

AN UPDATED REVIEW OF THE PYTHONS INCLUDING RESOLUTION OF ISSUES OF TAXONOMY AND NOMENCLATURE.

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ABSTRACT

This paper reviews the python group of snakes. It resolves issues of taxonomy and nomenclature, including by means of publication (this paper), effectively settling any disputes about potential validity of names for use according to the ICZN rules for various well-defined taxa.

In accordance with the ICZN code, this paper formally names one new genus (*Jackypython* gen. nov.), one new subgenus (*Rawlingspython* subgen. nov), two new species, (*Morelia wellsii* sp. nov. and *Australiasis funki* sp. nov.) and one new subspecies, (*Chondropython viridis adelynhoserae* subsp. nov.). A neotype is designated for *A. amethystina*.

Furthermore, four subspecies within the genus *Aspidites* and one subspecies within *Leiopython* are formally named.

Assessed are matters relating to the genus *Leiopython* and a 2008 paper by Wulf Schleich.

This paper redefines the family composition at tribe level.

As a result, one new tribe is erected, namely Broghammerini tribe nov..

For the pre-existing tribe Moreliini there are four newly identified subtribes, namely Moreliina subtribe nov., Aspiditesina subtribe nov., Katrinina subtribe nov. and Antaresiina subtribe nov..

Refer also to relevant notes within this paper.

Keywords: snake; reptile; *Jackypython*; *Rawlingspython*; *adelynhoserae*; *Leiopython*; *hoserae*; Schleich; Wüster; Williams; smuggling, animal cruelty; *albertisi*; taxonomy; fraud; wikipedia; *biakensis*; *barkerorum*; *bennettorum*; *huonensis*; *fredparkeri*; *wellsii*; *antaresia*; *Morelia*; *funki*; *Chondropython*; *Australiasis*; *Katrinus*; *Shireenhoserus*; *Lenhoserus*; *Aspidites*; *neildaviei*; *rickjonesi*; *adelynnensis*; *panoptes*; python; Broghammerini; Aspiditesina; Katrinina; Antaresiina; Moreliina; Moreliini; Pythonini.

INTRODUCTION

The "true" pythons of Africa, Asia and Australasia had for most of the last century been placed in the sub-family Pythoninae, although in recent years, there has been a move by taxonomists to elevate this status to full family (as in Pythonidae), which is agreed by this author.

The classification of the pythonidae as defined by Romer (1956) p. 572, (he referred to them as pythoninae) has been the subject of intense debate.

The pythonidae are separated from the boidae by the presence of a supraorbital bone, egg-laying versus live bearing, scalation differences and other characters (McDowall 1975).

There have also been numerous published studies detailing the morphology and biochemistry of the pythonidae and related snakes.

Due to a number of factors including the commercial significance of these snakes, their generally large size and popularity among hobbyist keepers and more recently government-backed attempts to remove these snakes from private keepers in several countries, there have been numerous studies into the taxonomy of these snakes.

Furthermore, there has also been a vast amount of previously unreported or relatively little-known information about the pythonidae published in other scientific and popular literature, including in such publications as: Banks (1974, 1980), Barker and Barker (1994a, 1994b, 1995, 1999), Barnett (1979, 1987, 1993, 1999), Broghammer (2001), Bullian (1994), Chiras (1982), Comber (1999), Covacevich and Limpus (1973), Cox (1991), David and Vogel (1996), Dunn (1979), Ehmann (1992), Fearn (1996), FitzSimmons (1970), Gharpurey (1962), Gow (1977, 1981, 1989), Greer (1997), Heijden (1988), Hoser (1981a, 1981b, 1981c, 1982,

1988, 1989, 1990, 1991a, 1991b, 1992, 1993a, 1993b, 1995, 1996, 1999a, 1999b, 1999c, 1999d), Kend (1992, 1997), Kend and Kend (1992), Kortlang (1989), Krauss (1995), Maguire (1995), Martin (1973), Maryan (1984), Maryan and George (1998), Mattison (1980), Mavromichalis and Bloem (1994), McDowell (1984), McLain (1980), Mirtschin and Davis (1992), Murdoch (1999), O'Shea (1996), Reitingger (1978), Romer (1956), Rooyendijk (1999), Ross (1973, 1978), Ross and Marzec (1990), Schwaner and Dessauer (1981), Sheargold (1979), Shine (1991), Shine, Ambariyanto, Harlow, Mumpuni, (1998), Smith (1981a, 1981b, 1985), Sonneman (1999), Storr, Smith and Johnstone (1986), Stull (1932, 1935), Thomson (1935), Webber (1978), Weigel (1988), Wells and Wellington (1983, 1985), Williams (1992), Wilson and Knowles (1988), Worrell (1951, 1970) and the many further sources of information referred to directly in these publications. Even this list of publications is far from the complete available record about pythons.

Among the better known taxonomic studies in recent times dealing specifically with the Pythonidae are Harvey, Barker, Ammerman and Chippendale. (2000), Keogh, Barker and Shine (2001), Kluge (1993), McDowall (1975) and Rawlings et. al. (2008), Underwood and Stimson (1990) and others.

This forms an enormous database of information on these snakes. Notwithstanding this vast body of available evidence, the taxonomic arrangements used in the past by most authors have been generally inconsistent across the group. However Hoser 2004a, presented a classification that made sense of the data and was later corroborated in full by the data presented by Rawlings et. al. 2008, (see in particular Fig A at top of page 614), although the authors stopped short of going the logical next step and adopting in full the nomenclature of Hoser 2004a.

They did however adopt usage of the genus name *Brogghammerus* Hoser 2004 for the species *reticulatus*, adding to the genus, the species *timoriensis*, transferring it from the Hoser 2004 position of *Australiasis*. That move is currently supported herein, but solely on the basis of acceptance of the data of rawlings, et. al. 2008.

As the rest of the data of Rawlings et. al. 2008 and later authors (e.g. Schleip 2008), supports the Hoser 2004a taxonomy, it stands to reason that over time, the nomenclature of Hoser 2004a, will move into general usage, unless earlier overlooked synonyms for names used emerges.

This paper does not seek to rehash the detail of Hoser 2004a, which in effect is adopted herein in toto, save for additions or changes indicated here. However it does seek to revisit the taxonomy and nomenclature with a view to filling gaps, in particular the division of the Pythonidae at the level between family and genus. To do this, all genera are assigned to appropriate tribes which are formally described according to the ICZN code (published in 1999) for the first time.

Hoser 2004a, stated:

"The author believes that further taxa will be formally described at both the species and subspecies level in years to come".

This statement has been shown to be correct, as recently as in 2011 (see Zug et. al. 2011) and now by the contents of this paper.

Diagnostic information for the Australasian genera as named in Hoser 2000b and Hoser 2004a, namely *Aspidites* Peters 1876, *Antaresia* Wells and Wellington 1983, *Australiasis* Wells and Wellington 1983, *Bothrochilus* Fitzinger 1843, *Chondropython* Meyer 1874, *Katrinus* Hoser 2000, *Leiopython* Hubrecht 1879, *Lenhoserus* Hoser 2000, *Liasis* Gray 1840, *Morelia* Gray 1842, *Nyctophilopython* Wells and Wellington 1985 or the various non-Australasian genera, is not repeated in this paper. The earlier paper (Hoser 2000) is on the internet at the url <http://www.smuggled.com/pytrev1.htm> and Hoser (2004a) is on the internet at: <http://www.smuggled.com/pytrev2.htm>. Both are also available from that domain (www.smuggled.com) as pdf files in the same format, pagination, fonts, etc, as originally published.

For detailed diagnostic information about the genera named in the previous paragraph, readers are hereby directed to the original descriptions as cited and/or the popular literature which more than

adequately separates the best known component species as cited at the rear of this paper. This paper does not significantly amend the taxonomy used in the paper Hoser (2000b), save for the addition of more recently described species and/or subspecies. The taxonomy used in Hoser (2000b) has been widely adopted in the twelve years since publication. Examples include: Clark 2002, Kuroski 2001 and 2002 (all for *Morelia harrisoni*), and Schleip 2001 (for the various subspecies of *L. albertisi*) as named formally by Hoser (2000b).

In this paper is a list of all currently (as of this paper) recognised tribes, genera, subgenera, species and subspecies of python, including those formally named for the first time herein. It should be noted that in the period 2000 to present (March 2012) claims have been made that certain taxa named by this author in publications prior to this date (2012) were not validly published according to the ICZN's code (in force from 2000)(cited herein twice, as "Ride et. al. 1999" and also "ICZN 1999"). While I would dispute these claims, the problem is more easily dealt with by way of description herein "as new" to settle the nomenclature and give stability of names for other workers.

These formal descriptions are incorporated within the text of this paper.

RELEVANT KEY FACTS AND COMMENTS

The following is directly relevant to the formal descriptions that follow, the general taxonomy used and forms a part of the descriptions and this paper.

The list published with this paper of all python taxa, arranged via their tribe arrangements in itself shows the taxonomic conclusions made by this author.

However a few other comments in this regard are warranted.

Two genera of snakes, namely *Loxocemus* and *Calabaria* are not closely related to other python genera and were removed from the "Pythoninae" in 1976 by Underwood. They are now placed in different subfamilies or in a different family altogether.

More recent evidence (including Heise, et. al. (1995) p. 261, Fig. 1.) confirms this move by Underwood and those two genera have been effectively ignored for the purposes of this paper.

Calabaria are readily separated from all true pythons (excluding *Aspidites* from Australia) by their more-or-less cylindrical body shape and the fact that their head is not distinct from the neck as in true pythons (again excluding *Aspidites*).

Aspidites can be readily separated by their yellowish brown body colour and dorsal pattern with a tendency towards distinct or indistinct transverse banding. By contrast for *Calabaria* the dorsal colour in *Calabaria* is a more dark and reddish brown and the pattern is not tending towards transverse banding in any way.

The results of Heise, et. al. (1995) also suggested that the old-world Pythoninae should in fact be elevated to the level of family (adopted herein), thereby excluding the boids from the new world, who in turn should be placed into a separate family. Likewise for the Calabariinae from Africa and Loxoceminae from North America. The relationships of the subfamilies Bolyeriinae, and Erycinae with respect to the other "boids" remains generally uncertain, but it is obvious that they do not form a part of the Pythonidae.

This author agrees with Stimson (1969) p. 28, in designating *molurus* the type species for the genus *Python*.

The past moves by Kluge (1993) to make *Katrinus mackloti* and *Katrinus fuscus* synonymous were rejected by this author in Hoser (2000b) and have been corroborated by other authors (again see Hoser (2000b)). Likewise for Kluge's (1993) erection of the genus *Apodora* to accommodate the species *Liasis papuana* (see also below).

The evidence does not support the position of Kluge (1993).

Neither move is to be taken as a personal attack against Arnold Kluge in any way or as necessarily that this author disagrees with any other conclusions made by Kluge in his other herpetological works.

The results and data as published by Underwood and Stimson (1990) p. 592 top and elsewhere in the same paper and several more recent critiques of the same paper give unequivocal support

for the erection of the genus *Katrinus* by Hoser (2000b) and to a lesser extent give support to the erection of the genus *Lenhoserus* by Hoser (2000b) if one is to accept the proposition that the species *viridis* (and *azureus*) should be separated from the other *Morelia* and placed into its/their own genus *Chondropython*, and/or that the Scrub Pythons (*Australiasis*) should be placed in a genus on their own apart from *Morelia* and *Chondropython*.

McDowall 1975, provided ample reasons for *Chondropython* to remain separate from *Morelia*, including different hemipenial morphology and this position is upheld here. The data of Rawlings et. al. 2008, support all the above, including the placement of *Apodora* into (junior) synonymy with *Liasis*.

The widely published diagnostic feature of *Apodora*, being the black pigment separating the scales, and allegedly absent in *Liasis* is simply not consistent. Australian Olive Pythons (*Liasis olivaceus*) also commonly have black pigment between the scales. This means in effect there is no obvious means to separate *Apodora* from *Liasis* at the generic level.

The African species name "*saxuloides*" (Miller and Smith 1979) is merely a junior synonym for the species *sebae*. Also see Broadley (1984).

The obvious physical character differences between the smaller species of Asiatic and African pythons from the larger species (herein listed as: *Python*, *Shireenhoserus*, *Aspidoboa*, *Helionomus* and *Broghammerus*) and the lack of any recent evidence of common ancestry make a compelling case for the resurrection of and creation of a total of two new genera to accommodate the Asian and African species respectively as was done by Hoser 2004a.

The species within each of the five relevant genera *Python*, *Aspidoboa*, *Helionomus*, *Broghammerus* and *Shireenhoserus* can all be separated from one another by the differences in the following character states in combination: number of and position of labial pits, dentition, hemipenial morphology, average adult size, general build, typical head markings and body colouration, breeding biology and average relative egg size and number, head and body scalation. A cursory examination of the relevant component species will more than adequately establish this fact.

These characteristics for each species are detailed in general regional texts, including those cited at the end of this paper.

FURTHER TAXONOMIC ISSUES INVOLVING THE PYTHONS THAT ARE RESOLVED IN THIS PAPER

For the *Chondropython*, (relegated by some authors to subgenus or ignored in favor of the wider encompassing "*Morelia*" which has name date priority), the two obvious species have available names, as does one of the obvious subspecies (the Australian one). However another from Normanby Island in the Milne Bay Province of PNG does not, and hence it is formally described and diagnosed in this paper.

In the broadly interpreted *Morelia* group, the *carinata* species group (as a monotypic species) is herein placed in its own genus, away from the smooth-scaled congeners, generally known as "Carpet Pythons" and including the similar "Diamond Python".

A previously undescribed form of Carpet Python from the Diamantina River drainage basin in inland eastern Australia is also formally described and named herein for the first time as *Morelia wellsii* sp. nov..

While the level of subgenus has not always been widely used in the Pythonidae, it is appropriate that when a genus has two or more distinct groups of species, that subgenus be employed to delineate the groups, especially if and when most taxonomists will not choose to split the genus into two, but yet recognize the obvious species groups within.

In the case of the *Antaresia*, the distinctive Ant-hill Python is moved into a group of its own in a new subgenus, away from the other named taxa in the genus.

Within the Pythonidae, there is no evidence for any other obvious splits to subgenus level and/or alternatively there are names available already in the event that obvious divisions are made.

In my view, the species most likely have more unnamed subspe-

cies is *Broghammerus reticulatus*, whose distribution includes relatively unstudied areas in the form of islands between continental Asia and Australia.

In terms of unnamed python subspecies and to resolve any ambiguity, the form of *Leiopython albertsi* from the Island of Mussau in the Saint Matthias Group, Bismarck Archipelago is formally described later in this paper.

Although new species of python are still being formally described (see for example Zug et. al. 2011), these descriptions fit within the parameters of reassessment of wider-ranging "species" long known to science, as opposed to totally new species being "discovered" as a result of collecting expeditions or similar.

In colloquial terms, we'd call this "splitting as opposed to finding". Within Australia there are unconfirmed reports of large pythons found in the ranges near the WA/NT border. While these snakes may be of a recognised taxon such as *Morelia bredli*, an *Aspidites* species, or even perhaps *Liasis olivaceus*, there remains a possibility of an unnamed form occurring in this relatively unexplored region. Such a situation is relatively unusual in terms of the modern world and locations pythons are known to occur.

The latter part of this paper divides similar well-defined genera into groupings, formally identified as tribes in accordance with the ICZN code (rules) of 1999, current as of 2000.

SCRUB PYTHONS GENUS AUSTRALIASIS

As of 2012, these snakes are grouped by most authors within the genus *Morelia*.

I do not support this placement for several reasons.

Myself and a growing number of others, including Wells and Wellington (1983) place them within their erected genus "*Australiasis*". While there is a likelihood of *Australiasis* moving into common usage at the subgenus level, my view is that with a sizeable number of component species placed within the genus, including three newly named by Harvey et. al. 2000, plus one species they resurrected from synonymy, another formally described and named here, resurrection of yet another from synonymy (again of "*amethystina*") (making a total of seven species) and the obvious differences to the Carpet Pythons *Morelia*, the genus designation for *Australiasis* will come into common usage as it now defines a sizeable group.

Here *Australiasis* is treated as a full genus, separated from *Morelia*, but placed in the same tribe.

Resolution of the taxonomy within the *Australiasis* group was done quite effectively by Harvey et. al. 2000, who also assigned names to three of those taxa for which names were unavailable (see updated list in this paper), but failed to divide what was left of the nominate form *amethystina*, even though the remaining three way split was obvious on their own published data.

While not relevant to what follows, I should note that these authors placed the species within the genus *Morelia* not *Australiasis*.

Of peripheral relevance is that a serious problem in the past has been when ecological studies on a "single" species later are found to have included several and with the lack of identifying notes at the time of the original study, the ultimate worth of the study is devalued in the light of newer information.

One such example is that of Shine (1980) who's study on Death Adders (*Acanthophis* spp.) was later found to have included several species lumped as one and from widely different climatic zones, but who at the time failed to take appropriate notes of the locality data for material examined.

Based primarily on the information provided by "Fig 6" from Harvey et. al. and other data within the paper I generally agree with their paper's findings and conclusions, including that what they defined as the species *amethystina* was in fact a composite of at least three, which they chose not to subdivide in terms of naming them.

In terms of their paper, the Scrub Pythons can also be identified and classified by their apparently allopatric distributions as indicated in the list in this paper.

Other than the use of the generic name *Australiasis*, the only significant change in nomenclature from Harvey et. al. is the removal of "*kinghorni*" because, in my view it remains as a junior

synonym for “*clarki*”, which comes from the “Australian” side of Torres Strait and must (in the absence of contrary evidence) therefore be deemed to be of the same taxon as “*kinghorni*”.

Also note that Harvey et. al. page 162, specifically identify the Murray Island scrub pythons as being of the same taxon that they refer to the more recently named “*kinghorni*”, thereby again giving “*clarki*” priority under the ICZN rules.

This accords with the decision made by Hoser 2000b for the same taxon in terms of identity of the relevant snakes and priority of name.

Although Harvey et. al. 2000 claim to have examined the holotype *clarki* and concluded it matched the profile of *amethystina* and not “*kinghorni*” as defined by them, the authors failed to be specific as to on what basis, leading me to believe there may not in fact have been a sound basis for this based on observed physical or colour traits, noting that as a preserved specimen of some age, colouration may not have been a good indicator.

If they instead opted for *kinghorni* over *clarki* due to “common usage” this should have been indicated by them and it was not.

Failure to mount a “stability” claim for *kinghorni* over *clarki*, has led me to continue to use this name for the Australian *Australiasis*.

There have been reports by private collectors in Australia that there are in fact two forms of Scrub Python found in North Queensland. However I have no evidence before me to support these claims, other than perhaps minor colour variations, attributable to minor phenotypic differences. The claims may however warrant investigation.

Harvey, Barker, Ammerman and Chippendale (2000) provided sufficient evidence for the formal recognition of *Australiasis duceboracensis* (Gunther, 1879) from New Ireland in the Bismark Archipelago as a full species (as opposed to being merely a local variant of *Australiasis amethystina*), including by the possession of a totally different colouration in life, but in the end of the paper failed to make this obvious move, merely reporting these snakes as a probable undescribed species lumped within the *amethystina* complex.

Hence it's inclusion in the list here under the name *Australiasis duceboracensis*.

Furthermore the New Ireland *Australiasis* are on the evidence of Harvey et. al. different to the north-west New Guinea specimens, which in turn are different from those south of the main central range and east of the Sepik River drainage.

I note that an analysis of the cytochrome b mitochondrial DNA sequence by Harvey, Barker, Ammerman and Chippendale (2000) for the Bismark Islands form showed a 5% divergence from what they described as the nominate New Guinea form.

In a later paper by Keogh, Barker and Shine (2001), two other python species (namely *breitensteini* and *curtus*) were confirmed as being distinct at the species level with a mere 3% divergence of the same cytochrome b mitochondrial DNA sequence using the same test.

It didn't escape this author's notice that David Barker was a co-author of both papers and hence one finds it hard to otherwise reconcile this inconsistency.

No disrespect is implied here, however it is important that the inconsistency be appropriately corrected.

As mentioned already, besides the New Ireland Scrub Pythons, Harvey et. al. identified as separate forms the Scrub Pythons from the North and the South of the main central cordillera of New Guinea, with apparent confusion east of the Sepik River, where specimens appear to match those from the south of the central range. The, north-south separation broadly accords with the position in existence for genera *Chondropython* and *Leiopython* (one species on either side of the central range) (Rawlings and Donnellan 2003, for *Chondropython* and Hoser 2000 for *Leiopython* confirmed by Schleich 2008) and is no doubt a result of the same factors and physical barriers.

Harvey, Barker, Ammerman and Chippendale (2000) also recommended the designation of a neotype for *Australiasis amethystina*. As of end 2011 this had not happened.

DESIGNATION OF A NEOTYPE FOR AUSTRALIASIS AMETHISTINA (SCHNEIDER 1801)

To remove potential confusion and instability in the taxonomy of this group, a neotype for *amethystina* is designated herein, in accordance with Article 75 of the current ICZN code.

Harvey et. al. 2000, (p. 155) determined that the holotype for *A. amethystina* had been lost and gave a detailed explanation of the fact.

They also detailed the relevant status of each of the holotypes of what they described as synonyms, although one of these *duceboracensis* has been elevated to be a separate species herein based on the data of Harvey et. al. 2000.

In accordance with Article 75.3 of the code it is herein noted that there is further potential for recognition of further species within what is now identified as *A. amethystina* if and when further collection of material within the New Guinea region is done, in particular from the region east of the Sepik River in Papua New Guinea. Refer to the comments of Harvey et. al. 2000 (p. 172).

As a result of these relevant factors and under Article 75.3.1 of the code the neotype is assigned to clarify the status of “typical” *A. amethystina* to be a reference point for the taxon.

Under Article 75.3.2 of the code, I refer to the diagnosis of the species-group taxon *A. amethystina* on pages 154-158 of Harvey et. al. 2000.

Under Articles 75.3.3. and 75.3.7. of the ICZN code, I herein designate the neotype for *Australiasis amethystina* as a female specimen no. 107155, from Maka, Lake Murray, western District, PNG. The generic placement for this taxon has varied with recent authors and included *Morelia*, *Liasis*, and *Python*.

The American Museum of Natural History is a government owned public facility that allows researchers access to the collections and the neotype already is lodged with and belongs to this facility.

Under Article 75.3.4. I herein state that the original holotype specimen for *A. amethystina* has apparently been permanently lost and searches have been unable to locate it. Refer to the summary of relevant events on page 155 of Harvey et. al. 2000.

Based on the original description of the holotype by Peters 1876, (see his figure 2), the neotype matches the same species within the description. Relevant to article 75.3.5 of the code, this detail has been corroborated by Harvey et. al. 2000.

In accordance with Article 75.3.6 of the code, I note that the type locality of the neotype is not known, other than obviously being the general region it could possibly come from (near New Guinea) or perhaps eastern Indonesia. However the description of the holotype excludes outlier locations including island groups where cogenetic snakes do not match the original species descriptions (refer again to Harvey et. al. 2000).

The form north of the range, identified by Harvey et. al. as being different, remains undescribed as of 2012 so is therefore described as a new species herein, namely *Australiasis funki* sp. nov..

Species of the genus *Australiasis*

Thus below is published a list identifying all Scrub Pythons (*Australiasis*) with a “species” name and the locations they occur.

Following is a description of the new species, *Australiasis funki* sp. nov.

As presented now, there are in fact no (known) unnamed taxa, with the possible exception of the specimens from east of the Sepik River and north of the main central range of PNG.

A diagnosis for the genus is also provided herein.

Australiasis Wells and Wellington 2003

Diagnosis:

The following is based on the generic and tribal classifications within this paper.

Australiasis is a genus of large (up to about 5 metres, average (adults) 3.5 metres) slender pythons. The slender build separates *Australiasis* from all others within Moreliini which are either medium to stocky in build.

The long prehensile tail separates this genus from all other pythons

(outside Moreliini).

