012b, 2013, 2015a-f) as well as by Wellington (2015), by which stage the trio and others in their cohort had devised a new plan in the guise of Rhodin *et al.* (2015), which accepted the reality that *Spracklandus* was validly published, as were other names of myself published before 2009 and after that year.

The new plan was for an ICZN Plenary ruling declaring all "Hoser names" unavailable in science and to allow the so-called Wüster gang to be able to overwrite all Hoser names with those of themselves.

The ICZN rejected their application with a near unanimous vote against them and also affirmed the validity of *Spracklandus* having priority over the illegally coined *Afronaja* (ICZN 2021).

Meanwhile Branch died on 10 October 2018 at which time there was zero evidence to show he had done any significant work at all on the relevant species within *Duberria* or towards publishing any formal description of it.

Notable is that for many years he had despotic control over the journal of the Herpetological Association of Africa, in which he also published regularly, but nothing of relevance in terms of any formal description of any *Duberria* was published there.

Also notable is that Don Broadley died on 10 March 2016, effectively leaving a vacuum in terms of the formal naming of many still unnamed African reptiles and no further progress in terms of identifying and naming any overlooked species of *Duberria*.

Rather than seeing potentially overlooked species being extirpated through habitat destruction, pests, pathogens or any other form of benign neglect, the genus *Duberria* was assessed by myself with a view to identifying and naming any overlooked species.

MATERIALS AND METHODS

Inspection of original descriptions of each relevant putative species and subspecies was undertaken.

This in turn was combined with relevant morphological and molecular studies that have been published.

The known distributions were matched with known biogeographical barriers and areas of likely absence, to confirm that given populations were or were not interbreeding.

Finally relevant specimens, living, dead or from photos with good quality location data was inspected to confirm consistent differences and whether or not each form was distinct at either the species or subspecies level.

Literature relevant to the taxonomy and nomenclature of the genus *Duberria sensu lato* included Boulenger (1888, 1894), Branch (1993), Broadley (1958), Cowling *et al.* (2009), Daniels *et al.* (2009), Edwards *et al.* (2018), Engelbrecht *et al.* (2013), Fitzinger (1826), Hoser (2021), Kulenkampff *et al.* (2019), Laurent (1956), Linnaeus (1758), Loveridge (1936), Partridge and Maud (1987), Peters (1854), Portillo *et al.* (2018), Ride *et al.* (1999), Skelton-Bourgeois (1961), Spawls (2002), Sternfeld (1912), Theobald (1868), Joger *et al.* (2008), Wallach *et al.* (2014) and sources cited therein.

RESULTS

The molecular study of Kulenkampff *et al.* (2019) confirmed that there are at least four so-called cryptic species within South African *D. lutrix*.

Current taxonomy including for example Kulenkampff *et al.* (2019) treats all South African *D. lutrix* as a single subspecies, within nominate *D. lutrix*, with a type locality of Cape of Good Hope, just south of Cape Town, Western Cape, South Africa.

I inspected specimens from each of the four main clades of South African *D. lutrix* and was able to find consistent differences, enabling species level identification.

With no available synonyms for any of the three forms other than for the fourth type form for *D. lutrix*, all three others are formally named herein as new species in accordance with the rules of the *International Code of Zoological Nomenclature* (Ride *et al.* 1999, as amended online since, via ICZN 2012).

Edwards *et al.* 2018 (as published at: http://biodiversityadvisor.sanbi.org/wp-content/uploads/2018/11/7_Phylogenetic-relationships-in-the-slug-eater-snakes-Duberria.pdf) provided evidence to show that the following taxa (as identified by themselves below) should be recognized as full species, being:

D. rhodesiana

D. shirana

D. variegata

D. lutrix lutrix

D. l. atriventris

D. l. abyssinica

D. l. basilewskyi

In spite of finding all diverged from one another at least 6 MYA, they did not formally elevate the latter three putative subspecies to the level of full species.

They did not analyse sequences of the putative taxon *D. curryindahli* (Laurent, 1956), but as it was collected proximally to their "*D. l. atriventris*" it is safe to contend that it is conspecific.

Within each of the above putative species, Edwards *et al.* (2018) found no major divergences within populations, except for within their South African "*D. lutrix lutrix*" which effectively matched the later published results of Kulenkampff *et al.* (2019).

Cyclophis catenatus Theobald, 1868 was synonymised by Boulenger (1894) with the type form of *D. lutrix* (from Western Cape), confirming the lack of availability of names for the other South African forms.

TAXONOMIC ACTIONS

On the basis of the preceding the genus *Duberria* Fitzinger, 1826 is herein treated as having ten species and no subspecies.

These are:

Duberria abyssinica (Boulenger, 1894)

D. atriventris (Sternfeld, 1912)

D. basilewskyi (Skelton-Bourgeois, 1961)

D. lutrix (Linnaeus, 1758) (type for genus)

D. rhodesiana (Broadley, 1958)

D. shirana (Boulenger, 1894)

D. variegata (Peters, 1854).

and three forms formally named for the first time below, being:

D. hoserae sp. nov.

D. woolfi sp. nov.

D. edwardsi sp. nov.

INFORMATION RELEVANT TO THE FORMAL DESCRIPTIONS THAT FOLLOW

In terms of the descriptions that follow, the following should be noted:

There is no conflict of interest in terms of this paper or the conclusions arrived at herein.

Several people including anonymous peer reviewers who revised the manuscript prior to publication are also thanked as are relevant staff at museums who made specimens and records available in line with international obligations.

In terms of the following formal descriptions, spellings should not be altered in any way for any purpose unless expressly and exclusively called for by the rules governing Zoological Nomenclature as administered by the International Commission of Zoological Nomenclature (ICZN).

This includes if gender assignment of suffixes seems incorrect, Latinisation is wrong, apparent spelling mistakes and so on (see Article 32.5.1 of the Code).

In the unlikely event two or more newly named taxa are deemed to be the same by a first reviser, then the name to be used and retained is that which first appears in this paper by way of page priority and as listed in the abstract keywords.

Some material in descriptions for taxa may be repeated for other taxa in this paper and this is necessary to ensure each fully complies with the provisions of the *International Code of Zoological Nomenclature* (fourth edition) (Ride *et al.* 1999) as amended online since.

Material downloaded from the internet and cited anywhere in this paper was downloaded and checked most recently as of 18 May 2022 (including if also viewed prior), unless otherwise stated and was accurate in terms of the content cited herein as of that date.

Any online citations within this paper, including copied emails and the like, are not necessarily cited in the references part of this paper and have the same most recent viewing date as just given.

Unless otherwise stated explicitly, colour and other descriptions apply to living and **fully mature adult specimens** of generally good health, as seen by day, and not under any form of stress by means such as excessive cool, heat, dehydration, excessive ageing, abnormal skin or reaction to chemical or other input.

SVL or SV means snout-vent length, TL means tail length,

While numerous texts and references were consulted prior to publication of this paper, the criteria used to separate the relevant genera, subgenera, species or subspecies has already been spelt out and/or is done so within each formal description and does not rely on material within publications not explicitly cited herein.

DUBERRIA HOSERAE SP. NOV.

LSIDDurn:lsid:zoobank.org:act:24F4E38E-4819-4F4A-8DBA-7C187C9B7078

Holotype: A preserved specimen at the Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, USA, specimen number MCZ:Herp:R-41954 collected from Woodbush, Pietersburg district, Limpopo, South Africa, Latitude -23.9, Longitude 29.45 E.

This facility allows access to its holdings.

Paratype: A preserved specimen at the Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, USA, specimen number MCZ Herp R-41953 collected from Haenertsburg, Pietersburg district, Limpopo, South Africa, Latitude -23.933 S., Longitude 29.95 E.

Diagnosis: Until now, all three species *Duberria hoserae* sp. nov. from Limpopo, South Africa, *D. woolfi* sp. nov. from the vicinity of Sabie, Mpumalanga, South Africa and *D. edwardsi* sp. nov. from coastal regions between East London and Sodwana Bay on the Eastern Cape of South Africa (and potentially slightly north of there) have been treated as populations of *Duberria lutrix* (Linnaeus, 1758), or alternatively of a nominate subspecies of that form being populations of *Duberria lutrix lutrix*.

Type *D. lutrix* is from the Cape of Good Hope, Western Cape, South Africa and this species as defined herein is found from around Cape Town along the coast and nearby as far east the area of Grahamstown, where it is separated from *D. woolfi* sp. nov. by the biogeographical barrier known as the Bedford Gap, which sits between Grahamstown and Port Elizabeth, extending from further inland as an arid intrusion separating the relevant populations.

The arid intrusion is caused by a break in the fold ranges funnelling hot dry air through the area when winds come from the north in warmer months.

The four species are separated from one another by the following unique suites of characters:

D. lutrix (*sensu stricto*) is readily identified by being a dark chocolate brown dorsally with well defined dark greyish black on the flanks, the mid dorsal line consists only of scattered dots, well separated and mainly only on the anterior end of the body. Head is medium grey all over the top and sides. There is a slight lightening in the upper labials of some specimens.

D. hoserae sp. nov. is a distinctive light yellow brown dorsally, with a well defined, relatively thick and unbroken blackish mid dorsal stripe anteriorly, becoming broken as large thick dots on the mid body and posterior to this. Flanks are blackish with a well defined upper edge. Head brown but with a greyish tinge.

D. woolfi sp. nov. has a copper brown dorsum, except for the head which is dull brown. Upper flanks are black, with ill defined upper boundary and lower flanks grading to whitish, again with an ill defined boundary. The mid dorsal line is indistinct, consisting of tiny semi-distinct closely spaced greyish spots extending from nape to tail.

D. edwardsi sp. nov. is dull brown or reddish-brown above, with slightly darker flanks that are also brown and bounded at the top by a semi-distinct white boundary, this feature being unique to this species as compared to the other three above. Head is slightly darker than the body. Upper labials, especially at the rear are either whitish, or whitish-yellow. That the flanks do not form obvious dark blackish lines is a common distinguishing feature of adults of this species, this trait usually only being seen in extremely aged specimens of the other three species detailed above.

The four preceding species are separated from other six species in the genus *Duberria* Fitzinger, 1826, being *Duberria abyssinica* (Boulenger, 1894), *Duberria atriventris* (Sternfeld, 1912), *D. basilewskyi* (Skelton-Bourgeois, 1961), *D. rhodesiana* (Broadley, 1958), *D. shirana* (Boulenger, 1894) and *D. variegata* (Peters, 1854). by the following suite of characters; the dorsal colouration of yellowish brown to dark brown, usually with a broken mid-dorsal line of some kind that is usually consisting of numerous spots; distinctively grey to brown flanks, generally distinct, or if not so, with some kind of upper border; the venter is cream with a dark dotted line; 116-142 ventrals; two postoculars.

Snakes in the genus *Duberria* are separated from all other African colubrid snakes by the following suite of characters: No enlarged grooved fangs (for injecting venom) in the upper jaw; smooth scales; short tail; pupil round; loreal shield either absent or tiny; nasal single; rostral small.

In turn the African colubrids are separated from all other African snakes by not being worm-like in form; head is somewhat distinct from the body; belly has transversely enlarged ventral scales; eyes well developed, movable and with a transparent spectacle; fewer than 50 mid-body scale rows; labials without deep, heat sensitive pits and no remnants of vestigial hind-limbs or pelvic spurs.

D. lutrix (*sensu stricto*) in life is depicted online at: <https://www.inaturalist.org/observations/9409272> and

<https://www.inaturalist.org/observations/42930489>

D. hoserae sp. nov. in life is depicted online at:

<https://www.inaturalist.org/observations/56108457>

D. woolfi sp. nov. in life is depicted online at:

<https://www.inaturalist.org/observations/113315675>

D. edwardsi sp. nov. in life is depicted online at:

<https://www.inaturalist.org/observations/10850565>

Kulenkampff *et al.* (2019) estimated a divergence of the clade identified herein as *D. hoseerae* sp. nov. of 3.42 MYA from other putative *D. lutrix*, including what is identified herein as *D. woolfi* sp. nov. and *D. edwardsi* sp. nov..

Kulenkampff *et al.* (2019) estimated a divergence of the clade identified herein as *D. woolfi* sp. nov. of 2.05 MYA from other putative *D. lutrix*, including what is identified herein as *D. edwardsi* sp. nov., but excluding *D. hoseerae* sp. nov. from which it diverged 3.42 MYA.

Kulenkampff *et al.* (2019) estimated a divergence of the clade identified herein as *D. edwardsi* sp. nov. of 1.23 MYA from *D. lutrix* as defined in this paper and of 2.05 MYA and 3.42 MYA from *D. woolfi* sp. nov. and *D. hoseerae* sp. nov. respectively.

Distribution: *D. hoseerae* sp. nov. is only known from elevated regions of Limpopo, South Africa and based on the limited known range of the species, must be treated as an "at risk" species.

Etymology: The species *D. hoseerae* sp. nov. is named in honour of my long-suffering wife, Shireen Hoser, born in the wild back blocks of Athlone, Cape Town, South Africa in recognition her many contributions to the herpetology of Africa, Australia and elsewhere.

DUBERRIA WOOLFI SP. NOV.

LSIDDurn:lsid:zoobank.org:act:CBA848B1-DDE3-43C7-A146-394B24547E37

Holotype: A preserved specimen in the Port Elizabeth Museum Reptile Collection, Gqeberha (Port Elizabeth), South Africa, specimen number PEM R 22549 collected from Sabie. Mpumalanga, South Africa . Latitude 25.501990 S., Longitude 30.473158 E.

This facility allows access to its holdings.

Paratype: A preserved specimen in the Port Elizabeth Museum Reptile Collection, Gqeberha (Port Elizabeth), South Africa, specimen number PEM R 22550 collected from Sabie. Mpumalanga, South Africa . Latitude 25.501990 S., Longitude 30.473158 E.

Diagnosis: Until now, all three species *Duberria woolfi* sp. nov. from the vicinity of Sabie, Mpumalanga, South Africa, *D. hoseerae* sp. nov. from Limpopo, South Africa and *D. edwardsi* sp. nov. from coastal regions between East London and Sodwana Bay on the Eastern Cape of South Africa (and potentially slightly north of there) have been treated as populations of *Duberria lutrix* (Linnaeus, 1758), or alternatively of a nominate subspecies of that form being populations of *Duberria lutrix lutrix*.

Type *D. lutrix* is from the Cape of Good Hope, Western Cape, South Africa and this species as defined herein is found from around Cape Town along the coast and nearby as far east the area of Grahamstown, where it is separated from *D. woolfi* sp. nov. by the biogeographical barrier known as the Bedford Gap, which sits between Grahamstown and Port Elizabeth, extending from inland as an arid intrusion separating the relevant populations.

The arid intrusion is caused by a break in the fold ranges funnelling hot dry air through the area when winds come from the north in warmer months.

The four species are separated from one another by the following unique suites of characters:

D. lutrix (*sensu stricto*) is readily identified by being a dark chocolate brown dorsally with well defined dark greyish black on the flanks, the mid dorsal line consists only of scattered dots, well separated and mainly only on the anterior end of the body. Head is medium grey all over the top and sides. There is a slight lightening in upper labials of some specimens.

D. hoseerae sp. nov. is a distinctive light yellow brown dorsally, with a well defined, relatively thick and unbroken blackish mid dorsal stripe anteriorly, becoming broken as large thick dots on

the mid body and posterior to this. Flanks are blackish with a well defined upper edge. Head brown but with a greyish tinge.

D. woolfi sp. nov. has a copper brown dorsum, except for the head which is dull brown. Upper flanks are black, with ill defined upper boundary and lower flanks grading to whitish, again with an ill defined boundary. The mid dorsal line is indistinct, consisting of tiny semi-distinct closely spaced greyish spots extending from nape to tail.

D. edwardsi sp. nov. is dull brown or reddish-brown above, with slightly darker flanks that are also brown and bounded at the top by a semi-distinct white boundary, this feature being unique to this species as compared to the other three above. Head is slightly darker than the body. Upper labials, especially at the rear are either whitish, or whitish-yellow. That the flanks do not form obvious dark blackish lines is a common distinguishing feature of adults of this species, this trait usually only being seen in extremely aged specimens of the other three species detailed above.

The four preceding species are separated from other six species in the genus *Duberria* Fitzinger, 1826, being *Duberria abyssinica* (Boulenger, 1894), *Duberria atriventris* (Sternfeld, 1912), *D. basilewskyi* (Skelton-Bourgeois, 1961), *D. rhodesiana* (Broadley, 1958), *D. shirana* (Boulenger, 1894) and *D. variegata* (Peters, 1854). by the following suite of characters; the dorsal colouration of yellowish brown to dark brown, usually with a broken mid-dorsal line of some kind that is usually consisting of numerous spots; distinctively grey to brown flanks, generally distinct, or if not so, with some kind of upper border; the venter is cream with a dark dotted line; 116-142 ventrals; two postoculars.

Snakes in the genus *Duberria* are separated from all other African colubrid snakes by the following suite of characters: No enlarged grooved fangs (for injecting venom) in the upper jaw; smooth scales; short tail; pupil round; loreal shield either absent or tiny; nasal single; rostral small.

In turn the African colubrids are separated from all other African snakes by not being worm-like in form; head is somewhat distinct from the body; belly has transversely enlarged ventral scales; eyes well developed, movable and with a transparent spectacle; fewer than 50 mid-body scale rows; labials without deep, heat sensitive pits and no remnants of vestigial hind-limbs or pelvic spurs.

D. lutrix (*sensu stricto*) in life is depicted online at:

<https://www.inaturalist.org/observations/9409272>

and

<https://www.inaturalist.org/observations/42930489>

D. hoseerae sp. nov. in life is depicted online at:

<https://www.inaturalist.org/observations/56108457>

D. woolfi sp. nov. in life is depicted online at:

<https://www.inaturalist.org/observations/113315675>

D. edwardsi sp. nov. in life is depicted online at:

<https://www.inaturalist.org/observations/10850565>

Kulenkampff *et al.* (2019) estimated a divergence of the clade identified herein as *D. hoseerae* sp. nov. of 3.42 MYA from other putative *D. lutrix*, including what is identified herein as *D. woolfi* sp. nov. and *D. edwardsi* sp. nov..

Kulenkampff *et al.* (2019) estimated a divergence of the clade identified herein as *D. woolfi* sp. nov. of 2.05 MYA from other putative *D. lutrix*, including what is identified herein as *D. edwardsi* sp. nov., but excluding *D. hoseerae* sp. nov. from which it diverged 3.42 MYA.

Kulenkampff *et al.* (2019) estimated a divergence of the clade identified herein as *D. edwardsi* sp. nov. of 1.23 MYA from *D. lutrix* as defined in this paper and of 2.05 MYA and 3.42 MYA from *D. woolfi* sp. nov. and *D. hoseerae* sp. nov. respectively.

Distribution: *D. woolfi* sp. nov. is only known from elevated regions in the vicinity of Sabie, Mpumalanga, South Africa and based on the limited known range of the species, must be treated as an "at risk" species.

Etymology: The species *D. woolfi* sp. nov. is named in honour

of Paul Woolf of Walloon, (Brisbane), Queensland, Australia, the foundation president of the Herpetological Society of Queensland Incorporated in recognition of his many contributions to herpetology globally over many decades.

DUBERRIA EDWARDSI SP. NOV.

LSIDDurn:lsid:zoobank.org:act:0539ABDD-6AE5-442D-B9D0-BCDC79BBA811

Holotype: A preserved specimen at the Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, USA, specimen number MCZ Herp R-42639 collected from Port St Johns, Pondoland, Eastern Cape Province, South Africa, Latitude -31.633 S., Longitude 29.533 E.

This facility allows access to its holdings.

Paratypes: Six preserved specimens at the Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, USA, specimen numbers MCZ Herp R-42640-42645 collected from Port St Johns, Pondoland, Eastern Cape Province, South Africa, Latitude -31.633 S., Longitude 29.533 E.

Diagnosis: Until now, all three species *Duberria edwardsi* sp. nov. from coastal regions between East London and Sodwana Bay on the Eastern Cape of South Africa (and potentially slightly north of there), *D. hoserae* sp. nov. from Limpopo, South Africa and *D. woolfi* sp. nov. from the vicinity of Sabie, Mpumalanga, South Africa have been treated as populations of *Duberria lutrix* (Linnaeus, 1758), or alternatively of a nominate subspecies of that form being populations of *Duberria lutrix lutrix*.

Type *D. lutrix* is from the Cape of Good Hope, Western Cape, South Africa and this species as defined herein is found from around Cape Town along the coast and nearby as far east the area of Grahamstown, where it is separated from *D. woolfi* sp. nov. by the biogeographical barrier known as the Bedford Gap, which sits between Grahamstown and Port Elizabeth, extending from inland as an arid intrusion separating the relevant populations.

The arid intrusion is caused by a break in the fold ranges funnelling hot dry air through the area when winds come from the north in warmer months.

The four species are separated from one another by the following unique suites of characters:

D. lutrix (*sensu stricto*) is readily identified by being a dark chocolate brown dorsally with well defined dark greyish black on the flanks, the mid dorsal line consists only of scattered dots, well separated and mainly only on the anterior end of the body. Head is medium grey all over the top and sides. There is a slight lightening in upper labials of some specimens.

D. hoserae sp. nov. is a distinctive light yellow brown dorsally, with a well defined, relatively thick and unbroken blackish mid dorsal stripe anteriorly, becoming broken as large thick dots on the mid body and posterior to this. Flanks are blackish with a well defined upper edge. Head brown but with a greyish tinge.

D. woolfi sp. nov. has a copper brown dorsum, except for the head which is dull brown. Upper flanks are black, with ill defined upper boundary and lower flanks grading to whitish, again with an ill defined boundary. The mid dorsal line is indistinct, consisting of tiny semi-distinct closely spaced greyish spots extending from nape to tail.

D. edwardsi sp. nov. is dull brown or reddish-brown above, with slightly darker flanks that are also brown and bounded at the top by a semi-distinct white boundary, this feature being unique to this species as compared to the other three above. Head is slightly darker than the body. Upper labials, especially at the rear are either whitish, or whitish-yellow. That the flanks do not form obvious dark blackish lines is a common distinguishing feature of adults of this species, this trait usually only being seen in extremely aged specimens of the other three species detailed above.

The four preceding species are separated from other six species in the genus *Duberria* Fitzinger, 1826, being *Duberria abyssinica* (Boulenger, 1894), *Duberria atriventris* (Sternfeld, 1912), *D.*

basilewskyi (Skelton-Bourgeois, 1961), *D. rhodesiana* (Broadley, 1958), *D. shirana* (Boulenger, 1894) and *D. variegata* (Peters, 1854). by the following suite of characters; the dorsal colouration of yellowish brown to dark brown, usually with a broken mid-dorsal line of some kind that is usually consisting of numerous spots; distinctively grey to brown flanks, generally distinct, or if not so, with some kind of upper border; the venter is cream with a dark dotted line; 116-142 ventrals; two postoculars.

Snakes in the genus *Duberria* are separated from all other African colubrid snakes by the following suite of characters: No enlarged grooved fangs (for injecting venom) in the upper jaw; smooth scales; short tail; pupil round; loreal shield either absent or tiny; nasal single; rostral small.

In turn the African colubrids are separated from all other African snakes by not being worm-like in form; head is somewhat distinct from the body; belly has transversely enlarged ventral scales; eyes well developed, movable and with a transparent spectacle; fewer than 50 mid-body scale rows; labials without deep, heat sensitive pits and no remnants of vestigial hind-limbs or pelvic spurs.

D. lutrix (*sensu stricto*) in life is depicted online at:

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D. woolfi sp. nov. in life is depicted online at:

<https://www.inaturalist.org/observations/113315675>

D. edwardsi sp. nov. in life is depicted online at:

<https://www.inaturalist.org/observations/10850565>

Kulenkampff *et al.* (2019) estimated a divergence of the clade identified herein as *D. hoserae* sp. nov. of 3.42 MYA from other putative *D. lutrix*, including what is identified herein as *D. woolfi* sp. nov. and *D. edwardsi* sp. nov..