The extremely large symmetrical parietals in contact along the midline separates this genus from genera *Morelia* and *Chondropython*. *Lenhoserus* is readily separated from *Australiasis* by its black dorsum with white or yellow vertical bars on the flanks and fewer supralabials (4 in front of the eye and 8-11 in total versus five in front of the eye and 12-16 in total for *Australiasis*), as well as 14-17 infralabials versus 19-23.

Nyctophilopython and *Jackypython* gen. nov. both have smaller (tending to irregular) plates at the rear of the head rather than the over-large parietals seen in *Australiasis*. *Jackypython* gen. nov. is readily separated from all other pythons by its strongly keeled scales.

Australiasis is separated from the Pythonini by the fact that the infralabial pits are better defined than the supralabial pits as seen in Pythonini.

Australiasis is separated from Aspiditesina by the presence of labial pits, which are not present in Aspiditesina.

Australiasis is separated from all other Moreliini except those within the subtribe Moreliina by the strongly prehensile tail.

LIST OF AUSTRALIASIS SPECIES (DISTRIBUTION INFORMATION INCLUDED)

Australiasis amethystina (Schneider 1801), Southern half of island New Guinea and perhaps further afield.

Australiasis clarki (Barbour 1914), Continental Australia and immediately adjacent islands.

Australiasis clastolepis (Harvey et. al. 2000), Ambon/Ceram and nearby islands.

Australiasis duceboracensis (Günther 1879), Bismarck Archipelago.

Australiasis nauta (Harvey et. al. 2000), Tanimbar Islands.

Australiasis tracyae (Harvey et. al. 2000), Halmahera and nearby islands.

Australiasis funki sp. nov. (this paper), north-west New Guinea, north of the main central cordillera, commencing west of the Sepik River, PNG.

AUSTRALIASIS FUNKI SP. NOV.

Holotype: A male specimen in the American Museum of Natural History (AMNH) specimen number: 62635 from Benhard Camp, Idenburg River, Irian Jaya.

Diagnosis: A large python, typical as for the genus.

It would in the past have been identified as *A. amethystina*.

In life the snake presents as a medium to pale brown snake, with a darker pattern. The posterior third lacks a pattern of any sort and the labials are darkly barred. The tongue is dark blue or black, (as opposed to pink, light blue or mottled in most *A. amethystina* and *A. kinghorni*).

There are two prominent neck bars, regardless of whether the snake is of the "patterned" or "unpatterned" form, with specimens intermediate between the two extremes of patterning and no pattern occurring.

The presence of the prominent neck bars in *Australiasis funki* sp. nov. separates this taxon from *A. amethystina*, *A. duceboracensis*, *A. clastolepis* and *A. clarki*, (which lack them) 100 per cent of the time.

A. nauta is separated from *Australiasis funki* sp. nov. by the fact that its patterning consists of 90-110 cream paravertebral blotches that fuse to form bands on the posterior third of the body and tail.

A. nauta is further separated from *Australiasis funki* sp. nov. by the relative lack of markings on the head, noting that the margins of the head shields aren't outlined with dark pigment.

While *A. tracyae* may appear superficially similar to *Australiasis funki* sp. nov., it is separated from the latter by its red iris and the fact that it has a distinct pattern of broad bands running the length of the body.

There are no other described species within the genus or known taxa with which *A. funki* sp. nov. could possibly be confused with.

To separate snakes of this genera from other python genera, see the descriptions of this genus within this paper and of the relevant

tribes within this paper as well.

Distributed north of the central cordillera of New Guinea, east of the Sepik River system and west to beyond Sorong, Irian Jaya. The taxon may extend to other adjacent areas.

Common name: Bar necked Scrub Python.

Comments: In line with others of this genus, these are best described as a large snake with an attitude to match. Long regarded in the reptile-keeping hobby as "junk pythons", the Scrub Pythons as commonly termed, have a number of features that do not bode well for their captive husbandry.

Juveniles are often notoriously difficult to get feeding. My own experiences shows that young may often need to be force-fed when not feeding voluntarily and even when force-fed will try to regurgitate food, unless food is forced a long way down.

With determination, these snakes will progress and eventually feed on their own, although often only when the keeper physically leaves the room they are in.

Besides the feeding issues, young snakes tend to bite at the handler when the opportunity arises, move away at high speed, and defecate as a defence when picked up. They have an extremely long reach when striking.

The feces is often sprayed on the handler.

As snakes get older, their feeding becomes more consistent, but the attitude does not always disappear, with adults often maintaining their "rage" against handlers.

Notwithstanding this, calm specimens do exist and some individuals can be handled for years without attempting to bite the owner.

Males engage in combat and in some cases one may kill another.

While intelligence is hard to measure in animals like snakes, captives do give the impression of being a highly intelligent animal to a greater degree than other smaller species of snakes.

Etymology: Named in honour of Dr. Richard Funk, veterinary surgeon and herpetologist, presently (as of March 2012) at Mesa Arizona.

Funk has an extensive list of formal qualifications in herpetology and the expertise with reptiles that comes from being in his late 60's and spending a lifetime working with reptiles.

His love of reptiles is an inspiration to all.

In early 2011, I first spoke with Dr Funk by phone. I had contacted him in relation to his expertise in venomoid surgery in relation to pending legal proceedings in Australia, relating to false claims by business rivals that my own venomoid snakes had regenerated venom and were a public hazard.

I had been referred to Dr Funk from another veterinary surgeon, Doug Mader.

While I had met Dr. Funk in 1993, I had no recall of this in 2011. Like myself, Funk had been subjected to false claims that snakes he had devenomized surgically had regenerated venom.

Of note is that his expertise in venomoid surgery (over 200 successful operations) and a chapter in Doug Mader's "*Reptile Medicine and Surgery*" (Mader 2006) was disregarded by a corrupt Victorian VCAT judge Pamela Jenkins in March 2012, in favour of a false and anonymous blog post sponsored by "tongs.com" claiming venomoids regenerate venom.

The claim, not supported by any evidence whatsoever was tendered by Department of Sustainability and Environment Victoria (DSE) lawyers in a tribunal hearing and the judge, biased from the outset, ruled the DSE's evidence compelling!

The ultimate "ruling" in the case by Pamela Jenkins "found" as court certified "fact" that all this author's venomoid snakes (most having been created in the period 2004-5) were as of 2012 highly dangerous as all had regenerated their venom.

More dangerously, this lie has been widely reposted on the internet to claim that dozens of bites sustained by myself and others from the venomoids, not resulting in envenomation of any sort, were "lucky" and the result of so-called "dry bites".

With this "judgement" likely to be widely posted (as has happened already in terms of a similar earlier judgement) and believed by other snake handlers, it is likely persons bitten by highly venomous snakes will take a risk and a gamble on the bite being dry.

The ultimate result of an unnecessary death, or death avoided had first aid and treatment been sought immediately.

In 2011 snake handler Aleta Stacey died as a result of heeding similar (false) advice about the alleged high frequency of “dry bites”.

It was reported in the media that she'd received this advice from another reptile handler, Al Coritz, a man who has campaigned heavily against this author's venomoids and made many false claims about venomoids and their alleged venom regeneration.

In summary, while corrupt and dishonest people may attack Funk and his expertise with reptiles, it is appropriate that his decades long contributions to herpetology and similar contributions to the medicine and welfare of countless captive reptiles should be recognised.

CARPET PYTHONS AND THE ROUGH-SCALED PYTHON

Until the description of *M. carinata* by Smith (1981) based on a recently discovered specimen from Western Australia, all so-called “Carpet Pythons” were known to be essentially similar in form and smooth-scaled.

While the taxonomy at the genus level has been in a state of flux, *sensu-stricto*, the genus *Morelia* has included just the smooth-scaled Carpet/Diamond Pythons, treated in turn by many authors as a “super-species” or species complex.

MtDNA evidence hasn't necessarily resolved the taxonomy of the group because different results in DNA do not necessarily match observed differences in phenotype or observed behaviours.

Even allowing for differences in opinions in terms of where to draw the line in terms of where one species starts or finishes, the DNA evidence has been ambiguous for several reasons, including the difficulty of sampling all local populations.

However within the Carpet/Diamond Pythons all species are apparently allopatric to one another, sometimes being referred to as regional races, (often with so-called “intergrades” known as shown in Hoser 1989), with the notable exception of the rough-scaled species, *carinata*, which is sympatric with *M. variegata* (the top-end Carpet Python).

Noting the obvious differences between *M. carinata*, not just in having keeled versus smooth-scales, but dentition and other differences between these and other “Carpet Pythons” it makes sense to split these snakes apart.

Until 2011 I was of the view that subgenus was the appropriate designation for the rough-scaled pythons.

However on 7 April 2011, I acquired four newly hatched *carinata* and have over several months been able to observe these snakes closely, in terms of physical attributes, ontogenic changes and general habits, including temperament, feeding, digestion, shedding and so on.

Observed conditions such as physical build can lead to improper conclusions based on failure to observe like-for-like comparisons between taxa. This includes for example mistaking obese conditions as “normal”, or other matters.

Having compared the smooth-scaled “carpet pythons” with the rough-scaled ones within a single facility and over many months, as well as assessing the published DNA and other data on these snakes, I have come to the inescapable conclusion that these snakes should be recognised as distinct at the genus level.

Hence there is no alternative but to assign the taxon described by Laurie Smith as *carinata* to a new genus.

JACKYPYTHON GEN. NOV.

Type species: *Python carinatus* Smith 1980.

Diagnosis: The only strongly keeled python in Australia or for that matter anywhere else. This alone separates the taxa.

Further and/or alternatively separated from smooth-scaled Carpet Pythons by longer and more recurved teeth (average 25% longer than for all other *Morelia*, with *Morelia* and species within the genus being defined as in Hoser 2000b).

Further separated from the “smooth-scaled” Carpet Pythons by an enlarged circular frontal shield and extreme thinning of the neck. Restricted to Western Australia's Kimberley region.

Notes: Common name is the “Rough-scaled Python”.

In captivity, they appear to be trouble free. Juveniles are occasionally poor feeders as compared to normal smooth-scaled “Carpet Pythons”, but as they grow, their appetite improves. Noted in captives was that the through-time for food eaten by these snakes (that is from eating to defecating) is considerably longer than seen in other “Carpet Pythons” in like-for-like comparisons, in terms of same food size and temperature. Captives seem to be crepuscular to nocturnal.

Etymology: Named after the younger daughter of this author, Jacky Hoser in honor of her valuable education work at reptile demonstrations and the like, including from the age of three safely handling venomoid versions of the world's five deadliest snake genera, namely *Parademansia*, *Oxyuranus*, *Pseudonaja*, *Notechis* and *Acanthophis* and most importantly after seven years of doing so, never having had a single bite! This emphatically proves that the best way to avoid snakebites is to be nice to them.

A NEW CARPET PYTHON FROM INLAND EASTERN AUSTRALIA

In the beginning of 1987 when preparing the book *Australian reptiles and frogs* (Hoser 1989), Neil Charles then of Brisbane allowed me to photograph one or more “Carpet Pythons” found in trees adjacent to lagoons (namely the Goyder's Lagoon) that formed a part of the Diamantina River drainage in far south-west Queensland and nearby South Australia.

At the time, they were thought to be a variant of the Murray Darling Carpet Snake formally known as *Morelia metcalfei* Wells and Wellington 1985. This was on the basis of obvious pattern similarities as well as similarity in demeanour.

This opinion was published in Hoser (1989) and remained my view for some years.

More recently a number of herpetologists have pointed out significant differences between specimens of each form, leading me to believe that colour and size similarities derive from convergence and that in the case of both forms, they have arrived at their present forms in relative isolation from one another and due to convergence in evolution rather than contact.

Both *Morelia metcalfei* Wells and Wellington 1985 and the newly described form, herein named *Morelia wellsii* sp. nov. are separated by a distance of some hundreds of kilometers, shown to be uninhabited by either species through intense collecting spanning many years.

While it may be speculated that these areas may once have been colonised by Carpet Pythons of either form predating white settlement, there is no evidence for this and the geological evidence also contradicts this view.

Prior to the Holocene, Australia was considerably cooler and drier. The general region in question would have been even less favourable for Carpet Pythons than at present.

That the two groups of snakes *Morelia metcalfei* Wells and Wellington 1985 and *Morelia wellsii* sp. nov. evolved in recent times in isolation from one another has also been confirmed by the published results of the DNA studies of Taylor, et. al. 2003 and Taylor 2005.

MORELIA WELLSII SP. NOV.

Holotype: A specimen in the South Australian Museum, R19222 from 80 km north of Poonjalass Creek, Goyders Lagoon, SA.

Paratype: A specimen in the South Australian Museum, R2174 from the Diamantina River, Queensland.

Diagnosis: A smallish form of carpet python with a disposition not generally aggressive to people.

In the normal situation it would until now have been identified as *Morelia macdowellii*.

However *Morelia wellsii* sp. nov. is separated by orangeish and cream blotches on the dorsal surface as opposed to brown (or grey) and cream blotches.

In *Morelia macdowellii* the lighter (cream) dorsal blotches are either fully or near fully etched with black, usually being a scale in width. In *Morelia wellsii* sp. nov., the black surrounding the dorsal cream blotches is usually broken and only about half a scale in width.

On the head of *Morelia wellsii* sp. nov., the white streak running behind the upper eye along the back of the head is three times as

wide as the dark line below, whereas in *Morelia macdowelli* the white streak running behind the upper eye along the back of the head is only twice as wide.

Morelia wellsi sp. nov. lacks dark pigment in the region in front of the eye, or when present it is relatively indistinct. By contrast *Morelia macdowelli* and all other Carpet Pythons (*Morelia*) do as a rule, have a distinct dark patch running in front of the eye. The only exception to this trait is *Morelia bredli*, which as a rule lacks a distinct dark patch, but which is separated from all other *Morelia* including *Morelia wellsi* sp. nov. by the blueish grey eye. If one were to include the species *carinata* in *Morelia*, which also has a bluish grey eye, (like *M. bredli*) then *carinata* would be separated by the keeled dorsal scales.

Ventrally, *Morelia wellsi* sp. nov. tends to be creamish in colour. Ventrally *Morelia macdowelli* has grey colouration on many scales, excluding those near the forebody.

Morelia wellsi sp. nov. is a smallish *Morelia*, breeding in captivity at about 1.5 metres in length.

Morelia wellsi sp. nov., though known from a limited region, is abundant where habitat permits and is not regarded as endangered or under threat from collectors.

In terms of the latter, Carpet Pythons are common in captivity and the demand is not sufficiently high to warrant large amounts to be collected from the remote areas they are found.

Etymology: Named in honour of a well-known Australian taxonomist, Richard W. Wells. He is known variously among some of his peers as vermin and was labelled by eminent herpetologist Hal Cogger as "The AIDS of herpetology" in the 1980's. In spite of the tirades of abuse he has copped from others and the fact that his "errors" are numerous and well documented, his legacy will be in the form of what he got correct and not what he got wrong.

In many cases his taxonomic proposals were lampooned simply because they were ahead of their time and not due to any intrinsic error.

Criticisms (sometimes justified) levelled against Wells by others in the form of allegedly improper and incomplete descriptions (not compliant with the ICZN code) could sometimes be put to his critics.

Furthermore and of note is that in the case of Wells his published shortcomings, errors and the like only relate to a small percentage of his published works.

More than 20 years after his two most controversial papers (Wells and Wellington 1983 and Wells and Wellington 1985) were published, many of the taxonomic proposals have been widely adopted and are in common usage. Propositions of Wells and Wellington labelled as ridiculous in the 1980's are now derided by critics as "obvious", including for example the designation of the python genus *Antaresia*.

It is fitting in the case of *Morelia wellsi*, that a species be named in honour of a man who named several now widely recognised taxa within the same genus.

CHONDROPYTHON MEYER 1874

Designation of so-called "Green Pythons" in the genus *Chondropython* has been the normal situation among taxonomists for most of the past 100 years. Having said this, in recent times a number of taxonomists lumped the Green Pythons in the genus *Morelia*, noting the obvious affinities between the two groups.

Hobbyists still call the snakes "Chondro's" regardless of what scientific name they use.

Allowing for the latter placement of these snakes in the supergenus "*Morelia*", these snakes remain outside the core *Morelia* group of "Carpet Pythons", with the *Australiasis* snakes (so-called Scrub Pythons) also forming a different group.

If one doesn't accept the obvious splits to include the genera *Australiasis*, *Lenhoserus* and *Chondropython*, then all preceding names are available at the subgenus level.

For the purposes of this paper and following on from Hoser 2000b, *Chondropython* is treated here as a full genus.

Rawlings and Donellan (2003) in their Phylogeographic Analysis of the Green Python, yielded results in accordance with similar

studies for other snake genera with similar cross New Guinea distributions, including *Acanthophis* (Hoser 1998), *Leiopython* (Hoser 2000b) and *Australiasis* (Harvey et. al. 2000).

While Hoser 1998, Hoser 2000a and Hoser 2000b did not relate their taxonomic findings with geological evidence in terms of seeking explanations for results, other authors including Harvey et. al. (2000) have.

They have stated that as a result of the formation and uplifting of the central New Guinea range commencing about 5 million years before present, species were split into allopatric groups which in turn speciated, giving the present day results.

Hence the barriers affecting one species seems to have similarly affected others, giving a near mirror image distribution patterns for the various python genera (as diagnosed by Hoser 2000b) and also perhaps elapid groups as well.

That Rawlings and Donellan found evidence to support two species of Green Python was not a surprise and had been anticipated by hobbyist keepers for decades.

They wrote:

"The pattern of relationships found for mitochondrial and nuclear genes suggests the presence of two species of *M. viridis*, one present north of the central cordillera and the other present in Southern New Guinea and Australia."

Their mtDNA evidence in terms of the outlier Australian population concurred with Hoser 2000b and McDowell 1975 in that while it had clear affinities to the southern New Guinea snakes, they were derived from them in relatively recent geological time and by a migration south from the main population.

Hobbyist keepers in Europe and the USA were well aware of the different pattern morphs from different locations over many years, including differences between those from north and south of the main dividing range.

While Rawlings and Donellan 2003 didn't concern themselves with nomenclature of the regional forms of Green Python, all taxa have been named at the species level.

This contradicts Rawlings et. al. 2008, p. 604, who stated the northern New Guinea taxon is "unnamed", when in fact it was named in 1875 by Meyer (*azureus*).

Furthermore one of two obvious subspecies, the Australian Green Python (*Chondropython viridis shireenae*) Hoser 2003 has also been named.

A second highly distinct form of Green Python, hitherto unnamed and from Normanby Island, Milne Bay Province, PNG, is formally described for the first time here as the subspecies *Chondropython viridis adelynhoserae* subsp. nov.

That these snakes differ from other *Chondropython* has been speculated for some time. However until recently I had not seen any specimens in life or good quality photos of specimens in life. DNA evidence as provided by Rawlings and Donnellan 2003 also supports the hypothesis that these snakes differ from other *Chondropython* and are reproductively isolated from them and have been for some time.

For the record, *Chondropython pulcher* Sauvage 1878, is a synonym of *C. azureus* Meyer 1875 being derived from the same general region as *C. azureus*.

CHONDROPYTHON VIRIDIS ADELYNHOSERAE SUBSP. NOV.

Holotype: A specimen in the Australian Museum R129716, from Normanby Island, Milne Bay, Papua New Guinea.

Diagnosis: This is the form of Green Python restricted to Normanby Island, Milne Bay Province, PNG.

It is separated from all other *Chondropython* in New Guinea and Australia by its adult dorsal pattern of (smallish) white blotches that in the main do not cover the spinal ridge, as seen in all other Australian and other PNG *Chondropython*.

Sometimes *Chondropython* from elsewhere will have similar blotches, but invariably, these snakes either also have a mid-dorsal line or dots (not seen in *adelynhoserae*), or the blotches run well over the spinal (mid dorsal) mid-line.

MtDNA for the holotype was examined by Rawlings and Donnellan 2003 and compared with other *Chondropython* yielding traits broadly in line with *C. viridis viridis* (but a three per cent sequence divergence) (see p. 41 their paper). Having said that, it also shared five nucleotide substitutions that would otherwise be synapomorphies of the northern lineage, one of which is an indel.

This result in terms of mtDNA and base pair analysis, as published by Rawlings and Donnellan 2003, forms an additional and/or alternative diagnostic means of identifying and separating *C. v. adelynhoserae* subsp. nov. from other *Chondropython*.

In other words, the taxon *C. v. adelynhoserae* subsp. nov. can be separated from other *C. viridis* by the degree of base pair separation/divergence of mtDNA and/or nuclear DNA as detailed by Rawlings and Donnellan 2003.

This is the only *Chondropython* taxon found on Normanby Island, Milne Bay Province, PNG and is allopatric to all other *C. viridis* or *C. azureus*.

Etymology: Named after the elder daughter of this author, Adelyn (pronounced: Adder-lyn) Hoser, in honor of her valuable education work at educational reptile demonstrations and the like, including from the age of five safely handling venomoid versions of the world's five deadliest snake genera, namely *Parademansia*, *Oxyuranus*, *Pseudonaja*, *Notechis* and *Acanthophis* and most importantly after five years of doing so, never having had a single bite! This emphatically proves that the best way to avoid snake-bites is to be nice to them.

She is further recognised for volunteering to take bites from venomoid snakes, namely an Inland Taipan (*Parademansia microlepidota*) and Death Adder (*Acanthophis bottomi*) in front of an audience in mid 2011 in a series of bites that were videotaped, to emphatically rebut the lies from business rivals and corrupt DSE officials that these snakes were dangerous and had regenerated venom.

Scandalous is that these same people who had lied about the snakes regenerating venom, then twisted things around to make the false claim that I had been trying to murder my own daughter, a false claim even effectively rehased by corrupt VCAT judge Pamela Jenkins.

CHONDROPYTHON SUMMARY

Based on what is now believed to be allopatric distribution and factors outlined elsewhere, the named taxa of Green Python are now as follows:

Chondropython viridis (Schlegel 1872), southern New Guinea generally and offshore Islands.

Chondropython viridis shireenae Hoser 2003, Australia only.
Chondropython viridis adelynhoserae subsp. nov. (this paper), Normanby Island, New Guinea.

Chondropython azureus Meyer 1875, New Guinea north of the central range, including offshore islands.

Maxwell (2005), gave detailed information about local "races" of *Chondropython*, including from islands. However noting the extreme phenotypic variation of the genus and the non-sampling of intermediate populations (when available), and the added variables of local adaptations to altitude and so on resulting in localized colour variants and the like, there is no evidence that any of the forms identified in that book warrant recognition beyond the taxa (to subspecies level) identified in this paper based on available evidence, most notably that of Rawlings and Donnellan 2003.

Notwithstanding this, the book remains mandatory reading for those with an interest in the genus.

ANTARESIA

The genus was first erected by Wells and Wellington (1984) (or 1985).

While this genus was generally ignored throughout the 1980's, following its adoption by Barker and Barker in 1994, the name has moved into general usage.

It includes all species formerly grouped as "*childreni*" (formerly placed in the genus "*Liasis*" or occasionally even "*Bothrochilus*") and later split by various authors into three taxa, namely *childreni*, *stimsoni* (for which *saxacola* Wells and Wellington 1984 has

priority but may or may not be available, see below) and *maculosus*, as well as very different taxon, known as the Ant-hill Python, *A. perthensis*.

The first three taxa are all apparently allopatric and essentially similar in most respects, which is why for many years all were treated as a single variable species.

Antaresia perthensis is sympatric to *A. stimsoni/saxacola* in the Pilbara of Western Australia. It is different in terms of its smaller adult size, more stocky build, smaller (average) clutch size, colouration, habits and scalation (notably mid-body row count) and while clearly has affinities with the others in the genus, is apart from them. Hence it is appropriate that it be separated from its congeners at a level above species and yet not as a full-genus. Hence the creation of a new subgenus for the taxon.

RAWLINGSPYTHON SUBGEN NOV.

Type Species: *Liasis perthensis* Stull 1932

Diagnosis: Separated from all other *Antaresia* by 31-35 mid-body scale rows, versus 37-47 mid body rows for all other recognized species in the genus *Antaresia*, namely *A. saxacola* (or *A. stimsoni*), *A. childreni* and *A. maculosus*.

No other snakes are likely to be confused with *Rawlingspython* subgen. nov.

Further separated from other *Antaresia* by the generally reddish color, including blotches and background, versus a generally brownish background color for all other *Antaresia*.

If blotches in other *Antaresia* are reddish (as opposed to actually red), they will still be on a yellowish, whitish or brown background color.

Rawlingspython are smaller as adults (to 61 cm long), versus to 105 cm long or larger for all other *Antaresia*.

Etymology: Named after Adelaide-based Museum researcher, Lesley H. Rawlings in recognition of her work on python systematics.

SAXACOLA VERSUS STIMSONI

Until the publication of Hoser 2000b, most herpetologists in Australia identified the so-called Western Children's Python as *A. stimsoni*, as described by Smith (1985).

The name "*stimsoni*" emerged shortly after Wells and Wellington's paper naming the same taxon "*saxacola*".

As a result of a petition to the ICZN seeking suppression of the relevant Wells and Wellington paper, the Smith name gained wide usage, but the Wells and Wellington one didn't.

The petition to the ICZN failed in 1991, (see Storr, Smith and Johnstone 2002) or the ICZN's ruling as published, by which stage "*saxacola*" had been all but forgotten by most herpetologists.

Following resurrection of "*saxacola*" by Hoser 2000b, as part of an overview of python systematics, Aplin wrote the following in Storr, Smith and Johnstone (2002):

"The rules controlling the names of animals dictate that the oldest available name be applied to any given species and that the descriptions meet certain minimum criteria to ensure identification. Although the name *saxacola* narrowly predates *Liasis stimsoni orientalis* it was proposed without any form of differential diagnosis and is thus regarded as a *nomen nudem* (literally 'naked name') and hence is unavailable (Aplin and Smith 2001). Hoser (2000) has attempted to encourage the use of *saxacola* but has failed to address the issue of non-availability."

Hoser 2000b (myself) used the name "*saxacola*" on the basis that the original Wells and Wellington description had a seven line "diagnosis" following the heading, viewing that as satisfying the ICZN code.

The relevant section of the code/rules is, Article 13.1.1, which as noted earlier here, reads:

"13.1.1. be accompanied by a description or definition that states in words characters that are purported to differentiate the taxon"

The diagnosis, is the only part of the Wells and Wellington description in doubt.

Richard Wells in various phone conversations alleges that his (Wells and Wellington 1984) description fits this, in that even if his diagnosis fails, it “purports” to differentiate the taxon and that is good enough.

“Purport” is defined later in this paper, when discussing yet another taxonomic dispute.

Aplin says that under his interpretation of the code the Wells and Wellington description fails.

My personal view is that the description of *saxacola*, does fit within the guidelines of Article 13.1.1 (on it's most liberal of interpretations) on the basis that Wells and Wellington could argue that by referring their new taxon to images of the same taxon and the other species they say are likely to be confused with it, (in their description) they have compared the new taxon with that it is likely to be confused with. Wells and Wellington could also argue that they have not considered congeners (as recognized by them at the time) as the differences are obvious and not needed to be diagnosed.

This is of course a subjective judgment, but unfortunately on which it all seems to turn.

So as to enable readers to properly ascertain the relative merits of Aplin's argument against *saxacola*, as compared to the potential arguments in favor of usage of the name, I have reprinted the relevant passage from Wells and Wellington 1984 in it's entirety and unedited below:

“PYTHONIDAE

ANTARESIA Wells and Wellington, 1984

Antaresia childreni (Gray, 1842)

Antaresia gilberti (Gray, 1842)

Antaresia maculosus (Peters, 1873)

Antaresia perthensis (Stull, 1932)

Antaresia saxacola sp. Nov.

Holotype: An adult specimen in the Australian Museum R60304. Collected at 6 km north of Barrow Creek, (on Stuart Highway) Northern Territory (21 04'S X 134 10'E) on 16 January, 1977 by Peter Rankin and Grant Husband.

Diagnosis: A member of the *Antaresia childreni* complex most closely related to *Antaresia gilberti* and believed confined to central Australia. *Antaresia saxacola* is figured in Cogger (1983:Plates 174 and 409 from Wilcannia, New South Wales). Gow (1977, Snakes of the Darwin Area) illustrates its congener *Antaresia childreni*. The holotype of *Antaresia saxacola* measures 102.5 cm snout-vent length and 9.6 cm to tail length.

Etymology: The name refers to its essentially rock-dwelling habits.”

The above was reprinted due to the general difficulty most herpetologists have in acquiring original copies of the relevant Wells and Wellington paper.

In another published rebuttal of the Wells and Wellington description of *A. saxacola*, Underwood and Stimson (1990) alleged that the original Wells and Wellington description failed to comply with the relevant ICZN code (namely article 13(a)). In arguing this, they stated that Wells and Wellington failed to “say how it differs” from the closely related species.

The argument again hinges on the word “purport” as written in the code, with the counter argument by Wells and Wellington logically being that their description at least purported to differentiate the taxon, even if in hindsight they did a terrible job of their description and may not have actually differentiated the taxon in material factual reality.

This is especially so noting that the new taxon is identified by Wells and Wellington as being “confined to central Australia”, while the other species of relevance all came from coastal regions (based on the known type localities and the inference by the words of the description). The diagnosis also refers to the snake's “essentially rock dwelling habits”, which taken on it's own could be said to imply (correctly or otherwise) that the other snakes in the genus are not necessarily rock dwelling.

In other words, while the Wells and Wellington description of *A. saxacola* is not terribly useful or clear, it does as I have made clear earlier (in my view) comply with Article 13(a) of the relevant code and all other relevant parts and therefore the name is available under the code.

As it is the first available name for the said taxon, it is therefore the name that must be used as it carries date priority over *A. stimsoni* (Article 23.1 of the code).

Having said the above, most Australian herpetologists do not as of 2012 recognize or use the name “*saxacola*” and perhaps ultimate resolution of the issue will be through a specific petition to the ICZN.

This in my view should happen sooner rather than later in order to resolve any potential confusion. In any event, I am sure that sooner or later the issue of the name for this taxon will probably come before the commission either for determination, or perhaps as an application to suppress a senior synonym on the basis of “non-use”.

ASPIDITES TAXONOMY

Various geographical races were recognized long before Hoser 2000, formally named some of them (see relevant references in Hoser 2000). According to Ken Aplin in Storr, Smith and Johnstone (2002), two names first used by Hoser (2000b), *Aspidites melanocephalus daveii* and *Aspidites ramsayi richardjonesii* are “*nomen nudem*” on the basis that they only differentiate taxa on the basis of distribution and that alone is not a distinguishing character. Furthermore the argument is advanced that both names are invalid, as essentially similar diagnostic features (excluding distribution) are used for other newly named taxa, namely *A. melanocephalus adelynnensis* and *A. ramsayi panoptes* both names of which are accepted as “available” for their said taxa and take precedence on the basis that they appear before the “unavailable” names in the original paper and hence have “page priority”.

Unlike in the case of *Antaresia saxacola*, for which there is an alternative name available on the basis of it's (allegedly) being a “*nomen nudem*”, namely *A. stimsoni* Smith 1985, there are as yet no other available names for the *Aspidites* taxa identified by Hoser by distribution (alone?) under the above “*nomen nudem*” names.

Hence in order to stabilize the taxonomy and nomenclature for the genus, the two relevant taxa, the north-west Woma and the north-west Black-headed Python are both formally named and described here.

Rather than have any further destabilization of the nomenclature, different name combinations are adopted for the relevant taxa for “new” descriptions of them.

This is to ensure stability of names used from now on.

This is important as with newly legalized collection and breeding of these pythons in the three main states of WA, NT and SA, increasing numbers are now captive and being studied and it is important that biological information obtained is correctly attributed to the correct regional taxa.

Furthermore a diagnosis of the genus as a whole is provided here, which is largely similar to that printed in Hoser (2000b) however with important changes and updates.

While Aplin did not state a reliance on Article 24.2.2. of the ICZN rules (ICZN 1999), in his work in terms of determining which *Aspidites* subspecies names took precedence in terms of being the available name, if one were to accept that he in fact relied upon this article, then he spelt out those actually published first in terms of either page or position priority.

Assuming however that Aplin has not sought to be a “first reviser”, which appears the reasonable position based on his writings, and so as to remove any ambiguity, I seek herein to rely on section 24.2.2. of the code to be the “first reviser” and to assign valid available names on the basis of the same page or positional priority in the original Hoser 2000 paper.

In other words the names to be hereafter regarded as available from Hoser 2000 on the basis of section 24.2.2 of the ICZN rules are, *Aspidites melanocephalus adelynnensis* Hoser 2000, and *Aspidites ramsayi panoptes* Hoser 2000.

Hence the end result is the same whether or not one accepts that I

am in fact the "first reviser".

However there may be a claim from other quarters that "none" of the Hoser 2000 *Aspidites* descriptions are valid. Hence to remove such claims, all are described as new species herein.

GENUS *ASPIDITES* PETERS 1876

Aspidites is a genus of large terrestrial Pythons endemic to continental Australia. These pythons are readily distinguished from all other Australian species by the apparent absence of pits on the labial or rostral scales, although in Black-headed Pythons (*A. melanocephalus*) at least, a tiny vertical slit on the rostral region is apparently equivalent. Other diagnostic traits are the absence of teeth on the premaxilla and enlarged symmetrical shields on the top of the head. Prior to now, most authorities have divided the genus into two well-defined species. These are the Black-headed Python (*A. melanocephalus*) and the Woma (*A. ramsayi*).

The former is separated from the latter by its distinct glossy black head. At best the latter only has black markings on the head. Few authors recognize subspecies or races. Those that have subdivided the above species into races or regional variants, include Barker and Barker (1994a) and Wells and Wellington (1985a). The former recognized different races without naming them, while the latter recognized *A. collaris* as described by Longman in 1913 (see below).

Taxonomy of this genus has gained greater interest in recent years with the introduction of more formalized reptile-keeper licensing systems in most Australian states combined with the high prices of specimens traded. Authorities in some states have taken a strong stand against hybridization of races of snakes, a view shared by a substantial number of private keepers.

Noting that distinct differences between races of *Aspidites* are well known and acknowledged and that for many years a substantial number of herpetologists have recognized different races as being at least different subspecies, it is somewhat surprising that up until now no one has put names to these different races. Black-headed Pythons and Womas are known to occur sympatrically in parts of Western Australia, with this author catching both species on the western edge of the Great Sandy Desert, north of Port Hedland, WA. (refer to photos published in Hoser 1989).

There is presently no evidence of cross-breeding between the two species either in the wild or captivity.

However Hoser (2007) demonstrated how easy it was to extract semen from snakes, including a NT specimen of *A. melanocephalus*, for the purposes of inseminating other snakes of choice, making cross-breeding of taxa far easier than had previously been the case.

Smith (1981) also found similar sympatry between both species in Western Australia. Worrell (1963) recorded sympatry between both species in the Northern Territory. To date no similar sympatry has been recorded in Queensland. That sympatry occurs between the two species of *Aspidites* is not altogether surprising as their habitat preferences are somewhat generalist, with the snakes being found in a variety of habitat, soil and vegetation types. Biological information about *Aspidites* is provided by Cogger (1996), Barker and Barker (1994a), Hoser (1981, 1989), Sonneman (1999) Storr, Smith and Johnstone (1986), Worrell (1970) and others.

Excellent photos of *Aspidites* are provided by the authors named immediately above. Photos of habitats inhabited by *Aspidites* are provided by a number of authors including Hoser (1989) and Barker and Barker (1994a). Barker and Barker (1994a) provide an excellent bibliography of cited references on *Aspidites* and pythons in general including cases of captive breeding, breeding data and other useful material. Type material for all species listed below has not necessarily been inspected by this author, however this author has inspected a substantial number of specimens including from the type localities given.

Of minor relevance here is that while it was in the past thought that *Aspidites* were an arcane group of pythons, current thought (agreed by this author) is that they are a recently derived group of pythons and from stock similar to other pythons in the region.

Notable is their absence from New Guinea, an island connected to Australia in the recent geological past, further noting that *Aspidites* is common along the northern coastline of Australia.

ASPIDITES MELANOCEPHALUS (KREFFT, 1864)

Type locality is Port Dennison (Bowen) in North-east Queensland. The holotype is held in the British Museum of Natural History (UK). *Aspidites melanocephalus melanocephalus*, the nominate subspecies, is herein restricted to an area approximating the Queensland border with the Northern Territory. Most Black-headed Pythons in captivity in Australia are of this form.

ASPIDITES MELANOCEPHALUS ADELYNENSIS SUBSP. NOV.

HOLOTYPE: A specimen at the Western Australian Museum, number 51208 from Wyndham, WA Lat: 15° 28' Long:128° 06'

PARATYPE: A specimen at the Western Australian Museum, number 17115 from 8 km south of Wyndham, WA. Lat: 15° 28' Long:128° 07'

DIAGNOSIS: Known only from Kimberley region of WA, this population of Black-headed Pythons appears to be isolated from the population to the south in the Pilbara. It is uncertain as to how much gene flow occurs between this population and that to the east in the adjacent parts of WA and the NT.

Aspidites melanocephalus adelynensis like *A. m. rickjonesi* (see below) is separated from other Black-headed Pythons by usually having one loreal, no suboculars and a single pair of large parietals, while most NT and Queensland Black-headed Pythons have 2-4 loreals, 1-2 suboculars and 2-4 pairs of parietals. *A. m. adelynensis* is separated from *A. m. rickjonesi* by the possession of yellowish lighter bands as opposed to whitish lighter bands in *A. m. rickjonesi*.

It is also separated from *A. rickjonesi* by distribution.

It is separated by part of the western flank of the Great Sandy Desert where it meets the WA coast. There are no unusually "high light" specimens of *A. m. adelynensis* known (as occurs in *A. m. rickjonesi*).

Aspidites melanocephalus rickjonesi subsp. nov. is further separated from other *A. melanocephalus* by it's smaller adult size (average 180 cm total length in measured specimens), versus average of 200 cm total length in measured specimens of *A. melanocephalus adelynensis* from further north in WA (The Kimberley region) and 210 cm for *A. melanocephalus melanocephalus* the taxon from north-east Australia.

Analysis of the mitochondrial DNA of *A. m. adelynensis* will further ascertain the differences between this and the other Black-headed Pythons, in particular, how much genetic interaction has occurred between this population and those to the east.

ETYMOLOGY: Named after Adelyn Hoser, the author's daughter. See elsewhere this paper for more details. .

ASPIDITES MELANOCEPHALUS RICKJONESI SUBSP. NOV.

HOLOTYPE: A specimen at the Western Australian Museum, number 46170 from Tom Price WA Lat:22° 39' Long:117° 40'.

PARATYPE: A specimen at the Western Australian Museum, number 12268 from near Port Hedland, WA. Lat: 20° 19' Long: 118° 34'.

DIAGNOSIS: Known only from Pilbara region of WA, this population of Black-headed Pythons appears to be isolated from the population to the north in the Kimberley Ranges. Some but not all specimens of *A. m. rickjonesi* are of a distinctly lighter than usual ground colour. However this is not a general diagnostic characteristic on it's own.

What is diagnostic of this taxon as opposed to all other *A. melanocephalus* is that the lighter cross-bands have a distinctive whitish hue, as opposed to the yellowish hue in the lighter cross-bands of all other *A. melanocephalus*.

Aspidites melanocephalus rickjonesi like *A. m. adelynensis* (see above) is separated from other Black-headed Pythons by usually having one loreal, no suboculars and a single pair of large parietals, while most NT and Queensland Black-headed Pythons (*A. m. melanocephalus*) have 2-4 loreals, 1-2 suboculars and 2-4 pairs of parietals.

In this taxon *Aspidites melanocephalus rickjonesi* subsp. nov. the large parietals are more circular in shape than those seen in both the other subspecies, which are either jagged in shape) (as seen in *A. m. adelynensis*) or as distinctly smallish circular with irregular edging/irregular shape in *A. melanocephalus melanocephalus* from

eastern parts of Australia.

Aspidites melanocephalus rickjonesi subsp. nov. is further separated from other *A. melanocephalus* by its smaller adult size (average 180 cm total length in measured specimens), versus average of 200 cm total length in measured specimens of *A. melanocephalus adelynensis* from further north in WA (The Kimberly region) and 210 cm for *A. melanocephalus melanocephalus* the taxon from north-east Australia. This author has caught both lighter and more 'normal' coloured specimens in the Goldsworthy/Shay Gap areas of WA. In the northern part of the Pilbara region, the Black-headed Pythons seem to be more common in the hillier areas, while the Womas (*A. ramsayi*) appear to be found more in the red sand-dune habitats. *A. m. rickjonesi* is separated from *A. m. adelynensis* by distribution, being separated by part of the western flank of the Great Sandy Desert where it meets the WA coast. These same differences were identified by Barker and Barker (1994a).

Wild caught specimens of *A. m. rickjonesi* caught have also demonstrated behavioral differences that diagnose it as separate from other *A. melanocephalus*. Unlike the other subspecies that tend to rear up and hiss when caught, this trait is only seen in this taxon when harassed, as opposed to merely encountered. Analysis of the mitochondrial DNA of *A. m. rickjonesi* will further ascertain the differences between this and the other Black-headed Pythons.

ETYMOLOGY: Named after a NSW Member of Parliament, Richard Jones, also known as "Rick Jones" for his ongoing contributions towards wildlife conservation, integrity in government and other matters. An honest and decent parliamentarian such as Richard Jones is a rare thing in Australia. That is also why he isn't with a major party.

ASPIDITES RAMSAYI MACLEAY, 1882

The type locality is Fort Bourke in NSW. The snake later described by Longman in 1913 as *Aspidites collaris* from near Cunnamulla, Queensland, is believed to be the same race as the nominate form and is treated here as being synonymous. The distance between Bourke and Cunnamulla is not substantial. Habitats, including soils and vegetation regimes and herpetofaunas in the two areas are essentially similar.

Thus the type form of Woma is in fact the Eastern Australian form. It is distinctly more grey in dorsal colour (as opposed to yellowish brown) than both the western subspecies and has far more prominent dark markings over the eyes as compared to more western specimens which may or may not have such markings. While distributional information for Womas in Australia is patchy, partly in reflection of the relatively remote areas that they occur in, most herpetologists believe that it is not continuous throughout the arid parts of Australia.

For the purposes of this paper, and until information to the contrary is received, the nominate subspecies, *Aspidites ramsayi ramsayi* is herein restricted to inland parts of NSW and adjacent Queensland, essentially confined to the upper Darling River basin.

All three subspecies of *Aspidites ramsayi* are believed to be allopatric.

ASPIDITES RAMSAYI PANOPTES SUBSP. NOV.

HOLOTYPE: A specimen at the Western Australian Museum, number 43459 from Burracoppin, WA Lat: 31° 24' Long:118° 29'.

PARATYPE: A specimen at the Western Australian Museum, number 17662 from Merredin, WA. Lat: 31° 31' Long:118° 14'

DIAGNOSIS: This race of Womas has a lower average ventral and subcaudal count than the main race (see Barker and Barker 1984). Unlike the nominate form *A. r. ramsayi*, *A. r. panoptes* does not retain the juvenile darkening over the eyes in adults. This latter trait is a trait shared with *A. r. richardjonesii*, also of WA, (see below). This is the south-western Woma. It is separated from all other Womas by distribution (Smith 1981).

Hoser 2000 stated that the population is believed to be isolated from the main centralian population by a belt of heavy soils between Karalee and Zanthus, WA (Smith, 1981). In the absence of evidence to the contrary, this author accepts Smith's proposition (see below). In south-western Australia at least, this south-western

population appears to be in terminal decline (Brian Bush, pers. comm.). The probable causes include introduced predators such as foxes and cats, habitat destruction and perhaps other unknown causes.

Aplin in Storr, Smith and Johnstone (2002) noted that habitat in south-west WA had changed dramatically within the last 16,000 years and as a result, it'd be reasonable to expect that the present isolation of the south-west WA population from the nearby Nullabor population is recent in geological terms and therefore the snakes there should be attributed to the same taxon.

In terms of physical traits, the southern Australian population, as in that found in South Australia, but not including red-soiled areas in the state's furthest north, should also be attributed to this subspecies in the absence of evidence to the contrary.

The basis of this assertion is the physical similarity of the snakes as mentioned elsewhere in this paper, but including physical size, morphology, scalation, pattern, demeanor and known biology. The specimens from red-soil areas of the NT and north-west are of a distinctly smaller and more gracile race and are described as a separate subspecies below, named herein as, *A. r. neildaviei*.

A. ramsayi neildaviei subsp. nov. (see below) is separated from *A. r. panoptes* by its distinctive yellowish hue in its base colour as opposed to brownish in *A. r. panoptes*.

A. r. panoptes also has cross-bands that are indistinct as compared to *A. ramsayi neildaviei* subsp. nov. (see description below). Each of the previous characters alone and/or in combination separate these two subspecies taxa.

A. ramsayi neildaviei is also separated from *A. r. panoptes* and all other *A. ramsayi* by its considerably more placid behavior.

All three subspecies of *Aspidites ramsayi* are believed to be allopatric.

ETYMOLOGY: The subspecies was named *panoptes* due to popularity of the scientific name for a species of monitor lizard among some Australians. Therefore I have bowed to their wishes and legitimately named another reptile by this name. ICZN rules allow species from different family and genus to carry the same species name.

ASPIDITES RAMSAYI NEILDAVIEII SUBSP. NOV.

HOLOTYPE: A specimen at the Western Australian Museum, number 34070 from near Port Hedland, WA Lat: 20° 19' Long:118° 34'.

DIAGNOSIS: Unlike *A. r. ramsayi*, this form loses the juvenile pattern (of darkening) around the eyes at maturity and separates these taxa. This is diagnostic for the subspecies. While this trait is also diagnostic for *A. r. panoptes* (see description above), the two forms are separated by a vast distance, including most of the Pilbara region. *A. r. neildaviei* is also separated from *A. r. ramsayi* by distribution.

Previously it was thought that the form was only known from the Western edge of the Great Sandy Desert in WA. This population (and subspecies) is actually thought to extend into central Australia, being common throughout most of the "red center".

A. ramsayi neildaviei subsp. nov. is separated from *A. r. panoptes* by its distinctive yellowish hue in its base colour as opposed to brownish in *A. r. panoptes*.

A. r. panoptes also has cross-bands that are indistinct as compared to *A. ramsayi neildaviei* subsp. nov. Each of the previous characters alone and/or in combination separate these two subspecies taxa.

A. ramsayi neildaviei is also separated from *A. r. panoptes* and all other *A. ramsayi* by its considerably more placid behavior.

Wild caught specimens of other *A. ramsayi* will tend to rear up and even strike when first caught. This is not the case for *A. ramsayi neildaviei* subsp. nov., which rarely if ever rears up or attempts to bite when first caught.

It was thought until recently that Centralian populations appeared to have characteristics intermediate between the Easternmost and Westernmost populations of *A. ramsayi*, that is now thought not to be the case and those specimens are generally attributable to this taxon and not the nominate *A. ramsayi ramsayi*.

A. ramsayi ramsayi is separated from other *A. ramsayi* subspecies by more grey in dorsal colour (as opposed to yellowish brown) than both the western subspecies and has far more prominent dark markings over the eyes as compared to more western specimens which may or may not have such markings and if they do, to a markedly lesser extent than seen in *A. ramsayi ramsayi*.

Of the various *Aspidites ramsayi* subspecies, *A. ramsayi neildaviei* subsp. nov. has the smallest average adult size, being 150 cm total length in adults, versus 160-180 cm total length for all other named subspecies measured, or for which specimen/group measurements were available.

These average size measurements have been corroborated against the now sizeable number of *Aspidites ramsayi* of all regional subspecies from across Australia now in captivity. While some *Aspidites ramsayi neildaviei* may have a limited amount of darkening around the eyes (especially in juveniles), this is never to the standard extent seen in *A. ramsayi ramsayi* from inland Eastern Australia.

Captive *A. ramsayi neildaviei* average 8-10 eggs per clutch versus 12-16 for reported cases of the subspecies from mid-south Australia, herein also referred to as *A. r. panoptes*.