Kulenkampff *et al.* (2019) estimated a divergence of the clade identified herein as *D. woolfi* sp. nov. of 2.05 MYA from other putative *D. lutrix*, including what is identified herein as *D. edwardsi* sp. nov., but excluding *D. hoserae* sp. nov. from which it diverged 3.42 MYA.

Kulenkampff *et al.* (2019) estimated a divergence of the clade identified herein as *D. edwardsi* sp. nov. of 1.23 MYA from *D. lutrix* as defined in this paper and of 2.05 MYA and 3.42 MYA from *D. woolfi* sp. nov. and *D. hoserae* sp. nov. respectively.

Distribution: *D. edwardsi* sp. nov. is only known from coastal regions between East London and Sodwana Bay on the Eastern Cape of South Africa, and potentially slightly north of there.

Etymology: The species *D. edwardsi* sp. nov. is named in honour of Euan Edwards of Robina, Gold Coast, Queensland, Australia, in recognition of his many contributions to herpetology globally over many decades, including significant field research in various parts of Africa as recently as 2022.

SUMMARY

The underestimation of species diversity in South Africa in 2022 within a common putative species *Duberria lutrix* (Linnaeus, 1758) is cause for concern. Two of the three newly described species appear to be range restricted in the north-east of South Africa in an area experiencing rapid human population growth and the corresponding habitat destruction that comes with this.

While all species within *Duberria* Fitzinger, 1826 seem to be partial to non-dense urbanisation and human disturbances of places they live in, rapid declines in previously "secure" or "common" species are common in the world as human mediated influences increase.

Hence it is important that not only are the range restricted populations of these species monitored closely for adverse changes, but other currently unrecognized species diversity needs to be formally identified and named as matter of urgency. Formally identifying and naming taxa is of course the first and

most important step towards their long term conservation.

For decades, William Branch, employed at the Port Elizabeth Museum and Donald Broadley of Zimbabwe exercised a despotic form of hegemony over herpetology in southern Africa, in which as a pair, they literally monopolized the taxonomy and naming of new species in the region.

This was primarily ego driven and has had seriously adverse wildlife conservation outcomes in the same forms as outlined in Hoser (1989, 1991, 1993, 1996, 2007, 2012a, 2012b, 2015a-f, 2007, 2019a and 2019b) and Hawkeswood (2021).

Broadley died on 10 March 2016, closely followed by Branch on 10 October 2018.

In 2007 (allegedly) and again in 2009, Branch told others to keep their "hands off" *Duberria lutix* as he was supposedly going to be describing the Port St Johns population as a new species.

He made numerous threats to others. At times Branch militarised law enforcement officers against those he saw as rivals, as did Broadley in similar circumstances.

This they did by instigating illegal armed raids on the families and homes of their victims, usually followed by faked criminal charges and prosecutions.

Branch died before he made any concrete steps towards formally describing the Port St Johns population of putative *Duberria lutrix*. But over at least a decade he had successfully managed to monopolize the taxon and effectively freeze all substantive research on it.

He did the same for numerous other African reptiles.

This was neither good scientific practice or good for conservation.

If currently unrecognized southern African reptile species do become extinct, it will be a very sad legacy left by Bill Branch and Don Broadley.

In order to rectify the damage caused by both men over some decades I implore others to step into the vacuum they have created and to assist in the task of identifying and naming species of herpetofauna from southern Africa expeditiously and before any become extinct in the manner detailed in the case of Australian species documented in Hoser (2019a, 2019b).

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CONFLICTS OF INTEREST - NONE**Cite this paper as:**

Hoser, R. T. 2022. Hiding in plain sight! Three new species of Slug Eater snakes (Serpentes: Colubroidea: *Duberria* Fitzinger, 1826) from South Africa. *Australasian Journal of Herpetology* 58:21-27.

***Euanedwardsserpens subradiatus* (Schlegel, 1837) revisited and formally divided into six allopatric species based on morphological and genetic divergence.**

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Received 1 April 2022, Accepted 13 June 2022, Published 28 June 2022.

ABSTRACT

The species originally described as *Coluber subradiatus* Schlegel, 1837, has been transferred to various genera, including, *Elaphe* Wagler, 1832, *Coelognathus* Fitzinger, 1843 and most recently *Euanedwardsserpens* Hoser, 2012.

Until now in 2022, the species *Euanedwardsserpens subradiatus* has been treated as a single biological entity distributed in the Lesser Sunda Islands of Indonesia, including Lombok, Sumbawa, Sumba, Komodo, Rinca, Flores, Alor, Roti, Semau, Timor (including Timor-Leste) and Wetar.

De Lang (2011) stated “*Coelognathus subradiatus* in the Lesser Sundas is a species complex”, but in the 11 years since that publication, none of the other unnamed relevant species have been formally named.

In line with morphological and molecular evidence, corroborated by deep sea biogeographical barriers that remained during ice-age maxima, the single putative species is split six ways, with five formally named for the first time in accordance with the *International Code of Zoological Nomenclature* (Ride *et al.* 1999).

Keywords: Herpetology; taxonomy; snake; nomenclature; Indonesia; Sunda; ratsnake; Timor; Sumba; Sumbawa; Flores; Alor; Wetar; Semau; Roti; Rinca; Lombok; *Euanedwardsserpens*; *Coelognathus*; *Elaphe*; *subradiatus*; lectotype; designation; new species; *adelynhoserae*; *euanedwardsi*; *floresensis*; *wetarensis*; *sumbaensis*.

INTRODUCTION

The species originally described as *Coluber subradiatus* Schlegel, 1837, better known as the Lesser Sundas Ratsnake has been transferred to various genera, including, *Elaphe* Wagler, 1832, *Coelognathus* Fitzinger, 1843 and most recently *Euanedwardsserpens* Hoser, 2012.

Euanedwardsserpens Hoser, 2012 was created scientifically on the basis of morphological and molecular divergence of the relevant species.

Currently, as of 2022, the species *Euanedwardsserpens subradiatus* is treated as a single biological entity distributed in the Lesser Sunda Islands of Indonesia, including Lombok, Sumbawa, Sumba, Komodo, Rinca, Flores, Alor, Roti, Semau, Timor (including Timor-Leste) and Wetar.

De Lang (2011) stated “*Coelognathus subradiatus* in the Lesser Sundas is a species complex”, but in the 11 years since that publication, none of the unnamed relevant species have been formally named.

The progress of scientific studies with regards to these snakes may be impeded by the failure to correctly identify the relevant biological entities and so it was decided to formally name the unnamed forms to correct this problem.

De Lang (2011) was not the first to flag that there may be more

than one form of putative *Euanedwardsserpens subradiatus* occupying the known distribution.

How *et al.* (1996) provided evidence of more than one species in the complex as have other more recent authors.

In line with morphological and molecular evidence, corroborated by deep sea biogeographical barriers that remained during ice-age maxima, the single putative species is split six ways, with five formally named for the first time in accordance with the *International Code of Zoological Nomenclature* (Ride *et al.* 1999).

MATERIALS AND METHODS

Before the decision was made to formally name the relevant forms of putative *E. subradiatus* specimens from across the range of putative *E. subradiatus* were inspected (live, dead and from photos with quality location data), along with a review of the relevant published literature on the putative species, including all notable morphological and molecular studies.

These were also cross-checked with other studies relevant to known sea level minima during times of glacial maxima in the Pliocene-Pleistocene epochs as a means to attempt to calibrate measured genetic divergences in the relevant published studies. Literature relevant to the putative species *E. subradiatus* and the taxonomic decisions made herein include Bethencourt (1897), Boulenger (1894, 1987, 1898), De Lang (2011), Helfenberger

(2001), Hoser (2012b, 2022), How *et al.* (1996), Knight (2009), Maryanto *et al.* (2021), Mecke (2016), Mertens (1930), Pyron and Burbrink (2013), Pyron *et al.* (2013), Reilly *et al.* (2017, 2019a, 2019b, 2021), Ride *et al.* (1999), Schlegel (1837a, 1837b), Schulz (1988, 1996a, 1996b), Simpson (1977), Vinciguerra (1892), Wagler (1830), Wallace (1860), Wallach *et al.* (2014) and sources cited therein.

RESULTS

As noted already in this paper and flagged prior to the preparation of this paper, molecular studies indicated species-level division within putative *E. subradiatus*.

Reilly *et al.* (2021) showed estimated divergences between the following main populations:

Alor Island, 4.5 MYA from all others;

Timor and Wetar islands 3.6 MYA from all others (exl. Alor Island at 4.5 MYA) and 1.3 MYA from one another;

Flores and Sumbawa islands 3.6 MYA from all others (exl. Alor Island at 4.5 MYA) and 1.5 MYA from one another;

There is clearly an unarguable basis to formally recognize at least three valid species based on the molecular divergence, assuming each can be morphologically defined.

In terms of the lesser splits at 1.3-1.5 MYA, these sit at the cusp of species and subspecies in terms of these definitions in herpetology based on molecular and morphological results.

However as the relevant forms can be separated morphologically and they are well and truly isolated by deep sea barriers and therefore evolving separately, with no obvious genetic mixing, I have no hesitation at all in accepting each entity as a valid species.

A further divergent form from Sumba Island is also identified herein as a morphologically divergent species, also separated by a deep sea barrier, not removed in recent times of glacial maxima and likely to be of similar divergence to the other forms, at least at the lower level, being in excess of 1.3 MYA.

Each of the relevant forms could be distinguished from one another by consistent morphological differences, confirming the correctness of identifying each as a separate species.

FORMAL DESIGNATION OF A LECTOTYPE IN ACCORDANCE WITH THE INTERNATIONAL CODE OF ZOOLOGICAL NOMENCLATURE

The only available name for any of the preceding species is for the snake originally named as *Coluber subradiatus* Schlegel, 1837, based on a syntype series from potentially more than one location.

In order to maintain stability of names, I herein **designate** a **lectotype** for the species originally named as *Coluber subradiatus* Schlegel, 1837 in accordance with Article 74 of the *International Code of Zoological Nomenclature* (Ride *et al.* 1999) for the syntype animal, currently held at the Naturalis Museum, The Netherlands, specimen number RMNH.RENA.403, collected from Timor, by S. Müller.

This lectotype is now the unique bearer of the name of the nominal species-group taxon and the standard for its application (Articles 74.1 all parts, 74.3 all parts).

FORMAL NAMING OF FIVE NEW SPECIES ALL UNTIL NOW TREATED AS PUTATIVE "COLUBER SUBRADIATUS".

As already noted, the current genus-level assignment for the putative taxon is *Euanedwardsserpens* Hoser, 2012.

In the absence of any available names for any of the five other identified taxa, each are formally named herein, as five species.

The form *E. subradiatus* (Schlegel, 1837) is herein confined to Timor and immediately offshore islands.

In terms of the descriptions that follow, the following should be noted:

There is no conflict of interest in terms of this paper or the conclusions arrived at herein.

Several people including anonymous peer reviewers who revised the manuscript prior to publication are also thanked as are

relevant staff at museums who made specimens and records available in line with international obligations.

In terms of the following formal descriptions, spellings should not be altered in any way for any purpose unless expressly and exclusively called for by the rules governing Zoological Nomenclature as administered by the International Commission of Zoological Nomenclature (ICZN).

This includes if gender assignment of suffixes seems incorrect, Latinisation is wrong, apparent spelling mistakes and so on (see Article 32.5.1 of the Code).

In the unlikely event two or more newly named taxa are deemed to be the same by a first reviser, then the name to be used and retained is that which first appears in this paper by way of page priority and as listed in the abstract keywords.

Some material in descriptions for taxa may be repeated for other taxa in this paper and this is necessary to ensure each fully complies with the provisions of the *International Code of Zoological Nomenclature* (fourth edition) (Ride *et al.* 1999) as amended online since (ICZN 2012).

Material downloaded from the internet and cited anywhere in this paper was downloaded and checked most recently as of 10 June 2022 (including if also viewed prior), unless otherwise stated and was accurate in terms of the content cited herein as of that date.

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Unless otherwise stated explicitly, colour and other descriptions apply to living and **fully mature adult specimens** of generally good health, as seen by day, and not under any form of stress by means such as excessive cool, heat, dehydration, excessive ageing, abnormal skin or reaction to chemical or other input.

SVL or SV means snout-vent length, TL means tail length.

While numerous texts and references were consulted prior to publication of this paper, the criteria used to separate the relevant genera, subgenera, species or subspecies has already been spelt out and/or is done so within each formal description and does not rely on material within publications not explicitly cited herein.

EUANEDWARDSSERPENS HOSERAE SP. NOV.

LSIDurn:lsid:zoobank.org:act:BBAC5BF1-65C6-4127-8CB4-D2A69535C331

Holotype: A preserved specimen at the Museum of Vertebrate Zoology, University of California, Berkeley, California, USA, specimen number MVZ 292828 collected from Alor Desa Waisika, Kecamatan Alor Timor Laut, Kabupaten Alor, Provinsi Nusa Tenggara Timur, Indonesia, Latitude -8.18916 S., Longitude 124.75098 E at 70 metres elevation.

This facility allows access to its holdings.

Paratypes: Three preserved female specimens at the Museum of Natural History, London, UK, specimen numbers 1897.12.30.19-21 collected from Alor Island.

Diagnosis: Until now each of *Euanedwardsserpens hoserae* sp. nov., *E. euanedwardsi* sp. nov., *E. florensensis* sp. nov., *E. wetarensis* sp. nov. and *E. sumbaensis* sp. nov. have all been treated as populations of *Euanedwardsserpens subradiatus* (Schlegel, 1837), a species still more widely known as *Coelognathus subradiatus* (Schlegel, 1837) or *Elaphe subradiatus* (Schlegel, 1837), otherwise known as the Lesser Sundas Rat Snake.

Because of the significant variation in specimens both by age and within a single population, diagnosing the relevant species has not been attempted until now. However each of the following six species can be separated from one another as follows:

Euanedwardsserpens subradiatus (Schlegel, 1837) from Timor and immediately adjacent small islands, including Roti Island to the south, is separated from the other five species by the following unique suite of characters:

Medium to light brown dorsally with a strong russet tinge, always

a well defined black line running from the eye, posteriorly to the rear of the head at the upper labial, where there is an obvious break before one or more lines commence and run down the body in one or more longitudinal lines or rows of broken spots in a longitudinal manner. These markings usually stop or fade about 1/3 of the way down the body, after which the snake is generally unmarked. Top of head is brownish and unmarked. Upper labials are yellowish. Iris is a dark reddish brown in colour.

E. hoseræ sp. nov. from Alor Island and possibly Pantar Island to the immediate west is separated from the other five species by the following unique suite of characters:

The dorsum is a light yellowish brown to beige in colour and without any russet tinge. The top of the head has a pair of distinct black spots on the central edge of each of the supraciliaries. The black line running posteriorly from the eye to the upper labial is relatively short and ends on the second upper labial past the eye. Back of head may have some semi-distinct black marks but the upper neck is unmarked. About two head lengths down the body irregular black markings arrange in a longitudinal manner in two irregular longitudinal lines on either side of the median line, before breaking up about a third of the way down the body.

A light yellowish-brown iris.

E. euanedwardsi sp. nov. from Sumbawa Island and Lombok to the west is separated from the other five species by the following unique suite of characters:

Dorsal surface of head and neck is an olive brown, becoming slightly reddish brown posteriorly from about a third of the way down the body.

The head is generally devoid of markings. There is a very indistinct and short, narrow dark brown streak running from behind the middle of the eye, posteriorly down the two adjacent labials to about halfway down the second labial. Lower parts of all upper labials are white, turning brown higher, but without a well-defined boundary. Commencing about 2-3 head lengths down the neck from the back of the head are two rows of spotted scales, forming broken longitudinal lines running down the first half of the body length, before disappearing. About five head lengths past the back of the head are two similar lines of dots running in similar dotted longitudinal lines along each of the flanks along the middle of each. These become as prominent as those near the mid-dorsal line but also fade lower down the body. Iris is a dull orange-brown colour.

E. floresensis sp. nov. from Flores, Komodo, Rinca, Adonara and Lembata is similar in most respects to *E. euanedwardsi* sp. nov. as described above, but is separated from that species by having a yellowish tinge in colour at the anterior end of the body, grading through brown to become a dark reddish brown posteriorly; lower flanks invariably have one or more dark blotches, sometimes in a longitudinal array; some black spots on the upper dorsum may be expanded to be significantly larger than most of the rest in the longitudinal array and the iris is a light yellow with orange tinge, to light orange in colour.

E. wetarensis sp. nov. from Wetar Island is similar in most respects to *E. subradiatus* as described above, but is separated from that species by being olive brown dorsally, becoming slightly darker at the rear body, with spotting and broken lines and the like far more prominent on the flanks than on the dorsum, invariably aligned in a linear manner and far more prominent on the anterior third to half of the body; top of head brownish, upper labials yellowish and iris is a medium yellowish-brown colour.

E. sumbaensis sp. nov. from Sumba Island is similar in most respects to *E. subradiatus* as described above, but is separated from that species (and *E. wetarensis* sp. nov.) by being a dark olive-brown dorsally, with spotting and broken lines and the like more prominent on the dorsum than the flanks, being well-defined and black, (versus dark-brown to off-black in the other two species) and a dark brown iris.

E. subradiatus (Schlegel, 1837), *E. adelynhoseræ* sp. nov., *E. euanedwardsi* sp. nov., *E. floresensis* sp. nov., *E. wetarensis* sp. nov. and *E. sumbaensis* sp. nov. are separated from all

other species within *Euanedwardsserpens* Hoser, 2012 by the following suite of characters:

Rostral much broader than deep; internasals as long as broad or a little broader, shorter than the prefrontals; frontal one and one sixth to one and a half as long as broad, as long as or a little shorter than its distance from the end of the snout, shorter than the parietals; loreal usually longer than deep; a subocular below the ocular; two postoculars; temporals usually 2+2; eight or nine upper labials, fifth and sixth labials entering the eye; four or five lower labials in contact with the anterior chin-shields, which are much shorter than the posterior ones; scales in 23 or 25 rows (25 or 27 on the neck), more or less strongly keeled on the posterior half of the body, the outer series without a trace of a keel. 228-242 ventrals which have an obtuse lateral keel; anal entire; subcaudals 80-100 (all divided). A dorsum that is brownish above, with sometimes with black flecks, spotting or stripes that may tend to form a pair of black stripes along each side of the anterior third of the body, either on the dorsum, the flanks or both; a short black streak of some sort is usually seen behind the eye; lower parts uniform yellowish (effectively modified from Boulenger 1894 and De Lang 2011).

Snakes in the genus *Euanedwardsserpens* Hoser, 2012, were defined as follows:

“Diagnosis: A group large ratsnakes found in the Southeast Asian region, typified by a vertically compressed body and an angled relatively pointed head and snout. Often defensive (interpreted commonly as “aggressive”) to people when encountered and to a greater degree than most other ratsnake genera, with specimens commonly struggling against the handler if handled.

Helfenberger (2001) separated *Coelognathus* from the other Eurasian ratsnakes based on anatomical and osteological features as well as electrophoretic loci and used this to diagnose that genus *sensu lato*, including (in effect) the genera *Euanedwardsserpens* gen. nov. and *Cynophis* in terms of their common attributes.

This information is relied upon herein as part of this diagnosis as relevant.

These snakes are medium to large and relatively long and slender, have correspondingly high ventral scale and precaudal vertebra counts and have a distinctly long and slender head, which separates them from all other ratsnake genera except *Orthriophis*. However these genera are easily separated by viewing the head colouration. In *Orthriophis* the post-orbital stripe runs more-or-less parallel with the jawline, whereas is *Coelognathus* it distinctly points downwards towards the back of the jaw, although this may be either broken, or one of two such lines, the other running in an upward direction.

If in any doubt, *Orthriophis* is also separated from the genera *Coelognathus*, *Cyanophis* and *Euanedwardsserpens* gen. nov. by having a divided anal plate as opposed to a single one.

Snakes of the ratsnake genus *Gonyosoma* Wagler, 1828 also have a divided anal.

Separation of the three relevant genera (namely *Coelognathus*, *Cyanophis* and *Euanedwardsserpens* gen. nov.) is done as follows:

The species *Coelognathus radiatus* (now the entire content of that genus as defined herein) is separated from all other Asian ratsnakes (including those of genera *Cyanophis* and *Euanedwardsserpens* gen. nov.) by having a short interpulmonary bronchus (see plate 1A-D, Fig 4, Tables 1-2 in Utiger et. al. 2005).

Snakes of the genera *Coelognathus* and *Euanedwardsserpens* gen. nov. as defined herein always have three supralabials in contact with the eye. By contrast *Cyanophis helena* does not. *Coelognathus radiatus* also differs from the other relevant taxa (*Cyanophis* and *Euanedwardsserpens* gen. nov.) by the possession of a relatively short and stout hemipenis, versus long, slender and subcylindrical (sometimes tapering distally) (particularly) in the snakes of the genus *Euanedwardsserpens*

gen. nov..

If the snake does not identify as being within the genera *Coelognathus* or *Cyanophis* it will be in the genus *Euanedwardsserpens* gen. nov."

E. subradiatus (Schlegel, 1837) from Timor and Roti Island is depicted in life in De Lang (2011) on pages 81 and 82 and online at:

<https://www.inaturalist.org/observations/5202489>
and

<https://www.inaturalist.org/observations/5202442>

E. hoserae sp. nov. from Alor Island is depicted in life in Reilly et al. (2021) on page 270.

E. euanedwardsi sp. nov. from Sumbawa and Lombok is depicted in life online at:

<https://www.inaturalist.org/observations/14932611>
and

<https://www.inaturalist.org/observations/100236888>

E. floresensis sp. nov. from Rinca and Flores is depicted in life in De Lang (2011) on pages 77-79 and online at:

<https://www.inaturalist.org/observations/82422738>

E. sumbaensis sp. nov. is depicted in life in Maryanto et al. (2021) on page 68 top left.

Reilly et al. (2021) found a 4.5 MYA divergence of *E. hoserae* sp. nov. from the other five species also until now treated as putative *E. subradiatus* confirming the sense in treating *E. hoserae* sp. nov. as a species rather than a subspecies.

Distribution: *E. hoserae* sp. nov. is confined to Alor Island, Provinsi Nusa Tenggara Timur, Indonesia.

Etymology: *E. hoserae* sp. nov. is named in honour of my mother, Katrina Hoser, of Lane Cove, New South Wales, Australia in recognition of enormous contributions to herpetology spanning many decades.

EUANEDWARDSSERPENS EUANEDWARDSI SP. NOV.

LSIDDurn:lsid:zoobank.org:act:31202998-C2BA-49C3-B47D-297E9DB9CC4B

Holotype: A preserved specimen at the Museum of Vertebrate Zoology at the University of California, Berkeley, California, USA, specimen number MVZ:Herp:292831 collected from Desa Tolotangga, Kecamatan Monta, Kabupaten Bima, Sumbawa Island, Provinsi Nusa Tenggara Barat, Indonesia, Latitude -08.76643 S., Longitude 118.60496 E. Snout vent length (SV) is 1345 mm, tail length 252 mm, weight 546.6 grams.

This facility allows access to its holdings.

Paratype: A preserved specimen at the Museum of Vertebrate Zoology at the University of California, Berkeley, California, USA, specimen number MVZ:Herp:292830 collected from Desa Bolo, Kecamatan Bolo, Kabupaten Bima, Sumbawa Island, Provinsi Nusa Tenggara Barat, Indonesia, Latitude -08.51034 S., Longitude 118.59798 E. Snout vent length (SV) is 1170 mm, tail length 230 mm.

Diagnosis: Until now each of *Euanedwardsserpens euanedwardsi* sp. nov., *E. hoserae* sp. nov., *E. floresensis* sp. nov., *E. wetarensis* sp. nov. and *E. sumbaensis* sp. nov. have all been treated as populations of *Euanedwardsserpens subradiatus* (Schlegel, 1837), a species still more widely known as *Coelognathus subradiatus* (Schlegel, 1837) or *Elaphe subradiatus* (Schlegel, 1837), otherwise known as the Lesser Sundas Rat Snake.