The smaller clutch sizes seems to be a direct reflection of smaller adult sizes, with individual egg masses apparently being generally similar.

The demarcation between *A. ramsayi neildaviei* subsp. nov. and *A. ramsayi ramsayi* is believed to be in the region of Western Queensland, south of Mount Isa, through a wide area known to have Black-headed Pythons (*A. melanocephalus*), but not *A. ramsayi*.

All three subspecies of *Aspidites ramsayi* are believed to be allopatric.

ETYMOLOGY: Named after Neil Davie, founder of the Victorian Association of Amateur Herpetologists (VAAH) for ongoing services to herpetology, including the period beyond his involvement in that society, including in his work for conservation and his education related work with reptiles.

SPECIES AND SUBSPECIES OF ASPIDITES NOW RECOGNISED

Aspidites melanocephalus (Krefft, 1864)

Aspidites melanocephalus adelynsensis subsp. nov. (this paper)

Aspidites melanocephalus rickjonesi subsp. nov. (this paper)

Aspidites ramsayi (Macleay, 1882)

Aspidites ramsayi panoptes subsp. nov. (this paper)

Aspidites ramsayi neildaviei subsp. nov. (this paper)

Total of 2 species comprising six subspecies.

LEIOPYTHON AND RELEVANT EVENTS LEADING TO THE PUBLICATION OF SCHLEIP 2008

The snake, known generally as the White-lipped Python, *Liasis albertisii* Peters and Doria, (1878), was inadvertently redescribed the following year as *Leiopython gracilis* by Hubrecht (1879), who also created the monotypic genus for the taxon, namely *Leiopython*.

Over the intervening 120 years the taxonomy of the genus remained stable at the species level, but the genus assignment varied in line with general trends in python taxonomy, with various authors assigning the taxon to the genera *Liasis* (e.g. Stull, 1935, Stimson, 1969, McDowell, 1975), *Bothrochilus* (e.g. Cogger, Cameron and Cogger, 1983, Hoser, 1989, Rawlings, et. al. 2008), *Lisalia* (e.g. Wells and Wellington, 1984) and *Morelia* (e.g. Underwood and Stimson, 1990).

Kluge 1993, and most authors since then, including O'Shea (1996), Hoser (2000b and later papers), O'Shea (2007a, 2007b) have referred the taxon to the genus *Leiopython*, with the nomenclature at the genus level remaining that way to at least 2008 with very few exceptions.

While this paper continues to place the White-lipped Pythons in the genus *Leiopython*, the genus placement of these snakes is not of importance in the context of this paper.

For many years, it's been known that there were two distinct variants being identified as "White-lipped Python", this taxon,

lumped generically as "*L. albertisii*", including the northern "brown race" and the southern "black race" (see for example O'Shea 2007a).

The differences, included size, behavioural, including temperament and scalation. The two variants were also separated by distribution, in the form of the central New Guinea Cordillera and that both may be different species was known by many herpetologists for many years, including throughout the latter part of the twentieth century (O'Shea 2007a). Hence the formal naming of the taxon as *Leiopython hoseerae* Hoser 2000, by Hoser 2000b was relatively uncontroversial and widely accepted by herpetologists and appearing in numerous relevant publications including for example Allison (2006) and O'Shea (2008).

The division of serpent taxa separated by the main central range of New Guinea, was not just done with regards to the genus *Leiopython*.

Hoser 1998 did a similar split for the snakes of the genus *Acanthophis*, erecting a new species (*A. barnetti*) for those found north of the main range, that until then were undescribed and also long recognised as a distinct species (see O'Shea 1996, p. 158). Rawlings and Donnellan (2003) did the same for the Green Pythons (*Chondropython viridis*) placed by them in the genus "*Morelia*", with species names already available for north and south populations.

Harvey et. al. looked at MtDNA of the Scrub Pythons (the "*amethystina*" species complex, which they placed in "*Morelia*") and in line with the published results for this species complex in Hoser 2000b decided that there were grounds to declare those north of the range (east of the Sepik River) a different species to those from the south.

(As stated in Hoser 2000b, Hoser 2000b, deferred naming these snakes pending the paper being published by Harvey et. al., stating:

"This author had assigned names to forms previously regarded as *A. amethystina* that is found in Islands to the north-west and south-west of New Guinea, however they were withdrawn from this paper after it became apparent that David Barker and others were similarly subdividing the genus *Austroliasis* as it is described here."

Notwithstanding this statement and the fact that both Hoser 2000b and Harvey et. al. (including David Barker) were published in 2000, this didn't stop a habitual liar and long-term adversary of Raymond Hoser, Mr. John Weigel from posting on the "australianherps" list server in 2001 the false statement that Raymond Hoser was plotting to "steal" naming rights for those taxa from Barker et. al.. Those posts remained on the internet as of at least 2008.

In line with Harvey et. al.'s results for "*Morelia amethystina*" in terms of northern New Guinea specimens being assignable to a single species level taxon (p. 171 their paper, see figs A, B, and C), Hoser, 2000b independently did the same for the pythons assigned to the taxon *L. albertisii* in that all from the mirroring region were assigned to the taxon *albertisii*.

Noting that the geographical and physical barriers affecting the genera *Acanthophis* (see Hoser 1998), "*Morelia viridis*" (see Rawlings and Donnellan 2003), "*Morelia amethystina*" (see Harvey et. al. 2000) and *Leiopython* (see Hoser 2000b) were apparently one and the same, it was totally expected that all four studies, across two (mainly) terrestrial snake families, demonstrated species splits broadly along the same regions (and movement barriers), even though all studies were on different taxa and used quite different materials and methods to arrive at essentially the same results.

These results are notable in that while it'd be reasonable to infer that the python taxon "*amethystina*" may be larger and perhaps more mobile than "*L. albertisii*" (see Harvey et. al.'s comments for their new "*amethystina*" taxon), studies across Australia for *Acanthophis* (NSW and WA studies by Hoser, summarised in Hoser 2002), have indicated these snakes to be considerably less mobile and therefore more prone to speciation than for other pythons (which would by all known measures include *Leiopython*),

and yet to date, no island specific population of *Acanthophis* for Biak has been described or named.

The two most outlying populations of *Leiopython albertisi*, namely those from the (south) eastern extreme and those from the northern extreme, both away from the (far west located) type localities for both *albertisi* and *gracilis*, were designated subspecies status on the basis of minor head scalation and other differences by Hoser 2000b (as redefined and agreed by Schleich 2008) and with limited sample sizes, and on the basis of a continuous distribution at the present time and/or very recent past (within the last 12,000 years).

At the time (2000) and even now, Hoser (this author) was of the view that not enough evidence warranted splitting of those populations to the species level.

Until end 2008, the Hoser 2000b divisions of the genus *Leiopython* were generally recognised by herpetologists with an interest in *Leiopython*.

Leiopython hoserae Hoser 2000 was readily adopted by authors (e.g. Allison, 2007, O'Shea 2007b and others), while no publishing authors regarded any regional races of *L. albertisi* (the two named subspecies) as being of distinct species and not one single publication appeared in print recognising or naming those variants as species, even to the extent of identifying different populations.

THE TRUTH HATERS

Dissent in terms of the Hoser taxonomy was only voiced by a group known as the "truth haters" or "the Hoser critics", centred on two men, namely a serial wildlife smuggler David John Williams and his close friend Wolfgang Wüster a Wales based "academic" at Bangor University with a history of publishing sloppy work.

Wulf Schleich, author of a paper known herein as "Schleich 2008" is a close friend of the above pair.

Relevant here is that like them, he's also had too much spare time on his hands and through his own website created in 2001 (www.leiopython.de) and others he visits and posts on via webforums, he has joined in the anti-truth and hate campaign by means of non-stop posts adverse of Hoser wherever he felt his arguments would gain traction.

None of their continual barrage of criticisms has had a grain of merit. However using their excess amounts of spare time and the near limitless resources of the internet, these men have managed to wage a campaign against myself (Hoser) of a scale and magnitude that is truly amazing.

Recruiting a small-band of misfits, with the ability to repeatedly post under false names and to censor and edit internet sites they control, these men have at times created a veneer and perception that there is widespread disagreement with the various Hoser taxonomy papers (and anything else to do with "Hoser", including the extremely popular venomoid (surgically devenomized) snakes). However the reality among qualified practicing herpetologists has been very different (Hoser 2004c).

By and large the Hoser taxonomy has been very routine and uncontroversial and the divisions at species level generally been of well-defined taxa, conservatively definable via a myriad of criteria.

No one has petitioned the ICZN in relation to any of the Hoser papers, indicating a general lack of concern in terms of the taxonomy and nomenclature.

Outside the group of people to be described in more detail below, the general perception of "Hoser taxonomy" has been that it is at times too conservative, befitting the position of a "lumper" as opposed to a "splitter".

This was voiced by Wells (2002), the result being further splits of taxa examined by Hoser being proposed by other authors, including one may suppose Schleich (2008), although as this paper shows shortly, the professed views of Schleich cannot be found to be consistent, credible or for that matter even honestly held by Schleich himself.

THE ORIGINAL "TRUTH HATER" THE CONVICTED REPTILE SMUGGLER DAVID JOHN WILLIAMS

In his view his reason to hate "Hoser" was justified on the basis that he was adversely named in both "*Smuggled*" books, (Hoser

1993 and Hoser 1996) and that forms the original basis of his ongoing hatred since then, which has over time expanded.

While the material in the books were true and correct as easily confirmed by publicly available court records (see Magistrate's Court of Queensland 1997), Williams has held the grudge against Hoser and pursued it ruthlessly and without scruple.

David John Williams, posting on the internet as "Toxinologist" and other names is a man with numerous serious convictions for animal cruelty and wildlife smuggling (see for example a fraction of the number of his crimes and convictions in the full transcripts of Magistrates Court of Queensland (1997)).

Williams and his close friend Wolfgang Wüster have both been guilty or party to a serious case of scientific fraud as detailed by Hoser 2001a and Hoser 2001b.

That scientific fraud revolved around an improperly altered (on at least three occasions) "online" paper that was published in the first instance as an alleged critique of the description of *Pailsus pailsi* Hoser 1998.

Since then, his alleged co-conspirator in the fraud Brian Starkey (listed by Williams as a junior co-author of the fraudulent and ever-changing online paper Williams and Starkey (1999 – three versions, listed here as "a", "b" and "c")), has stated that he had no part in the fraud and that Williams had without his permission included his name as co-author in the fraudulently altered paper and in fact printed material that both men knew was patently untrue.

The ill-fated paper did in it's first incarnations claim that the newly described species "*Pailsus pailsi* Hoser 1998" was in fact nothing more than a small or underfed Mulga Snake *Cannia* ("*Pseudechis*") *australis*. The claim was underpinned by some statistical gymnastics not unlike some of those seen in the 2008 Schleich paper.

Williams altered and reposted the paper at least three times (cited herein as Williams and Starkey 1999a, 1999b and 1999c), the varied versions being dutifully downloaded by myself and others and now archived and accessible in a single file on the internet as part of the historical record of the fraud, or alternatively separately from the website <http://www.smuggled.com/Sland1.htm> as links to their originally published forms.

The final altered version of the paper, that had it's publication date post-dated effectively reversed the original claims about *Pailsus* and falsely inferred Williams was set to describe the New Guinea taxon, *rossignollii*, actually described and named in Hoser 2000a with the publication Hoser 2000a, long predating the first actual uploading and posting in January 2001 of Williams and Starkey (1999), version "c".

Williams then made false claims on "www.kingsnake.com" and the internet chat forum "australianherps" along the lines that Hoser had stolen his "naming rights" to the New Guinea taxon, later changing it to the claim that Hoser had sought to do so, but inadvertently named another taxon (namely *rossignollii*), with Williams still about to name yet another unnamed taxon, for which fortuitously his enemy Hoser did not have access to the specimens.

In spite of Williams making these claims in 2001, as of 2008 he has failed to identify or name any such taxon, even though in 2005, he coauthored a paper ostensibly on the taxonomy of the "*Pailsus*" / "*Pseudechis*" group of snakes (Wüster et. al. 2005). That paper did not name any new taxa anywhere!

This again shows the unreliability of statements or material published that Williams and his associates write.

As it happens, Williams had nothing whatsoever to do with the initial discovery or naming of the *Pailsus rossignollii* taxon (see Hoser 2000a), although in a book he published in 2005 (Williams et. al. 2005), he did recognise it as valid taxon that had been properly named by Hoser in Hoser 2000a (see pages 58, 59 and the distribution map in the Williams book, now identifying the *rossignollii* taxon as also occurring in PNG in the alleged region of his allegedly undescribed similar taxon).

This was significant in itself as it reversed opposing dogma as published by his close associate Wüster et. al. (2001) to the effect that *Pailsus rossignollii* was either "*nomen nudem*" (see the definition of the term in ICZN (1999), or *Pailsus rossignollii* was

alternatively not a valid taxon, that had in turn been widely reposted and cited by Williams as "fact".

Shortly after publication of the 2000 description of *Pailsus rossignolii*, Wüster had posted on Peter Uetz's reptile database "synonymous with *P. australis*, W. Wüster pers. comm", which we now know to have been a deliberate lie on his part.

Notably however, while Williams chose to use the Hoser material in his book (on venomous species from New Guinea), and in spite of an extensive bibliography, Williams chose to deliberately exclude any Hoser publications from his references list in spite of several being key publications on the relevant groups of snakes and yet he chose to cite his own and Wüster's publications (post-dating the Hoser ones by some years) that had committed the morally reprehensible sin of plagiarising the key Hoser results (see below). However in spite of the above facts relating to the description of the two Hoser *Pailsus* species in 1998 and 2000, Brian Starkey actually had no role in the false claims made in the ever-morphing paper originally published and dated from 1999 (Williams and Starkey 1999a), (AKA version 1). In 2008, the "alleged" or "stated" co-author Brian Starkey wrote in an e-mail of that ill-fated 1999 paper that:

"I had absolutely nothing to do with time alteration and the reposting on web.

If fact I was in two minds about the whole paper, without even seeing a specimen of *pailus*. I didn't want to pass judgement until I had got out there and looked for myself. I did four trips asap to the area and found a couple of specimens 40-50 km from Cloncurry. I knew as soon as I saw my first DOR, that you were right! When I showed David a few pic's and close ups he knew too! Then I got a live specimen amongst a small group of rocks, so fast I nearly lost it. I have probably seen about 3 live and 4-5 DOR specimens in 9 or more trips. I wish we didn't jump the gun.

But David wrote the paper and added my name. I never actually wrote a word, although he may have quoted things I said during phone conversations.

And that's the truth."

In other words, Williams had knowingly published false information and conclusions to try to convince third parties of his lie that *Pailsus pailsi* Hoser 1998 was not a valid taxon.

As mentioned already, Williams has had an axe to grind against Hoser and used it constantly to attack my credibility, after being adversely named in both "*Smuggled*" books, (Hoser 1993, 1996).

Those books detailed numerous cases of animal cruelty and reptile smuggling involving Williams in the periods predating publication of both books. For all cases referred to in the books, he was ultimately charged, convicted and fined by the Australian or Queensland governments, the last relevant case being finalized in 1997 for extreme cruelty to live reptiles and smuggling-related matters.

As mentioned already, himself and his close associates, including a so-called academic named Wolfgang Wüster from a University in Wales, UK, have since spent much of their paid time stalking the internet telling people not to use so-called "Hoser names".

They have done this while simultaneously committing the ethically repugnant crime of plagiarising Hoser research papers and republishing the results in their own later publications (e.g. Williams, et. al. 2005, Wüster, et. al. 2005), while consistently failing to appropriately cite or acknowledge the original source of the "findings" (also see Williams, Wüster and Fry 2006).

A close friend of theirs, with a similar "anti-Hoser" position was a self-admitted "amateur herpetologist" (see text at: <http://leiopython.de/en/vita.html> downloaded on 28 December 2008, or last words page 19, Schleip 2008a) by the name of Wulf Schleip, who in the period after 2001, took a strong interest in the snakes of the genus *Leiopython* which he had as "pets, and to his obvious dislike found that one of just two named and obvious species in the genus was "*Leiopython hoserae*".

Wüster's best known critique of the "Hoser taxonomy" was a paper

he shopped to various journals before it got through a new and gullible editor at *Litteratura Serpentina* in 2001. The paper has since been posted by Wüster and all other "Hoser haters" widely over the web and elsewhere to further their cause, including by Williams, Schleip and others.

However all the central arguments in the paper (Wüster et. al. 2001, and later ones repeating the same or similar lies) have long since been shown to be false (see for example Hoser 2001a, 2001b, in direct reference to the Wüster et. al. piece, or alternatively Kuch, et. al. 2005, Rawlings et. al. 2008 and others who in turn rebut the false claims by Wüster et. al. relating to the Hoser taxonomy), but that has never stopped these men from repeating, embellishing and further exaggerating their lies and false claims on internet posts and even hard-copy publications, including for example (Williams, Wüster and Fry 2006).

Williams and Wüster have a history of "shopping" their "papers" through friendly and not so friendly editors to publish material that under normal circumstances would never pass even the most basic of editorial processes in anything masquerading as "scientific literature".

Simultaneously they have phoned and written to journal editors making false claims, threats and even sending legal letters, trying to harass and intimidate editors not to publish material correcting their lies. Affected journal editors include those from *Crocodylian*, *Herpfile*, *Litteratura Serpentina*, *Boydii*, *Monitor* and others as well as even the *Herald-Sun* newspaper in Melbourne.

The latter received numerous threats and then even a letter (later passed to myself) after the newspaper published a world first photo of Raymond Hoser "free handling" a large number of the world's top four deadliest snakes (*Parademansia microlepidota*, *Oxyuranus scutellatus*, *Pseudonaja textilis* and *Notechis scutatus*), that happened to be the world's first venomoids of those taxa (Hoser 2004b), even though the accompanying captions and stories had no relevance or references to Williams, Wüster or their associates or in theory gave them any reason to contact the newspaper.

This is mentioned merely to indicate the obsessiveness and extent of the campaign against Hoser interests by these men and the degree to which they actively "stalk" and try to counter any favourable mentions of "Hoser" in any context.

FURTHER FRAUDULENT ACTIVITY BY THE CONVICTED REPTILE SMUGGLER DAVID WILLIAMS

This is detailed here due to the fact that Schleip has by his own admissions in his 2008 paper worked closely with this convicted conman and that it appears he employs similar morals.

In a widely reported statement made by a PNG Pharmacist, Richard McGuinness in 2008, David Williams also stole dozens of vials of snake anti-venom from government stores when not authorised to do so.

Noting the serious ongoing shortage of such anti-venom in PNG, the obvious outcome would be an increase in the number of lives lost to snakebite in a country where annual deaths are measured in the thousands.

Williams denied re-selling the anti-venom on the black-market, instead stating that he had used the missing vials for live-saving work, as in treating bite victims.

The explanation was rubbished by McGuinness who stated that there was no evidence to back up the Williams claims.

It was alleged he was selling it illegally to natives at a profit, even though many of the purchasers would have lacked refrigeration necessary to store the antivenom.

To date Williams has not provided any detailed explanation to rebut the McGuinness claims.

Furthermore, Williams had been shown on the ABC TV programme "*Foreign Correspondent*" masquerading as "Dr", David Williams even though he was not a medical practitioner of any form. Furthermore he had no PhD or other similar qualification allowing him to use the title "Dr" to describe himself in the footage filmed at end 2007 and screened in early 2008.

Several news reports in PNG and Australia also saw Williams

identified as being involved in a fraudulent act of improperly arranging the import of Indian anti-venom, ostensibly to be used to treat snakebites in New Guinea.

Such anti-venom is useless on PNG snakes and PNG, Port Moresby City Pharmacy boss Mahesh Patel condemned Williams and his agents for promoting its use or availability in New Guinea, saying that his activities could put lives at risk (see Marshall (2008) and material cited therein and Staff Reporters 2008)).

At the time the debacle emerged of the improper importation of the wrong anti-venom emerged, David Williams justified the importation and ordering the anti-venom on the basis he was planning a trip to regions to the west where such anti-venom may work on some of the local species and hence was a better alternative to having nothing.

EARLIER INCIDENTS INVOLVING REPTILE SMUGGLER DAVID WILLIAMS

Williams was also the principal of a now defunct enterprise called "Austoxin".

Set-up in around 1994/6 ostensibly to save lives in New Guinea by supposedly supplying venom to make anti-venom, the enterprise actually turned out to be a highly organised reptile smuggling racket that intended to illegally send reptiles out of the country to supply an illegal global reptile trade.

When it collapsed, the debacle was widely reported in the PNG and Australian tabloid media at the time and labelled potentially the largest reptile smuggling racket in PNG history with the unwitting involvement of the then Deputy PM who was also apparently duped by Williams.

Williams blamed the debacle on his business partner Wayne Lewis, who in turn blamed Williams.

Regardless of who was to blame, Williams fled the country.

In a widely circulated statement made on 17 December 2007 (Lewis 2007a), Lewis wrote:

"My name is Wayne Lewis and I was one of the founding Directors of Austoxin P/L and a Director of Austoxin (PNG) Ltd. I ran the exhibits in shopping centre's in Australia during the 94/95 period and made ALL of Williams reptile transactions on his behalf. I then spent a year in Port Moresby in total limbo both during and after Williams fell out with Ed Jones, John Ellsworth and Chris Hiaveta the then deputy PM of PNG. A bit of research will confirm these facts. I can attest to all of Williams illegal transactions during the period as well as drug importation from PNG to Australia by someone who I've read is now Williams business partner."

A letter by Lewis sent via e-mail and hard copy, dated 18 December 2007 (Lewis 2007b) sent to the Australian Broadcasting Corporation (ABC), not widely disseminated is printed below for the benefit of the public record.

So that I am not accused of misquoting the letter, it is reproduced in full.

"From: Rocky Guyforfun <rockybloke@gmail.com>
Date: 18 Dec 2007 22:18
Subject: URGENT. Upcoming episode relating to DAVID WILLIAMS in PNG.
To: foreign2@your.abc.net.au
Dear Sirs.
This is a rather long winded summary but I implore you to read it thoroughly.
This is a basic narration of my associations with DAVID

JOHN WILLIAMS that involves both conspired and direct criminal activity. I have

original documentation to prove any and all claims made in this

correspondence.

I have been following with keen interest the activities of David John

Williams and in particular the press surrounding his project in Papua New

Guinea. I understand that your program is dedicating time to an episode on

the above mentioned. I feel it necessary, after viewing a 60 Minutes episode

recently on the same subject, to raise concerns regarding the portrayal of

Williams as an all round nice guy dedicated to the salvation of the people

of PNG with regard to snakebite..

I was involved with Williams in a venture in the mid nineties called

Austoxin Pty. Ltd and Austoxin (PNG) Ltd. The primary aim of the companies

was to further the research of venom components for medical applications.

Further aims were to provide educational displays to the public and schools.

A partnership was entered into with Sydney University under the direction of

Prof. Richard Kristopherson. (spelling error) to provide whole dried venom

for research purposes. The company recruited numerous private shareholders

and other stake holders. The founding directors were David Williams, Wayne

Lewis and Laurie Haddrick. All of Cairns, Qld. The company started way under

capitalized and things went down hill fast financially. Williams basically

lived from the company bank accounts and the company premises were always up

market residential rental properties. I was in charge of the travelling

displays and PNG company. I was later accused of fraud by Williams and

slandered in emails by him at the time with regard to the PNG company. All

since proven false.

The PNG company was incorporated with Williams, Lewis and John Ellsworth as

directors. The aim of this company was to collect animals to produce venom

for both the World Health Organization and Sydney University. Also the

export of native fauna to the USA through an American fauna dealer Ed Jones

was planned and implemented. The plan was to get PNG nationals to capture

large quantities of native reptiles, amphibians and mammals for dispatch to

the USA via Jones. Initially this was to be done in accordance with the

CITES agreement at the time and the then Deputy PM. Chris Hiaveta was the

major financier and was able to pull strings when questions were asked. In

the end no animals were sent to the USA as Williams fell

out with Hiaveta's representative Ellsworth and Jones over the export of animals. Williams and Jones were for the export. Hiaveta and Ellsworth were against due to mounting political pressures in PNG and the Police Superannuation Fund scandal that Hiaveta was embroiled in.