Because of the significant variation in specimens both by age and within a single population, diagnosing the relevant species has not been attempted until now. However each of the following six species can be separated from one another as follows:

Euanedwardsserpens subradiatus (Schlegel, 1837) from Timor and immediately adjacent islands, including Roti Island to the south, is separated from the other five species by the following unique suite of characters:

Medium to light brown dorsally with a strong russet tinge, always a well defined black line running from the eye, posteriorly to the

rear of the head at the upper labial, where there is an obvious break before one or more lines commence and run down the body in one or more longitudinal lines or rows of broken spots in a longitudinal manner. These markings usually stop or fade about 1/3 of the way down the body, after which the snake is generally unmarked. Top of head is brownish and unmarked. Upper labials are yellowish. Iris is a dark reddish brown in colour.

E. hoserae sp. nov. from Alor Island and possibly Pantar Island to the immediate west is separated from the other five species by the following unique suite of characters:

The dorsum is a light yellowish brown to beige in colour and without any russet tinge. The top of the head has a pair of distinct black spots on the central edge of each of the supraciliaries. The black line running posteriorly from the eye to the upper labial is relatively short and ends on the second upper labial past the eye. Back of head may have some semi-distinct black marks but the upper neck is unmarked. About two head lengths down the body irregular black markings arrange in a longitudinal manner in two irregular longitudinal lines on either side of the median line, before breaking up about a third of the way down the body.

A light yellowish-brown iris.

E. euanedwardsi sp. nov. from Sumbawa Island and Lombok to the west is separated from the other five species by the following unique suite of characters:

Dorsal surface of head and neck is an olive brown, becoming slightly reddish brown posteriorly from about a third of the way down the body.

The head is generally devoid of markings. There is a very indistinct and short, narrow dark brown streak running from behind the middle of the eye, posteriorly down the two adjacent labials to about halfway down the second labial. Lower parts of all upper labials are white, turning brown higher, but without a well-defined boundary. Commencing about 2-3 head lengths down the neck from the back of the head are two rows of spotted scales, forming broken longitudinal lines running down the first half of the body length, before disappearing. About five head lengths past the back of the head are two similar lines of dots running in similar dotted longitudinal lines along each of the flanks along the middle of each. These become as prominent as those near the mid-dorsal line but also fade lower down the body. Iris is a dull orange-brown colour.

E. floresensis sp. nov. from Flores, Komodo, Rinca, Adonara and Lembata is similar in most respects to *E. euanedwardsi* sp. nov. as described above, but is separated from that species by having a yellowish tinge in colour at the anterior end of the body, grading through brown to become a dark reddish brown posteriorly; lower flanks invariably have one or more dark blotches, sometimes in a longitudinal array; some black spots on the upper dorsum may be expanded to be significantly larger than most of the rest in the longitudinal array and the iris is a light yellow with orange tinge, to light orange in colour.

E. wetarensis sp. nov. from Wetar Island is similar in most respects to *E. subradiatus* as described above, but is separated from that species by being olive brown dorsally, becoming slightly darker at the rear body, with spotting and broken lines and the like far more prominent on the flanks than on the dorsum, invariably aligned in a linear manner and far more prominent on the anterior third to half of the body; top of head brownish, upper labials yellowish and iris is a medium yellowish-brown colour.

E. sumbaensis sp. nov. from Sumba Island is similar in most respects to *E. subradiatus* as described above, but is separated from that species (and *E. wetarensis* sp. nov.) by being a dark olive-brown dorsally, with spotting and broken lines and the like more prominent on the dorsum than the flanks, being well-defined and black, (versus dark-brown to off-black in the other two species) and a dark brown iris.

E. subradiatus (Schlegel, 1837), *E. adelynhoserae* sp. nov., *E. euanedwardsi* sp. nov., *E. floresensis* sp. nov., *E. wetarensis* sp. nov. and *E. sumbaensis* sp. nov. are separated from all other species within *Euanedwardsserpens* Hoser, 2012 by the

following suite of characters:

Rostral much broader than deep; internasals as long as broad or a little broader, shorter than the prefrontals; frontal one and one sixth to one and a half as long as broad, as long as or a little shorter than its distance from the end of the snout, shorter than the parietals; loreal usually longer than deep; a subocular below the ocular; two postoculars; temporals usually 2+2; eight or nine upper labials, fifth and sixth labials entering the eye; four or five lower labials in contact with the anterior chin-shields, which are much shorter than the posterior ones; scales in 23 or 25 rows (25 or 27 on the neck), more or less strongly keeled on the posterior half of the body, the outer series without a trace of a keel. 228-242 ventrals which have an obtuse lateral keel; anal entire; subcaudals 80-100 (all divided). A dorsum that is brownish above, with sometimes with black flecks, spotting or stripes that may tend to form a pair of black stripes along each side of the anterior third of the body, either on the dorsum, the flanks or both; a short black streak of some sort is usually seen behind the eye; lower parts uniform yellowish (effectively modified from Boulenger 1894 and De Lang 2011).

Snakes in the genus *Euanedwardsserpens* Hoser, 2012, were defined as follows:

“Diagnosis: A group large ratsnakes found in the Southeast Asian region, typified by a vertically compressed body and an angled relatively pointed head and snout. Often defensive (interpreted commonly as “aggressive”) to people when encountered and to a greater degree than most other ratsnake genera, with specimens commonly struggling against the handler if handled.

Helpfenberger (2001) separated *Coelognathus* from the other Eurasian ratsnakes based on anatomical and osteological features as well as electrophoretic loci and used this to diagnose that genus *sensu lato*, including (in effect) the genera *Euanedwardsserpens* *gen. nov.* and *Cynophis* in terms of their common attributes.

This information is relied upon herein as part of this diagnosis as relevant.

These snakes are medium to large and relatively long and slender, have correspondingly high ventral scale and precaudal vertebra counts and have a distinctly long and slender head, which separates them from all other ratsnake genera except *Orthriophis*. However these genera are easily separated by viewing the head colouration. In *Orthriophis* the post-orbital stripe runs more-or-less parallel with the jawline, whereas in *Coelognathus* it distinctly points downwards towards the back of the jaw, although this may be either broken, or one of two such lines, the other running in an upward direction.

If in any doubt, *Orthriophis* is also separated from the genera *Coelognathus*, *Cyanophis* and *Euanedwardsserpens* *gen. nov.* by having a divided anal plate as opposed to a single one.

Snakes of the ratsnake genus *Gonyosoma* Wagler, 1828 also have a divided anal.

Separation of the three relevant genera (namely *Coelognathus*, *Cyanophis* and *Euanedwardsserpens* *gen. nov.*) is done as follows:

The species *Coelognathus radiatus* (now the entire content of that genus as defined herein) is separated from all other Asian ratsnakes (including those of genera *Cyanophis* and *Euanedwardsserpens* *gen. nov.*) by having a short interpulmonary bronchus (see plate 1A-D, Fig 4, Tables 1-2 in Utiger *et al.* 2005).

Snakes of the genera *Coelognathus* and *Euanedwardsserpens* *gen. nov.* as defined herein always have three supralabials in contact with the eye. By contrast *Cyanophis helena* does not.

Coelognathus radiatus also differs from the other relevant taxa (*Cyanophis* and *Euanedwardsserpens* *gen. nov.*) by the possession of a relatively short and stout hemipenis, versus long, slender and subcylindrical (sometimes tapering distally) (particularly) in the snakes of the genus *Euanedwardsserpens* *gen. nov.*

If the snake does not identify as being within the genera *Coelognathus* or *Cyanophis* it will be in the genus *Euanedwardsserpens* *gen. nov.*”

E. subradiatus (Schlegel, 1837) from Timor and Roti Island is depicted in life in De Lang (2011) on pages 81 and 82 and online at:

<https://www.inaturalist.org/observations/5202489>
and

<https://www.inaturalist.org/observations/5202442>

E. hoserae *sp. nov.* from Alor island is depicted in life in Reilly *et al.* (2021) on page 270.

E. euanedwardsi *sp. nov.* from Sumbawa and Lombok is depicted in life online at:

<https://www.inaturalist.org/observations/14932611>
and

<https://www.inaturalist.org/observations/100236888>

E. floresensis *sp. nov.* from Rinca and Flores is depicted in life in De Lang (2011) on pages 77-79 and online at:

<https://www.inaturalist.org/observations/82422738>

E. sumbaensis *sp. nov.* is depicted in life in Maryanto *et al.* (2021) on page 68 top left.

Reilly *et al.* (2021) found a 3.6 MYA divergence of *E. euanedwardsi* *sp. nov.* from nominate *E. subradiatus* and a divergence of 1.6 MYA from *E. floresensis* *sp. nov.*, being the closest related species, confirming the sense in treating *E. euanedwardsi* *sp. nov.* as a full species rather than as a subspecies.

Distribution: *E. euanedwardsi* *sp. nov.* is confined to Sumbawa and Lombok islands, Indonesia.

Etymology: *E. euanedwardsi* *sp. nov.* is named in honour of Euan Edwards of Robina (Gold Coast), Queensland, Australia in recognition of many decades of important work involving herpetology and wildlife conservation worldwide.

EUANEDWARDSSERPENS FLORESENSIS SP. NOV.

LSIDurn:lsid:zoobank.org:act:FC762839-EAC6-4280-AFEE-9EBDBDCF9915

Holotype: A preserved specimen at the Museum of Vertebrate Zoology at the University of California, Berkeley, California, USA, specimen number MVZ:Herp:292829 collected from Desa Mataloko, Kecamatan Golewa, Kabupaten Ngada, Flores Island, Provinsi Nusa Tenggara Timur, Indonesia, Latitude -08.82344 S., Longitude 121.04986 E. at 1103 metres elevation. This facility allows access to its holdings.

Paratypes: 1/ A preserved specimen (1510 mm in total length) at the University of Florida at the Florida Museum of Natural History, Florida, USA, specimen number UF Herp 36202 collected from 4.5 km east of Maumere, Flores Island, Provinsi Nusa Tenggara Timur, Indonesia. 2/ A preserved specimen at the University of Florida at the Florida Museum of Natural History, Florida, USA, specimen number UF Herp 39778 collected from near Djarek, Flores Island, Provinsi Nusa Tenggara Timur, Indonesia at an elevation of 80 metres. 3/ A preserved male specimen at the Natural History Museum, London, UK, specimen number BMNH 1897.6.21.46, collected from Flores Island Provinsi Nusa Tenggara Timur, Indonesia. 4/ Two preserved specimens at the Naturalis Biodiversity Center, The Netherlands, specimen number ZMA.RENA.16874 collected from Larantoeke, East Flores Island, Provinsi Nusa Tenggara Timur, Indonesia. 5/ A preserved specimen at the Naturalis Biodiversity Center, The Netherlands, specimen number ZMA.RENA.16871 collected from Sikka, Flores Island, Provinsi Nusa Tenggara Timur, Indonesia.

Diagnosis: Until now each of *Euanedwardsserpens floresensis* *sp. nov.*, *E. euanedwardsi* *sp. nov.*, *E. hoserae* *sp. nov.*, *E. wetarensis* *sp. nov.* and *E. sumbaensis* *sp. nov.* have all been treated as populations of *Euanedwardsserpens subradiatus* (Schlegel, 1837), a species still more widely known as *Coelognathus subradiatus* (Schlegel, 1837) or *Elaphe subradiatus* (Schlegel, 1837), otherwise known as the Lesser

Sundas Rat Snake.

Because of the significant variation in specimens both by age and within a single population, diagnosing the relevant species has not been attempted until now. However each of the following six species can be separated from one another as follows:

Euanedwardsserpens subradiatus (Schlegel, 1837) from Timor and immediately adjacent islands, including Roti Island to the south, is separated from the other five species by the following unique suite of characters:

Medium to light brown dorsally with a strong russet tinge, always a well defined black line running from the eye, posteriorly to the rear of the head at the upper labial, where there is an obvious break before one or more lines commence and run down the body in one or more longitudinal lines or rows of broken spots in a longitudinal manner. These markings usually stop or fade about 1/3 of the way down the body, after which the snake is generally unmarked. Top of head is brownish and unmarked. Upper labials are yellowish. Iris is a dark reddish brown in colour.

E. hoseræ sp. nov. from Alor Island and possibly Pantar Island to the immediate west is separated from the other five species by the following unique suite of characters:

The dorsum is a light yellowish brown to beige in colour and without any russet tinge. The top of the head has a pair of distinct black spots on the central edge of each of the supraciliaries. The black line running posteriorly from the eye to the upper labial is relatively short and ends on the second upper labial past the eye. Back of head may have some semi-distinct black marks but the upper neck is unmarked. About two head lengths down the body irregular black markings arrange in a longitudinal manner in two irregular longitudinal lines on either side of the median line, before breaking up about a third of the way down the body.

A light yellowish-brown iris.

E. euanedwardsi sp. nov. from Sumbawa Island and Lombok to the west is separated from the other five species by the following unique suite of characters:

Dorsal surface of head and neck is an olive brown, becoming slightly reddish brown posteriorly from about a third of the way down the body.

The head is generally devoid of markings. There is a very indistinct and short, narrow dark brown streak running from behind the middle of the eye, posteriorly down the two adjacent labials to about halfway down the second labial. Lower parts of all upper labials are white, turning brown higher, but without a well-defined boundary. Commencing about 2-3 head lengths down the neck from the back of the head are two rows of spotted scales, forming broken longitudinal lines running down the first half of the body length, before disappearing. About five head lengths past the back of the head are two similar lines of dots running in similar dotted longitudinal lines along each of the flanks along the middle of each. These become as prominent as those near the mid-dorsal line but also fade lower down the body. Iris is a dull orange-brown colour.

E. floresensis sp. nov. from Flores, Komodo, Rinca, Adonara and Lembata is similar in most respects to *E. euanedwardsi* sp. nov. as described above, but is separated from that species by having a yellowish tinge in colour at the anterior end of the body, grading through brown to become a dark reddish brown posteriorly; lower flanks invariably have one or more dark blotches, sometimes in a longitudinal array; some black spots on the upper dorsum may be expanded to be significantly larger than most of the rest in the longitudinal array and the iris is a light yellow with orange tinge, to light orange in colour.

E. wetarensis sp. nov. from Wetar Island is similar in most respects to *E. subradiatus* as described above, but is separated from that species by being olive brown dorsally, becoming slightly darker at the rear body, with spotting and broken lines and the like far more prominent on the flanks than on the dorsum, invariably aligned in a linear manner and far more prominent on the anterior third to half of the body; top of head brownish, upper labials yellowish and iris is a medium yellowish-brown colour.

E. sumbaensis sp. nov. from Sumba Island is similar in most respects to *E. subradiatus* as described above, but is separated from that species (and *E. wetarensis* sp. nov.) by being a dark olive-brown dorsally, with spotting and broken lines and the like more prominent on the dorsum than the flanks, being well-defined and black, (versus dark-brown to off-black in the other two species) and a dark brown iris.

E. subradiatus (Schlegel, 1837), *E. adelynhoserae* sp. nov., *E. euanedwardsi* sp. nov., *E. floresensis* sp. nov., *E. wetarensis* sp. nov. and *E. sumbaensis* sp. nov. are separated from all other species within *Euanedwardsserpens* Hoser, 2012 by the following suite of characters:

Rostral much broader than deep; internasals as long as broad or a little broader, shorter than the prefrontals; frontal one and one sixth to one and a half as long as broad, as long as or a little shorter than its distance from the end of the snout, shorter than the parietals; loreal usually longer than deep; a subocular below the ocular; two postoculars; temporals usually 2+2; eight or nine upper labials, fifth and sixth labials entering the eye; four or five lower labials in contact with the anterior chin-shields, which are much shorter than the posterior ones; scales in 23 or 25 rows (25 or 27 on the neck), more or less strongly keeled on the posterior half of the body, the outer series without a trace of a keel. 228-242 ventrals which have an obtuse lateral keel; anal entire; subcaudals 80-100 (all divided). A dorsum that is brownish above, with sometimes with black flecks, spotting or stripes that may tend to form a pair of black stripes along each side of the anterior third of the body, either on the dorsum, the flanks or both; a short black streak of some sort is usually seen behind the eye; lower parts uniform yellowish (effectively modified from Boulenger 1894 and De Lang 2011).

Snakes in the genus *Euanedwardsserpens* Hoser, 2012, were defined as follows:

“Diagnosis: A group large ratsnakes found in the Southeast Asian region, typified by a vertically compressed body and an angled relatively pointed head and snout. Often defensive (interpreted commonly as “aggressive”) to people when encountered and to a greater degree than most other ratsnake genera, with specimens commonly struggling against the handler if handled.

Helfenberger (2001) separated *Coelognathus* from the other Eurasian ratsnakes based on anatomical and osteological features as well as electrophoretic loci and used this to diagnose that genus *sensu lato*, including (in effect) the genera *Euanedwardsserpens* gen. nov. and *Cynophis* in terms of their common attributes.

This information is relied upon herein as part of this diagnosis as relevant.

These snakes are medium to large and relatively long and slender, have correspondingly high ventral scale and precaudal vertebra counts and have a distinctly long and slender head, which separates them from all other ratsnake genera except *Orthriophis*. However these genera are easily separated by viewing the head colouration. In *Orthriophis* the post-orbital stripe runs more-or-less parallel with the jawline, whereas in *Coelognathus* it distinctly points downwards towards the back of the jaw, although this may be either broken, or one of two such lines, the other running in an upward direction.

If in any doubt, *Orthriophis* is also separated from the genera *Coelognathus*, *Cyanophis* and *Euanedwardsserpens* gen. nov. by having a divided anal plate as opposed to a single one.

Snakes of the ratsnake genus *Gonyosoma* Wagler, 1828 also have a divided anal.

Separation of the three relevant genera (namely *Coelognathus*, *Cyanophis* and *Euanedwardsserpens* gen. nov.) is done as follows:

The species *Coelognathus radiatus* (now the entire content of that genus as defined herein) is separated from all other Asian ratsnakes (including those of genera *Cyanophis* and *Euanedwardsserpens* gen. nov.) by having a short

interpulmonary bronchus (see plate 1A-D, Fig 4, Tables 1-2 in Utiger *et al.* 2005).

Snakes of the genera *Coelognathus* and *Euanedwardsserpens* *gen. nov.* as defined herein always have three supralabials in contact with the eye. By contrast *Cyanophis helena* does not. *Coelognathus radiatus* also differs from the other relevant taxa (*Cyanophis* and *Euanedwardsserpens* *gen. nov.*) by the possession of a relatively short and stout hemipenis, versus long, slender and subcylindrical (sometimes tapering distally) (particularly) in the snakes of the genus *Euanedwardsserpens* *gen. nov.*.

If the snake does not identify as being within the genera *Coelognathus* or *Cyanophis* it will be in the genus *Euanedwardsserpens* *gen. nov.*"

E. subradiatus (Schlegel, 1837) from Timor and Roti Island is depicted in life in De Lang (2011) on pages 81 and 82 and online at:

<https://www.inaturalist.org/observations/5202489>
and

<https://www.inaturalist.org/observations/5202442>

E. hoserae *sp. nov.* from Alor island is depicted in life in Reilly *et al.* (2021) on page 270.

E. euanedwardsi *sp. nov.* from Sumbawa and Lombok is depicted in life online at:

<https://www.inaturalist.org/observations/14932611>
and

<https://www.inaturalist.org/observations/100236888>

E. floresensis *sp. nov.* from Rinca and Flores is depicted in life in De Lang (2011) on pages 77-79 and online at:

<https://www.inaturalist.org/observations/82422738>

E. sumbaensis *sp. nov.* is depicted in life in Maryanto *et al.* (2021) on page 68 top left.

Reilly *et al.* (2021) found a 3.6 MYA divergence of *E. floresensis* *sp. nov.* from nominate *E. subradiatus* and a divergence of 1.6 MYA from *E. euanedwardsi* *sp. nov.*, being the closest related species, confirming the sense in treating *E. floresensis* *sp. nov.* as a full species rather than as a subspecies.

Distribution: *E. floresensis* *sp. nov.* is a taxon confined to Flores, Komodo, Rinca, Adonara and Lembata.

Etymology: The new species is named in reflection of the largest and best-known island from where it occurs and also in reflection of the type locality.

EUANEDWARDSSERPENS WETARENSIS SP. NOV.

LSIDurn:lsid:zoobank.org:act:4873FD9F-9857-4115-B9B0-7983B5B5C191

Holotype: A preserved specimen at the Museum of Vertebrate Zoology at the University of California, Berkeley, California, USA, specimen number MVZ: Herp:292833 collected from Wetar Desa Ilwaki, Kecamatan Wetar Selatan, Kabupaten Maluku Barat Daya, Provinsi Maluku, Indonesia, Latitude -7.92627 S., Longitude 126.40800 E.

This facility allows access to its holdings.

Diagnosis: Until now each of *Euanedwardsserpens wetarensis* *sp. nov.*, *E. euanedwardsi* *sp. nov.*, *E. hoserae* *sp. nov.*, *E. floresensis* *sp. nov.* and *E. sumbaensis* *sp. nov.* have all been treated as populations of *Euanedwardsserpens subradiatus* (Schlegel, 1837), a species still more widely known as *Coelognathus subradiatus* (Schlegel, 1837) or *Elaphe subradiatus* (Schlegel, 1837), otherwise known as the Lesser Sundas Rat Snake.

Because of the significant variation in specimens both by age and within a single population, diagnosing the relevant species has not been attempted until now. However each of the following six species can be separated from one another as follows:

Euanedwardsserpens subradiatus (Schlegel, 1837) from Timor and immediately adjacent islands, including Roti Island to the south, is separated from the other five species by the following unique suite of characters:

Medium to light brown dorsally with a strong russet tinge, always a well defined black line running from the eye, posteriorly to the rear of the head at the upper labial, where there is an obvious break before one or more lines commence and run down the body in one or more longitudinal lines or rows of broken spots in a longitudinal manner. These markings usually stop or fade about 1/3 of the way down the body, after which the snake is generally unmarked. Top of head is brownish and unmarked. Upper labials are yellowish. Iris is a dark reddish brown in colour.

E. hoserae *sp. nov.* from Alor Island and possibly Pantar Island to the immediate west is separated from the other five species by the following unique suite of characters:

The dorsum is a light yellowish brown to beige in colour and without any russet tinge. The top of the head has a pair of distinct black spots on the central edge of each of the supraciliaries. The black line running posteriorly from the eye to the upper labial is relatively short and ends on the second upper labial past the eye. Back of head may have some semi-distinct black marks but the upper neck is unmarked. About two head lengths down the body irregular black markings arrange in a longitudinal manner in two irregular longitudinal lines on either side of the median line, before breaking up about a third of the way down the body.

A light yellowish-brown iris.

E. euanedwardsi *sp. nov.* from Sumbawa Island and Lombok to the west is separated from the other five species by the following unique suite of characters:

Dorsal surface of head and neck is an olive brown, becoming slightly reddish brown posteriorly from about a third of the way down the body.

The head is generally devoid of markings. There is a very indistinct and short, narrow dark brown streak running from behind the middle of the eye, posteriorly down the two adjacent labials to about halfway down the second labial. Lower parts of all upper labials are white, turning brown higher, but without a well-defined boundary. Commencing about 2-3 head lengths down the neck from the back of the head are two rows of spotted scales, forming broken longitudinal lines running down the first half of the body length, before disappearing. About five head lengths past the back of the head are two similar lines of dots running in similar dotted longitudinal lines along each of the flanks along the middle of each. These become as prominent as those near the mid-dorsal line but also fade lower down the body. Iris is a dull orange-brown colour.

E. floresensis *sp. nov.* from Flores, Komodo, Rinca, Adonara and Lembata is similar in most respects to *E. euanedwardsi* *sp. nov.* as described above, but is separated from that species by having a yellowish tinge in colour at the anterior end of the body, grading through brown to become a dark reddish brown posteriorly; lower flanks invariably have one or more dark blotches, sometimes in a longitudinal array; some black spots on the upper dorsum may be expanded to be significantly larger than most of the rest in the longitudinal array and the iris is a light yellow with orange tinge, to light orange in colour.

E. wetarensis *sp. nov.* from Wetar Island is similar in most respects to *E. subradiatus* as described above, but is separated from that species by being olive brown dorsally, becoming slightly darker at the rear body, with spotting and broken lines and the like far more prominent on the flanks than on the dorsum, invariably aligned in a linear manner and far more prominent on the anterior third to half of the body; top of head brownish, upper labials yellowish and iris is a medium yellowish-brown colour.

E. sumbaensis *sp. nov.* from Sumba Island is similar in most respects to *E. subradiatus* as described above, but is separated from that species (and *E. wetarensis* *sp. nov.*) by being a dark olive-brown dorsally, with spotting and broken lines and the like more prominent on the dorsum than the flanks, being well-defined and black, (versus dark-brown to off-black in the other two species) and a dark brown iris.

E. subradiatus (Schlegel, 1837), *E. adelynhoserae* *sp. nov.*, *E. euanedwardsi* *sp. nov.*, *E. floresensis* *sp. nov.*, *E. wetarensis*

sp. nov. and *E. sumbaensis sp. nov.* are separated from all other species within *Euanedwardsserpens* Hoser, 2012 by the following suite of characters:

Rostral much broader than deep; internasals as long as broad or a little broader, shorter than the prefrontals; frontal one and one sixth to one and a half as long as broad, as long as or a little shorter than its distance from the end of the snout, shorter than the parietals; loreal usually longer than deep; a subocular below the ocular; two postoculars; temporals usually 2+2; eight or nine upper labials, fifth and sixth labials entering the eye; four or five lower labials in contact with the anterior chin-shields, which are much shorter than the posterior ones; scales in 23 or 25 rows (25 or 27 on the neck), more or less strongly keeled on the posterior half of the body, the outer series without a trace of a keel. 228-242 ventrals which have an obtuse lateral keel; anal entire; subcaudals 80-100 (all divided). A dorsum that is brownish above, with sometimes with black flecks, spotting or stripes that may tend to form a pair of black stripes along each side of the anterior third of the body, either on the dorsum, the flanks or both; a short black streak of some sort is usually seen behind the eye; lower parts uniform yellowish (effectively modified from Boulenger 1894 and De Lang 2011).

Snakes in the genus *Euanedwardsserpens* Hoser, 2012, were defined as follows:

“Diagnosis: A group large ratsnakes found in the Southeast Asian region, typified by a vertically compressed body and an angled relatively pointed head and snout. Often defensive (interpreted commonly as “aggressive”) to people when encountered and to a greater degree than most other ratsnake genera, with specimens commonly struggling against the handler if handled.

Helfenberger (2001) separated *Coelognathus* from the other Eurasian ratsnakes based on anatomical and osteological features as well as electrophoretic loci and used this to diagnose that genus *sensu lato*, including (in effect) the genera *Euanedwardsserpens gen. nov.* and *Cynophis* in terms of their common attributes.

This information is relied upon herein as part of this diagnosis as relevant.

These snakes are medium to large and relatively long and slender, have correspondingly high ventral scale and precaudal vertebra counts and have a distinctly long and slender head, which separates them from all other ratsnake genera except *Orthriophis*. However these genera are easily separated by viewing the head colouration. In *Orthriophis* the post-orbital stripe runs more-or-less parallel with the jawline, whereas in *Coelognathus* it distinctly points downwards towards the back of the jaw, although this may be either broken, or one of two such lines, the other running in an upward direction.

If in any doubt, *Orthriophis* is also separated from the genera *Coelognathus*, *Cyanophis* and *Euanedwardsserpens gen. nov.* by having a divided anal plate as opposed to a single one.

Snakes of the ratsnake genus *Gonyosoma* Wagler, 1828 also have a divided anal.

Separation of the three relevant genera (namely *Coelognathus*, *Cyanophis* and *Euanedwardsserpens gen. nov.*) is done as follows:

The species *Coelognathus radiatus* (now the entire content of that genus as defined herein) is separated from all other Asian ratsnakes (including those of genera *Cyanophis* and *Euanedwardsserpens gen. nov.*) by having a short interpulmonary bronchus (see plate 1A-D, Fig 4, Tables 1-2 in Utiger *et. al.* 2005).

Snakes of the genera *Coelognathus* and *Euanedwardsserpens gen. nov.* as defined herein always have three supralabials in contact with the eye. By contrast *Cyanophis helena* does not.

Coelognathus radiatus also differs from the other relevant taxa (*Cyanophis* and *Euanedwardsserpens gen. nov.*) by the possession of a relatively short and stout hemipenis, versus long, slender and subcylindrical (sometimes tapering distally

(particularly) in the snakes of the genus *Euanedwardsserpens gen. nov.*

If the snake does not identify as being within the genera *Coelognathus* or *Cyanophis* it will be in the genus *Euanedwardsserpens gen. nov.*”

E. subradiatus (Schlegel, 1837) from Timor and Roti Island is depicted in life in De Lang (2011) on pages 81 and 82 and online at:

<https://www.inaturalist.org/observations/5202489>

and

<https://www.inaturalist.org/observations/5202442>

E. hoserae sp. nov. from Alor island is depicted in life in Reilly *et al.* (2021) on page 270.

E. euanedwardsi sp. nov. from Sumbawa and Lombok is depicted in life online at:

<https://www.inaturalist.org/observations/14932611>

and

<https://www.inaturalist.org/observations/100236888>

E. floresensis sp. nov. from Rinca and Flores is depicted in life in De Lang (2011) on pages 77-79 and online at:

<https://www.inaturalist.org/observations/82422738>

E. sumbaensis sp. nov. is depicted in life in Maryanto *et al.* (2021) on page 68 top left.

Reilly *et al.* (2021) found a 1.3 MYA divergence of *E. wetarensis sp. nov.* from nominate *E. subradiatus* and a divergence of 3.6 MYA from their next nearest related species, confirming the sense in treating *E. wetarensis sp. nov.* as a full species rather than as a subspecies.

Distribution: *E. wetarensis sp. nov.* is a taxon confined to Wetar Island, Indonesia.

Etymology: The new species is named in reflection of the island from where it occurs and also in reflection of the (same) type locality.

EUANEDWARDSSERPENS SUMBAENSIS SP. NOV.

LSIDurn:lsid:zoobank.org:act:9D8DF9D1-79B1-47F1-9B4F-9373C4196484

Holotype: A preserved specimen at the Naturalis Biodiversity Center, The Netherlands, specimen number ZMA.RENA.16876 collected from Kambera, Sumba Island, Indonesia.

Paratype: A preserved male specimen at the Museum of Natural History, London, UK, specimen number BMNH 1897.6.21.47, collected from Sumba Island, Indonesia.

Diagnosis: Until now each of *Euanedwardsserpens sumbaensis sp. nov.*, *E. euanedwardsi sp. nov.*, *E. hoserae sp. nov.*, *E. floresensis sp. nov.* and *E. wetarensis sp. nov.* have all been treated as populations of *Euanedwardsserpens subradiatus* (Schlegel, 1837), a species still more widely known as *Coelognathus subradiatus* (Schlegel, 1837) or *Elaphe subradiatus* (Schlegel, 1837), otherwise known as the Lesser Sunda Rat Snake.

Because of the significant variation in specimens both by age and within a single population, diagnosing the relevant species has not been attempted until now. However each of the following six species can be separated from one another as follows:

Euanedwardsserpens subradiatus (Schlegel, 1837) from Timor and immediately adjacent islands, including Roti Island to the south, is separated from the other five species by the following unique suite of characters:

Medium to light brown dorsally with a strong russet tinge, always a well defined black line running from the eye, posteriorly to the rear of the head at the upper labial, where there is an obvious break before one or more lines commence and run down the body in one or more longitudinal lines or rows of broken spots in a longitudinal manner. These markings usually stop or fade about 1/3 of the way down the body, after which the snake is generally unmarked. Top of head is brownish and unmarked. Upper labials are yellowish. Iris is a dark reddish brown in colour.

E. hoserae sp. nov. from Alor Island and possibly Pantar Island

to the immediate west is separated from the other five species by the following unique suite of characters:

The dorsum is a light yellowish brown to beige in colour and without any russet tinge. The top of the head has a pair of distinct black spots on the central edge of each of the supraciliaries. The black line running posteriorly from the eye to the upper labial is relatively short and ends on the second upper labial past the eye. Back of head may have some semi-distinct black marks but the upper neck is unmarked. About two head lengths down the body irregular black markings arrange in a longitudinal manner in two irregular longitudinal lines on either side of the median line, before breaking up about a third of the way down the body.

A light yellowish-brown iris.

E. euanedwardsi sp. nov. from Sumbawa Island and Lombok to the west is separated from the other five species by the following unique suite of characters:

Dorsal surface of head and neck is an olive brown, becoming slightly reddish brown posteriorly from about a third of the way down the body.

the head is generally devoid of markings. There is a very indistinct and short, narrow dark brown streak running from behind the middle of the eye, posteriorly down the two adjacent labials to about halfway down the second labial. Lower parts of all upper labials are white, turning brown higher, but without a well-defined boundary. Commencing about 2-3 head lengths down the neck from the back of the head are two rows of spotted scales, forming broken longitudinal lines running down the first half of the body length, before disappearing. About five head lengths past the back of the head are two similar lines of dots running in similar dotted longitudinal lines along each of the flanks along the middle of each. These become as prominent as those near the mid-dorsal line but also fade lower down the body. Iris is a dull orange-brown colour.

E. floresensis sp. nov. from Flores, Komodo, Rinca, Adonara and Lembata is similar in most respects to *E. euanedwardsi* sp. nov. as described above, but is separated from that species by having a yellowish tinge in colour at the anterior end of the body, grading through brown to become a dark reddish brown posteriorly; lower flanks invariably have one or more dark blotches, sometimes in a longitudinal array; some black spots on the upper dorsum may be expanded to be significantly larger than most of the rest in the longitudinal array and the iris is a light yellow with orange tinge, to light orange in colour.

E. wetarensis sp. nov. from Wetar Island is similar in most respects to *E. subradiatus* as described above, but is separated from that species by being olive brown dorsally, becoming slightly darker at the rear body, with spotting and broken lines and the like far more prominent on the flanks than on the dorsum, invariably aligned in a linear manner and far more prominent on the anterior third to half of the body; top of head brownish, upper labials yellowish and iris is a medium yellowish-brown colour.

E. sumbaensis sp. nov. from Sumba Island is similar in most respects to *E. subradiatus* as described above, but is separated from that species (and *E. wetarensis* sp. nov.) by being a dark olive-brown dorsally, with spotting and broken lines and the like more prominent on the dorsum than the flanks, being well-defined and black, (versus dark-brown to off-black in the other two species) and a dark brown iris.

E. subradiatus (Schlegel, 1837), *E. adelynhoserae* sp. nov., *E. euanedwardsi* sp. nov., *E. floresensis* sp. nov., *E. wetarensis* sp. nov. and *E. sumbaensis* sp. nov. are separated from all other species within *Euanedwardsserpens* Hoser, 2012 by the following suite of characters:

Rostral much broader than deep; internasals as long as broad or a little broader, shorter than the prefrontals; frontal one and one sixth to one and a half as long as broad, as long as or a little shorter than its distance from the end of the snout, shorter than the parietals; loreal usually longer than deep; a subocular below the ocular; two postoculars; temporals usually 2+2; eight or nine upper labials, fifth and sixth labials entering the eye;

four or five lower labials in contact with the anterior chin-shields, which are much shorter than the posterior ones; scales in 23 or 25 rows (25 or 27 on the neck), more or less strongly keeled on the posterior half of the body, the outer series without a trace of a keel. 228-242 ventrals which have an obtuse lateral keel; anal entire; subcaudals 80-100 (all divided). A dorsum that is brownish above, with sometimes with black flecks, spotting or stripes that may tend to form a pair of black stripes along each side of the anterior third of the body, either on the dorsum, the flanks or both; a short black streak of some sort is usually seen behind the eye; lower parts uniform yellowish (effectively modified from Boulenger 1894 and De Lang 2011).

Snakes in the genus *Euanedwardsserpens* Hoser, 2012, were defined as follows:

“Diagnosis: A group large ratsnakes found in the Southeast Asian region, typified by a vertically compressed body and an angled relatively pointed head and snout. Often defensive (interpreted commonly as “aggressive”) to people when encountered and to a greater degree than most other ratsnake genera, with specimens commonly struggling against the handler if handled.

Helffenberger (2001) separated *Coelognathus* from the other Eurasian ratsnakes based on anatomical and osteological features as well as electrophoretic loci and used this to diagnose that genus *sensu lato*, including (in effect) the genera *Euanedwardsserpens* gen. nov. and *Cyanophis* in terms of their common attributes.

This information is relied upon herein as part of this diagnosis as relevant.

These snakes are medium to large and relatively long and slender, have correspondingly high ventral scale and precaudal vertebra counts and have a distinctly long and slender head, which separates them from all other ratsnake genera except *Orthriophis*. However these genera are easily separated by viewing the head colouration. In *Orthriophis* the post-orbital stripe runs more-or-less parallel with the jawline, whereas is *Coelognathus* it distinctly points downwards towards the back of the jaw, although this may be either broken, or one of two such lines, the other running in an upward direction.

If in any doubt, *Orthriophis* is also separated from the genera *Coelognathus*, *Cyanophis* and *Euanedwardsserpens* gen. nov. by having a divided anal plate as opposed to a single one. Snakes of the ratsnake genus *Gonyosoma* Wagler, 1828 also have a divided anal.

Separation of the three relevant genera (namely *Coelognathus*, *Cyanophis* and *Euanedwardsserpens* gen. nov.) is done as follows:

The species *Coelognathus radiatus* (now the entire content of that genus as defined herein) is separated from all other Asian ratsnakes (including those of genera *Cyanophis* and *Euanedwardsserpens* gen. nov.) by having a short interpulmonary bronchus (see plate 1A-D, Fig 4, Tables 1-2 in Utiger *et. al.* 2005).

Snakes of the genera *Coelognathus* and *Euanedwardsserpens* gen. nov. as defined herein always have three supralabials in contact with the eye. By contrast *Cyanophis helena* does not.

Coelognathus radiatus also differs from the other relevant taxa (*Cyanophis* and *Euanedwardsserpens* gen. nov.) by the possession of a relatively short and stout hemipenis, versus long, slender and subcylindrical (sometimes tapering distally) (particularly) in the snakes of the genus *Euanedwardsserpens* gen. nov..

If the snake does not identify as being within the genera *Coelognathus* or *Cyanophis* it will be in the genus *Euanedwardsserpens* gen. nov.”

E. subradiatus (Schlegel, 1837) from Timor and Roti Island is depicted in life in De Lang (2011) on pages 81 and 82 and online at:

<https://www.inaturalist.org/observations/5202489>

and

<https://www.inaturalist.org/observations/5202442>

E. hoseræ sp. nov. from Alor island is depicted in life in Reilly *et al.* (2021) on page 270.

E. euanedwardsi sp. nov. from Sumbawa and Lombok is depicted in life online at:

<https://www.inaturalist.org/observations/14932611>

and

<https://www.inaturalist.org/observations/100236888>

E. floresensis sp. nov. from Rinca and Flores is depicted in life in De Lang (2011) on pages 77-79 and online at:

<https://www.inaturalist.org/observations/82422738>

E. sumbaensis sp. nov. is depicted in life in Maryanto *et al.* (2021) on page 68 top left.

Distribution: *E. sumbaensis* sp. nov. is only known from Sumba Island, Indonesia.

Etymology: *E. sumbaensis* sp. nov. is named in reflection of its type locality and the only known or expected distribution.

CONSERVATION

Each of the preceding five new species and the other related taxon, *E. subradiatus* (Schlegel, 1837) are believed to be reasonably common where they occur and not under any known existential threat.

However it is common knowledge that island populations are most vulnerable to extinctions (see for example the cases in Hoser, 1991).

They are particularly vulnerable to introduced predators and/or competing species to which they may not have evolved adequate protection from.

Due to the range restricted nature of each species and their vulnerabilities, they should be treated as vulnerable species and managed accordingly.

Aspects of conservation of Australasian reptiles discussed by Hoser (1989, 1991, 1993 and 1996) apply to these species, as do the comments of Hoser (2019a, 2019b).

The lesser Sundas have been long neglected by zoologists and conservation agencies alike and there remains a huge amount of formally undescribed taxa on various islands including of prominent species (Hoser 2022, Reilly *et al.* 2017, 2019a, 2019b, 2021).

Identification of and naming of the relevant species is the first and most important step in terms of the long term conservation of each.

It is important that each species is named once and only once!

They should not be subjected to unwarranted taxonomic vandalism as being practiced by the Wolfgang Wüster gang as detailed by Cogger (2014), Dubois (2014), Dubois *et al.* (1988), Hoser (2007, 2009, 2012a-c, 2013, 2015a-f, 2017, 2019a-b), Hawkeswood (2021) and ICZN (2021).

The ICZN formally rejected the Wolfgang Wüster gang's many applications (e.g. Kaiser, 2012, 2013, 2014a-b, Kaiser *et al.* 2012, 2013 and Rhodin *et al.* 2015) to overwrite names of myself (Hoser) and others (ICZN 2021) and their other anti-science and anti-wildlife conservation actions.

The ICZN stated that all names of Hoser and others subject of the Wüster gang's unlawful attacks were valid and available, without need to formally make a plenary ruling to effect what was already in effect and obvious.

Separately Hawkeswood (2021) said exactly the same thing.

This is not the first time the ICZN have had to deal with the Wolfgang Wüster gang's immoral, anti-science and anti-conservation actions.

In 1991, the same gang of thieves were ruled against by the ICZN in the matter of names proposed by Wells and Wellington in 1984, 1985a and 1985b.

Notwithstanding the ruling of the ICZN in 1991 (ICZN 1991), in favour of Wells and Wellington's works and a second ruling in their favour in 2001 (ICZN 2001) arising from Sprackland *et al.*

(1997) and the ongoing availability of the Wells and Wellington names to the biological sciences, the group known as the Wolfgang Wüster gang of thieves have pressured publishing authors not to use or adopt the Wells and Wellington names (see Hoser 2007, 2009, 2012a, 2012c, 2013, 2015 a-f, 2017, 2019a-b) and more recently those I have formally proposed (see Hoser, 2001a, 2001b).

This attack has been at numerous levels, ranging from control of editors of journals, lies, defamation and a number of other anti-science tactics (see also Shine 1987, Sprackland *et al.* 1997).

Following on from the ICZN ruling of 2021 (ICZN 2021), the scourge of the Wolfgang Wüster's gang of thieves actions should now be removed from the biological sciences and before any of the five species newly named here become threatened with extinction as a result.

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CONFLICT OF INTEREST

None.

Cite this paper as:

Hoser, R. T. 2022. *Euanedwardsserpens subradiatus* (Schlegel, 1837) revisited and formally divided into six allopatric species based on morphological and genetic divergence. *Australasian Journal of Herpetology* 58:28-39.

Australasian Journal of Herpetology®

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Two new species of Cobra from South-east Asia (Serpentes: Elapidae: *Naja*).

LSIDURN:LSID:ZOOBANK.ORG:PUB:8619509E-1EAB-42E3-87DC-B6BD094F3A71

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Received 1 April 2022, Accepted 15 June 2022, Published 28 June 2022.

ABSTRACT

In spite of a significant amount of interest in True Cobras, genus *Naja* Laurenti, 1768, including numerous taxonomic works over the past 200 years, new forms await discovery and formal identification. Recently named true cobras include *Boulengerina adelynhoserae* Hoser, 2013 and *Boulengerina jackyhoserae* Hoser, 2013. I note that recently a notorious criminal Welsh Wolfgang Wüster with an interest in venomous snakes has illegally coined some non-ICZN names in an unscientific publication for the same taxa. Those names should be ignored as they are at best junior synonyms and therefore cannot not used. This paper formally names two new species from south-east Asia in accordance with the rules of the *International Code of Zoological Nomenclature* (Ride *et al.* 1999). These are *Naja reduci* sp. nov. from the Lesser Sundas, Indonesia, formerly treated as an eastern population of *N. sputatrix* Boie, 1827, and *N. latebras* sp. nov. from the north-east of Thailand and nearby parts of western Cambodia and south Vietnam, from within the Mekong drainage system, formerly treated as a population of *Naja kaouthia* Lesson, 1831. Formal identification and naming these two new species in accordance with the rules of the *International Code of Zoological Nomenclature* (Ride *et al.* 1999) is the first and most important step in the long term protection of, and survival for, these two vulnerable snake taxa. **Keywords:** Herpetology; taxonomy; snake; nomenclature; Asia; Cobra; *Naja*; Lesser Sundas; Komodo; Rinca; Flores; Alor; Indonesia; Thailand; Cambodia; Vietnam; *sputatrix*; *kaouthia*; *atra*; new species; *reduci*; *latebras*.

INTRODUCTION

True Cobras, genus *Naja* Laurenti, 1768 are one of the world's iconic snake genera. They are not just well-known to science, but also to lay people the world over.

In spite of countless scientific investigations, Cobra taxonomy is far from settled. In 2013, Hoser (2013) formally named two overlooked species within the True Cobra genus *Boulengerina* Dollo, 1886 from Africa.

These were *Boulengerina adelynhoserae* Hoser, 2013 and *Boulengerina jackyhoserae* Hoser, 2013.

I note that recently a notorious Welsh animal abuser and criminal named Wolfgang Wüster with an interest in venomous snakes has coined some non-ICZN names for the same taxa.

As they are best junior synonyms of the correct ICZN names of Hoser (2013), the later names should not be used to identify the relevant taxa.

Two other species of unnamed Asiatic Cobra have been generally known in herpetology for some years and in view of the fact that no one has indicated a desire to formally name them, I decided to confirm that they were in fact distinct at the species level and then assuming they were so, to formally name them in

accordance with the rules of the *International Code of Zoological Nomenclature* (Ride *et al.* 1999) as amended since (ICZN 2012). Formally naming a new taxon is the first and most important step in the conservation of the species, assuming them to be a newly identified species.

The candidate species were 1/ The Lesser Sundas population of putative *N. sputatrix* Boie, 1827, long known to be morphologically divergent from the type form from Java (see for example De Lang 2011b), and 2/ The population of putative *Naja kaouthia* Lesson, 1831 identified as a species distinct from other Thai *N. kaouthia* inspected from North-east Thailand, north east of the central ranges in the upper reaches of the Mekong drainage, central Thailand near Bangkok and southern Thailand (see for example Ratnarathorn *et al.* 2019).

MATERIALS AND METHODS

Specimens from across the range of putative *Naja sputatrix* Boie, 1827 and *Naja kaouthia* Lesson, 1831 in south-east Asia and southern Asia were inspected (live, dead and from photos with quality location data), along with a review of the relevant published literature on the putative species, including all notable morphological and molecular studies.

These were also cross-checked with other studies relevant to known sea level minima during times of glacial maxima in the Pliocene-Pleistocene epochs as a means to calibrate measured genetic divergences in the relevant published studies if at all possible and in this case of both potentially new species, to confirm likely distributions and zones of admixture during times of glacial minima and maxima.

Changes in rainfall and habitat over the past 5 million years were also assessed in terms of barrier creation for putative species and their potential divergences. This included cold zones, wet and dry zones and zones of inundation.

Museum holdings were audited with a view to ascertaining accurate and likely distributions across south-east Asia and south Asia, with a view to determining preferred habitats and exclusionary zones likely to facilitate speciation.