I ran the PNG company and was under the direct instruction of Williams and Jones. Initially enclosures were sent from Australia and set up in a Port Moresby warehouse. Numerous specimens were caught by the initial group of Australian expats including Williams, Lewis, Brian Starkey. Specimens included were Chondropythons, Carpet Snakes, Northern Tree Snakes, Papuan Taipans, Small Eyed Snakes, Monitors and Gekkos. All of which I still have photographs of inside the enclosures at the PNG warehouse. Only two of those species are of any use for venom research. Williams instructions to me upon departure to PNG was to get the export of the reptiles moving as fast as possible to provide funding for the Australian operation which by that stage was in dire straits financially.

The fact that PNG did not allow the export of native fauna under the CITES agreement was generally considered by Williams et al something to be overcome by Hiaveta. I was recruited by Ellsworth and Hiaveta to continue the PNG operation without the export side of it. However due to family health issues in Australia I returned to Australia leaving Austoxin and severing any and all association with Williams. I was a very naive person to be involved in such a level of business at the time and relied on Williams apparent expertise. This was found to be misplaced trust as with Williams appearances are often deceptive.

Williams may be on a noble crusade these days however his past is exceptionally blemished with criminal offences against fauna and trade in fauna in Australia. I acted as his middle man in the mid nineties and made numerous illegal reptile sales on his behalf, using his licence, to some prominent amateur herpetologist in QLD and Victoria. He swapped Dept. of Environment and Heritage implants from his captive bred animals to wild caught specimens and sold these and their wild caught offspring, though me, on numerous occasions. I was prosecuted by the DEH in 1995 for illegal movement of Williams animals, on his license, to a movie shoot for the movie All Men Are Liars. My signature is on all movement documents from 1994 to

mid 1996. Williams himself was convicted of cruelty charges in 1997 relating to rotting animals found in the former Austoxin warehouse in Bolton St Cairns by a DEH raid. I was interviewed by Mike Chepp from DEH and provided my opinions on the state of the animals at the time. Williams was fined some \$7500 and a conviction recorded.

David Williams is a very personable chap who exudes confidence and sincerity, however I have seen the other side of his persona and believe me, though he may well be giving his full commitment to his research in PNG, he is capable of great deception and has always been driven by his ego and need for professional recognition. This overrides all other aspects of David.

I can be contacted on this email address
Your sincerely
Wayne Lewis."

Also obtained was a raft of supporting documents, including many from David Williams himself, which confirmed the detail of the above, including that Williams had unsuccessfully raised obscure legal arguments as an appeal defense against his convictions and fines for culpable cruelty to reptiles and smuggling (Williams 1997). The appeal failed with all fines and penalties being re-imposed. Before the Austoxin debacle, David Williams had pled guilty in Australia to smuggling reptiles in the post in an unrelated incident. In another incident, David Williams went to a company trading as "Network Rentals and Rent A Ute", where he hired a truck to use for a reptile demonstration. According to a statement by a debt collector,

"The truck was reported stolen after a few weeks, the police caught Williams driving it, but did not do anything as he paid by cheque and it bounced so they said it was a civil matter now."

At the end, Williams wasn't pursued for the debt as he lacked assets and the truck itself had been recovered intact. See Woolf (2008) for details.

The details of these and other Williams incidents are all beyond the scope of this paper, but readily accessible via court files, news clips of the relevant times and other relevant means.

A mere fraction of these are listed in the bibliographies in Hoser (1993) and Hoser (1996).

HOLIDAY INN COMPETITION AND VOTE RIGGING EXPOSED

At end 2007 and early 2008 David Williams decided to promote himself as some kind of unsung hero, saving people from death by Snakebite in Papua New Guinea.

He successfully got funds from the "Australian Venom Research Unit" (AVRU), in Melbourne for what are best described as "collecting trips" and the like.

He solicited and duped the ABC TV's "*Foreign Correspondent*" into doing a favourable story about him that was later shown to be fraudulent (see previous in this paper), including what a number of herpetologists speculated was the alleged faking of a Taipan bite. The bite was not shown on camera, immediately arousing suspicions, as every other part of the alleged event was shown on camera. Furthermore Williams made an apparent near "instant" recovery by the next day (unlikely in terms of a Taipan envenomation), and made inconsistent statements in terms of availability of anti-venom on the ABC broadcast and on internet forums including www.aussiereptilekeeper.com, the latter of which he said he had spare antivenom stored at his facility.

In hindsight that may have been some of the vials of anti-venom he had been accused of stealing (see above).

Then there was the already mentioned making false statements to acquire a special order of Indian snake anti-venom for resale in PNG, even though it was of no use to local species.

Peter Lloyd, an ABC work colleague of the reporter who worked with Williams in the New Guinea story, was shortly after, in July 2008 caught and prosecuted for Drug Trafficking in Singapore. He pled guilty to three drug-related offences, including possessing 0.41 grams of methamphetamine, or "ice" and was sentenced to 10 months' jail on 2 December 2008 (Meade 2008).

Also following the making of the ABC report, Williams was also exposed for improper conduct elsewhere as part of his broad campaign to masquerade as a life-saving hero from New Guinea. In early 2008, Williams and associates, Wolfgang Wüster, Wulf Schleip, Al Coritz and Mark O'Shea spammed internet sites and most major internet reptile forums seeking people to vote for him as a so-called "Everyday hero" in a contest where the winner got a free all inclusive holiday at a hotel run by the Holiday Inn group valued by them at US\$20,000.00.

Wüster posted on UK sites and others including <http://www.reptileforums.co.uk> inviting reptile enthusiasts to post multiple votes for Williams (see Wüster 2008) being touted as "one of us".

Williams and the same crew that usually devote their endless hours of spare time attacking myself had found a new cause to promote and as their actions didn't impinge on me, it was a useful diversion.

My only regret is that the competition didn't run for several years! The history of the competition is thankfully recorded on the archived posts of the many reptile forums easily searchable via the internet and not yet deleted or edited.

As the competition progressed Williams found himself being outvoted by an academic from Pakistan and so Williams and others stepped up the campaign for votes.

They then called for people to register multiple votes and even encouraged people to register fake e-mail addresses solely to bolster votes for Williams.

One of Wüster's students posting under the name of "Gaboon" on <http://www.reptileforums.co.uk> even sought higher marks from his University teacher (Wüster) if he voted for Williams (Gaboon 2008).

The Gaboon post followed numerous repeated pleas for assistance by Wüster on the same forum and others.

On the UK forum there was a general disinterest, so Wüster repeatedly had to "bump" the thread to make it seen (in at least one case merely posting the word "bump"), or otherwise it'd have dropped off the main front page of the site, making the thread less likely to be seen by third parties.

As the contest drew to a close Williams sent a message out, also reposted by his helpers, including Wüster at: <http://www.reptileforums.co.uk>,

The message read:

"I am especially grateful to my friends Shane Hunter from ARK in Australia, Mark (O'Shea) and Wolfgang in the UK, Al Coritz and Chris Harper in the USA, and Wulf Schleip from Europe, who promoted this contest fiercely, spending many long hours at the keyboard or on the phone to mates stirring up interest."

However it appears that the help wasn't all above board.

At the end of the competition, Williams was disqualified for vote rigging as identified by the Hotel Chain running the contest.

In order to beat the main competitor, Williams or someone working on his behalf had illegally inflated his vote tally near the end by improperly adding a massive 4,000 votes at the last instant, in order to get him over the line as alleged "winner".

Based on a separate post by Williams on <http://www.reptileforums.co.uk> (and many others) he implied that the fraudulent votes had come from a single computer (see Williams 2008), which seems to be patently obvious in hindsight, especially noting the skills in false and cross-posting Williams and associates has developed over the preceding ten years.

It also emerged that Williams also faced potential disqualification

for making a false claim about himself on the Hotel chain's own website <http://www.holidayinneverdayheroes.com/readmore.aspx?id=57&page=1> which also happened to be against the Hotel chain's guidelines

As mentioned before, working with Williams in this fraudulent debacle were his close friends, Wolfgang Wüster, Mark O'Shea, Wulf Schleip, Shane Hunter and Al Coritz.

Coritz even went to the extent of filming and posting a video on "youtube" (at: <http://au.youtube.com/watch?v=QzgluS-tIKc>) of him ranting on, solely for the purpose of calling on other reptile enthusiasts to vote for Williams.

Coritz is better known to herpetologists for the squalid conditions he kept a wild-caught Taipan through another video he posted on "Youtube" at: <http://au.youtube.com/watch?v=ujBiDuloYgm>.

This shows an emaciated snake at his home covered in exo-parasites, as a result having failed to shed properly in an unventilated cage replete with an inappropriate turned up and spilt water bowl, creating a bacteriological cocktail of a nightmare as the by-product it is shown mixed with an inappropriately wet substrate and uncleaned faecal matter strewn across the cage in a room with loose electrical wires forming a potential death trap for both snake and handler!

While one may ask what the relevance of this hotel competition fraud has to do with reptile taxonomy and the like, it goes to show how this group of men will use improper means to peddle views, including to make out that they are more widespread than is actually the case.

In the case of the Hotel competition, Williams managed to garner at least 4,000 votes for himself, with the obvious aim and intention to mislead innocent persons and to form a false perception that there was a groundswell of independent people in support of him, for virtuous work he had probably never done, which was never the case.

His actual support base was at best a mere handful of people.

There is absolutely no doubt at all that following publication of this paper that Williams, Schleip and Wüster will post material contrary to the facts and views that are in this paper including under fake ID's, as well as use their influence to improperly censor out balancing viewpoints on forums that they control.

This will be done in order to lead to a false perception that their views are those of the majority of herpetologists, which quite clearly they never have been.

SUCCESS BY SCHLEIP, WÜSTER AND WILLIAMS IN MISINFORMATION CAMPAIGNS

Unfortunately these men continue to run their warped campaigns because at times they do have a degree of success and it is this level of success that is cause for concern, as it relies on tactics of bullying and censorship, rather than persuasive and valid arguments.

To give an accurate appraisal and motive for their improper actions, some further instances of their actions should be related.

The major taxonomic act of Hoser 2004a was the erection of a genus for the *reticulatus* pythons, transferring them from "*Python*" to a new genus, "*Broghammerus* Hoser 2004".

Essentially adopting diagnostic characters derived from earlier authors, most notably McDowell (1975), the most notable thing about the designation was that no one had attempted it earlier, which was point raised by a number of independent commentators.

The morphological and behavioural differences between the Reticulated and Indian/Burmese pythons is stark and for them to be placed in separate genera made eminent sense.

Following publication of Hoser 2004a, Schleip and Wüster true to usual form stalked the internet in usual fashion and bullied people into not using the name *Broghammerus*, including in places like www.kingsnake.com and elsewhere.

On 24 July 2004, I posted at <http://forums.kingsnake.com/view.php?id=520074,520074> (Hoser, 2004d) advising merely of the publication in accordance with the ICZN rules.

The relevant section is:

"Recommendation 8A. Wide dissemination. Authors

have a responsibility to ensure that new scientific names, nomenclatural acts, and information likely to affect nomenclature are made widely known."

Immediately, Schleip, made repeated posts here and elsewhere specifically discouraging persons from using *Broghammerus*, but without providing any sensible reasons for the position. (See Schleip 2004b, 2004c).

Schleip of course was joined by Wüster on the same forum, who supported his position in favour of non-usage of *Broghammerus*, again without providing any sensible reason, but nevertheless making considerable noise, (see Wüster 2004a and 2004b as examples) with numerous similar posts on other sites made by both men, whenever reference was made either to the Hoser paper or the name *Broghammerus*.

As a result of their bullying and vigilance in stifling dissent, the name did not get widespread usage.

Google searches as of early 2008, showed that without exception, whenever the name "*Broghammerus*" was raised on any internet forum (anywhere in the world), Schleip, Williams and Wüster would descend on the thread to condemn use of the name and flame and bully anyone who supported it, including forcing supportive posts to be deleted, in order to present a false view that the use of *Broghammerus* was not generally supported.

The men would invariably refer in their posts to the online version of Wüster et. al. 2001, posted on Wüster's own university-funded website, the alleged (and long discredited) facts in the paper being justification not to use Hoser-names.

In 2008, Rawlings et. al. independently and without any input from Hoser, published their own paper that using mtDNA data, not surprisingly confirmed the Hoser 2004a position and adopted the use of *Broghammerus*, extending it to include *timoriensis* (a taxon with which I have little expertise), that action being the significant taxonomic move in the paper.

Noting that Wüster and Williams have in the past been ruthless in stopping publications in favour of the Hoser positions, including harassing and intimidating journal editors, it's fair to assume that neither were aware of the paper's imminent publication or the central conclusions.

None of, Wüster, Williams, Schleip or close associates, Fry, Coritz, (Peter) Mirtschin or O'Shea are listed in any way as being consulted or assisting in the paper in the acknowledgements, which is notable, as had any been aware of the paper, they'd almost certainly have tried to stop it's publication as they have done previously. Alternatively they would harassed the authors not to use "Hoser taxonomy".

This paper effectively undermined the Wüster et. al. claims that "Hoser" was a useless and clueless amateur (Wüster et. al. 2001), who's taxonomy should be forcibly suppressed and ignored (again see Wüster et. al. 2001), thereby leading other herpetologists to accept the Rawlings et. al. position and adopt *Broghammerus* for the *reticulatus* group.

Wüster, Schleip and Williams continued to stalk the web and "flaming" anyone who dared use the term "*Broghammerus*" including through the use of assumed names, but eventually the tide became overwhelming, as had occurred some years earlier, when Wüster had fought a losing battle against the acceptance of *Acanthophis wellsi* Hoser 1998 (see details of Wüster's campaign about this in Hoser 2001b).

The comments during this campaign were to say the least improper, like for example:

"Raymond Hoser should be banned from EVER having a scientific description considered as valid",

posted anonymously on: <http://www.albertareptilesociety.org/forum/archive/index.php?t-963.html> on 23 Feb 2008, or a post by Wüster ("in person" this time) on 2 December 2008 on an obscure South African reptile forum at: <http://www.sareptiles.co.za/forum/viewtopic.php?f=5&p=104864> where he said that he'd never in his life use the term "*Broghammerus*", (Wüster 2004c).

There is no doubt that as for other Hoser-named taxa that manage to gain widespread acceptance in spite of the bullying and

misinformation by Wüster, Schleip and Williams, their campaign of hatred will descend to the usual mud-slinging and false claims.

These will be along the lines that Raymond Hoser stole all the research work out of someone else's filing cabinet and deliberately "scooped" them in naming the taxon/taxa before they could do so.

THE HISTORY OF THE WEBSITE WWW.LEIOPYTHON.DE

In 2001, a private snake hobbyist by the name of Wulf Schleip from Germany, created the website www.leiopython.de. Here he professed to disseminate information on the genus *Leiopython*, which happened to be the genus/species of snake he was keeping at the time.

At first his site recognised both taxa (*albertisi* and *hoserae*) as different species, which was in line with accepted taxonomy of 2001, noting that Hoser (2000b) had in the case of the latter, merely formalized a long recognised species arrangement.

Schleip gave accounts of both as different species, which was appropriate for a website purporting to be an up-to-date reference for the genus.

Unfortunately, and presumably as a result of his frequenting similar internet chat groups to the convicted smuggler David Williams, Schleip soon became a close friend and associate of him and Wüster, generally offering support to Williams whenever he "flamed" or attacked others and of course in the ill-fated Hotel Competition detailed above.

Significantly in the context of this paper, from at least 2004, and after a series of posts on webforums, including "www.kingsnake.com" by Wolfgang Wüster and convicted smuggler David Williams, Schleip amended his site to deny the legitimacy of the taxon *hoserae*, variously declaring it "*nomen nudem*" in numerous places and also stating that the southern black "race" regularly climbed the central range of New Guinea to hybridise with the Northern "race" of *L. albertisi* (Schleip 2007b). Put simply, he joined the David Williams campaign of lies and hate against "Hoser".

By way of example, in a post to <http://www.herpbreeder.com/> Schleip also denied the existence of *L. hoserae*, going so far as to infer that he had mtDNA evidence that didn't support the Hoser 2000b designation (Schleip 2004).

Based on the mtDNA material in the Schleip 2008 paper, we now know his 2004 statement to be totally dishonest, which must therefore make everything else Schleip writes similarly questionable and worthy of closer assessment before accepted as "correct" as would commonly be the place after a sizeable taxonomic treatise is published.

While either of Schleip's "new" 2004 concepts are patently ridiculous, there was no means or for that matter reason for myself to try to change or remove the offending material.

The internet is full of questionable material, and in terms of Schleip's website, it was just one of many being run by persons of questionable integrity with undisclosed (to their readers) axes to grind.

Schleip avidly posted on internet forums and elsewhere his consistently negative views of Hoser, on all matters, ranging on taxonomy, venomoid (devenomized snakes), wildlife legislation, education and so on.

Schleip also edited the "Wikipedia" webpage for *Leiopython* on many occasions, where he made sure that the view that there was only one species in the genus was peddled and remained so, even when others edited the site to indicate the generally prevailing (post 2000) view that there was two species in the genus (*albertisi* and *hoserae*), giving him the opportunity to edit it back to the single species view. This was at:

<http://en.wikipedia.org/wiki/Leiopython>

and the edit history is publicly available via a link on the page.

As late as 12 December 2008, and following editing by Schleip, that site read as follows:

"*Leiopython* is a monotypic genus created for the non-venomous python species, *L. albertisii*, found in New Guinea. No subspecies are currently recognized."

For the record, in terms of all the Hoser descriptions of taxa, they

most certainly conformed with the relevant "Rules" as published by the ICZN (ICZN 1999).

Hence the names were all "available". However neither myself or anyone else can force anyone to use those or any other names to describe given taxa.

Furthermore, while anything is possible, it seemed unlikely to me that a forest-dwelling python would be able to climb extremely high, sometimes snow-capped hills of the New Guinea central cordillera to find other snakes to breed with, especially as in over 100 years no one has ever found any snake that is apparently intermediate or hybrid in any way to the taxa *L. albertisi* and *L. hoserae*.

The Schleip website and comments by Wüster, including those he published in *Litteratura Serpentina* in 2001, were in the materially relevant times clearly an attack on Hoser as opposed to any credible scientific assault on the taxonomy or nomenclature of the relevant Hoser papers.

As it happens, all major taxonomic conclusions (and following on nomenclature) of the Hoser papers, have been corroborated by independent studies of other herpetologists and generally been viewed by them as conservative.

The list runs broadly as follows:

- Hoser 1998/2002 *Acanthophis* taxonomy (confirmed by Aplin and Donnellan 1999, Wells 2002, bootlegged and agreed by Fry et. al. 2002 and Wüster et. al. 2005)(also see support from Starkey 2008 dating back many years)
- Hoser 2000b/2003a/2004a *Python* Taxonomy (confirmed by Rawlings and Donnellan 2003 ("*Chondropython*"), Rawlings, et. al. 2008 ("*Broghammerus*" and other genera), O'Shea 2007a, 2007b ("*Leiopython*"), Schleip 2008 ("*Leiopython hoserae*" and other), Wells 2005 ("*Morelia*" Carpet Pythons))
- Hoser 1998/2000a/2001 "*Pseudechis*" group taxonomy (confirmed by Kuch, et. al. 2005, bootlegged and agreed by Wüster et. al. 2005)
- Hoser 2001a/2001b *Pseudonaja* taxonomy (bootlegged and agreed by Williams et. al. 2008)
- For other Hoser-named taxa, e.g. *Tropidechis sadleri*
- Hoser 2003 (Hoser 2003b), which are generally easily and consistently diagnosed species (there has never been public argument in terms of the original findings)(See J. Craig Venter Institute 2008).

Of significance to this paper is that as of late 2008, Schleip's website was still peddling the line that the Hoser taxonomy for the genus *Leiopython* was wrong and that all could be assigned to a single species.

Also of note is the consistent (opposing Hoser) position of Schleip (and Williams and Wüster), no matter how absurd the opposing position actually is.

All three men control websites running anti-Hoser petitions, the main one as of 2006-8 being one against Raymond Hoser being allowed to own or possess venomoid (devenomized) snakes for the purposes of being able to do educational wildlife demonstrations without putting the public at risk.

In terms of that petition and websites associated with it, the three men have peddled countless lies, including most seriously that the Hoser venomoid snakes have regenerated venom and are dangerous.

After a video of numerous world's deadliest snakes, venomoid snakes biting Hoser (with no effect) appeared on "youtube" these men and/or associates petitioned "youtube" to have the video removed, the actual reason being it made a mockery of their lies.

On 24 December 2008, when I posted material on websites calling for an end to the sale and use of "glue traps" to kill snakes in Australia, the "Hoser haters" posted material on "www.aussiereptilekeeper.com" in support of the continued use of the traps (see Hunter 2008) on the same day, which remained unchallenged (for at least a fortnight) solely on the basis that the position was opposite to the Hoser one, with Schleip being a poster on and official sponsor of the site/server/s at the materially relevant time, including on 28 December 2008!

THE SCHLEIP 2008 PAPER ON *LEIOPYTHON*

Late in 2008, Schleip removed all material from his website.

In a download (dated 7 December) all that was written there was: "This site is closed for major updates and will be relaunched in a couple of days!"

(cited here as Schleip 2008c).

The site was in fact reloaded and relaunched on 10 December 2008.

The significance of the relaunch was that all his material denying the existence of the taxon *L. hoserae* was removed and Schleip had suddenly and without appropriate explanation or apology declared the species as valid!

The site's relaunch was based around the simultaneous (within days prior) publication of his 2008 paper, broadly accepting the Hoser taxonomy and in turn "creating" three new species of Brown *Leiopython* from the northern New Guinea region.

On 28 December 2008, he posted details of his newly published paper on *Leiopython* taxonomy on the website www.aussiereptilekeeper, a site moderated by the convicted reptile smuggler David John Williams, whose main reason to exist is to attack Raymond Hoser (this author) and numerous other places to advertise his new paper and new "species".

As inferred earlier, Williams cannot be sued for defamation due to his lack of assets.

A search of the internet yielded abstracts of the Schleip paper only, (at: <http://www.bioone.org/perlserv/?request=get-abstract&doi=10.1670%2F06-182R5.1>) see Bioone (2008), with full copies only available through a so-called "paywall".

The widespread availability of the abstract, in contrast to the full paper was significant in terms of the major discrepancies that emerged between the two.

I was able to acquire a photocopy of the publication through a Museum-based subscriber to the *Journal of herpetology*.

Firstly, the abstract was quite definitive in stating it's basis for diagnosing and describing new taxa of *Leiopython*, including mtDNA, which one would reasonably assume would be for those species that may otherwise have a questionable diagnosis.

However a read of the paper itself had the data revealing a different picture to that inferred in the abstract and essentially no different to that of Hoser 2000b (see below).

While the Schleip website (all pages) broadly mirrored his findings as published in Schleip 2008a (the paper in the *Journal of Herpetology*), (we'll call all pages on the server as of 28 Dec 08 (Schleip 2008b)), there were a number of notable differences.

The differences in essence were a more vitriolic attack on myself and less editorial discipline leading to his inadvertent and inconsistent statements including some on various webpages stating that all the northern white-lipped pythons are of the same species, namely "*L. albertisi*"!

These points are only raised here to demonstrate the sloppy methodology of Schleip and how motive dictates what he writes, as opposed to the facts as they should be written.

Note for example that Schleip made at least four substantive changes (edits) to his website/s (at: www.leiopython.de) in December 2008 alone!

He was also apparently active at Wikipedia, this time apparently making anonymous edits to webpages for *Leiopython*. This time however he was changing the pages to indicate all new taxa as recognised in his 2008 paper. That Schleip was the editor was revealed via a reverse IP address search giving the European address of his internet gateway and seeing that it matched his footprint elsewhere on the web.

In fairness to Schleip he could sustain an argument that he had suddenly as of end 2008, changed his mind about *Leiopython* and reversed his tune denying the existence of the Hoser-named taxa. This is not a hanging offence, but a proper explanation and apology would have been ethical.

Also in fairness to Schleip, the ICZN rules do call for "wide dissemination" of taxonomic work, and Schleip could legitimately

claim his stalking the web to (now) promote his published paper fitted this request from the ICZN.

However it is prudent to point out the hypocrisy here as Schleich, Wüster and Williams have put in print many times that Hoser's wide dissemination of taxonomy papers amounts to nothing more than "self promotion", (see Wüster et. al. 2001, or Williams et. al. 2006) and then as reposted and promoted on the web at "aussiereptilekeeper" by Schleich.

However even allowing for Schleich's editorial inconsistencies, complete dishonesty and hypocrisy, the fact remains that Schleich has managed to have a taxonomic paper published.

Regardless of how badly either that or his webpage are written, whether or not his newly "created" species are actually valid ultimately turns on the evidence and it is this that is herein assessed and found to be lacking.

THE *LEIOPYTHON* SPECIES

Hoser 2000b taxonomy recognised *L. albertisi* and *L. hoserae* (the latter) as described in the paper. Two subspecies, namely *L. albertisi bennetorum* from an eastern extremity of the range and *L. albertisi barkerorum* (name amended) from the northern extremity were also formally described and named at the subspecies level.

At the species level, both the latter are synonyms of *L. albertisi*.

While as recently as 2007, Schleich repeatedly claimed expertise on *Leiopython* and that *L. hoserae* and the Hoser-named subspecies did not exist (see for example his 2007 Wikipedia edits), in his paper published around December 2008 and his website (version end Dec 2008), Schleich accepted that *L. hoserae* was both a valid taxon and validly named (as in the name available under the ICZN code).

More dramatically, he elevated the "*bennetorum*" to full species.

True to past form he alleged there was no basis to separate *barkerorum* in any way from *L. albertisi* and that it was also "*nomen nudem*" (more on this aspect later).

None of the above so far made the Schleich paper notable in any way, or for that matter worthy of comment. However what was worthy of analysis here was the dramatic move by Schleich of creating three new species of Brown *Leiopython*, namely *L. fredparkeri* and *L. huonensis* from the mainland New Guinea population of *L. albertisi* and *L. biakensis* for the specimens from the Island of Biak.

MTDNA EVIDENCE

In his abstract published and widely disseminated on the web, Schleich indicated that he had assessed this to confirm that his division of *Leiopython* is in fact correct.

He wrote:

"Additional evidence for some species was obtained by maximum parsimony and maximum likelihood analysis of mitochondrial DNA sequences (cytochrome *b* gene) taken from GenBank. Besides three conventional taxa, two new mainland species and one new island species were recognised in accordance with the evolutionary species concept"

However a read of his paper showed he in fact provided no DNA evidence whatsoever to separate any of his newly named northern taxa from one another or for that matter from the nominate race of *L. albertisi*.

The only conclusive mtDNA evidence given by Schleich is in his Figure 4, which shows separation of *L. hoserae* Hoser 2000 from "*L. albertisi*" from Madang (summarised also in the text of the second page (second column) of his paper).

While that confirms the taxonomic position of Hoser 2000b, in contrast to Schleich's own posts on Wikipedia and elsewhere at least to mid 2007, the non-publication of similar data splitting his own "new" species seems to indicate that the evidence he acquired (if he in fact looked) went against his published argument in favour of the new "species".

Interestingly for his newly created "species" "*fredparkeri*", Schleich wrote:

"this assignment should be subject to future studies on a genetic basis".

Which was in total contrast to what was written in his widely posted abstract!

This comment also showed that he either did not conduct genetic studies on this species, or alternatively his results weren't published as they went against his clear desire to name new "taxa" and be believed by his readers.

The key element of the use of genetics in determining new species is that it is essential only when the delineation of taxa may otherwise be difficult or questionable.

Most species known to science were never delineated on the basis of mtDNA due to the fact that it wasn't necessary as the differences between taxa were substantive and obvious.

In the case of *L. hoserae*, versus *L. albertisi*, the need to look at mtDNA to confirm the validity of the species designation was at best slight and in my view, totally unnecessary.

The two taxa are obviously very different, obviously allopatric, being split by a very substantive barrier and hence obviously different species (see for example O'Shea's comments on this in O'Shea 2007a).

By contrast all the northern *Leiopython* are essentially similar in most respects (phenotypically alike), as conceded by Schleich, not divided by any obvious and permanent barriers, extremely common throughout their range and hence are the obvious targets for mtDNA analysis as inferred in the widely disseminated abstract, but not delivered on in the actual paper.

In other words the abstract as published and disseminated is misleading and dishonest.

SEPARATION OF THE THREE SCHLEIP CREATED SPECIES

Until now, all the Schleich taxa would have been recognised as stock, standard *L. albertisi* for his newly created "*biakensis*", or "*L. albertisi bennetorum*" for his "*huonensis*" or "*fredparkeri*".

Notable also is that until publication of his 2008, paper Schleich was vocal (on his website) in declaring that separated distribution was not a useful basis to identify taxa.

This view was taken because it was a key plank in his printed rebuttal of the Hoser-named taxa.

In the 2008 paper, Schleich relied heavily on so-called "Operational Taxonomic Units" to allege what he called "geographically isolated or disjunctive populations", later also used to separate his new "species".

This is of course based on the limited collection of specimens he had at his disposal, noting that most of the relevant parts of Island New Guinea (and nearby) is relatively uninhabited and not collected for reptiles, meaning that it'd be almost impossible to claim no *Leiopython* inhabit intervening regions, unless of course one is talking about an island population, which then makes potential "rafting" of snakes an issue and seems obvious in the base of Biak.

Hence, the end point as stated in his paper for defining these new "species" using his relatively newly invoked "evolutionary species concept" (or ESC) is that his species populations are genetically isolated from one another by being distributionally disjunct.

While the central cordillera can give a safe bet southern New Guinea *Leiopython* have been separated from the northern population for anything up to 5 million years (mtDNA separation of about 10% as stated by Schleich), no such barrier either recently past or present is known to separate any of the northern populations, including the island race from Biak, which as recently as 12,500 years ago was virtually joined to the rest of New Guinea, (see for example figs 10 and 11 in Harvey et. al. 2000, with specific reference to Biak and it's being effectively joined to part of the Sahul Shelf).

Those authors (Harvey et. al. 2000) found that by molecular analysis the Scrub Python snakes from Biak were effectively identical to those from nearby mainland New Guinea (Fig. 6., p. 153). Hence it'd be expected a similar situation would exist for the White-lipped Pythons (*Leiopython*). Furthermore, noting the findings of Harvey et. al. were published eight years earlier and known to Schleich, it'd have been incumbent for him to provide contrary data for his own new taxa from the same place.

Schleip had not done this!

This raises more questions than it answers, and besides raising questions about Schleip's bad methodology, it also raises the ethical issue of whether or not he's deliberately chosen to exclude data he knew wouldn't fit his predetermined aim to "find" new species-level taxa, where none actually existed!

Alternatively, has he chosen not to investigate where it may lead to findings contrary to that which he seeks to publish and disseminate.

In terms of his morphological analysis, Schleip deliberately excluded a host of characters, such as temporals, parietals and postoculars on the alleged basis that there was an allegedly "random distribution between different populations".

However these scales are routinely used to split other python taxa including some from Australasia (see for example, Hoser 2000b, noting that the relevant diagnoses are in turn adopted from earlier authors and therefore not merely Hoser inventions).

However it is clear that the exclusion of characters that give no statistical standing in favour of one population versus another have been excluded by Schleip solely so as to inflate the relative importance of the obscure characteristics (based on ridiculously small sample sizes) he seeks to rely upon to separate his newly created "species".

In terms of the Schleip created species *huonensis*, it is notable that it is found immediately to the west of the distribution for "*L. bennetorum*". Schleip's diagnosis for the newly created taxon, states that it's effectively inseparable from *bennetorum* save for "the lower number of loreal and prefrontal scales as well as a lower average number of postoculars".

The question then begs, are these minor scale differences observed in pitifully small samples of snakes sufficient grounds to split these snakes off as a separate species?

Also, what of snakes found between the stated known locations for these two "taxa", are they different again? Or are they simply intermediates, as seems likely.

Hedging his bets each way, in the regions between his newly created "taxa" Schleip has marked his distribution map (Fig five in the paper) with a series of strategically placed question marks (notation being "populations of unclear taxonomic status").

If one were to assume the logical Schleip species theory to it's logical conclusion, each question mark would represent a new species, giving several new taxa, and an end-point of many essentially similar species in the "*Leiopython albertisi*" species complex, when for other similarly distributed (and similarly mobile) python taxa in the same region ("*amethystina*", "*viridis*", etc), there is only one of each.

Actually, *Chondropython azureus* is a considerably less mobile taxon than *L. albertisi*, and yet only one species occupies the same range as all of Schleip's newly created *Leiopython* species, which is a result that in the absence of a good reason, simply defies logic.

Leiopython fredparkeri, according to Schleip yields scale counts intermediate between *L. albertisi*", "*L. bennetorum*" and his newly created "*L. huonensis*", which is of course totally expected as these snakes are found between the known locations for these.

Rather than providing evidence for the existence of a new species of *Leiopython*, Schleip has in fact provided further evidence of clinal variation in the range of the taxon *L. albertisi*, within the region of Northern New Guinea.

The same situation is of course seen with "*L. huonensis*" with it being essentially intermediate in form between "*L. bennetorum*" and "*L. fredparkeri*", the "species" between which it's known.

Again, Schleip has chosen to exclude snakes found in regions between these newly created "species" as they would almost certainly be clinal (again) to those he has named.

Hence the true picture revealed is one of clinal variation in the north New Guinea *Leiopython*, rather than any evidence of speciation, discounting of course "recent" man-made barriers, such as roads, farms, fences and the like, similar to those erected worldwide in the last 2000 years.

Although my understanding is that as of 2012, most of this region is

still either jungle or relatively primitive farms.

Schleip's diagnosis of his newly created "species", *L. biakensis* is the most hypocritical act in his paper, as shown here.

The use of head scalation characters to separate this "species" from all other Brown *Leiopython*, breaks down, so he relies on cutting up his samples to give the appearance of consistent differences in his critically important "diagnosis". Yes, he even splits Irian Jaya *L. albertisi* from New Guinea ones to get his statistical gymnastics over the line in terms of diagnosing his "species".

This is of course the hallmark of his paper in that he uses, statistics with dodgy parameters and questionable statistical tests to prove his alleged consistent differences (using carefully selected parameters), based on selected samples and on the exclusion of intermediate (often clinal) specimens that may distort his end figures.

Things are made worse when he concedes that his sample size of his newly created "species" *L. biakensis*, is just two animals, and the best differentiating feature from *L. albertisi* from nearby Irian Jaya he has is merely "two labials entering the orbit" in his newly created *L. biakensis*.

It's also noted here that assuming this trait to be unique to those specimens, it may not be consistent among others from Biak!

Schleip also stated:

"This allopatric population shows little, but diagnosable morphological differences to other species. Brongersma (1956) assumed this population to form an incipient race. Because of the geographic distance to the mainland populations, of *Leiopython albertisi*, it is unlikely that gene flow occurs among these populations. Hence this population is considered reproductively isolated (sensu Wiens, 2004) and in accordance with Frost and Hills (1990) and based on the ESC (sensu Frost and Kluge, 1994), the assignment of specific rank to this population seems justified."

In other words the primary basis for separating this "taxon" is distribution and a crude "assumption" without data from an author 52 years ago.

Jumping the gun is a thought that springs to mind here, but lack of data is another serious problem.

Schleip repeats the distribution argument (allopatric populations) at length in his final justification for the creation of his three new "species", using selective quotes taken out of context from papers by Frost and Hillis (1990), Frost and Kluge (1994) and Wiens (2004), giving an observer like myself the impression that Schleip hopes that no one chooses to read either the detail of the cited papers, or for that matter even the detail of the data he's presented himself.

Taking the Schleip interpretations and argument to it's logical end point, you would have almost all island populations of almost all vertebrate species potentially being elevated to new "species" under his newly warped interpretation of the ESC.

Likewise for every species found in valleys that are separated by barriers such as low hills, poor habitat, roads, farms, factories and so on, even if the habitat barriers were no more than a few hundred years old.

With many hundreds of islands offshore to New Guinea, many separated for less than 12,500 years, you can see the potential for a taxonomic nightmare emerging, not just for herpetologists, but all biologists, in terms if the idea of naming all island populations full species ever takes hold.

However such an outcome will keep editors of publications like "*Zootaxa*" busy for a long, long time!

The hypocrisy part of Schleip's use of distribution as the key driver to creating his "species" "*biakensis*" is that for the previous 8 years and even in his 2008 paper, he argued strongly against the recognition of the *L. albertisi* from Mussau Island as distinct, claiming distribution is not a useful character.

That population is however that named by his enemy (Hoser), in Hoser 2000b as *L. albertisi barkeri* (correctly amended to *barkerorum*) regarded by Schleip 2008 and associates (as posted

on the internet) as "*Nomen nudem*".

In Schleip's 2008 paper he wrote a diatribe claiming the taxon was a "*nomen nudem*" and also arguing:

"Allopatric distribution may itself separate the Massau Island population geographically, but it is highly questionable if this alone is able to distinguish a taxon from another, regardless of the underlying species concept."

So while allopatric distribution apparently pushes Schleip's own vague "species" over the line, it is not sufficient grounds to push a similarly isolated island population (more distant from the main population) over the line as a separate taxon.

The evolutionary species concept (ESC) was employed by zoologists to account for allopatric and other reproductively isolated populations of similar animals that were not ever likely to breed or evolve together as a species and hence would for the indefinite future evolve apart.

In terms of its use and application in the classification of pythons, recent examples of papers and outcomes include Harvey et. al. 2000 and others. Schleip's 2008 interpretation of the ESC is so warped and extreme, that taken to its logical end-point, you could foresee two sibling snakes separated in plastic tubs being declared separate taxa on the basis of scalation differences in traits known to be variable if the owner said "I will not put these snakes together, ever!"

I have one such example in my facility in terms of sibling Olive Pythons, both demonstrating different head shield configurations, and using the Schleip theories as practiced could both be renamed as "new" species under his warped ESC interpretation.

DOES WULF SCHLEIP REALLY THINK THE BROWN L. ALBERTISI ARE REALLY SEVERAL SPECIES?

Frankly I doubt it.

After one analyses the statistical gymnastics of Schleip and one allows for the unaccounted for specimens from the mainly uncollected parts of island New Guinea, his excluded samples and the like, it becomes clear that it'd be difficult for a herpetologist to accurately assign a random brown *Leiopython* to any specific taxa as identified by Schleip in his 2008 paper.

Put simply, there are too many question marks.

As it happens, Schleip himself seems unable to do this for specimens analysed in his own paper for which he states he is unable to identify provenance.

Perhaps more tellingly is his website that he revamped and reloaded in December 2008.

On a number of his web-pages he talks about the husbandry of White-lipped Pythons" and on these he always splits the snakes into just two species, namely the "southern white-lipped python *Leiopython hoserae*" and the "Northern White-lipped Python *Leiopython.albertisi*", the latter of which is discussed as a single species and never with reference to his myriad "new" taxa.

A "BIG NAME HUNTER" IS ISOLATED

Ironically it was Schleip's colleague Wüster in 2007, who spoke to an editor of the journal "*Nature*" for an article later printed and titled "Big Name Hunters" (Borrell 2007).

In the poorly written article Wüster spoke of so-called "amateur" (defined by himself as not being on the government payroll) taxonomists "naming" species in a rush so as to get a "big name" for themselves or to "scoop" competitors.

Wüster was as always attacking Hoser, describing the Hoser papers as "shoddy descriptions" and making what he knew to be the false claim that Hoser had deliberately scooped Aplin to name *Acanthophis wellsi*.

The *Nature* article was poorly written, having liberal quotes from Wüster, with myself never being interviewed or even aware of the article until the time of publication.

The lack of balance in the article was perhaps best seen in the citations, which liberally referred to the Wüster criticisms of the Hoser papers, while failing to cite a single paper from myself (or for that matter many of the others by others independently supporting the Hoser position).

Notwithstanding this lack of balance, the reporter managed to state

about myself that "There's no one in history that's spent so much time dealing with, looking at catching and breeding Death Adders" and that the description of myself (Hoser) as an "amateur" is "complete rubbish".

The amazing part of this attack on myself by Wüster was that at the time he was still actively bootlegging my papers and their findings in his various publications, including making numerous false claims of "firsts".

One was in a 2005 paper (Wüster et. al. 2005), where he made the audacious "discovery" that *Acanthophis praelongus* was restricted to Cape York and not across northern Australia as formerly thought.

Of course the same position had been established by Hoser 1998, and confirmed by Hoser 2002 and Wells 2002, putting Wüster et. al. third in line to have made the "discovery"!

This particular series of lies by Wüster et. al., isn't the key part of the "Big Name Hunter" story.

More significant is that at the same approximate time, it was his mate Wulf Schleip who was actually guilty of the sin of rushing to print names of taxa without sufficient evidence, or as Wüster, Schleip and Williams repeatedly claimed (for myself) descriptions lacking testable evidence.

Furthermore it seems that Wüster was aware of the fact that Schleip's new "taxa" are on questionable grounds.

In the acknowledgements, Wüster is gratefully thanked by Schleip for revising drafts of the manuscript. Yet he is not listed as co-author as one would expect.

This is significant as Wüster, being an academic based in Wales, usually rushes to have himself listed as a co-author in papers of taxonomic nature (see citations here and elsewhere, including his own website at: <http://biology.bangor.ac.uk/~bss166/>, which incidentally has a single banner advert that links to Shane Hunter's anti-Hoser petition at: <http://www.aussiereptileclassifieds.com/phpPETITION/>, itself a rich source of lies and misinformation about myself (Hoser) and venomoid (devenomized) snakes produced at our facility, and also proudly boasts Schleip as an "official sponsor").

Similar occurs with the convicted reptile smuggler, David John Williams, recently fined \$7,500 for animal cruelty and smuggling, who is also one who usually jumps at the chance to be listed as co-author. Schleip gratefully thanks him, but again does not list him as co-author.

Schleip's summary in his paper states that he has failed to look at intermediate and perhaps clinal populations. Schleip's summary admits to looking at mtDNA for the Black *Leiopython*, long recognised as separate from the rest, but fails to provide similar mtDNA data for his alleged new taxa and admits that such work would be necessary to confirm the taxa.

Surely this basic work should have been done before he rushed to print and put names to alleged taxa and not left to someone else to either validate or repudiate his own position.

Or was it merely a case of Wüster's mate Wulf Schleip being guilty of rushing to be a "Big Name Hunter!" as written about in the journal *Nature*.

Even more amazing is that the editor's of a journal such as the *Journal of Herpetology*, actually allowed such premature and sloppy work to be published!

One may guess that with so many lies, damned lies, or statistics, that the editor in chief may not have read the devil in the detail.

"DILUTION" OF A SPECIES – THE END POINT OF TAXONOMIC EXAGGERATION

The relative importance of a species is diluted when one becomes many. If the change is warranted, so be it. However in the case of the Brown *Leiopython* there seems to be a case of so-called "taxonomic exaggeration", whereby the significance of minor differences are being exaggerated in order to push a group of snakes over the line in terms of being more than a single species.

As seen in Orchids (Pillon and Chase 2006), we may see in snakes such as *Leiopython* excess funds and resources being devoted to the conservation of alleged taxa that don't really warrant

it, such as perhaps for a regional group, that in real terms may not be significantly different to those elsewhere.

Noting the already stretched resources in terms of conserving threatened reptiles, taxonomic exaggeration by Schleip in terms of the brown *Leiopython* is not just against the sane principals of modern taxonomy, but also potentially against long term reptile and wildlife conservation efforts if such misconduct is allowed to go on uncondemned.

In Australia, we already are seeing the ill-effects of taxonomic exaggeration diverting funds away from more meaningful projects. In Victoria for example the local wildlife department (called DSE), is spending vast amounts of money counting numbers of Carpet Pythons (*Morelia metcalfei*) from this state, where they are only found in a small part of the state and hence have a "rare" listing, on the alleged basis of alleged differences to specimens found north and east of Victoria where they remain generally widespread across most of NSW and nearby parts of SA and Qld.

Broadly speaking the taxon is under no threat and the efforts spent counting local Victorian snakes could be far better spent on other projects.

If the creation of *Leiopython* "species" that satisfies an innate urge by hobbyist snake keeper Wulf Schleip for self gratification becomes widely accepted and adopted, a potential outcome may be other hobbyists rushing to print with poorly constructed descriptions that end up clogging herpetological journals with dodgy statistical analysis and the like to literally "baffle readers with bullshit" in order to get gratification of pseudo-species with their names attached seen in other third party publications.

IS *LEIOPYTHON ALBERTISI BARKERORUM* "NOMEN NUDEM"?

Both on his revamped (December 2008) website and in his 2008 paper, Schleip states that *Leiopython albertisi barkeri* Hoser 2000 is a "nomen nudem".

The only positive of this argument by Schleip is that for the first time ever, he'd put in print that the other named "Hoser taxa" are in fact validly named, contradicting earlier versions of his website, as well as his many 2007 "edits" of "Wikipedia" or for that matter Schleip (2004)!

Just as Schleip has quoted out of context and misrepresented facts to get to a predetermined and preferred position with his newly created "species", it appears he has similarly done the same thing to arrive at his desired position that the Hoser name is a *nomen nudem*, even if the facts don't necessarily support his claim.

To simplify things, I shall reprint in full the original diagnosis from the original description in Hoser 2000b. The undisputed Holotype details and the like are excluded here, even though under the ICZN rules such details are mandatory.

"DIAGNOSIS: This is the subspecies of *L. albertisi* that is endemic to Mussau Island in the Saint Matthias Group, Bismarck Archipelago. It is separated from *L. albertisi albertisi* by the mutually exclusive distribution and by analysis of mitochondrial DNA. Ventral counts for this species are near the lower limit for the range for New Guinea *L. albertisi*. The trait may be used as a potential indicator for the subspecies in the absence of other data. Other scalation counts and properties also overlap with those of the type subspecies."

Schleip 2008a claimed that the diagnosis didn't comply with Article 13.1.1 of the code, saying "yet Hoser (2000) had failed to provide evidence for these statements". He then said:

"Allopatric distribution itself may separate the Massau Island population geographically, but it is highly questionable if this alone is able to distinguish a taxon from another regardless of the underlying species concept".

In other words, Schleip claimed the name was *nomen nudem* on the basis my diagnosis lacked evidence!

However article 13.1.1 of the code makes no such mention of evidence or characters.

The relevant part of the code in fact reads:

"Article 13. Names published after 1930.

13.1. Requirements. To be available, every new name published after 1930 must satisfy the provisions of Article 11 and must

13.1.1. be accompanied by a description or definition that states in words characters that are purported to differentiate the taxon"

The significance is that the diagnosis itself does not need to be correct or have evidence to support it!

The word "purport" is not defined by the code, but most dictionary definitions are similar.

From the *Webster's New Twentieth Century Dictionary*, published in 1970, by the World Publishing Company, USA, (Various 1970) the definition is:

"purport. Anglo/French

1/ To profess or claim it's meaning

2/ To give the appearance of, often falsely of being, in lending, etc."

As it happens there are countless examples in zoology of validly described taxa having diagnoses that are totally wrong or false and yet the names remain 'available' under the code, provided the other essential ingredients such as a name bearing holotype are met.

In other words, in my view even if the Hoser 2000b diagnosis for *L. albertisi barkerorum* is totally wrong and false, or pure unmitigated crap, the mere fact there is a diagnosis purporting something, makes the name available.

A similar situation happened recently with Wells and Wellington diagnoses for skinks in the genus *Cyclodomorphus*. Shea found the original diagnosis for a taxon (*C. michaeli*) to be wrong, but the Wells and Wellington name remained available and hence was used by the later author as the first available name. See Wells and Wellington 1983 and 1985 and then Shea 1995 for the detail. There are countless similar such cases. In other words, by my interpretation of the code, the name *Leiopython barkerorum* remains available under the code (ICZN 1999).