Literature relevant to the putative species *Naja sputatrix* Boie, 1827 including previously synonymised forms and relevant taxonomic decisions made herein include Auffenberg (1980), Bergman (1962), Berthold (1840, Boie (1827), Boulenger (1896), Chowdhury *et al.* (2021), Das (2012), De Lang (2011a, 2011b, 2017), De Lang and Vogel (2005), Harrington *et al.* (2018), Hoser (2009, 2012a, 2012b, 2013), Kopstein (1928, 1938), Mavromichalis and Silvia (1995), Mertens (1930), Milto and Lukin (2020), Pyron *et al.* (2013), Slowinski and Wüster (2000), Smetzers (1998), Van Hoesel (1958, 1959), Wallach *et al.* (2014), Wüster (1993, 1996a), Wüster and Thorpe (1989, 1991), Zonneveld *et al.* (2018) and sources cited therein.

Literature relevant to the putative species *Naja kaouthia* Lesson, 1831 including previously synonymised forms and relevant taxonomic decisions made herein include Ahmad *et al.* (2009), Barbour (1909), Boulenger (1896), Cantor (1842), Chan-ard *et al.* (1999, 2015), Cope (1860), Cox (1995), Cox *et al.* (1998), Currin (2016), Das (2012), Das *et al.* (2009), Das and Biswas (2017), Dutta *et al.* (2009), Frömberg (2007), Geissler *et al.* (2011, 2019), Giri *et al.* (2021), Gray (1834), Grismer *et al.* (2008a, 2008b), Grossmann and Tillack (2001), Gumprecht (2009), Hallmen (2005, 2006), Hartmann and Steiner (1985), Hoser (2009, 2012a, 2012b, 2013), Höröld (2009), Jackson (2002), Kästle *et al.* (2013), Kocczynski (1993), Kramer (1977), Kyi and Zug (2003), Laita (2013), Lalremsanga *et al.* (2011), Lalitpuia *et al.* (2008), Laopichienpong *et al.* (2016), Lenz (2012), Leong and Guttensohn (2018), Lesson (1831), Leviton *et al.* (2003), Lin *et al.* (2008), Lingenhöle and Trutnau (1989), Luu (2020), Mahony *et al.* (2009), Majumder *et al.* (2012), Manthey and Grossmann (1997), Murthy (2010), Nath *et al.* (2011), Nguyen *et al.* (2009), Nguyen *et al.* (2018), Olivier (2008), Orlov *et al.* (2003a, 2003b), Paira *et al.* (2022), Pandey (2018), Paterna (2019), Pauwels *et al.* (2013), Pham *et al.* (2020), Purkayastha (2013, 2018), Pyron *et al.* (2013), Ratnarathorn *et al.* (2019), Rosén (1904), Santra and Wüster (2017), Sharma (2004), Sharma *et al.* (2013), Smith (1943), Stejneger (1910), Thomas (1970), Tshewang and Letro (2018), Von Martens (1876), Wallach *et al.* (2014), Wangyal (2019), Whitaker and Captian (2004), Winchell (2003a, 2003b, 2011), Wüster (1993, 1996b, 1998), Wüster and Thorpe (1991, 1992), Wüster *et al.* (1995), Zhao (2006), Ziegler (2002), Zug and Mulcahy (2019) and sources cited therein.

I make a point of noting that while most of what the notorious animal abuser Wolfgang Wüster has published is unscientific rubbish, some does have relevance to Cobras and masquerades as works on the taxonomy of relevant species. As those publications were included in the thorough audit of the relevant species and relied upon in terms of the judgements herein (even though not surprisingly contrary to the judgements in those papers, as Wüster got the most important things completely wrong), it would be unethical for me not to cite them, or to pretend those works do not exist.

RESULTS

Prima facie, the morphological divergence of Lesser Sundas putative *Naja sputatrix* Boie, 1827 as outlined by De Lang (2011), combined with the biogeographical evidence of a deep sea

barrier separating the easternmost populations (not being land at times of Ice Age maxima), was enough to confirm that they were of a different species. Inspection of specimens confirmed this contention and so this form is formally named as a new species, *Naja reduci* sp. nov. in accordance with the rules of the *International Code of Zoological Nomenclature* (Ride *et al.* 1999) as amended since (ICZN 2012).

Other than the type form of *N. sputatrix* with a type locality of Java, that being a different species, there were no available synonyms for the Lesser Sunda population.

In terms of the north-east Thailand population of putative *Naja kaouthia* Lesson, 1831, a review of the literature was conducted first to confirm an absence of potential synonym names for this taxon.

The type form of *Naja kaouthia* Lesson, 1831 comes from Bengal, India and appears to be of the same or similar form as found in the north west, centre and south of Thailand, noting Laopichienpong *et al.* (2016) found them to be divergent. In any event, the name *Naja kaouthia suphanensis* Nutaphand, 1986, with a type locality of the Suphan Buri province in Central Thailand is also available for this population.

Other synonym names applied to the type form of *Naja atra* Cantor, 1842, which had already been identified by Ratnarathorn *et al.* (2019) as yet another distinctive species, meaning none could be applied to the potentially unnamed north-east Thai form that was morphologically like *N. kaouthia*.

The molecular results of Ratnarathorn *et al.* (2019), flagged the north-east Thailand population of putative *N. kaouthia* as a separate species to the central Thailand form of *Naja kaouthia*, (in turn flagged as separate from the type form from Bengal, India by Laopichienpong *et al.* 2016).

Ratnarathorn *et al.* (2019), also provided morphological evidence to support their contention.

In their paper they seemed confused as to which of the two populations were in fact of the type form of *N. kaouthia*, (probably neither) but my own inspection of specimens has confirmed that the most similar are the ones found across Thailand, except the north-east section which drains into the Mekong River system. Inspection of further specimens from Cambodia and parts of south-west Vietnam confirmed that this putative taxon also occupied these areas.

So in summary on the basis of molecular divergence, morphological differences and geographic allopatry, based on a known biogeographical barrier (being a set of high hills in central north Thailand), I have no hesitation in identifying this undescribed form as a new species.

The species is formally named *N. latebras* sp. nov. in accordance with the rules of the *International Code of Zoological Nomenclature* (Ride *et al.* 1999).

NOTES ON THE FORMAL DESCRIPTIONS THAT FOLLOW

In terms of the descriptions that follow, the following should be noted:

There is no conflict of interest in terms of this paper or the conclusions arrived at herein.

Several people including anonymous peer reviewers who revised the manuscript prior to publication are also thanked as are relevant staff at museums who made specimens and records available in line with international obligations.

In terms of the following formal descriptions, spellings should not be altered in any way for any purpose unless expressly and exclusively called for by the rules governing Zoological Nomenclature as administered by the International Commission of Zoological Nomenclature (ICZN).

This includes if gender assignment of suffixes seems incorrect, Latinisation is wrong, apparent spelling mistakes and so on (see Article 32.5.1 of the Code).

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Unless otherwise stated explicitly, colour and other descriptions apply to living and **fully mature adult specimens** of generally good health, as seen by day, and not under any form of stress by means such as excessive cool, heat, dehydration, excessive ageing, abnormal skin or reaction to chemical or other input. SVL or SV means snout-vent length, TL means tail length.

While numerous texts and references were consulted prior to publication of this paper, the criteria used to separate the relevant genera, subgenera, species or subspecies has already been spelt out and/or is done so within each formal description and does not rely on material within publications not explicitly cited herein.

NAJA REDUCI SP. NOV.

LSIDDurn:lsid:zoobank.org:act:A823B245-A2A0-470F-8789-06BFDD68EDA3

Holotype: A preserved specimen in the Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, USA, specimen number MCZ Herp R-26982 collected from Komodo Island, East Nusa Tenggara Province, Lesser Sunda Islands, Indonesia.

This facility allows access to its holdings.

Paratypes: 1/ A preserved specimen in the Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, USA, specimen number MCZ Herp R-26983 collected from Komodo Island, East Nusa Tenggara Province, Lesser Sunda Islands, Indonesia. 2/ Five preserved specimens in the University of Florida, Florida Museum of Natural History, Gainesville, Florida, USA, specimen numbers 28672 (male), 28678, 28679 (female), 28680 (female), and 39833 all collected from Komodo Island, East Nusa Tenggara Province, Lesser Sunda Islands, Indonesia.

Diagnosis: *Naja reduci sp. nov.* has until now been treated by all publishing authors as a Lesser Sundas population of *Naja sputatrix* Boie, 1827, with a type locality of Java and herein confined to that Island and Bali, as well as nearby Lombok and Sumbawa, the formal status of specimens on those latter two islands being somewhat uncertain as they are separated by a deep sea trench from both Java/Bali and all of Komodo, Rinca, Flores, Adonara and Lembata.

Based on morphology, the Cobras on Lombok and Sumbawa are tentatively referred to *N. sputatrix*.

Naja reduci sp. nov. is herein treated as the population found on the islands of Komodo, Rinca, Flores, Adonara and Lembata. The Cobras from Alor Island are tentatively treated herein as being of the same species due to similarity in form and colouration. All of Komodo, Rinca, Flores, Adonara and Lembata were connected during recent ice-age minima to the exclusion of the other named islands. Alor Island sits to the east of these islands and is proximal.

Naja reduci sp. nov. is separated from *Naja sputatrix* Boie, 1827 by the following suite of characters:

The hood when extended is narrower in that it is four scales wide, but when viewed from the underneath side, the bulge of the outermost scale, sits on the outer edge of the hood, versus wider in *N. sputatrix* where the hood is also four scales wide, but the bulge of the outermost scale, sits inside the outer edge of the hood; the lower two postoculars are tiny in *N. reduci sp. nov.* and when compared to the third postocular above, versus small, but of similar size to the one above in *N. sputatrix*; maximum adult size is 91 cm total length (Mertens 1930), versus 155 cm in *N. sputatrix* (Kopstein, 1928, 1934 and Bergman, 1962), which also corresponds with a thinner build in adult *N. reduci sp. nov.*

Both species (*N. reduci sp. nov.* and *N. sputatrix*) come in a variety of general colours as adults, ranging from black, dark

brown, olive, silver grey, bluish grey or even whitish, but are separated as follows: In *N. reduci sp. nov.* each dorsal scale has a whitish or yellowish anterior edge. In *N. sputatrix* this is not the case, meaning the dorsum is effectively unicolour. Cobra specimens from Lombok and Sumbawa have some lightening at the anterior edge, but it is of the same colour as the entire scale. In *N. reduci sp. nov.* there are usually 23 mid-body rows, versus usually 25 in *N. sputatrix* (but this trait varies in both species, so is not in itself diagnostic).

Both *N. reduci sp. nov.* and *N. sputatrix* are separated from all other Asiatic Cobras in the genus *Naja* (being the entirety of that genus as defined by Hoser 2009, as in not including African species as per the diagnosis in Hoser 2009), by the following unique combination of characters:

Head short and blunt, not distinct from the neck; Eye well-developed and with a round pupil, being one third to one half the length of the snout. No loreal. Rostral one and a quarter to one and a half times as broad as deep, its upper portion measuring one quarter to one half its distance from the frontal; internasals as long as or shorter than the prefrontals, in contact with the preocular; frontal as long as broad or longer than broad, as broad as or little broader than the single supraocular, as long as or a little longer than its distance from the rostral; one preocular; three postoculars; temporals 2+3; seven upper labials, third deepest, seventh largest, third and fourth entering the eye; four lower labials in contact with the anterior chin-shields, which are as long as or longer than the posterior ones.

Body scales smooth and body firm; neck dilatable (to four scales wide when viewed from the ventral side). 21-35 scales round the neck, usually 23 mid-body scale rows, but ranging from 17 to 25. Ventrals 160-188; anal entire; subcaudals 40-56.

Colouration variable, including black, dark brown, olive, silver grey, bluish grey or even whitish. Venter is white to yellow. Sometimes some ventrals, usually around numbers 14-23 have dark-grey posterior edges. The anterior edges of the ventrals and the outer dorsal scale rows are white or yellow, which contrasts with the darker dorsal colour (and even more so in young animals). Neck markings are barely discernable or absent; usually being in the form of a small light mark on either side of the vertebral line, or less often a faint v-shaped mark, with the apex directed posteriorly. As a rule there is one or more dark, transverse throat bands, which become visible when the neck is expanded. Juveniles commonly lack neck markings (the preceding also being largely modified from Boulenger 1986 and De Lang 2011b as a template).

N. reduci sp. nov. in life is depicted in De Lang (2011b) on pages 142, 144, 145 and 147 at top, as well as online at: <https://www.inaturalist.org/observations/39525104> and

<https://www.inaturalist.org/observations/35630270>

N. sputatrix in life is depicted online at:

<https://www.inaturalist.org/observations/36740255>

and

<https://www.inaturalist.org/observations/120819785>

and

<https://www.inaturalist.org/observations/65990526>

In common with other large elapids of generalized habits, *N. reduci sp. nov.* appear to do well in human altered habitats finding shelter under man made debris, including of course, sheets of metal and with the added benefit of a food source in the form of rodents, meaning they tend to gravitate to places that provide such items.

Distribution: *Naja reduci sp. nov.* is herein restricted to the islands of Komodo, Rinca, Flores, Adonara and Lembata. Cobras found on islands east or west of these may not be of this taxon.

Etymology: The name *Naja reduci sp. nov.* comes from the Latin word "*reduci*" which means reduced in size, in reflection of the size reduction of this form as compared to the closely related species *N. sputatrix* to which it is most closely related.

NAJA LATEBRAS SP. NOV.

LSIDDurn:lsid:zoobank.org:act:0CEDEA2F-7A6E-4553-8484-E4D3FD3CD7C7

Holotype: A preserved specimen at the Field Museum of Natural History, Chicago, Illinois, USA, specimen number FMNH Amphibians and Reptiles 259176 collected from Siem Reap Province, Cambodia.

This facility allows access to its holdings.

Paratype: A preserved specimen at the Field Museum of Natural History, Chicago, Illinois, USA, specimen number FMNH Amphibians and Reptiles 259118 collected from the Kien Giang, Vinh Thuan District, Vietnam.

Diagnosis: Until now *Naja latebras sp. nov.* has been treated as a population of the better-known species *Naja kaouthia* Lesson, 1831, with a type locality of Bengal, India, herein taken as including divergent specimens from central, southern and north-west Thailand (for which the name *Naja kaouthia suphanensis* Nutaphand, 1986 is available) or possibly *Naja atra* Cantor, 1842 with a type locality of Zhoushan, China, also found in nearby north Vietnam, which are all quite different taxa.

Naja latebras sp. nov. is separated from *Naja kaouthia* Lesson, 1831 of both type form from India/Bangladesh and specimens from central Thailand near Bangkok as well as the south of Thailand and north-west (and *Naja atra* Cantor, 1842) by the following unique combination of characters:

Dorsum is a dark, blackish, olive brown colour, becoming yellowish on the very lower flanks (usually a silver black in younger specimens); interstitial skin is light brown to whitish (versus dark grey to black in both *N. kaouthia* and *N. atra*); light part of the monacle on the hood is beige bounded on both sides with a jagged clack edge, the inside being slighter more blackish than the outside areas of the dorsum; black spots on the ventral scales seen in *N. kaouthia* are either reduced in intensity (as in faded) and sometimes absent in *N. latebras sp. nov.*; when viewed, the head of *N. latebras sp. nov.* appears to be flatter and wider posteriorly and longer at nasal area than in *N. kaouthia*. Anteriorly, the dorsum of *N. latebras sp. nov.* is fractionally darker than at the rear of the body. By contrast in *N. kaouthia* the posterior part of the dorsum is noticeably darker.

All of *Naja latebras sp. nov.*, *N. kaouthia* (both central and west Thai form and that from the type locality region in India/Bangladesh) and *N. atra* are separated from all other Asiatic Cobras in the genus *Naja* (being the entirety of that genus as defined by Hoser 2009, as in not including African species as per the diagnosis in Hoser 2009), by the following unique combination of characters:

Eye moderate, being one third to one half the length of the snout. Rostral one and a quarter to one and a half times as broad as deep, its upper portion measuring a quarter to a half its distance from the frontal; internasals as long as or shorter than the prefrontals, in contact with the preocular; frontal as long as broad or longer than broad, as broad as or little broader than the single large supraocular, as long as or a little longer than its distance from the rostral; one preocular; three (occasionally two) postoculars; temporals 2+3 or 3+3; seven upper labials, third deepest, seventh largest, third and fourth entering the eye; four lower labials in contact with the anterior chin-shields, which are as long as or longer than the posterior. Neck dilatatable. 21-35 scales round the neck, 17-25 midbody rows. 163-205 ventrals. Single anal. 42-75 subcaudals.

Colouration is yellowish to dark brown, olive brown or blackish above, sometimes variable along the length of the snake and sometimes with more or less distinct light, black-edged cross-bars with a black-and-white or black-and-yellowish spectacle-mark on the hood usually black edged inside and out, or in a U-shape with a mask-shaped figure, as well as a black-and-white spot on each side of the lower surface of the hood. One or two dark brown cross-bands on the belly behind the hood.

Naja latebras sp. nov. in life from the type locality (Siem Reap Province, Cambodia) is depicted online at:

<https://www.inaturalist.org/observations/64191311>

N. kaouthia from the type region in India are depicted in life online at:

<https://www.inaturalist.org/observations/61787474> and

<https://www.inaturalist.org/observations/97231454>

Putative *N. kaouthia* from central Thailand are depicted in life online at:

<https://www.inaturalist.org/observations/42676461> and

and

<https://www.inaturalist.org/observations/88249942>

If they are later determined not to be *N. kaouthia* in the strictest sense (*sensu* Ratnarathorn *et al.* 2019), then the name *Naja kaouthia suphanensis* Nutaphand, 1986 is available for these animals.

N. atra from China are depicted in life online at:

<https://www.inaturalist.org/observations/77806825> and

and

<https://www.inaturalist.org/observations/100583277>

Distribution: *Naja latebras sp. nov.* appears to be distributed around the lower Mekong drainage in north-east Thailand, nearby Cambodia and south Vietnam.

Etymology: The species name *Naja latebras sp. nov.* comes from the Latin word “*latebras*” which means hiding, this being a good description of this species in that it has been hiding from science for the past 200 years.

CONSERVATION

In terms of both the above newly identified species, the comments of Hoser (1989, 1991, 1993, 1996, 2007, 2019a, 2019b) apply as do those of Chowdhury *et al.* (2021) and Paira *et al.* (2022).

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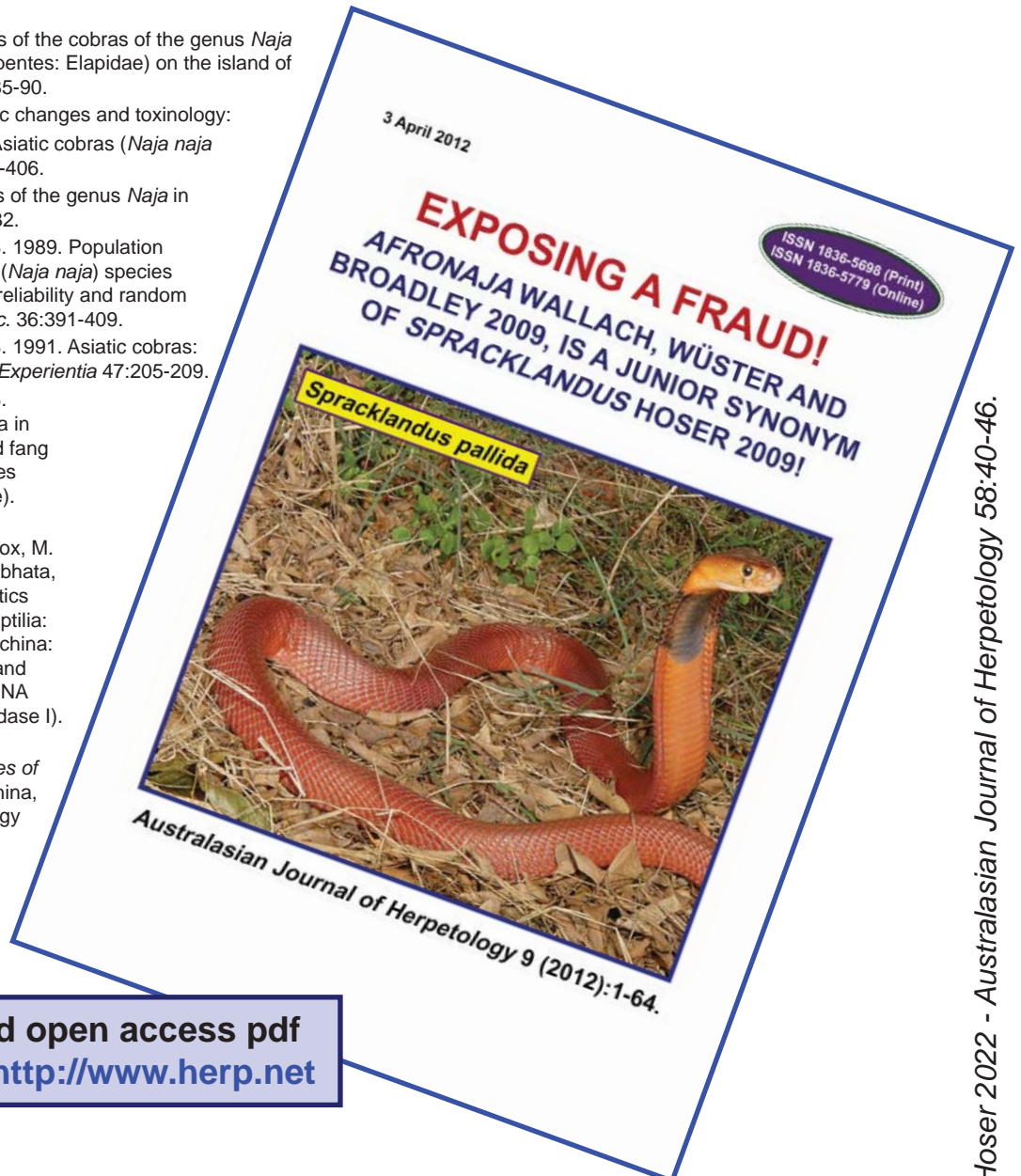
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CONFLICT OF INTEREST - NONE.

Cite this paper as:

Hoser, R. T. 2022. Two new species of Cobra from South-east Asia (Serpentes: Elapidae: *Naja*). *Australasian Journal of Herpetology* 58:40-46.



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Overlooked! Formal description of a new species of Green Viper from Eastern India and Burma.

LSIDURN:LSID:ZOOBANK.ORG:PUB:78047E7B-A7AA-46C6-87C8-1E761F34BBDA

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Received 24 May 2022, Accepted 29 May 2022, Published 28 June 2022.

ABSTRACT

A population of vipers in northern Myanmar and eastern India originally identified as being *Trimeresurus medoensis* Zhao, 1977, type locality Ani Bridge, Motuo, Xizang, China, at 1200 m elevation, is shown to be a morphologically divergent species.

These putative taxa were assigned to the genus *Viridovipera* Malhorta and Thorpe, 2004 by Hoser (2013), who also erected the subgenus *Simpsonvipera* Hoser, 2013 for what at the time was being treated as a single species.

The south-eastern population is herein formally named as *Viridovipera (Simpsonvipera) paracaeruleus* sp. nov.. It is physically separated from *V. medoensis* by the low elevation biogeographical barrier of the Brahmaputra drainage system.

V. paracaeruleus sp. nov. is readily separated from *V. medoensis* by the absence of a post-ocular streak.

A related species *V. mayaae* Rathee et al. 2022 is also placed in the subgenus *Simpsonvipera* Hoser, 2013.

A divergent subspecies of *V. paracaeruleus* sp. nov. is also formally named according to the rules of the *International Code of Zoological Nomenclature* (Ride et al. 1999) as amended online since, and is separated from the other two taxa by head scalation and hemipenal morphology.

Keywords: Snake; viper; Asia; Burma; Myanmar; India; China; Brahmaputra; *Trimeresurus*; *Viridovipera*; *Simpsonvipera*; *medoensis*; *mayaae*; New species; *paracaeruleus*; new subspecies; *ashokcaptaini*.