The rest of Schleip's diatribe about *Leiopython barkerorum* is similarly wrong and repetitive and most importantly never gets near the point referred to in the online abstract to the paper, namely the mtDNA.

Harvey et. al. 2000 found a 5% divergence in mtDNA between the New Ireland Scrub Pythons (herein identified as *Australiasis duceboracensis* Günther (1879)) and those from nearby mainland New Guinea (the northern taxon being referable to *A. amethistina*), (the genus name *Australiasis* having been proposed for the Scrub Pythons by Wells and Wellington and for consistency purposes has been adopted and used by Hoser 2000b and is preferred here at the genus level for the species complex), going on to say that each were probably a different species. Other authors (including Barker) have relied on a 3% divergence to separate three python species from the "curtus" group, from western Indonesia (Keogh et. al. 2001).

Noting the known location of "*Leiopython barkerorum* Hoser 2000" in the same general region as *Australiasis duceboracensis* Günther (1879), one would expect a similar mtDNA divergence for these snakes as compared to the mainland New Guinea animals, due to a likelihood of the snakes being affected by the same physical barriers and more importantly a known gap in the distribution of the brown *Leiopython* in the area generally inhabited by the species *Bothrochilus boa*.

In his bibliography, Schleip 2008a claims to have read Harvey et. al. 2000 (cited as a reference), and in spite of the undisputed facts above, Schleip has chosen not to compare mtDNA between the relevant populations of Brown *Leiopython* and yet has found an innate urge to attempt "purge" the Hoser taxon "*Leiopython barkerorum*" as a valid taxon, regardless of the underlying nomenclature and yet without any real evidence.

Again I note that the amazing thing about all this, is that a journal with the status of *Journal of Herpetology* even printed such a poorly written "paper" with such gaping holes in its methodology, leading to obvious questions about the quality of "peer review" in this instance.

STABILIZING THE NOMENCLATURE OF *LEIOPYTHON*

Schleip and associates as named have greater time, money and other resources than myself and a far greater demonstrated ability to make "noise", the upshot being that they may continue to destabilize the nomenclature of this genus for many years. In the first instance, the only sensible means to settle such "noise" may be to petition the ICZN, the process of which may take several more years to resolve.

Regardless of the arguments for or against the Hoser 2000 description of "*Leiopython albertisi barkeri*", the stabilizing of the nomenclature is important and as an alternative to a drawn out case before the ICZN, this paper seeks to stabilize the nomenclature by simpler means.

Therefore, and without reference to the Hoser 2000 description (Hoser 2000b), that taxon is described herein below as "new" and without reference to the Hoser 2000b paper, the significant net result of this action to most other taxonomists being a citation date of 2012 for the said taxon.

The relevant section of the ICZN rules (ICZN 1999) is printed below:

"nomen nudum (pl. nomina nuda), n.

A Latin term referring to a name that, if published before 1931, fails to conform to Article 12; or, if published after 1930, fails to conform to Article 13. A *nomen nudum* is not an available name, and therefore the same name may be made available later for the same or a different concept; in such a case it would take authorship and date [Arts. 50, 21] from that act of establishment, not from any earlier publication as a *nomen nudum*."

This section also applies to the genus, subgenus and subspecies descriptions elsewhere in this same paper.

***LEIOPYTHON ALBERTISI BARKERORUM* SUBSP. NOV.**

HOLOTYPE: A female specimen, at the Universitetets Zoologiske Museum, Copenhagen (R5444) collected by the Noona Dan Expedition, from the Island of Mussau, in the Saint Matthias Group, Bismarck Archipelago, Lat: 1° 30' Long: 149° 40'. Scalation is smooth with 267 ventrals and 72 subcaudals.

PARATYPE: A male specimen, at the Universitetets Zoologiske Museum, Copenhagen (R5445) collected by the Noona Dan Expedition, from the Island of Mussau, in the Saint Matthias Group, Bismarck Archipelago, Lat: 1° 30' 149° 40'. Scalation is smooth with 271 ventrals and 73 subcaudals.

DIAGNOSIS: This is the subspecies of *L. albertisi* that is endemic to Mussau Island in the Saint Matthias Group, Bismarck Archipelago. It is separated from *L. albertisi albertisi* and all other taxa formerly attributed to this species or genus (*Leiopython*) by the mutually exclusive distribution, which is diagnostic of this taxon either alone and/or in combination with other features/traits.

Also diagnostic of this taxon (separate or in combination with other features) is the positioning and nature of the whitish spot behind the eye. The spot is present in an upper post-ocular, but is brownish in colour, tending to yellow in the center. The scale immediately above this (the supra-ocular) has a similar brownish marking, that tends slightly closer to the eye itself and also borders the lower part of the scale. No other *Leiopython* other than this taxon has this exact scalation trait making this taxon easily separated from all other *Leiopython*.

Also diagnostic of this taxon (separate or in combination with other features) is the white barring of the lips, which rather than being whitish in colour, as seen in all other *Leiopython*, has a distinctive yellowish hue unique to this taxon.

The distinct white (or yellowish in the case of this taxon) barring of the upper labials in this taxon, which also separates this genus from all other pythons (except *Lenhoserus boeleni*, that's separated by a dorsal pattern not seen in *Leiopython*) is more extensive than for all other *Leiopython albertisi*. In this taxon, *Leiopython albertisi barkerorum* subsp. nov., an average of 60% of the labials are "light", whereas the ratio for other *Leiopython* is 45-50%. This alone and/or in combination with one or more other traits is diagnostic of this taxon, namely *Leiopython albertisi barkerorum* subsp. nov.

Ventral counts for this species are near the lower limit for the range for all other *L. albertisi* and taken as average counts are also diagnostic for this taxon, either alone or in combination with other diagnostic traits.

The details are as follows:

Average ventral count for *Leiopython albertisi barkerorum* subsp. nov. is 269

Average ventral count for *Leiopython albertisi* from West Papua and Salwatti Island is 278.2

Average ventral count for *Leiopython albertisi* from PNG only is 270.9

Average ventral count for *Leiopython albertisi* from the entire known range is 275.7

Analysis of mitochondrial DNA and nuclear DNA as a matter of course shows divergence of base pairs as compared to all other *Leiopython* not attributable to this taxon and is diagnostic of this taxon either alone or in combination with other diagnostic traits.

ETYMOLOGY: Named after two people, namely David and Tracy Barker of Texas. The husband and wife team have developed one of the most sophisticated python breeding facilities in the world. In recent years they have lobbied (unsuccessfully) against US Government restrictions on the interstate trade in large pythons, including Burmese Pythons (*Python molurus bivittatus*), by publishing several major papers in the *Bulletin of the Chicago Herpetological Society* and direct submissions to government.

OTHER DUBIOUS WORK BY SCHLEIP

Further reading of Schleip's paper shows that he has made other false or misleading statements, often in contradiction to the position accepted by most other herpetologists.

Adding to that some of the rubbish on his website, it'd be too tedious and time-consuming to list them all.

However, Hoser 2000b stated that the reports of "*L. albertisi*" (now known as *L. hoseae*) from the Australian territorial islands near the New Guinea landmass were probably false and based on misidentified water pythons. This assertion was based on the following:

Similarity in appearance to lay people.

A known abundance of Water Pythons in the area, including in recent (1990's and (now) beyond collecting expeditions).

Habitat being more suited to Water Pythons and not to *Leiopython*.

No *Leiopython* from the said island locations being lodged in museums in spite of intensive collecting in the area.

In the absence of evidence to the contrary, this position was in turn adopted by virtually all publishing herpetologists, including Steve Wilson (Wilson 2005), based at the Museum of Queensland, who of all people would know of any legitimate records of the taxon in Australian territory and has worked closely with most (legal) collectors at Sabai Island and other relevant places, and Swan (2007), accepting the Hoser (2000b) position stating, on page 18 of the book that he excluded the taxon (from his accounts of Australian pythons) on the basis that claims from Australian territory were inconsistent.

In spite of this, Schleip misrepresented Barker and Barker 1994 to claim and describe specimens from these islands.

However as Hoser 2000b had stated or inferred, the description of "Australian" *L. albertisi* was based on southern New Guinea animals that were by presumption those likely to be found on Australian territorial islands that straddle the south New Guinea coast and have been presumed to have the same or similar fauna (e.g. *Varanus prasinus*).

Being well-aware that the basis of the old reports of *Leiopython* from Australian territory were almost certainly false, or so unreliable as to best be treated as false, I e-mailed a query letter to the cited source, Dave Barker himself.

In an e-mail reply from Dave Barker dated 14 December 2008, thus post-dating the publication of Schleip's paper, Dave Barker himself confirmed the above and that his published description of

Australian *Leiopython* were based on second-hand reports and not any such specimens caught or sighted or confirmed by himself as being from Australian territory.

He stated:

“My account is based on other published reports.”

It's common-knowledge that the old reports are erroneous.

By way of example, Harry Ehmann's book (Ehmann 1992), erroneously depicted a Brown (north New Guinea), *Leiopython albertisi* and described it as an Australian taxon, referring it's distribution to Torres Strait Island, Australian territory.

On that basis and in the absence of any new evidence, it must remain the case that there are no *L. hoserae* (or *L. albertisi*) known from Australian territorial islands, which is of course contrary to the grossly misrepresented information in the Schleip paper, that somehow escaped judicious editorial quality control.

Hence some obvious questions arise.

Why didn't Schleip make a similar inquiry to my own December 2008 query of Barker to ascertain the facts about allegedly Australian *L. hoserae*, before printing old and questionable information?

Barker is not a hermit and is readily accessible via his website at: www.vpi.com

To his credit Barker is generally prompt at answering all bona-fide questions from all comers.

It seems even stranger that noting Schleip's constant use of the internet, including to incessantly promote multiple votes for the convicted reptile smuggler David Williams for an ill-fated Hotel contest, he was apparently unable, unwilling, or too lazy to check his basic facts on *Leiopython* before rushing to print and disseminate what is well-known to be false and inaccurate information.

Even more odd, is a notation near the end of the paper (page 19, Schleip 2008a) that says he thanks David G. Barker for sharing his great knowledge of the genus *Leiopython* with him, meaning perhaps Schleip either forgot to ask the logical questions of him, and/or he forgot the very simple answer, that I had to extract independently in December 2008.

CONTRARY TO THE ICZN CODE

Schleip's paper and website both repeatedly misrepresent the ICZN's code.

I can assume he hopes that not too many people actually read the relevant sections of the code and look into the detail.

However his repeated references to the code in the past 7 years on his website and the way he has constructed his paper of 2008 indicates he is familiar with the ICZN rules.

His manifestly inadequate descriptions of *Leiopython* taxa (in particular for his "*Leiopython biakensis*"), while thoroughly unconvincing as they stand and lacking in evidence to support their position, do fulfil the minimum requirements of the 1999 (effective 2000) code of the ICZN.

In other words all names are "available" within the meaning of the code.

The Schleip names are not *nomen nudem*!

One can reliably conclude that Schleip has literally thrown the names into the pool of available names with the vain hope that one day, one or two may actually be used, but on the basis of a more thorough analysis by another herpetologist.

On his website he does actually quote sections of the code, and it is evident that he has gleaned this either from a hard copy or more likely from the ICZN's website, where the rules are now posted (at: <http://www.iczn.org/iczn/index.jsp>).

However his continued vicious attacks and rhetoric against myself and the language used is totally in violation of the rules and the ethics within.

Under "Appendix A, Code of Ethics" one finds:

“5. Intemperate language should not be used in any discussion or writing which involves zoological nomenclature, and all debates should be conducted in a courteous and friendly manner.

6. Editors and others responsible for the publication of

zoological papers should avoid publishing any material which appears to them to contain a breach of the above principles.”

However on his internet site (where Schleip is editor and author) you find repeated fowl language and insults, for which there are no reasonable justifications and are therefore clear breaches of the ICZN's rules.

On his own website (December 2008 reloaded version), he makes a barrage of false claims about myself. There are too many to list here, as to do so would require yet more time wasted printing the truth (in the form of rebuttals of idiot claims).

But the end-point of his lies is his ultimate statement being that Raymond Hoser is:

“a taxonomic nerd and his actions are taxonomic vandalism!”

That clearly violates both points 5 and 6 of the ICZN's code of ethics. Schleip's, Wüster's and Williams' comments on third party sites are of course far worse!

This includes their extremely vitriolic and hateful posts on the ultimate hate site they frequently posted on in mid 2011. It was titled "Ray Hoser – Melbourne's Biggest Wanke". This facebook hate page was created by trademark bootlegger, Tony Harrison, after Youtube deleted over 800 web pages he had created for the express purpose of hosting "backlinks" to divert my clients to himself and a close friend in Victoria. He successfully diverted an average of over one customer a day away from the Snakebusters business for more than two years, ripping off the company many thousands of dollars.

Then there was the other offensive material, again in violation of the ICZN code posted by the group under false names.

SCHLEIP'S 2008 PAPER IN SUMMARY

Based on what's known about the population dynamics and taxonomy of all pythons in the Australasian region in the last five million years, combined with the published results of Schleip 2008a, it makes sense to continue to recognise the genus *Leiopython* in the format given by Hoser 2000b, even if one were to shift the two species, *albertisi* and *hoserae* to the genus *Bothrochilus* as done by Rawlings et. al. (2008). Schleip has provided evidence for the continued recognition of subspecies of *L. albertisi* named by Hoser in 2000b and at the same time provided limited evidence for the potential recognition of at least three other subspecies as named by Schleip in his 2008 paper.

There is however at the present time, no evidence to support the contention that *L. albertisi* as recognised by Hoser 2000b should be split into five or more very similar species at the species level using any liberal interpretation of any liberal species concept.

Morphological data does not support any such split and so far based on the quoted studies above, there seems to be no prospect of molecular data supporting any such split either. Unless and until any such evidence is published in a clear and unequivocal form, *Leiopython* as generally recognised should be regarded as a genus comprising two distinct species only, namely *L. albertisi* and *L. hoserae*.

The paper by the self-admitted "amateur herpetologist" Wulf Schleip (2008a) was sloppy, deceptive and amateurish and written by a novice reptile enthusiast who was way out of his depth and who was badly advised by his closest associates who clearly sought a pre-determined outcome, regardless of the evidence.

In the first instance it should have been totally rejected by the editors of the *Journal of Herpetology* as a case of "Big Name Hunting" by a man who (presumably unknown to the journal's editors) has a history of dishonesty, gross misrepresentations and at times who makes outright lies.

Schleip has been found to be culpably guilty of creating unnecessary confusion in terms of the taxonomy of an otherwise well-known and well-defined group of snakes that has been competently examined by numerous recognised experts in the past.

Schleip has been reckless by presenting a poorly written paper which by his own admissions within it, does nothing to stabilize taxonomy of the group and leaves no options other than for another person to revisit the taxonomy of the "species" *albertisi*

with a view to either creating yet more "species" via yet more "taxonomic exaggeration" for the snakes he claims are of indeterminate taxonomic status, or via the molecular data he should have provided with his 2008 paper, the eventual (and at this stage likely) position being that his newly created "species" will again be relegated to the synonymy with *L. albertisi* (at the species level).

The use of dishonest and improper methods by Schleip and his closest associates, the convicted reptile smuggler David Williams and questionable academic Wolfgang Wüster, as well as potential emulation by others should be seen as a threat and impediment to legitimate scientific inquiry and associated search for the truth.

The adverse effects of their actions will invariably impact far beyond the boundaries of routine discourse or debate by scientists. It will descend into areas as diverse as conservation, waste of public resources, legislation, defamation, law courts, improper censorship of legitimate and appropriate views, unwarranted confusion among disinterested third parties and elsewhere.

THE USE OF TRIBES IN CLASSIFICATION

Tribes have been employed by taxonomists for placement of genera for decades.

Smith (1977) presented a classification of all extant snakes, with the major part of the paper erecting new tribes for venomous snakes.

He did not list any tribes for the pythons.

Since this paper was published the snakes have been subdivided further at all levels of classification, from family down to species.

However the level between family and genus, namely tribe, has been overlooked by many herpetologists, even though the utility of grouping similar genera is patently obvious.

Zaher et al. 2009, created five new tribes within the Xenodontinae, (six new genera and two others resurrected).

Underwood and Stimson 1990, listed just two tribes for the Pythons, namely Pythonini and Moreliini, which at the time were thought to encompass all extant pythons.

However with Rawlings et al. 2008 finding that *Broghammerus* was widely divergent of the other two main groups of pythons (Pythonini and Moreliini), it has become clear that a new tribe, namely Broghammerini needs to be created. This inevitable act is therefore done here.

With numerous quite divergent genera within the Australasian pythons (Moreliini), it is also clear that there are four main groups of python genera, each with very distinct features, including species which in a number of cases have rarely if ever been placed within a single genus (e.g. *Leiopython* and *Liasis*).

As a result, it is appropriate to erect four new subtribes to accommodate each group of genera, even if this means one or two tribes are monotypic.

In the case of the subtribes containing several genera, they have been named in accordance with the recommendations of the ICZN code. Noting that all relevant genera are well-known, the newly named tribes or subtribes have been assigned names on the basis of the genus containing the largest number of recognised species, as per the accompanying lists published in this paper.

The diagnosis of each tribe (or subtribe) should also be read in conjunction with those for the other identified tribes (or subtribes) in order to further separate component genera and species from one another.

Names of tribes have been determined according the relevant sections of the code including, articles 29.2, 35.1, and 62.

FAMILY PYTHONIDAE

(Terminal taxon: *Python molurus*)

Diagnosis: Large, relatively slow moving, heavy bodied snakes. Oviparous, the eggs which are usually incubated by the female coiling around the adhered mass in order to assist temperature regulation of the eggs. They have a relatively high number of mid-body rows (never fewer than 30). With the exception of one species (*carinata*), all are smooth scaled. All kill their prey by constriction, or in the case some ground dwelling/burrowing species variants of this, in that they may force prey items against an object to cause asphyxiation. They have an elliptical pupil, but

most species can be found active by day or night, although in most areas nocturnal activity dominates.

All possess cloacal spurs on either side of the hind limb, which are generally used by the males when mating. Males commonly, but not always have larger cloacal spurs than the female.

TRIBE BROGHAMMERINI TRIBE NOV.

(Terminal taxon: *Broghammerus reticulatus*)

Diagnosis: These are large, moderately built pythons from the south-east Asian region, including Indonesia. Separated from the Pythonini by the fact that the infralabial pits are better defined than the supralabial pits as seen in Pythonini.

While physically superficially similar to Pythonini and Moreliini genera *Morelia* and *Liasis*, Broghammerini snakes can be separated from the others by the fact that the suborbital portion of the maxilla lacks any lateral flare or projection; the mandibular foremen of the compound bone lies below the posterior end of the dentary tooth row, rather than fully posterior to it. Broghammerini (*Broghammerus*) has a distinctive large medially divided frontal shield that no other pythons have and a relatively high mid-body scale row count of 55 or higher.

Broghammerini is separated from the subtribe Katrinina by having 55 or more mid body rows, versus 55 or less in the latter. The same feature (high number of mid body rows, separates Broghammerini from Antaresina, the latter having 35-45 mid body rows.

Broghammerini is separated from Aspiditesina by the fact that the latter does not have obvious labial pits.

The tail in Broghammerini is not strongly prehensile as seen in Moreliina.

Content: *Broghammerus* Hoser 2004.

Comments: A monotypic tribe consisting of one genus and two known species, one species *reticulatus* being widespread in the Indonesian archipelago and with several described subspecies. The longest living snake has been attributed to the species *Broghammerus reticulatus*. However none have ever been definitively verified and recorded as being in excess of 30 feet (or the slightly greater 10 metres).

TRIBE MORELIINI UNDERWOOD 1990

(Terminal taxon: *Morelia spilota*)

Diagnosis: Separated from the Pythonini by the fact that the infralabial pits are better defined than the supralabial pits as seen in Pythonini, with the exception of the snakes in the genus *Aspidites*. For those snakes, labial pits of any sort are absent, separating them from all other true pythons.

This tribe includes all pythons from the Australian/Papuan region, with the western distribution limit outside Australia being the western Indonesia region, where they are sympatric with other pythons, namely *Broghammerus*.

Content: Antaresiina subtribe nov., Aspiditesina subtribe nov., Moreliina subtribe nov., Katrinini subtribe nov.

Comments: A diverse, but obviously related group of pythons.

SUBTRIBE ANTARESIINA SUBTRIBE NOV.

(Terminal taxon: *Antaresia childreni*)

Diagnosis: Tail not prehensile. Adults always less than 180 cm in total length, usually well under 120 cm. Well defined pits in the lower labials. Of moderate build. Has a lower mid-body scale row count than snakes in the tribes Moreliini and Katrinini (35-45, versus over 45).

The following suite of characters separates this subtribe from all other pythons. Premaxilla is toothed, head shields are large and symmetrical, there are two or more loreal scales, the parietal shields are undivided, 31-49 mid-body rows, 205-300 ventrals, single anal, 30-45 subcaudals. Scales (at least on the rear of the body) have one or two apical pits.

Separated from *Bothrochilus* and *Leiopython* by having two pairs of prefrontals as opposed to a single pair. Separated from all Katrinina by two or more loreals versus a single loreal.

Separated from Aspiditesina by the presence of pits in the rear lower labials.

Separated from *Moreliina* by the fact that the latter has a strongly prehensile tail.

Separated from the Pythonini by the fact that the infralabial pits are better defined than the supralabial pits as seen in Pythonini.

Broghammerini (*Broghammerus*) has a distinctive large medially divided frontal shield that no other pythons have and a relatively high mid-body scale row count of 55 or higher.

Content: *Antaresia* Wells and Wellington 1983 (including subgenus *Rawlingspython* Hoser subgen nov.).

Comments: Generally small pythons. Physically conservative in that no body parts are extreme and while able to climb, these snakes are rarely found in trees.

SUBTRIBE ASPIDITESINA SUBTRIBE NOV.

(Terminal taxon: *Aspidites melanocephalus*)

Diagnosis: The only true pythons without distinctive pits in the upper or lower labials. Also lacks teeth on the premaxilla in contrast to all other pythons. This separates these snakes from all other relevant subtribes and also other python tribes.

Further separated from all other pythons by the fact that the head is not distinct from the relatively short neck, their relatively short blunt tail and other adaptations partially indicative of a burrowing lifestyle. Occupies virtually all habitats where found.

Content: *Aspidites* Peters 1876.

Comments: While the obvious labial pits seen in other Australasian pythons are absent in these snakes, small depressions can be sometimes seen on the snout of some individuals (usually in large *A. melanocephalus*).

SUBTRIBE KATRININA SUBTRIBE NOV.

(Terminal taxon: *Katrinus fuscus*)

Diagnosis: Large symmetrical head shields. Teeth on the premaxilla and well-defined pits in some rear infralabials.

Separated from *Antaresiina* by having a single loreal instead of two or more.

Separated from *Moreliina* by the fact that the tail is not strongly prehensile. Head in proportion to neck and body, with the head not being overly large and the neck is not narrow. In dry areas, they are usually associated with water.

Separated from *Aspiditesina* by the presence of labial pits, which are not present in *Aspiditesina*.

Separated from the Pythonini by the fact that the infralabial pits are better defined than the supralabial pits as seen in Pythonini.

Broghammerini (*Broghammerus*) has a distinctive large medially divided frontal shield that no other pythons have and a relatively high mid-body scale row count of 55 or higher.

Content: *Bothrochilus* Fitzinger 1843, *Katrinus* Hoser 2000, *Leiopython* Hubrecht 1879, *Liasis* Gray 1840.

Comments: The placement of *Bothrochilus* and *Leiopython* within this tribe is tentative and based on the published results of Rawlings et. al. 2008. Evidence of others, including Underwood, indicated placement in *Antaresiina* may have been more appropriate. Alternatively, the two genera (either "as is" or merged), may be placed in another separate subtribe.

SUBTRIBE MORELIINA SUBTRIBE NOV.

(Terminal taxon: *Morelia spilota*)

Diagnosis: A strongly prehensile tail, which separates this subtribe from all others. Large head that is distinct from the relatively narrow neck. The rear of the head usually fortified with bulbous fat deposits. Well defined pits in the lower labials. Small irregular head shields, or alternatively specimens with large head shields have a particularly long and prehensile tail. Well defined infralabial pits. Generally arboreal, although commonly found on the ground. Invariably associated with trees, although also found in rocky hill areas.