INTRODUCTION

The species *Trimeresurus medoensis* Zhao, 1977 was described from just two specimens from the south-eastern Xizang Autonomous Region in China. A morphologically similar third specimen from the vicinity of Myitkyina, northern Myanmar was formally referred to this species by Zhao et al. (1998). David et al. (2001) (cited herein as 2002a) redescribed *T. medoensis* including 26 specimens from the eastern Changlang District, State of Arunachal Pradesh, north-eastern India.

Those 26 specimens were also most similar to the Myanmar snakes referred to *Trimeresurus medoensis* Zhao, 1977 earlier, which were also inspected by David et al. (2001) (cited herein as 2002a).

While engaging in a genus-level review of the viper family that was published in Hoser (2013) and other papers in 2012, *Trimeresurus* Lacépède, 1804 *sensu lato* was broken up into genera and subgenera, with *Viridovipera medoensis* (Zhao, 1977), placed in the genus *Viridovipera* Malhorta and Thorpe, 2004 and furthermore within what was then treated as a monotypic subgenus *Simpsonvipera* Hoser, 2013, based on molecular divergence from congeners.

At the time it was noted that based on the publication of David et al. (2001) (cited herein as 2002a), there were consistent morphological differences between the two main populations of

putative *V. medoensis*.

Noting that there was a major biogeographical barrier separating the two main populations in the form of the Brahmaputra drainage system, it had been my intention to subdivide the two populations at either the species or subspecies level.

The question as to which level the taxonomic separation should be made was in fact answered by Rathee et al. (2022), who showed with molecular data that the two relevant populations of *V. medoensis* comprised at least two separate species, with the unnamed one being more divergent from their new species *V. mayaae* Rathee et al. 2022 than was *V. medoensis sensu stricto*, the otherwise closest related known species.

On the basis of the preceding and noting the extreme habitat destruction ongoing in the relevant region, I have no hesitation in formally naming the Burmese and east Indian population as a new species.

MATERIALS AND METHODS

A review of the relevant literature, pertaining to *V. medoensis sensu lato* was undertaken with a view to determining differences between specimens of the putative species, including in lieu of direct inspection of specimens.

Included in this were photos of the relevant type material and similar and specimens from across the known range of the

relevant species, which were assessed at close view.

The excellent publication of David *et al.* (2001) (cited herein as 2002a) in fact answered almost all relevant questions, even though in finality, the authors made (what in hindsight was) a judgment error in concluding that populations of putative *V. medoensis sensu lato* from China, eastern India and northern Burma were all of the same species.

The molecular study of Rathee *et al.* (2022) confirmed that there were in fact two or three species currently (as of 2022) being identified as *V. medoensis*.

Literature was checked for potential synonym names of which there were none.

The taxa in question were also checked in terms of relevant placement in terms of genus or subgenus, in line with relevant published literature.

The relevant publications in terms of putative *V. medoensis sensu lato* included Das (2012), David and Tong (1997), David *et al.* (2001, 2002a, 2002b, 2011), Dawson *et al.* (2008), Griffin *et al.* (2012), Gumprecht *et al.* (2004), Guo *et al.* (1999, 2015), Harrington *et al.* (2018), Hoser (2012, 2013), Lenz (2012), Leviton *et al.* (2003), Malhotra and Thorpe (2004), McDiarmid *et al.* (1999), Purkayastha *et al.* (2020), Rathee *et al.* (2022), Ride *et al.* (1999), Wallach *et al.* (2014), Wang *et al.* (2020), Whittaker and Captain (2004), Zhao and Jiang (1977), Zhao (2006) and sources cited therein.

RESULTS

As already outlined, that the Burmese population was morphologically divergent from the Chinese population referred to *V. medoensis*, that being the type form for the species, was already known and again confirmed.

Furthermore the Indian specimens biogeographically separated from the Burmese specimens by the Hukawang Valley in north-west Burma, are morphologically divergent. See for example the strongly indented supraocular in the south Burmese specimens, versus not so in the east Indian specimens.

This in my view means a taxonomic break between these two populations as well, herein taken as being at the subspecies level.

Both populations are at this stage assigned to the same species, being described herein as new as *V. paracaeruleus sp. nov.* using a Burmese specimen as the holotype for the species. The subspecies is herein also formally named as *V. paracaeruleus ashokcaptaini subsp. nov.* based on a live specimen from north eastern India that has since been released (after being photographed).

The preceding also means that the formerly monotypic subgenus *Simpsonvipera* Hoser, 2013, now has three species, namely *V. medoensis*, *V. mayaae* (Rathee, Purkayastha, Lalremsanga, Dalal, Biakzuala, Muansanga, Mirza, 2022) and the newly named *V. paracaeruleus sp. nov.*

In terms of the formal descriptions below, the spellings of the names is intentional and should not be altered unless absolutely necessary according to the rules of the ICZN as published in the *International Code of Zoological Nomenclature* (Ride *et al.* 1999), as amended online since.

VIRIDOVIPERA (SIMPSONVIPERA) PARACAERULEUS SP. NOV.

LSIDDurn:lsid:zoobank.org:act:3EEFCD17-9E8C-4F8D-B278-8639253DF93D

Holotype: A preserved young female specimen at the American Museum of Natural History, New York, USA, specimen number AMNH Herpetology R-58532, collected from near Myitkyina, Myanmar, Latitude 25.3946 N., Longitude 97.3841 E.

This facility allows access to its holdings.

Paratype: A preserved specimen at the Museum of Natural History, London, UK, specimen number 1936.7.4.43, collected at Nam Ti Valley, Kachin, Putao, Myanmar. It is incorrectly labelled "*Trimeresurus stejnegeri*." That is a taxon from mountains further east.

Detailed descriptions of both holotype and paratype of *V. paracaeruleus sp. nov.* are published in David *et al.* (2001) (cited herein as 2002a) and not repeated here.

Diagnosis: Until now *V. paracaeruleus sp. nov.* has been treated as a population of the species *V. medoensis* (Zhao, 1977), type locality Ani Bridge, Motuo, Xizang, China, at 1200 m elevation.

Type *V. medoensis* (Zhao, 1977) have a distinctive post-ocular streak, whereas *V. paracaeruleus sp. nov.* (both formally named subspecies) does not.

V. medoensis (Zhao, 1977) is herein confined to the type locality and nearby areas within China, being generally north of the main Brahmaputra River and Luhit Rivers drainage basin.

South and east of there in north-east India and far northern Myanmar is where *V. paracaeruleus sp. nov.* occurs.

The nominate form of *V. paracaeruleus sp. nov.* occurs from Myitkyina, Myanmar in the south and in the Kumon Bum mountain range extending north to the border with India.

This range is bound by low-lying drainage basins on each side to the east and west.

The nominate subspecies of *V. paracaeruleus sp. nov.* and *V. medoensis* are both readily separated from the subspecies *V. paracaeruleus ashokcaptaini subsp. nov.* by having a large supraocular on each side, long and wide, about 2.3/2.2 times as long as wide, much wider than the adjacent upper head scales and about 0.9/0.7 times as wide as internasals, strongly indented by the upper head scales; versus not so or only slightly indented in *V. paracaeruleus ashokcaptaini subsp. nov.*

V. paracaeruleus ashokcaptaini subsp. nov. is further separated from *V. medoensis* by having about 12 spines of irregular size on the proximal 2/3 of the hemipene (a trait presumably shared with *V. paracaeruleus sp. nov.*), versus about 15 spines in *V. medoensis*.

V. paracaeruleus ashokcaptaini subsp. nov. occurs west of the Hukawang Valley in north-west Burma, in the area of the Burmese and Indian Border, west to at least the Barail Range, India with the morphologically similar *V. mayaae* (Rathee *et al.*, 2022) being found in the elevated areas, south and west of there.

V. mayaae is separated from other members of the genus *Viridovipera* Malhorta and Thorpe, 2004 by having a rust coloured eye in males versus bright red or amber (rarely yellow) coloured in *V. stejnegeri* (Schmidt, 1925), yellow or yellowish green in *V. vogeli* (David, Vidal and Pauwels, 2001), bright or deep red in *V. yunnanensis* (Schmidt, 1925), or green or yellowish green in *V. medoensis*, *V. paracaeruleus sp. nov.* and *V. paracaeruleus ashokcaptaini subsp. nov.*

In all of *V. medoensis*, *V. paracaeruleus sp. nov.* and *V. paracaeruleus ashokcaptaini subsp. nov.* there is a green or yellow-green coloured eye in females versus yellow or amber in *V. stejnegeri*, yellow in *V. vogeli* and golden yellow in *V. yunnanensis*.

The three above species, within *Simpsonvipera subgen. nov.*, (being *V. medoensis*, *V. paracaeruleus sp. nov.* and *V. mayaae*) are separated from the rest of the genus *Viridovipera* and other Asian pitvipers by the following suite of characters:

17 dorsal mid-body scale rows, dorsal rows 7-11 slightly keeled; 8 upper labials, first upper labials separated from nasals by a distinct suture; green or bluish green above, yellowish white below, the two separated by a bright bicolored red (below) and white (above) ventrolateral stripe (in both males and females), which occupies the whole of the outermost scale row and a portion of the second row;

ventrals less than 150; hemipenes short, thick and spinose (12-15 spines) on the proximal 2/3. Total length in adult males is about 671 mm, adult females 650 mm; tail length in males is 125 mm, females 115 mm (modified from Hoser, 2013).

Distribution: *V. paracaeruleus sp. nov.* of the nominate form occurs in Myanmar from Myitkyina, Myanmar in the south (just north-west of there) and in the Kumon Bum mountain range extending north to the border with India. The range is bound by

low lying drainages to the east and west and lower hills between the Kumon Bum mountain range and the main Himalayas to the north.

The subspecies *V. paracaeruleus ashokcaptaini* subsp. nov. occurs west of the Hukawang Valley in north-west Burma, in the area of the Burmese and Indian Border, in the Patkai Bum and Mangin Ranges, west of the Chindiwin River drainage system, and is found west to at least the Barail Range, India with the morphologically similar *V. mayaae* Rathee *et al.* 2022 being found in the elevated areas, south and west of there.

There is no evidence of sympatry between any of the preceding named forms.

Etymology: *V. paracaeruleus* sp. nov. is named in reflection of the fact that in life some dorsal scales may be etched with blue, as is some interstitial skin, that may be either turquoise blue or dark blue, the name “*caeruleus*” in Latin meaning blue and the prefix “*para*” meaning not quite.

Preserved specimens also commonly get a bluish hue.

VIRIDOVIPERA PARACAERULEUS ASHOKCAPTAINI SUBSP. NOV.

LSIDurn:lsid:zoobank.org:act:4C3D6281-1B8E-45E7-A066-B808387772C4

Holotype: An adult specimen depicted in an image in Figure 1, at top left on page 225 in David, Captain and Bhatt (2001) published in *Hamadryad* 26(2), pp. 222-238, (cited here as 2002a).

It was found within 3 km of Gandhigram village (also known as Shidi), in Changlang District, Arunachal Pradesh, elevation 1,040 m a.s.l, India, Latitude 27.2627 N., Longitude 96.5455 E.

At the present time, I am unaware of any specimens of this taxon lodged in any museums anywhere.

Diagnosis: Until now *V. paracaeruleus* sp. nov. has been treated as a population of the species *V. medoensis* (Zhao, 1977), type locality Ani Bridge, Motuo, Xizang, China, at 1200 m elevation.

Type *V. medoensis* (Zhao, 1977) have a distinctive post-ocular streak, whereas *V. paracaeruleus* sp. nov. does not.

V. medoensis (Zhao, 1977) is herein confined to the type locality and nearby areas within China, being generally north of the main Brahmaputra River and Luhit Rivers drainage basin.

South and east of there in north-east India and far northern Myanmar is where *V. paracaeruleus* sp. nov. occurs.

The nominate form of *V. paracaeruleus* sp. nov. occurs from Myitkyina, Myanmar in the south and in the Kumon Bum mountain range extending north to the border with India.

This range is bound by low-lying drainage basins on each side to the east, west and north-west.

The nominate subspecies of *V. paracaeruleus* sp. nov. and *V. medoensis* are both readily separated from the subspecies *V. paracaeruleus ashokcaptaini* subsp. nov. by having a large supraocular on each side, long and wide, about 2.3/2.2 times as long as wide, much wider than the adjacent upper head scales and about 0.9/0.7 times as wide as internasals, strongly indented by the upper head scales; versus not so or only slightly indented in *V. paracaeruleus ashokcaptaini* subsp. nov..

V. paracaeruleus ashokcaptaini subsp. nov. is further separated from *V. medoensis* by having about 12 spines of irregular size on the proximal 2/3 of the hemipene (a trait presumably shared with *V. paracaeruleus* sp. nov.), versus about 15 spines in *V. medoensis*.

V. paracaeruleus ashokcaptaini subsp. nov. occurs west of the Hukawang Valley in north-west Burma, in the area of the Burmese and Indian Border, west to at least the Barail Range, India with the morphologically similar *V. mayaae* (Rathee *et al.*, 2022) being found in the elevated areas, south and west of there.

V. mayaae is separated from other members of the genus *Viridovipera* Malhorta and Thorpe, 2004 by having a rust coloured eye in males versus bright red or amber (rarely yellow) coloured in *V. stejnegeri* (Schmidt, 1925), yellow or yellowish green in *V. vogeli* (David, Vidal and Pauwels, 2001), bright

or deep red in *V. yunnanensis* (Schmidt, 1925), or green or yellowish green in *V. medoensis*, *V. paracaeruleus* sp. nov. and *V. paracaeruleus ashokcaptaini* subsp. nov..

In all of *V. medoensis*, *V. paracaeruleus* sp. nov. and *V. paracaeruleus ashokcaptaini* subsp. nov. there is a green or yellow-green coloured eye in females versus yellow or amber in *V. stejnegeri*, yellow in *V. vogeli* and golden yellow in *V. yunnanensis*.

The three above species, within *Simpsonvipera* subgen. nov., (being *V. medoensis*, *V. paracaeruleus* sp. nov. and *V. mayaae*) are separated from the rest of the genus *Viridovipera* and other Asian pitvipers by the following suite of characters:

17 dorsal mid-body scale rows, dorsal rows 7-11 slightly keeled; 8 upper labials, first upper labials separated from nasals by a distinct suture; green or bluish green above, yellowish white below, the two separated by a bright bicolored red (below) and white (above) ventrolateral stripe (in both males and females), which occupies the whole of the outermost scale row and a portion of the second row; ventrals less than 150; hemipenes short, thick and spinose (12-15 spines) on the proximal 2/3. Total length in adult males is about 671 mm, adult females 650 mm; tail length in males is 125 mm, females 115 mm (modified from Hoser, 2013).

Distribution: The subspecies *V. paracaeruleus ashokcaptaini* subsp. nov. occurs west of the Hukawang Valley in north-west Burma, in the area of the Burmese and Indian Border, in the Patkai Bum and Mangin Ranges, west of the Chindiwin River drainage system, and is found west to at least the Barail Range, India with the morphologically similar *V. mayaae* Rathee *et al.* 2022 being found in the elevated areas, south and west of there.

V. paracaeruleus paracaeruleus subsp. nov. of the nominate form (with the above description doubling up as a formal description of this new subspecies, with the holotype listed in the formal description of *V. paracaeruleus* sp. nov.) occurs in Myanmar from Myitkyina, Myanmar in the south (just north-west of there) and in the Kumon Bum mountain range extending north to the border with India. The range is bound by low lying drainages to the east and west and lower hills between the Kumon Bum mountain range and the main Himalayas to the north.

There is no evidence of sympatry between any of the preceding named forms.

Etymology: The subspecies *V. paracaeruleus ashokcaptaini* subsp. nov. is named in honour of Ashok Captain of Maharashtra, India in recognition of his work with the herpetofauna of India, including with respect of this formally named taxon.

SUMMARY

That undescribed species of viper can still be identified and formally named in 2022, says a lot about unrecorded diversity remaining within herpetology.

It goes without saying that within smaller forms such as small lizards in remote places, there must remain an even greater currently unrecorded species-level diversity.

The urgency with which these currently unnamed taxa need to be formally identified and managed to ensure their long-term survival cannot be understated.

According to the website <https://www.macrotrends.net> on 22 May 2022 the population of India rose by over 13 million people in year 2021 alone, rising from a base of 1.393 billion people.

All those people need to be fed, clothed, housed and so on, meaning yet more pressure on the few relatively wild and untouched places left.

Adjoining countries like Bangladesh and China are in a similar position with massive and growing human populations and the consequent environmental devastation.

The ecosystem crisis is further exacerbated by the urgent need for most of these populations of people who remain poor by world standards to raise living standards, which will also cause further habitat destruction as resources are extracted to help raise the very low current living standards.

Unfortunately, the long-term survival of both the preceding forms of snake formally named and many other reptile species in the region will only be assured if the rampant human population growth is stopped and reversed. Neither currently seem likely and may only happen in the event of some unforeseen human crisis such as war or pandemic.

However nature does abide by rules and you cannot have infinite growth within a finite system and so the long term prospects for both humanity, who's footprint on the planet is expanding and the reptile species in question, being confined to ever shrinking areas, can only be regarded as bleak as noted in Hoser (1989, 1991, 1993 and 1996).

Both the preceding formally named species are also subject to the existential threats outlined by Hoser (2019a-b).

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CONFLICTS OF INTEREST - NONE

A long overdue split: Russell's Viper *sensu lato* is formally split six ways (Squamata: Serpentes: Viperidae: *Daboia*)

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Received 1 April 2022, Accepted 14 June 2022, Published 28 June 2022.

ABSTRACT

In spite of it being one of the so-called "Big Four" snakes of India (Mukherjee 2021) and a well-known component of the south Asian snake fauna, the Russell's Viper *Daboia russelii* (Shaw and Nodder, 1797) from all parts of its range has not in recent years been subject of any taxonomic review.

This is in spite of the fact that morphologically and genetically divergent populations are known and have been so for some years.

Most recent publishing authors currently recognize only one or two species of south Asian *Daboia* Gray, 1842. These are typically just *D. russelii* from east India, west of the Ganges Delta, including nearby Pakistan at the western extremity of the range and *D. siamensis* (Smith, 1917), from extreme east India, east to Taiwan and south to Indonesia.

Other putative species have been formally named but have usually been synonymised since.

Following a review of the group across the known range, this paper recognizes six species, three of which are formally named for the first time in accordance with the rules of the *International Code of Zoological Nomenclature* (Ride *et al.* 1999).

In the case of the species *D. siamensis*, three subspecies are also recognized, although it is acknowledged a strong case for species-level recognition of these also exists.

Previously synonymised names are available for each.

The relevant newly named species are each believed to have diverged from their closest related congeners 2-3 MYA.

They also appear to be linked to major drainage systems, which is a correlation not noted by any previous author.

The two main clades of species are formally divided into subgenera, with the new genus *Oxyadaboia* *subgen. nov.* including those species from east of the Indian subcontinent, believed to have diverged from the other species 7-11 MYA.

Keywords: Herpetology; taxonomy; snake; nomenclature; Asia; Burma; Myanmar; Cambodia; Russell's Viper; *Daboia*; *russelii*; *siamensis*; *pulchella*; *elegans*; *nordicus*; *triseriartus*; *limitis*; *sublimitis*; *trinoculus*; *formosensis*; new subgenus; *Oxyadaboia*; new species; *crottyi*; *oxyi*; *sloppi*.

INTRODUCTION

The Russell's Viper (*Daboia russelii* Shaw and Nodder, 1797) is a large dangerous ground-dwelling Viper species from southern Asia.

In spite of it being one of the so-called "Big Four" snakes of India (Mukherjee 2021) and a well-known component of the south Asian snake fauna, the Russell's Viper *Daboia russelii* (Shaw and Nodder, 1797) from all parts of its range has not in recent years been subject of any taxonomic review.

This is in spite of the fact that morphologically and genetically divergent populations are known and have been so for some

years.

Most recent publishing authors currently recognize only one or two species of south Asian *Daboia* Gray, 1842. These are typically just *D. russelii* from east India west of the Ganges Delta, including nearby Pakistan at the western extremity of the range and *D. siamensis* (Smith, 1917), from extreme east India, east to Taiwan and south to Indonesia.

Other putative species have been formally named but have been usually synonymised since.

Thorpe *et al.* (2007) in conjunction with Wolfgang Wüster

published a review of "*Daboia russelii*" which guesstimated the divergence of the two main populations (Indian subcontinent and the rest) at 7-11 MYA and accordingly divided the two groups into *D. russelii* for the subcontinent animals and *D. siamensis* for the rest.

Various other forms were synonymised.

This was a significant act because Thorpe *et al.* (2007) also stated that within their published phylogeny, 5 or more groups diverged from one another 2-3 MYA, which would normally be treated as a species-level split.

In the decades since the publication of Thorpe *et al.* (2007), Wüster has attempted to set himself up as the gate-keeper of taxonomy and nomenclature in herpetology and aggressively discouraged anyone from working on taxa he claims "ownership" of, or daring to publish any taxonomy or nomenclature that is different to his.

Via his stooge Peter Uetz, managing a website called "The Reptile Database", Wüster peddles his warped world view of reptile taxonomy to others.

He also does much the same by planting other stooges on editorial boards of journals he seeks to control, even going so far as to try to get his stooge Scott Thomson elected to the International Commission of Zoological Nomenclature (ICZN), although that attempt in 2021 failed.

This position of Wüster trying to exert despotic control over taxonomy and nomenclature in herpetology was formalised in Kaiser (2012a, 2012b), with Kaiser (2012b) actually being a document written by Wüster himself. Better known as Wüster *et al.*, it was then published in a print journal as Kaiser *et al.* (2013) (even though in 2012 in Kaiser (2012a) he has stated he had played no part in writing the document), which after being discredited by Hoser (2013), was rejigged by Kaiser (2013 and 2014a-b), and then when this position became wholly untenable was formally ditched and superseded by Rhodin *et al.* (2015).

After the ICZN formally rejected the claims of Rhodin *et al.* (2015) in the ruling of ICZN (2021) the claim being contested as to cede power to Wüster that would have allowed him alone to usurp the ICZN's authority, the latest incarnation of Wüster's despotic attempt to control herpetological taxonomy and nomenclature is via his latest publication of relevance being Wüster *et al.* (2021).

Wüster *et al.* (2021) is a direct attack on the primacy of the International Commission of Zoological Nomenclature and the *International Code of Zoological Nomenclature* (Ride *et al.* 1999) and ICZN (2012).

The latter document is the rule book for all scientists with respect of nomenclature for zoology, except of course for Wolfgang Wüster and his gang of thieves who are best described as a bunch of crooks, who do occasionally attempt to dabble in science. Wüster has been running his various attacks on legitimate herpetologists for decades, including via his stooges and since at least 1987 (see Shine 1987, Shea 1987 and Sprackland *et al.* 1997).

These activities have been discredited by ICZN (1991, 2001, 2021), Cogger (2014), Dubois (2014), Dubois *et al.* (1988), Hoser (2001a, 2001b, 2007, 2009, 2012a, 2012c, 2013, 2015a-f, 2017, 2019a-b) Hawkeswood (2021) and numerous other scientists.

As a result of the preceding the taxonomy of *Daboia* in south Asia has been effectively on ice for the past 15 years!

Science must progress and with human population and environmental pressures increasing throughout southern Asia, the resolution of the taxonomy and nomenclature of the south Asian *Daboia* now becomes a matter of urgency.

This is particularly in view of significant declines in numbers of all relevant species across the Indian subcontinent, where the

putative species was most common and continued declines in populations elsewhere, which while thought to be extensive, are now known to be severely fragmented.

Hence the formal review of the genus and/or species across the known range.

MATERIALS AND METHODS

Notwithstanding the molecular results of Thorpe *et al.* (2007) which flagged a number of putative species, all were revisited as part of this study.

Specimens from across the range of putative *Daboia* in southern Asia were inspected (live, dead and from photos with quality location data), along with a review of the relevant published literature on the putative species, including all notable morphological and molecular studies.

These were also cross-checked with other studies relevant to known sea level minima during times of glacial maxima in the Pliocene-Pleistocene epochs as a means to calibrate measured genetic divergences in the relevant published studies if at all possible and in this case of *Daboia*, to confirm likely distributions and zones of admixture during times of glacial minima and maxima.

Museum holdings were audited with a view to ascertaining accurate and likely distributions across southern Asia, with a view to determining preferred habitats and exclusionary zones likely to facilitate speciation.

Literature relevant to the putative species *D. russelii* including previously synonymised forms and relevant taxonomic decisions made herein include Adil *et al.* (2020), Adler (2015), Adler *et al.* (2000), Avadhani (2005, 2006), Bannermann (1907a, 1907b), Bauer (2015), Bauer *et al.* (2015), Beolens *et al.* (2011), Bhattarai *et al.* (2018, 2020), Bhupathy and Sathishkumar (2013), Botejue *et al.* (2012), Brongersma (1958), Campbell (2015), Campbell and Verveniotou (2015), Chan-ard *et al.* (1999, 2015), Chettri and Chhetry (2013), Cox *et al.* (1998), Das (2012, 2015), Das and De Silva (2005), De Lang (2011a, 2011b, 2017), De Silva (1998), Deshmukh *et al.* (2020), Dowling (1993), Dowling and Jenner (1988), Dutta *et al.* (2009), Fenton (1905), Ganesh *et al.* (2018, 2020), Gayen *et al.* (2019), Glaudas (2021), Habib and Cheda (2010), Hamid (2020), Hoser (2012b, 2022), Ingle (2020), Ingle *et al.* (2019), Iskandar and Mumpuni (2002), Jadhav *et al.* (2018), Janzen *et al.* (2017), Jayakody (2001), Kalki *et al.* (2021), Karthik *et al.* (2018), Karunaratna and Thasun Amarasinghe (2011), Kästle *et al.* (2013), Khan (1983), Khan and Ahmad (2019), Khandakar and Jeny (2020), Kopstein (1936), Lenz (2012), Leviton *et al.* (2003), Madushanka and Ranathunga (2019), Maki (1931), Manhas *et al.* (2016, 2018), Manthey and Grossmann (1997), Masroor (2012), McDiarmid *et al.* (1999), Mertens (1927, 1930, 1957), Mukherjee (2021), Murthy (2010), Narayan Rao (1918), Neang *et al.* (2015), Norval *et al.* (2008), Paira *et al.* (2022), Palot (2015), Pandey (2018), Parmar and Shantilal (2019), Patel and Vyas (2019), Patel *et al.* (2018), Phelps (2010), Purkayastha (2013), Pyron *et al.* (2013), Rawat *et al.* (2020), Sahi and Koul (2020), Saikia *et al.* (2007), Sharma (2004), Sharma *et al.* (2013), Shaw and Nodder (1979), Smith (1917, 1943), Šmíd and Tolley (2019), Taylor (1965), Thakur (2011), Thorpe *et al.* (2007), Toriba (1993), Trivedi and Desai (2019), Tsetan and Ramanibai (2011), Vyas (2007a-b, 2011, 2013), Vyas and Thakur (2015), Wall (1905a, 1905b, 1906, 1907), Wallach *et al.* (2014), Welch (1994), Whittaker and Captain (2004), Winchell (2003a, 2003b), Wirth (2011), Wüster (1998), Wüster *et al.* (1992a, 1992b) and sources cited therein.

RESULTS

It turned out that Russell's Vipers preferred habitat includes plains, coastal lowlands, and hills of suitable habitat. Excessively humid environments such as rainforests are

avoided as are deserts, both of which are effective at splitting populations.

To that effect, it was noted that the south Asian populations of *Daboia* formed morphological and genetic groups based on major river valley drainages and associated landforms.

These were as follows:

- 1/ Indus River;
- 2/ Ganges/Brahmaputra drainage, including along the coast and hills of southern India, in particular the eastern Ghats;
- 3/ Irawaddy Basin (Myanmar);
- 4/ Chao Phraya (Thailand),
- 5/ Lower Mekong (Cambodia, Vietnam, east Thailand, Laos),
- 6/ South China Sea/Indonesia

With the first two groups diverging from one another in excess of 3 MYA, they are both herein recognized as full species.

These are within *D. russelii* (Shaw and Nodder, 1797) *sensu stricto*.

The type locality of *D. russelii* is India. Other available synonyms for this form, are *D. nordicus* (Deraniyagala, 1945) from Calcutta, *D. pulchella* Gray, 1842 from Sri Lanka, *D. elegans* (Daudin, 1803) from south-east India and *D. triseriartus* (Hermann, 1804) from Tamil Nadu, India (south India).

None can be applied to the form from the Indus Valley in Pakistan and so that is effectively unnamed.

Therefore it is formally named as *D. crottyi* sp. nov..

Both *D. russelii* and *D. crottyi* sp. nov. as pair are believed to have diverged from the species east of the Indian subcontinent 7-11 MYA (Thorpe et al. 2007). Combined with the obvious morphological and geographic divergence, it is appropriate the eastern clade of species be placed in a separate subgenus. As no name is available, the subgenus *Oxyadaboia* subgen. nov. with a type species of *Daboia* (*Oxyadaboia*) *oxyi* sp. nov. is erected to accommodate these taxa.

In terms of the other six populations of putative *D. russelii* or *D. siamensis* (Smith, 1917), all herein placed in the subgenus *Oxyadaboia* subgen. nov. the oldest potentially available synonym is *Coluber trinoculus* Schneider, 1802, but as it has not been used as correct since being formally synonymised with "*Vipera elegans*" by Merrem in 1820 (at page 153), this priority defers under the *International Code of Zoological Nomenclature* (Ride et al. 1999) to the widely used *D. siamensis* (Smith, 1917), with a type locality of 60 km north of Bangkok, Thailand. This name therefore accounts for the population centred on Chao Phraya, Thailand.

D. sublimitus (Kopstein, 1936) has a type locality of Java and so can be applied to the South China Sea/Indonesian population and so is an available name for the taxon.

Other available names for the same putative species (*D. siamensis*) are *D. limitis* (Mertens, 1927) from Endeh Island, an islet offshore from Flores in the Lesser Sundas and *D. formosensis* (Maki, 1931) from Taiwan.

Those two names can be applied to the relevant populations of the same species based on divergence of the forms, the latter including specimens from the nearby mainland of China.

Hence the preceding cluster, with three available names, are treated herein as *D. limitis* (Mertens, 1927) (from the Sunda Islands), being the oldest relevant available name, with the subspecies *D. limitis sublimitis* (Kopstein, 1936) from Java and *D. limitis formosensis* (Maki, 1931) from Taiwan and nearby coastal China.

Notwithstanding this conservative treatment, there is a strong argument for treating each of the trio as separate species.

Each are geographically disjunct, morphologically divergent and evolving as separate species. Furthermore all are likely to have diverged from one another somewhere between 2-3 MYA

sensu Thorpe et al. (2007).

A diagnostic separation of the relevant subspecies is done in the formal descriptions below for two relevant associated species, being the first such formal separation of the relevant forms in a peer reviewed scientific paper.

In terms of these morphologically and genetically similar snakes, spread across a wide geographical area and in the absence of obvious drainage basin, it was noted that in recent geological times the Sunda shelf occupied much of west Indonesia and the nearby South China sea, creating a relatively optimal corridor of habitat for transit of snakes across.

At times of ice-age maxima the local climate would have been considerably drier than seen at present enabling the putative species to move through areas now considered too moist for them to do so.

Having said this, each of the three main groups within this putative species (*D. siamensis*), are at least sufficiently divergent to warrant recognition as subspecies as is done here.

This leaves both the Irawaddy Basin (Myanmar) and lower Mekong (Cambodia, Vietnam, east Thailand, Laos) populations unnamed and without available names. As they are significantly divergent from all others, including being more divergent from all other forms than the above-named subspecies are from one another, these two populations are formally named as *B. oxyi* sp. nov. and *B. sloppi* sp. nov..

Hence in this paper there is in total, a new subgenus and three new species being formally named for the first time in accordance with the rules of the *International Code of Zoological Nomenclature* (Ride et al. 1999).

NOTES ON THE FORMAL DESCRIPTIONS THAT FOLLOW

In terms of the descriptions that follow, the following should be noted:

There is no conflict of interest in terms of this paper or the conclusions arrived at herein.

Several people including anonymous peer reviewers who revised the manuscript prior to publication are also thanked as are relevant staff at museums who made specimens and records available in line with international obligations.

In terms of the following formal descriptions, spellings should not be altered in any way for any purpose unless expressly and exclusively called for by the rules governing Zoological Nomenclature as administered by the International Commission of Zoological Nomenclature (ICZN).

This includes if gender assignment of suffixes seems incorrect, Latinisation is wrong, apparent spelling mistakes and so on (see Article 32.5.1 of the Code).

In the unlikely event two or more newly named taxa are deemed to be the same by a first reviser, then the name to be used and retained is that which first appears in this paper by way of page priority and as listed in the abstract keywords.

Some material in descriptions for taxa may be repeated for other taxa in this paper and this is necessary to ensure each fully complies with the provisions of the *International Code of Zoological Nomenclature* (fourth edition) (Ride et al. 1999) as amended online since (ICZN 2012).

Material downloaded from the internet and cited anywhere in this paper was downloaded and checked most recently as of 10 June 2022 (including if also viewed prior), unless otherwise stated and was accurate in terms of the content cited herein as of that date. Any online citations within this paper, including copied emails and the like, are not necessarily cited in the references part of this paper and have the same most recent viewing date as just given.

Unless otherwise stated explicitly, colour and other descriptions apply to living and **fully mature adult specimens** of generally good health, as seen by day, and not under any form of stress by means such as excessive cool, heat, dehydration, excessive ageing, abnormal skin or reaction to chemical or other input.

SVL or SV means snout-vent length, TL means tail length.

While numerous texts and references were consulted prior to publication of this paper, the criteria used to separate the relevant genera, subgenera, species or subspecies has already been spelt out and/or is done so within each formal description and does not rely on material within publications not explicitly cited herein.

OXYADABOIA SUBGEN. NOV.

LSIDurn:lsid:zoobank.org:act:4C60DB92-F854-4D24-A07C-050181BA133E

Type species: *Daboia oxyi* sp. nov. (AKA *Daboia* (*Oxyadaboia*) *oxyi* sp. nov.).

Diagnosis: Snakes in the nominate genus *Daboia* Gray, 1842 occur in the Indian subcontinent region. Snakes in the subgenus *Oxyadaboia subgen. nov.* occur in south-east Asia from far east India and Burma in the west, to Taiwan in the east and south to the Lesser Sundas, Indonesia. The distribution within this range is however patchy and appears to be associated with major drainage basins and lowland regions. The south-east Asian *Daboia* being the subgenus *Oxyadaboia subgen. nov.* are separated from *D. crottyi* sp. nov. and *D. russelii* (being the entirety of the type subgenus *Daboia* Gray, 1842), by dorsal colouration, which incorporates large dark dorsal squares or circles of irregular shape along the mid dorsal line combined with medium sized lateral squares with rounded and irregular edges and shape, while between the two are small but obvious dark triangles and other irregular shapes tending to form an additional row.

By contrast *D. crottyi* sp. nov. and *D. russelii* (being the entirety of the type subgenus *Daboia* Gray, 1842), are defined by very large dorsal circles or squares of irregular shape with large light coloured centres and similar but slightly smaller shapes of similar form on the lateral line (or flanks). There are no obvious dark triangles and other irregular shapes tending to form an additional row between these rows of larger markings.

Thorpe *et al.* (2007) in their account of the relevant species inadvertently reversed the correct species for the preceding characters in their Fig. 3. on page 214.

All south Asian *Daboia*, being the entirety of the genus *Daboia* Gray, 1842 as defined by Hoser (2012), are separated from all other vipers by the following suite of characters:

No sensory pit between nostril and eye; head very distinct from neck, above covered by small, keeled, imbricate scales, 6-9 between narrow supraoculars; nostril large, in large nasal shield which, below, is fused to the rostral; eye, with vertically elliptic pupil, surrounded by 10-15 small scales, 3-4 rows of small scales separating the circumocular scales from the upper labials; temporals small; 10-12 upper labials; 27-33 longitudinal rows of scales at midbody, all except outmost row strongly keeled; ventrals 153-180; subcaudals 41-64, all paired; colour above light brown with 3 longitudinal series of large black-margined brown spots or blotches, the vertebral series often merging to form a chain-like longitudinal stripe; in all species except *D. russelii* and *D. crottyi* sp. nov. there is an additional longitudinal series of small dark spots between the main vertebral and lateral series; yellowish white below occasionally with dark brown markings (modified from Leviton *et al.* 2003).

Daboia is separated from the closely related genus *Maxhoservipera* Hoser, 2012 by the less thick-set build of *Daboia* species and the fact that the dark blotch running into

the eye is considerably wider than the eye, as opposed to being roughly the same width. *Daboia* species are further separated by the dorsal pattern which is not in the zig-zag configuration seen in the genus *Maxhoservipera*.

The pattern in *Daboia* is a colour pattern consisting of a deep yellow, tan or brown ground colour, with three series of dark edged spots that run the length of the body on the mid-line and each of the flanks. Each of these spots has a black or dark brown ring around it, the outer border of which is sometimes intensified with a rim of white or yellow, but giving an impression of ovals, smooth circles or similar as opposed to the more typical viperine zig-zag or chain pattern. The dorsal spots, which usually number 23-30, may grow together, while the side spots may break apart (modified from Hoser, 2012).

Distribution: *Oxyadaboia subgen. nov.* occur in south-east Asia from far east India and Burma in the west, to Taiwan in the east and south to the Lesser Sundas, Indonesia. The distribution within this range is however patchy and appears to be associated with major drainage basins and lowland regions.

Etymology: As for the species *Daboia oxyi* sp. nov.. The spelling name for this subgenus should not be altered. The spelling is deliberate and it is a take on Australian slang as well.

Content: *Daboia* (*Oxyadaboia*) *oxyi* sp. nov. (type species); *D. (Oxyadaboia) limitis* (Mertens, 1927); *D. (Oxyadaboia) siamensis* (Smith, 1917); *D. (Oxyadaboia) sloppi* sp. nov..

Note: *D. (Oxyadaboia) limitis* includes the three subspecies *D. limitis limitis* (Mertens, 1927) from the Sunda Islands, Indonesia; *D. limitis formosensis* (Maki, 1931) from Taiwan and nearby China and *D. limitis sublimitis* (Kopstein, 1936) from Java, Indonesia.

DABOIA (DABOIA) CROTTYI SP. NOV.

LSIDurn:lsid:zoobank.org:act:6657305F-0550-4BAC-BBE9-DCFB66CABA7E

Holotype: A preserved specimen in the Carnegie Museum of Natural History, Pittsburgh, Pennsylvania, USA, specimen number CM Herps 69426 collected from Pindi Bhattan, Jhangh District, Pakistan.

This facility allows access to its holdings.

Paratype: A preserved specimen in the Museum of Vertebrate Zoology, University of California, Berkeley, California, USA, specimen number MVZ:Herp:248468 collected from Buddh Village, Sujawal, Thatta District, Sindh Province, Pakistan, Latitude 24.605307 N., Longitude 68.077217 E.

Diagnosis: *Daboia crottyi* sp. nov. has until now been treated as a western population of *D. russelii* (Shaw and Nodder, 1797).

Daboia crottyi sp. nov. has a distribution centred on the Indus Valley in Pakistan, but including relevant parts of north-west India.

D. russelii (Shaw and Nodder, 1797) is found in most parts of India, including the Ganges Brahmaputra drainage, southern India and also nearby low-elevation parts of Nepal.

The south Asian *Daboia* from further east, or south-east Asia being the subgenus *Oxyadaboia subgen. nov.* are separated from *D. crottyi* sp. nov. and *D. russelii* by dorsal colouration, which incorporates large dark dorsal squares or circles of irregular shape along the mid dorsal line combined with medium sized lateral squares with rounded and irregular edges and shape, while between the two are small but obvious dark triangles and other irregular shapes tending to form an additional row.

By contrast *D. crottyi* sp. nov. and *D. russelii* (being the entirety of the type subgenus *Daboia* Gray, 1842), are defined by very large dorsal circles or squares of irregular shape with

large light coloured centres (more-or-less along the mid-dorsal axis) and similar but slightly smaller shapes of similar form on the lateral line (or flanks). There are no obvious dark triangles and other irregular shapes tending to form an additional row between these rows of larger markings.

Thorpe *et al.* (2007) in their account of the relevant species inadvertently reversed the correct species for the preceding characters in their Fig. 3. on page 214.

D. russelii is readily separated from *D. crottyi* sp. nov. by having dark circles or similar of irregular shape along the mid-dorsal line that are boldly edged with black with the inner and outer edge being well-defined. The inner part of these shapes is light brown.

By contrast in *D. crottyi* sp. nov. the same blotches are edged with dark brown (rather than black) and the inner edge is either poorly defined or of similar colour to the adjoining part of the inside of the blotch, which is also a dark to medium brown colour.

In *D. crottyi* sp. nov. the interspaces between the blotches on the dorsum are brownish, rather than yellowish as seen in *D. russelii*.

In effect the preceding two trait differences means that *D. russelii* is a boldly coloured snake, whereas *D. crottyi* sp. nov. is not.

All south Asian *Daboia*, (both subgenera) being the entirety of the genus as defined by Hoser (2012), are separated from all other vipers by the following suite of characters:

No sensory pit between nostril and eye; head very distinct from neck, above covered by small, keeled, imbricate scales, 6-9 between narrow supraoculars; nostril large, in large nasal shield which, below, is fused to the rostral; eye, with vertically elliptic pupil, surrounded by 10-15 small scales, 3-4 rows of small scales separating the circumocular scales from the upper labials; temporals small; 10-12 upper labials; 27-33 longitudinal rows of scales at midbody, all except outermost row strongly keeled; ventrals 153-180; subcaudals 41-64, all paired; colour above light brown with 3 longitudinal series of large black-margined brown spots or blotches, the vertebral series often merging to form a chain-like longitudinal stripe; in all species except *D. russelii* and *D. crottyi* sp. nov. there is an additional longitudinal series of small dark spots or markings between the main vertebral and lateral series; yellowish white below occasionally with dark brown markings (modified from Leviton *et al.* 2003).

Daboia is separated from the closely related genus *Maxhoservipera* Hoser, 2012 by the less thick-set build of *Daboia* species, with *Maxhoservipera* being very stout in build and the fact that the dark blotch running into the eye is considerably wider than the eye, as opposed to being roughly the same width.

Daboia species are further separated by the dorsal pattern which is not in the obvious zig-zag configuration seen in the genus *Maxhoservipera*.

The pattern in *Daboia* is a colour pattern consisting of a deep yellow, tan or brown ground colour, with three series of dark edged spots that run the length of the body on the mid-line and each of the flanks. Each of these spots has a black or dark brown ring around it, the outer border of which is sometimes intensified with a rim of white or yellow, but giving an impression of ovals, smooth circles or similar as opposed to the more typical viperine zig-zag or chain pattern. The dorsal spots, which usually number 23-30, may grow together, while the side spots may break apart (modified from Hoser, 2012).

D. crottyi sp. nov. is depicted in life online at:

<https://www.inaturalist.org/observations/35578010>

and

<https://www.inaturalist.org/observations/34441219>

and

<https://www.flickr.com/photos/wildhiss/2884851637/>

D. russelii in life is depicted online at:

<https://www.inaturalist.org/observations/78201336>

and

<https://www.inaturalist.org/observations/36666824>

and

<https://www.inaturalist.org/observations/113401995>

and

<https://www.inaturalist.org/observations/71944667>

and

<https://www.inaturalist.org/observations/99969057>

and

<https://www.flickr.com/photos/wildlifer-india/5869356818/>

Distribution: *Daboia crottyi* sp. nov. has a distribution centred on the Indus Valley in Pakistan, extending in the north to Punjab and nearby in north-west India.

Etymology: *Daboia crottyi* sp. nov. was named in honour of a Great Dane cross Rottweiler Dog, named *Crotalus* or "Crotty" for short, in recognition of the 13 years of service he gave guarding our wildlife research facility in Australia. The name was also chosen as a species name as it is short, simple and easy to remember.

DABOIA (OXYADABOIA) OXYI SP. NOV.

LSIDurn:lsid:zoobank.org:act:A8BD1BC2-3732-45A0-8DFB-ABA28882DB5B

Holotype: A preserved adult male specimen at the California Academy of Sciences, San Francisco, California, USA, specimen number CAS HERP 210835 collected from Kyaukpadaung Township, near Myauk Taw Village, Mandalay Division, Myanmar (Burma), Latitude 21.00112 N., Longitude 95.14500 E.

This facility allows access to its holdings.

Paratypes: 1/ A preserved male specimen at the California Academy of Sciences, San Francisco, California, USA, specimen number CAS HERP 206671 caught crossing the road near Monywa, Sagaing Division, Myanmar (Burma) Latitude 22.21824 N., Longitude 95.34128 E. 2/ A preserved specimen in the California Academy of Sciences, San Francisco, California, USA, specimen number CAS HERP 205255 collected from farm fields on the east side of the road about 1 km from the road, being the Mandalay-Yangon Road, 96 km south of Mandalay, Mandalay Division, Myanmar (Burma), Latitude 21.19475 N., Longitude 96.04231 E. 3/ A preserved juvenile specimen at the California Academy of Sciences, San Francisco, California, USA, specimen number CAS HERP 216112 collected from Na Htoe Gyi Township, Minsontaung Wildlife Sanctuary, Mya Taung Village, Mandalay Division, Myanmar (Burma), Latitude 21.22586 N. Longitude 95.47599 E.

Diagnosis: *Daboia (Oxyadaboia) oxyi* sp. nov. has until now been treated as a population of either, *D. russelii* (Shaw and Nodder, 1797) with a type locality of India or more recently as a population of *D. siamensis* (Smith, 1917), with a type locality of 60 km north of Bangkok, Thailand.

While more closely related to the latter species, *D. oxyi* sp. nov. is sufficiently divergent to be treated as a separate species.

D. siamensis (Smith, 1917) from central Thailand, *D. oxyi* sp. nov. from the Irawaddy Basin Myanmar (Burma), *D. sloppi* sp. nov. from the lower Mekong basin (Cambodia, Vietnam, northern Thailand and Laos) and *D. limitis* (Mertens, 1927) from southern Indonesia (2 subspecies recognized herein from here) and southern China/Taiwan (another third subspecies recognized from here), being the entirety of the subgenus

Oxydaboia subgen. nov. are all separated from the nominate subgenus of *Daboia* Gray, 1842, being *D. russelii* from India/ Nepal and the closely related *D. crottyi sp. nov.* from the Indus Valley, Pakistan and nearby north-west India by dorsal colouration, which incorporates large dark dorsal squares or circles of irregular shape along the mid dorsal line combined with medium sized lateral squares with rounded and irregular edges and shape, while between the two are small but obvious dark triangles and other irregular shapes tending to form an additional row.

By contrast *D. crottyi sp. nov.* and *D. russelii* are defined by very large mid-dorsal circles or squares of irregular shape with large light coloured centres and similar but slightly smaller shapes of similar form on the lateral line (or flanks). There are no obvious dark triangles and other irregular shapes tending to form an additional row between these rows of larger markings.

By contrast *D. crottyi sp. nov.* and *D. russelii* are defined by very large mid-dorsal circles or squares of irregular shape with large light coloured centres and similar but slightly smaller shapes of similar form on the lateral line (or flanks). There are no obvious dark triangles and other irregular shapes tending to form an additional row between these rows of larger markings. Thorpe *et al.* (2007) in their account of the relevant species inadvertently reversed the correct species for the preceding characters in their Fig. 3. on page 214.

Species and subspecies within the subgenus *Oxydaboia subgen. nov.* are separated from one another by the following unique suites of characters:

Daboia oxyi sp. nov. from the Irawaddy Basin (Myanmar) is by far the most divergent of the species within the subgenus *Oxydaboia gen. nov.*, both by morphology and genetic divergence. It is separated from all other species in this subgenus by having a dorsum consisting of extremely large dark brown blotches along the mid-dorsal line and similarly large ones on the flanks. These blotches are blackish at the outer edges, but the majority of each blotch is an even dark brown. The third intermediate row of blotches between the main rows consists of mainly rounded edged triangles.

In combination the dark blotches effectively fill the dorsum and flanks so that the lighter interspaces, a light grey in this species, are reduced to form well-defined light grey lines separating the dark, being in the form of a reticulum, this being unique to this species. On the dorsum the large blotches commonly join to form a single shape along the spinal region, sometimes with a break and sometimes not. The dark spots on the flanks are so expanded that they tend to run into the ventral surface.

The tail has dark brown on top and is marked grey on the flanks.

Daboia siamensis (Smith, 1917) from the Chao Phraya region of central Thailand is very different to *D. oxyi sp. nov.* *D. siamensis* has blotches on the dorsum and flanks (the three main rows), being in the form of large circles of reduced size, with the interspaces being wide and a beige to yellow-brown colour. The smaller spots between the main rows are in the form of broken lines that are blackish-brown in colour. While in *D. oxyi sp. nov.* the dark blotches on the dorsum and flanks are the overwhelming bulk of the surface area, in *D. siamensis* this is not the case. The light interspaces are about half or even more than half of the surface area.

The dark circles on *D. siamensis* are a bright orange or orange-brown in colour, becoming dark brown to black on the extreme outer edges. The tail is mainly dark brown on top and marked light brown to beige on the flanks.

D. sloppi sp. nov. from the lower Mekong drainage of Cambodia and adjacent countries, being Myanmar, Laos and Thailand is similar in most respects to *D. siamensis* as

described above, but is separated from that species by having a reduced number of spots running along the dorsum and flanks, but of increased size, the result being that about half the body is still lighter interspace, this being a medium brown colour. Both the large blotches on the dorsum and the flanks are distinctively jagged edged as are the smaller blotches on the upper flank region. Tail is mainly light brown with some dark brown markings, mainly on the uppermost surfaces.

The smaller blotches on the flanks are also more numerous and these are prominent along much of the flank between larger blotches, versus not prominent or common on the flanks between larger blotches in *D. siamensis*, or otherwise absent along much of the flank.

Diagnostic for all three subspecies of *D. limitis* (Mertens, 1927), is that in terms of the larger spots on the dorsum and flanks, there is either no darkening, or no obvious darkening of the outer edges, as seen in all other species in this subgenus, namely *D. siamensis*, *D. sloppi sp. nov.* and *D. crottyi sp. nov.* *D. limitis limitis* of the type form from the Lesser Sundas, Indonesia are readily separated from the other subspecies by having a light grey dorsum which in turn has rows of odd-shaped dark grey to grey-brown blotches on the dorsum and flanks. The smaller spots or markings in between these larger spots are somewhat indistinct. Half or most of the dorsum is lighter interspaces and the larger spots on the flanks are still small as compared to other species and subspecies and fall way short of the ventral surface. White on the outer edges of the dorsal blotches is either absent or very minimal and barely noticeable.

D. limitis sublimitis (Kopstein, 1936) from Java is separated from the type form of *D. limitis limitis* and *D. limitis formosensis* (Maki, 1931) by being a light reddish-brown colour above, with chocolate brown blotches on the dorsum and flanks, these having a strong whitish etching on the outer edges. The tail is a light reddish brown with chocolate brown markings, mainly on the dorso-medial ridge.

D. limitis formosensis is separated from the other two subspecies of *D. limitis* by having a medium-grey dorsum overlain with dark grey blotches on the median line and on the flanks. Those blotches have an obvious thin white line etching each of them. The blotches on the dorsum and flanks are in the main consisting of well formed and evenly shaped ovals. In combination these blotches occupy most of the dorsum, (but not to the extent seen in *D. oxyi*), meaning that *D. limitis formosensis* is unique in the complex in having the overall appearance of being a dark, grey coloured snake. Circles on the lower flanks either approach or touch the boundary of the ventral surface. Tail is grey, with dark grey marking on the upper surface.

Daboia (Oxydaboia) oxyi sp. nov. is depicted in life online at: <https://www.flickr.com/photos/65586506@N04/27590045129/> and

<https://www.flickr.com/photos/65586506@N04/25497852268/>

D. (Oxydaboia) siamensis is depicted in life online at: <https://www.inaturalist.org/observations/105656167>

and

<https://www.inaturalist.org/observations/106157355>

and

<https://www.inaturalist.org/observations/14563329>

D. (Oxydaboia) sloppi sp. nov. is depicted in life in Fig. 8 on page 178 of Neang *et al.* (2015).

D. (Oxydaboia) limitis limitis is depicted in life in De Lang (2011b) on pages 261, 262, 264-267 and online at:

<https://www.inaturalist.org/observations/73293923>

and

<https://www.inaturalist.org/observations/35630271>

and
<https://www.inaturalist.org/observations/44841835>
 and
<https://www.flickr.com/photos/96574168@N02/27547836234/>
 and
<https://www.flickr.com/photos/hamidtun/50500544097/>
 and
<https://www.flickr.com/photos/96574168@N02/24217001436/>
D. (Oxyadaboia) limitis formosensis is depicted in life online at:
<https://www.inaturalist.org/observations/98589105>
 and
<https://www.inaturalist.org/observations/22192926>
 and
<https://www.inaturalist.org/observations/78564111>
 and
<https://www.inaturalist.org/observations/109822621>
 and
<https://www.flickr.com/photos/bobhawley/24487294678/>
D. (Oxyadaboia) limitis sublimitis is depicted in life online at:
https://www.flickr.com/photos/gazs_pics/17840504359/
D. russelii is readily separated from *D. crottyi* sp. nov. by having dark circles or similar of irregular shape along the mid-dorsal line that are boldly edged with black with both the inner and outer edge being well-defined. The inner part of these shapes is light brown.
 By contrast in *D. crottyi* sp. nov. the same blotches are edged with dark brown (rather than black) and the inner edge is either poorly defined or of similar colour to the adjoining part of the inside of the blotch, which is also a dark to medium brown colour.

In *D. crottyi* sp. nov. the interspaces between the blotches on the dorsum are brownish, rather than yellowish as seen in *D. russelii*.

In effect the preceding two trait differences means that *D. russelii* is a boldly coloured snake, whereas *D. crottyi* sp. nov. is not.

All south Asian *Daboia*, (both subgenera) being the entirety of the genus as defined by Hoser (2012), are separated from all other vipers by the following suite of characters:

No sensory pit between nostril and eye; head very distinct from neck, above covered by small, keeled, imbricate scales, 6-9 between narrow supraoculars; nostril large, in large nasal shield which, below, is fused to the rostral; eye, with vertically elliptic pupil, surrounded by 10-15 small scales, 3-4 rows of small scales separating the circumocular scales from the upper labials; temporals small; 10-12 upper labials; 27-33 longitudinal rows of scales at midbody, all except outmost row strongly keeled; ventrals 153-180; subcaudals 41-64, all paired; colour above light brown with 3 longitudinal series of large black-margined brown spots or blotches, the vertebral series often merging to form a chain-like longitudinal stripe; in all species except *D. russelii* and *D. crottyi* sp. nov. there is an additional longitudinal series of small dark spots between the main vertebral and lateral series; yellowish white below occasionally with dark brown markings (modified from Leviton *et al.* 2003).

Daboia is separated from the closely related genus *Maxhoservipera* Hoser, 2012 by the less thick-set build of *Daboia* species, with *Maxhoservipera* being very stout and the fact that the dark blotch running into the eye is considerably wider than the eye, as opposed to being roughly the same width.

Daboia species are further separated by the dorsal pattern which is not in the zig-zag configuration seen in the genus *Maxhoservipera*.

The pattern in *Daboia* is a colour pattern consisting of a deep yellow, tan or brown ground colour, with three series of dark edged spots that run the length of the body on the mid-line and flanks. Each of these spots has a black or dark brown ring around it, the outer border of which is sometimes intensified with a rim of white or yellow, but giving an impression of ovals, smooth circles or similar as opposed to the more typical viperine zig-zag or chain pattern. The dorsal spots, which usually number 23-30, may grow together, while the side spots may break apart (modified from Hoser, 2012).

D. (Daboia) crottyi sp. nov. is depicted in life online at:
<https://www.inaturalist.org/observations/35578010>

and
<https://www.inaturalist.org/observations/34441219>

D. (Daboia) russelii in life is depicted online at:
<https://www.inaturalist.org/observations/78201336>

and
<https://www.inaturalist.org/observations/36666824>

and
<https://www.inaturalist.org/observations/113401995>

and
<https://www.inaturalist.org/observations/71944667>

and
<https://www.inaturalist.org/observations/99969057>

Thorpe *et al.* (2007) found a 2-3 MYA divergence between what is herein treated as *D. oxyi* sp. nov. and its nearest congener.

Distribution: *D. oxyi* sp. nov. appears to be confined to the Irawaddy Basin Myanmar (Burma).

Etymology: *Daboia (Oxyadaboia) oxyi* sp. nov. (both subgenus and species) were named in honour of a Great Dane Dog, named *Oxyuranus* or "Oxy" for short, in recognition of the 8 years of service he gave guarding our wildlife research facility in Australia. The name was also chosen as a species name as it is short, simple and easy to remember.

DABOIA (OXYADABOIA) SLOPPI SP. NOV.

LSIDurn:lsid:zoobank.org:act:9C56F61C-F269-4B7A-8E82-066694EC6562

Holotype: An adult specimen depicted in an image in Fig 8 on page 178 in Neang *et al.* (2015) (missing head and tail), being Neang, T., Grismer, L. L., Hun, S. and Phan, C. 2015. New herpetofauna records and range extensions for *Daboia siamensis* (Smith, 1917) and *Gekko petricolus* Taylor, 1962 from Cambodia. *Cambodian Journal of Natural History* 2015(2)172-182.

The holotype was killed at Tropeang Tung Village, Samroang District, Bansay Reak Commune, Oddar Meanchey Province, Cambodia, Latitude 14.13136 N., Longitude 103.35239 E.

Diagnosis: *Daboia (Oxyadaboia) sloppi* sp. nov. has until now been treated as a population of either, *D. (Daboia) russelii* (Shaw and Nodder, 1797) with a type locality of India or more recently a population of *D. (Oxyadaboia) siamensis* (Smith, 1917), with a type locality of 60 km north of Bangkok, Thailand.

While more closely related to the latter species, *D. (Oxyadaboia) sloppi* sp. nov. is sufficiently divergent to be treated as a separate species.

D. (Oxyadaboia) siamensis (Smith, 1917) from central Thailand, *D. (Oxyadaboia) sloppi* sp. nov. from the lower Mekong basin (Cambodia, Vietnam, northern Thailand and Laos), *D. (Oxyadaboia) oxyi* sp. nov. from the Irawaddy Basin Myanmar (Burma) and *D. (Oxyadaboia) limitis* (Mertens, 1927) from southern Indonesia (2 subspecies recognized herein from here) and southern China/Taiwan (another third subspecies recognized from here), being the entirety of the subgenus *Oxyadaboia subgen. nov.* are all separated from the nominate subgenus of *Daboia* Gray, 1842, being *D. russelii* from India/

Nepal and the closely related *D. crottyi* sp. nov. from the Indus Valley, Pakistan and nearby north-west India by dorsal colouration, which incorporates large dark dorsal squares or circles of irregular shape along the mid dorsal line combined with medium sized lateral squares with rounded and irregular edges and shape, while between the two are small but obvious dark triangles and other irregular shapes tending to form an additional row.

By contrast *D. crottyi* sp. nov. and *D. russelii* are defined by very large dorsal circles or squares of irregular shape with large light coloured centres and similar but slightly smaller shapes of similar form on the lateral line (or flanks). There are no obvious dark triangles and other irregular shapes tending to form an additional row between these rows of larger markings. Thorpe *et al.* (2007) in their account of the relevant species inadvertently reversed the correct species for the preceding characters in their Fig. 3. on page 214.

Species and subspecies within the subgenus *Oxyadaboia* subgen. nov. are separated from one another by the following unique suites of characters:

Daboia oxyi sp. nov. from the Irawaddy Basin (Myanmar) is by far the most divergent of the species within the subgenus *Oxyadaboia* gen. nov., both by morphology and genetic divergence. It is separated from all other species in this subgenus by having a dorsum consisting of extremely large dark brown blotches along the mid-dorsal line and similarly large ones on the flanks. These blotches are blackish at the outer edges, but the majority of each blotch is an even dark brown. The third intermediate row of blotches between the main rows consists of mainly rounded edged triangles.

In combination the dark blotches effectively fill the dorsum and flanks so that the lighter interspaces, a light grey in this species, are reduced to form well-defined light grey lines separating the dark, being in the form of a reticulum, this being unique to this species. On the dorsum the large blotches commonly join to form a single shape along the spinal region, sometimes with a break and sometimes not. The dark spots on the flanks are so expanded that they tend to run into the ventral surface.

The tail has dark brown on top and is marked grey on the flanks.

Daboia siamensis (Smith, 1917) from the Chao Phraya region of central Thailand is very different to *D. oxyi* sp. nov.. *D. siamensis* has blotches on the dorsum and flanks (the three main rows), being in the form of large circles of reduced size, with the interspaces being wide and a beige to yellow-brown colour. The smaller spots between the main rows are in the form of broken lines that are blackish-brown in colour. While in *D. oxyi* sp. nov. the dark blotches on the dorsum and flanks are the overwhelming bulk of the surface area, in *D. siamensis* this is not the case. The light interspaces are about half or even more than half of the surface area.

The dark circles on *D. siamensis* are a bright orange or orange-brown in colour, becoming dark brown to black on the extreme outer edges. The tail is mainly dark brown on top and marked light brown to beige on the flanks.

D. sloppi sp. nov. from the lower Mekong drainage of Cambodia and adjacent countries, being Myanmar, Laos and Thailand is similar in most respects to *D. siamensis* as described above, but is separated from that species by having a reduced number of spots running along the dorsum and flanks, but of increased size, the result being that about half the body is still lighter interspace, this being a medium brown colour. Both the large blotches on the dorsum and the flanks are distinctively jagged edged as are the smaller blotches on the upper flank region. Tail is mainly light brown with some dark brown markings, mainly on the uppermost surfaces.

The smaller blotches on the flanks are also more numerous and these are prominent along much of the flank between larger blotches, versus not prominent or common on the flanks between larger blotches in *D. siamensis*, or otherwise absent along much of the flank.

Diagnostic for all three subspecies of *D. limitis* (Mertens, 1927), is that in terms of the larger spots on the dorsum and flanks, there is either no darkening, or no obvious darkening of the outer edges, as seen in all other species in this subgenus, namely *D. siamensis*, *D. sloppi* sp. nov. and *D. crottyi* sp. nov.. *D. limitis limitis* of the type form from the Lesser Sundas, Indonesia are readily separated from the other subspecies by having a light grey dorsum which in turn has rows of odd-shaped dark grey to grey-brown blotches on the dorsum and flanks. The smaller spots or markings in between these larger spots are somewhat indistinct. Half or most of the dorsum is lighter interspaces and the larger spots on the flanks are still small as compared to other species and fall way short of the ventral surface. White on the outer edges of the dorsal blotches is either absent or very minimal and barely noticeable.

D. limitis sublimitis (Kopstein, 1936) from Java is separated from the type form of *D. limitis limitis* and *D. limitis formosensis* (Maki, 1931) by being a light reddish-brown colour above, with chocolate brown blotches on the dorsum and flanks, these having a strong whitish etching on the outer edges.

The tail is a light reddish brown with chocolate brown markings, mainly on the dorso-medial ridge.

D. limitis formosensis is separated from the other two subspecies of *D. limitis* by having a medium-grey dorsum overlain with dark grey blotches on the median line and on the flanks. Those blotches have an obvious thin white line etching each of them. The blotches on the dorsum and flanks are in the main consisting of well formed and evenly shaped ovals. In combination these blotches occupy most of the dorsum, (but not to the extent seen in *D. oxyi*), meaning that *D. limitis formosensis* is unique in the complex in having the overall appearance of being a dark, grey coloured snake. Circles on the lower flanks either approach or touch the boundary of the ventral surface. Tail is grey, with dark grey marking on the upper surface.

Daboia (Oxyadaboia) oxyi sp. nov. is depicted in life online at: <https://www.flickr.com/photos/65586506@N04/27590045129/> and

<https://www.flickr.com/photos/65586506@N04/25497852268/>

D. siamensis is depicted in life online at:

<https://www.inaturalist.org/observations/105656167>

and

<https://www.inaturalist.org/observations/106157355>

and

<https://www.inaturalist.org/observations/14563329>

D. sloppi sp. nov. is depicted in life in Fig. 8 on page 178 of Neang *et al.* (2015).

D. limitis limitis is depicted in life in De Lang (2011b) on pages 261, 262, 264-267 and online at:

<https://www.inaturalist.org/observations/73293923>

and

<https://www.inaturalist.org/observations/35630271>

and

<https://www.flickr.com/photos/96574168@N02/27547836234/>

and

<https://www.flickr.com/photos/hamidun/50500544097/>

and

<https://www.flickr.com/photos/96574168@N02/24217001436/>

D. limitis formosensis is depicted in life online at:

<https://www.inaturalist.org/observations/98589105>
and
<https://www.inaturalist.org/observations/22192926>
and
<https://www.inaturalist.org/observations/78564111>
and
<https://www.inaturalist.org/observations/109822621>
and

<https://www.flickr.com/photos/bobhawley/24487294678/>

D. limitis sublimitis is depicted in life online at:

https://www.flickr.com/photos/gazs_pics/17840504359/

D. (Daboia) russelii is readily separated from *D. (Daboia) crottyi* sp. nov. by having dark circles or similar of irregular shape along the mid-dorsal line that are boldly edged with black with both the inner and outer edge being well-defined. The inner part of these shapes is light brown.

By contrast in *D. crottyi* sp. nov. the same blotches are edged with dark brown (rather than black) and the inner edge is either poorly defined or of similar colour to the adjoining part of the inside of the blotch, which is also a dark to medium brown colour.

In *D. crottyi* sp. nov. the interspaces between the blotches on the dorsum are brownish, rather than yellowish as seen in *D. russelii*.

In effect the preceding two trait differences means that *D. russelii* is a boldly coloured snake, whereas *D. crottyi* sp. nov. is not.

All south Asian *Daboia*, (both subgenera) being the entirety of the genus as defined by Hoser (2012), are separated from all other vipers by the following suite of characters:

No sensory pit between nostril and eye; head very distinct from neck, above covered by small, keeled, imbricate scales, 6-9 between narrow supraoculars; nostril large, in large nasal shield which, below, is fused to the rostral; eye, with vertically elliptic pupil, surrounded by 10-15 small scales, 3-4 rows of small scales separating the circumocular scales from the upper labials; temporals small; 10-12 upper labials; 27-33 longitudinal rows of scales at midbody, all except outermost row strongly keeled; ventrals 153-180; subcaudals 41-64, all paired; colour above light brown with 3 longitudinal series of large black-margined brown spots or blotches, the vertebral series often merging to form a chain-like longitudinal stripe; in all species except *D. russelii* and *D. crottyi* sp. nov. there is an additional longitudinal series of small dark spots between the main vertebral and lateral series; yellowish white below occasionally with dark brown markings (modified from Leviton *et al.* 2003).

Daboia is separated from the closely related genus *Maxhoservipera* Hoser, 2012 by the less thick-set build of *Daboia* species and the fact that the dark blotch running into the eye is considerably wider than the eye, as opposed to being roughly the same width. *Daboia* species are further separated by the dorsal pattern which is not in the zig-zag configuration seen in the genus *Maxhoservipera*.

The pattern in *Daboia* is a colour pattern consisting of a deep yellow, tan or brown ground colour, with three series of dark edged spots that run the length of the body on the mid-line and flanks. Each of these spots has a black or dark brown ring around it, the outer border of which is sometimes intensified with a rim of white or yellow, but giving an impression of ovals, smooth circles or similar as opposed to the more typical viperine zig-zag or chain pattern. The dorsal spots, which usually number 23-30, may grow together, while the side spots may break apart (modified from Hoser, 2012).

D. crottyi sp. nov. is depicted in life online at:

<https://www.inaturalist.org/observations/35578010>

and

<https://www.inaturalist.org/observations/34441219>

D. russelii in life is depicted online at:

<https://www.inaturalist.org/observations/78201336>

and

<https://www.inaturalist.org/observations/36666824>

and

<https://www.inaturalist.org/observations/113401995>

and

<https://www.inaturalist.org/observations/71944667>

and

<https://www.inaturalist.org/observations/99969057>

Thorpe *et al.* (2007) found a 2-3 MYA divergence between what is herein treated as *D. sloppi* sp. nov. and its nearest congener.

Distribution: *D. sloppi* sp. nov. appears to be confined to the lower Mekong basin (Cambodia, south Vietnam, northern Thailand and Laos).

Etymology: *Daboia (Oxydaboia) sloppi* sp. nov. is named in honour of a Great Dane Dog, named "Slop", in recognition of the 9 years of service he has given guarding our wildlife research facility in Australia, noting he remains alive and reasonably well as of mid 2022. The name was also chosen as a species name as it is short, simple and easy to remember. The spelling "sloppi" is intentional and should not be altered.

CONSERVATION

This was discussed in the introduction part of this paper with respect of the actions of the Wolfgang Wüster gang of thieves and their unscientific actions with regards to taxonomy and nomenclature. The relevant comments in Hoser (1989, 1991, 1993 and 1996) also apply.

Relevant also is the holotype specimen of *Daboia (Oxydaboia) sloppi* sp. nov. from Cambodia, which is regarded as one of least degraded parts of south east Asia and still an ecological disaster zone, noting the snake was decapitated!

Educating people not to kill vipers on sight is never easy, especially in third world countries where medical treatment for snakebite is either costly, or almost impossible to obtain.

This isn't helped by the fact that in charge of snakebite at the World Health Organisation (WHO) in 2022 is Australian David John Williams, who is a convicted wildlife trafficker, who was previously fined \$7,500 at Cairns Magistrates Court for wildlife smuggling and extreme animal abuse and cruelty.

While Williams is an expert at self-promotion, under his watch, avoidable deaths from snakebite globally have escalated.

It is important that the six species and two additional subspecies of *Daboia* each be conserved as separate entities and that the long-term conservation outcomes should not be dictated on the premise that all comprise a widespread single species as contended in the edicts of Kaiser *et al.* (2013).

That document, and others like it, including Shine (1987), Shea (1987), Kaiser (2012a, 2012b, 2013, 2014) and Rhodin *et al.* (2015) discredited by numerous authors, including ICZN (1991, 2001, 2021), Cogger (2014), Dubois (2014), Dubois *et al.* (1988), Hoser (2007, 2009, 2012a-c, 2013, 2015a-f, 2017, 2019a-b) and Hawkeswood (2021) is still widely used by members of the same cohort to justify unscientific acts of theft and plagiarism and actions which hasten the extinction of threatened species as detailed in Hoser (2019a, 2019b). Reliance on Kaiser *et al.* (2013) and its many reincarnations by the same gang of thieves as a pretext for misguided or corrupt governments to formally ignore newly identified species is directly contributing to the extinction of some of these species as further documented by Hoser (2019a, 2019b).

Daboia species should not be among them.

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CONFLICT OF INTEREST - NONE

Cite this paper as:

Hoser, R. T. 2022. A long overdue split: Russell's Viper *sensu lato* is formally split six ways (Squamata: Serpentes: Viperidae: *Daboia*). *Australasian Journal of Herpetology* 58:51-63.

Australasian Journal of Herpetology



Issue 58, 28 June 2022

ISSN 1836-5698 (Print)
ISSN 1836-5779 (Online)