Separated from the Pythonini by the fact that the infralabial pits are better defined than the supralabial pits as seen in Pythonini.

Broghammerini (*Broghammerus*) has a distinctive large medially divided frontal shield that no other pythons have and a relatively high mid-body scale row count of 55 or higher.

Content: *Australiasis* Wells and Wellington 1983, *Chondropython*

Mayer 1874, *Jackypython* gen. nov., *Lenhoserus* Hoser 2000, *Morelia* Gray 1842, *Nyctophilopython* Wells and Wellington 1985.

Comments: While *Australiasis* is a well-defined group and some authors have placed *Nyctophilopython* either within *Australiasis* or even an expanded *Morelia*, the genus is recognised here as distinct on the grounds of consistency and that other than large size, it's relationship with other *Australiasis* species may not be particularly close, as indicated by the results of Rawlings et. al. 2008. The results of Rawlings et. al. 2008 show *Katrinus* and *Liasis* to be separated similarly to the distance between *Australiasis* and *Nyctophilopython* and more importantly, all to be more widely separated than *Leiopython* and *Bothrochilus*.

Using conservative and historically commonly used, classification systems such as that employed by Cogger (2000) the use of the extended (in composition) genera *Liasis* and *Morelia*, in combination with the adoption of *Antaresia* is shown not to be consistent when reconciled with the data of Rawlings et. al. 2008 and the historical origins as plotted for the major groups of Australasian pythons.

TRIBE PYTHONINI UNDERWOOD 1990

(Terminal taxon: *Python molurus*)

Diagnosis: Generally heavy bodied pythons from outside the Australian/Papuan region. Includes all pythons from Africa and continental Asia, except *Broghammerus* (see above). All possess well defined heat sensitive pits in the labial region.

Separated from the other two tribes by the fact that the supralabial pits are better defined than the infralabial pits.

Content: *Aspidoboa* Sauvage 1884, *Helionomus* Gray 1842, *Python* Daudin 1803, *Shireenhoserus* Hoser 2004.

SUMMARY

The papers Hoser 2000b, 2003a, 2004a and this paper, including updates and changes indicated within each, do between them give an accurate overview of the systematics of the pythons of Australasia and elsewhere. This paper has updated and corrected material from these and other papers to present an up-to-date and coherent classification of the pythonidae at all levels below that of family.

In the absence of compelling evidence to the contrary, I would expect the nomenclature used within this paper to become widely used.

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A new genus of Jumping Pitviper from Middle America (Serpentes: Viperidae).

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ABSTRACT

This paper reviews the taxonomy of the *Atropoides picadoi* species group and finds that the genus *Atropoides* Werman 1992 as currently defined is paraphyletic. As a result of obvious morphological divergence and large genetic differences between component species the genus *Atropoides* is now restricted to the type species, *A. picadoi*. All other species are herein placed in a new genus, namely *Adelynhoserserpenae* gen. nov. that is herein formally named and defined according to the Zoological code.

Keywords: Taxonomic revision; new genus; Viperidae; Crotalinae; *Atropoides*; *Adelynhoserserpenae*; Hoser; snake; genus; *picadoi*; *indomitus*; *mexicanus*; *nummifer*; *occiduus*; *olmec*; pitviper.

INTRODUCTION

The so-called Jumping Pitvipers are native to Middle America and have gained their name due to their alleged ability to jump at a potential attacker. While this aspect of their behaviour and ability may be exaggerated, they are known to strike at birds flying in the air at close range.

All of these snakes are extremely thick-bodied, with the species taxon *A. nummifer* being the most stout and the quite substantially more gracile *A. picadoi* the most slender. However, the greatest recorded length is for *A. picadoi*, with one specimen allegedly measuring 120.2 cm (47 inches) in total length.

The head of these snakes is large, with relatively small eyes and a broadly rounded snout. The tail is short, not prehensile, and accounts for only about 15% of the total body length.

The color pattern usually consists of a grey-brown or reddish brown ground color (sometimes yellow, cream, purplish brown or black) overlaid with a series of lateral and dorsal blotches. The shape of these blotches is subject to some variation.

Numerous aspects of these snakes have been studied by various authors including, Burger (1950), Castoe et. al. (2005), Castoe and Parkinson (2006), Dunn (1939), March (1929), McCranie (2011), Parkinson (1999), Porras and Solórzano (2006) and Werman (1984).

There have been a number of studies into the so-called Jumping Pitvipers with a view to resolving the taxonomy of the group within the genus *Atropoides* as currently defined at beginning 2012.

Werman (1992) found them to be sufficiently distinct from other pitvipers to be removed from the genus *Porthidium*. He erected a new genus *Atropoides*.

This placement has been supported by most authors since, including, Campbell and Lamar (2004), Castoe, et. al. (2003) and others.

In their study of the molecular systematics of the group Castoe et. al. (2003) found that *A. picadoi* was divergent from all the other then described taxa within the genus *Atropoides* as defined by Werman in 1992.

The other species tested were, *A. nummifer*, *A. mexicanus*, *A. occiduus* and *A. olmec*, all of which clustered as a group, while *A. picadoi* showed closer affinities to *Cerrophidion godmani*.

Refer to fig 2, (all four diagrams) for the exact result.

The authors deferred making any taxonomic changes pending further research into the group of snakes.

Pyron et. al. (2011), did a broad-ranging study into the phylogeny of the advanced snakes (Colubroidea) which included analysis of four of six known species in the genus *Atropoides*.

The excluded species were *indomitus* and *mexicanus*.

The species *mexicanus* is essentially similar to *nummifer* and showed up as extremely close to this taxa in the 2003 results of Castoe et. al.

The taxon *indomitus* was formally described by Smith and Ferrari-Castro in 2008. Using mitochondrial gene sequence data, the authors found the new species *indomitus* to represent the sister species of *A. occiduus*, with 5.7 % sequence divergence separating the two taxa.

Both *A. occiduus* and *A. nummifer* were well-placed in the cluster strongly divergent from *A. picadoi* in the results of Castoe et. al. 2003, so a similar position for *indomitus* is easily inferred.

Pyron et. al.'s results of 2011, while restricted to four nominal

taxa within the nominal genus *Atropoides*, effectively mirrored and confirmed the results of Castoe et. al. (2003), again showing that *picadoi* is sufficiently divergent from the other taxa as to be placed in a separate genus.

As it is the taxon *A. picadoi* that is the type species for the genus *Atropoides*, it is all the other recognised species that must therefore be placed in a new genus.

The diagnosis of this new genus is done herein.

GENUS ADELYNHOSERSERPENAE GEN. NOV.

Type species: *Atropos nummifer* Rüppell 1845

(Currently recognised in most contemporary texts as *Atropoides nummifer*)

Diagnosis: *Adelynhoserserpene* gen. nov. is easily separated from the genus *Atropoides* by scalation. In *Adelynhoserserpene* males have 104-136 ventrals, versus 138-155 in *Atropoides* (Campbell and Lamar 2004), females have 103-138 ventrals, versus 143-145 in *Atropoides* (Campbell and Lamar 2004).

This difference reflects the physical reality that *Atropoides* is a much longer and more slender animal than all species in *Adelynhoserserpene* gen. nov.

In *Adelynhoserserpene* nasorostrals are often present, (as opposed to always absent in *Atropoides*), there is a single row of subfoveals separating prelacunal from supralabials (versus 1-3 rows of subfoveals separating prelacunal from supralabials in *Atropoides*).

Atropoides is defined above in this diagnosis as only including the species taxon *A. picadoi*.

A. picadoi is a relatively thinly bodied species, versus the thick-set body form of *Adelynhoserserpene*.

Character states such as intersupraoculars, supralabials, infalabials, dorsal mid-body scale rows and lateral body blotches are highly variable both between and within species and are not helpful in separating the genera.

However *Atropoides picadoi* has considerably smaller shields at the back of the head than all species of *Adelynhoserserpene*.

In *Atropoides* these shields would be defined as small, whereas in *Adelynhoserserpene* they'd be defined as medium (refer also to fig. 91 in Campbell and Lamar 2004).

The genus *Adelynhoserserpene* is found from northeastern Mexico southward through Central America to central Panama. They are usually forest dwellers.

For a detailed description of the snakes in the genus *Atropoides* as defined until now (which would act to diagnose this new genus in conjunction with the information above), refer to pages 274-290 of Campbell and Lamar (2004).

The very thickset build of *Adelynhoserserpene* easily separates them from other pitvipers.

Campbell and Lamar (2004), page 275, detailed minor hemipenial differences between the species *mexicanus* and *picadoi*, which was further investigated by Jadin, et. al. (2010) who found little significant differences between the various species in both genera.

However investigation of venom composition and toxicity is required, as so far it has been shown that in *Adelynhoserserpene* it seems to be considerably less toxic to humans than for *Atropoides picadoi* (Campbell and Lamar 2004).

Etymology: Named in honour of my eldest daughter, Adelyn Hoser, who by age 13 has more expertise with snakes than most people many times her age.

She has been handling the world's deadliest snakes since she was a baby and with complete safety as they were all venomoid (Hoser 2004), giving her unrivalled knowledge of the inner workings of venomous snakes. Hence it's fitting that she should be recognised by having a genus of venomous snakes named in her honour.

SPECIES WITHIN ADELYNHOSERSERPENAE GEN. NOV.

Adelynhoserserpene indomitus Smith and Ferrari-Castro, 2008
Adelynhoserserpene mexicanus (Duméril, Bibron and Duméril, 1854)

Adelynhoserserpene nummifer (Rüppell 1845)

Adelynhoserserpene occiduus (Hoge, 1966)

Adelynhoserserpene olmec (Perez-Higareda, Smith and Julia-Zertuche, 1985)

Species remaining in the genus *Atropoides* Werman 1992

Atropoides picadoi (Dunn, 1939)

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A REASSESSMENT OF THE HIGHER TAXONOMY OF THE VIPERIDAE.

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ABSTRACT

This paper reviews recent phylogenetic studies of the Vipers to revisit the higher taxonomy of the group, specifically with reference to the level between family and genus.

Three subfamilies Azemiopinae, Crotalinae and Viperinae are recognised.

The various tribes are redefined, diagnosed and named when there are no pre-existing valid names as determined by the ICZN rules current from year 2000.

As a result, a total of 16 tribes are herein formally defined and named, many of them new.

For the Azemiopinae, one previously named tribe is identified.

For the Crotalinae a total of 7 tribes are named and defined, 5 new, as well as several new subtribes.

For the Viperinae a total of 8 tribes are named and defined, 5 new, as well as several new subtribes.

Keywords: taxonomy; nomenclature; snake; viper; pitviper; Azemiopinae; family; tribe; subtribe; genera; genus; phylogeny; Hoser; Viperidae; Azemiopinae; Azemiopini; Viperinae; Atherini; Bitisini; Causini; Cerastini; Echiini; Proatherini; Pseudocerastini; Pseudocerastina; Eristicophina; Viperini; Maxhoserviperina; Montiviperina; Viperina; Crotalinae; Adelynhoserserpenini; Porthidiumina; Cerrophiidionina; Adelynhoserserpenina; Akistrodonini; Calloselasma; Crotalini; Crotalina; Piersonina; Jackyhoserini; Bothropina; Bothropoidina; Rhinocerophiina; Jackyhoserina; Bothrocophiina; Lachesini; Bothriechisina; Lachesina; Trimeresurusini; Tropicolaemusini.

INTRODUCTION

In the period 1975 to present (2012), there have been a large number of studies published in relation to the phylogeny of the extant (living) viperid snakes.

These published studies include the data and findings of Campbell and Lamar (2004), Fenwick, et. al. (2009), Heise, et. al. (1995), Lenk, et. al. (2000), Pyron et. al. (2010) and others, including those cited within these studies.

As of early 2012, the relationships between groups of genera have been consistently placed by various authors as cited above and therefore are not regarded as being in doubt.

Besides the standard taxonomic techniques, relying on morphology and more recently molecular means, ongoing ecological studies (e.g. Ineich, et. al. 2006) have provided alternative means by which to deduce relationships between viperid genera.

Smith et. al. (1977) provided a widely cited, referenced and used classification of all extant snakes down to tribe level.

However the point at where he drew the line between family and tribe was inconsistent.

The best indicator of this is seen by viewing the contrast between his treatment of the elapids with the vipers.

For the former he presented no less than 11 presumed tribes for the Australian elapid snakes alone.

By contrast he identified just five tribes for all the Solenoglyphs, including all the Viperidae from all parts of the world.

Added to this list has been the tribe *Atherini*, erected in the first instance by Groombridge in 1986 and later adopted by Broadley in 1996, leaving other major groups of the true Vipers effectively unnamed at the tribe level until now.

Using the results of numerous recent phylogenetic studies, including Broadley (1996), Kelly, et. al. (2003), Pyron et. al. (2011), those cited within those papers and others, I have herein corrected this anomaly and revisited the taxonomy of the Viperidae defining new groups according to the current ICZN rules (Ride 1999).

Published sources of relevant taxonomic data and opinions relied upon include: Beaman and Hayes (2008), Bryson, et. al. (2011), Campbell and Smith (2000), Castoe and Parkinson (2006), David et. al. (2002), Dawson, et. al. (2008), Fernandes (2005), Garrigues et. al. (2005), Gloyd and Conant (1989), Fernandes et. al. (2004), Grismer et. al. (2006), Gumprecht et. al. (2004), Guo et. al. (1999), Guo et. al. (2007), Guo et. al. (2009), Jadin et. al. (2010), Jadin, et. al. (2011), Klauber, L. M. (1972), Kraus, et. al. (1996), Malhorta and Thorpe (2004), McCranie (2011), McDairmid et. al. (1999), Meik and Pires-daSilva (2009), Pitman (1974), Smith (1941), Vogel (2006), Werman (1984), Werman (1992), Wüster and Bérnills (2011), Zamudio and Green (1997).

In terms of the publications cited herein, I have not accepted all the contents of all as either accurate, or agree with the conclusions. One of these publications has proven lies within it, that being Wüster and Bérnills (2011), see Hoser (2012f), however the paper does contain other relevant information not connected with the false statements in relation to myself and my earlier publications.

In terms of naming tribe contents at the genus level, I have not necessarily included all genus names proposed or actually in usage by herpetologists for the contents of each tribe in that recently erected genera that have not yet been widely accepted may have been omitted. However I have used all those most commonly in use at the present time for the relevant species level taxa.

As a result, where a given taxa is referred to a different genus name, it will as a matter of course be able to be referred back to one of the genus names pre-existing and herein as referring to the same species-level taxon for any given taxon.

As a relevant note, I mention that simultaneous to this publication, *Australasian Journal of Herpetology* Issue 11 has also been published. It contains several relevant papers reclassifying the pitvipers and Vipers, most notably the Rattlesnakes as well as species within Asia, Central America, South America and Africa/Middle East. As a result there are a number of new genus names used here (total four, plus those new for Rattlesnakes as well as various subgenera that may or may not be referred to herein).

It is also worth noting that all new placements have been confirmed by multivariate analysis including morphological studies and comparison of mtDNA between the relevant species level taxa and those within the genera they were formerly placed to confirm the merit and validity of the genera splits undertaken.

The relevant papers are also cited at the rear of this paper or the relevant Hoser papers (Hoser 2012a, 2012b, 2012c, 2012d and 2012e).

Some new genera as diagnosed in the papers (Hoser 2012a, 2012b, 2012c, 2012d and 2012e) are used for the purposes of naming new tribes and subtribes. For nomenclatural purposes, the original descriptions should also be treated as being as part of this paper.

THE ACTUAL FINDINGS AND PLACEMENT OF GROUPS

Authors have in the past had trouble placing the Azemiopine.

Pyron et. al. placed them primitive to the Crotalids and potentially the other Vipers as well.

Because it's not tenable to downgrade the status of the subfamilies Crotalinae and Viperinae to that of tribes, Azemiopine therefore is placed in the following list as a subfamily within the Viperidae. Because it is known only from a single genus, the taxon is also assigned a monotypic tribe.

As already mentioned, these lists include several Viperid genera named in papers published simultaneously with this paper in *Australasian Journal of Herpetology* issues 10 and 11 (both journals printed at the same time). The relevant papers are cited at the rear of this paper (Hoser 2012a, Hoser 2012b, Hoser 2012c, Hoser 2012d, Hoser 2012e) and their contents should also be treated as inclusive within this paper for nomenclatural purposes if and when relevant to the Zoological code. The two journals can if need be, be treated as two volumes of the same publication of the same date (8 April 2012).

Within the various levels, each group is placed in alphabetical order (except for the reversal of subfamilies Viperinae and Crotalinae), which as a matter of course may lead to the break up of what would have been more discrete phylogenetic units.

This alphabetical ordering of tribes and the like was done after the paper was written meaning that the relevant accounts for each tribe should best be read for close scrutiny with those of other phylogenetically close groups.

At the end of this paper is a list summarizing the current position in terms of tribes and content, which is essentially the same as the paper's actual contents, minus the diagnoses.

FAMILY VIPERIDAE

Diagnosis:

This diagnosis herein acts to separate all three subfamilies of the vipers as a combined diagnosis.

The Vipers are usually thickset snakes with large heads and keeled scales, giving the snakes an unmistakable appearance. They are further characterized by a pair of long, hollow, venom-injecting fangs attached to movable bones of the upper jaw (the maxillaries) that are folded back in the mouth when not in use. Their eyes usually, but not always, have vertically elliptical pupils and the eyes are relatively large.

No other snakes possess this complete suite of characters. Vipers are in turn split into two main subfamily groups, namely the pitted (subfamily Viperinae) and pitless vipers (subfamily Crotalinae). The pitless vipers, (viperinae) are those lacking distinctive heat sensitive pits between the eye and the nostril. The pitvipers are those which possess the heat sensitive pits.

A third subfamily named Azemiopinae is a monotypic subfamily created for the monotypic genus, *Azemiops*, that contains the venomous viper species *Azemiops feae*, otherwise known as the Fea's viper, which in turn is monotypic for the genus.

It is separated from the other vipers by its smooth dorsal scales rather than keeled scales.

The snake has a reasonably sturdy body and a short tail.

The head, which is slightly flattened and more elliptical in shape than triangular (like other vipers), is also not covered with numerous small scales like most other vipers, but with large symmetrical head shields like colubrids and the elapids.

This species does, however, have a pair of hollow, retracting fangs, although these are shorter than in true vipers and pitvipers.

The fangs have a ridge at the tip lateral to the discharge orifice, as well as a blade-like structure on the ventral surface otherwise seen only in some opistholyphous and atractaspid snakes. The venom glands are relatively small (Mebs et. al. 1994). Finally, unlike most vipers, Fea's viper is oviparous. The largest known total maximum length recorded for the taxa is 78 cm (Liem, et.

al. 1971). Long believed to be primitive in terms of the other viperids (Liem et. al. 1971), this position has been confirmed through studies of mitochondrial DNA, (Pyron et. al. 2010).

Vipers range in adult length from less than 25 cm (10 inches) in the Namaqua dwarf viper (*Bitis schneideri*) (a pitless viper) of southern Africa (a true viper) to more than 3 metres (10 feet) in the bushmaster (*Lachesis muta*) (a pitviper) of the Amazon basin and Central America. However it should be noted that both pitvipers and pitless ones average similar sizes and range between similar maximums and minimums. There are considerably more species of pitvipers than pitless ones.

SUBFAMILY AZEMIOPINAE

Diagnosis: See more detail under family Viperidae.

Vipers with smooth dorsal scales are family Azemiopinae.

Vipers without a pit between the nostril and eye and keeled dorsal scales are family Viperidae.

Vipers with a pit between the nostril and the eye and keeled dorsal scales are family Crotalidae.

Azemiopinae is a monotypic subfamily created for the monotypic genus, *Azemiops*, that contains the venomous viper species *Azemiops feae*, otherwise known as the Fea's viper, which in turn is monotypic for the genus.

The snake has a reasonably sturdy body and a short tail.

The head, which is slightly flattened and more elliptical in shape than triangular (like other vipers), is also not covered with numerous small scales like most other vipers, but with large symmetrical head shields like colubrids and the elapids.

This species does, however, have a pair of hollow, retracting fangs, although these are shorter than in true vipers and pitvipers.

The fangs have a ridge at the tip lateral to the discharge orifice, as well as a blade-like structure on the ventral surface otherwise seen only in some opisthoglyphous and atractaspid snakes. The venom glands are relatively small (Mebs et. Al. 1994). Finally, unlike most vipers, Fea's viper is oviparous. The largest known total maximum length recorded for the taxa is 78 cm (Liem, et. Al. 1971).

Long believed to be primitive in terms of the other viperids (Liem et. al. 1971), this position has been confirmed through studies of mitochondrial DNA, (Pyron et. al. 2010).

Content: *Azemiops* Boulenger, 1888.

Content of genus is monotypic for *Azemiops feae*.

Tribe Azemiopini Liem, Marx and Rabb 1971.

(Terminal Taxon: *Azemiops feae*)

Diagnosis: Vipers with smooth dorsal scales are family Azemiopinae.

Vipers without a pit between the nostril and eye and keeled dorsal scales are family Viperidae.

Vipers with a pit between the nostril and eye and keeled dorsal scales are family Crotalidae.

The subfamily Azemiopinae, tribe Azemiopini and genus *Azemiops* are monotypic for the single species, *Azemiops feae*. For further details about this taxon refer to Kardong (1986) and Marx and Olechowski (1970), Orlov (1997), Zhao and Adler (1993) and Zhao and Zhao (1991).

Content: *Azemiops* Boulenger, 1888.

Content of genus is monotypic for the species *Azemiops feae* Boulenger, 1888.

SUBFAMILY VIPERINAE (PITLESS VIPERS)

Diagnosis: See above (under family Viperidae).

Vipers without a pit between the nostril and eye are family Viperidae.

Vipers with a pit between the nostril and eye are family Crotalidae.

Vipers with smooth dorsal scales are family Azemiopinae.

Content: See for each tribe as listed below.

Tribe Atherini Groombridge, 1986

(Terminal Taxon: *Atheris chlorechis*)

Diagnosis: This group of snakes was for many years treated by many authors as being in the single genus *Atheris*.

This tribe is found only in the sub-Saharan Africa, excluding far southern Africa.

The best known genus remains *Atheris*, which is a group of tree-dwelling species.

Three ground-dwelling members of this tribe are now placed in three separate monotypic genera.

These are:

Adenorhinos barbouri (Loveridge, 1930), Uzungwe viper.

Montatheris hindii (Boulenger, 1910), Montane viper.

Proatheris superciliaris (Peters, 1855), Lowland viper.

In any event this tribe is separated from the other vipers within Africa by their their prehensile tails (they are mainly arboreal), that they don't puff their bodies up through the inhalation of air and also their generally smaller adult size.

Adults range in total body length from 40 cm (*Atheris katangensis*) to a maximum of 78 cm. (*A. squamigera*).

All species have a broad, triangular head that is distinct from the neck. The canthus is also distinct and the snout is broad. The crown is covered with small imbricate or smooth scales, none or few of which are enlarged. The eyes are relatively large eyes and have elliptical pupils. The eyes are separated from the supralabials by 1–3 scale rows and from the nasal by 2–3 scales.

The body is slender, tapering and slightly compressed, although slightly more stocky in the ground-dwelling species. The dorsal scales are overlapping, strongly keeled and have apical pits. Laterally these are smaller than the middorsals. Midbody there are 14–36 rows of dorsal scales. There are 133–175 rounded ventral scales. The subcaudal scales are single and number 38–67. In most species, the tail is extremely prehensile and can support the body while suspended from a branch or a twig.

Members of this group come in an amazing variety of colors and patterns, often within a single species. *Atheris ceratophora* and *A. squamigera* are particularly variable.

Content: *Adenorhinos* Marx and Rabb, 1965; *Atheris* Cope, 1862; *Montatheris* Broadley, 1996; *Proatheris* Broadley, 1996.

Tribe Bitisini Tribe nov.

(Terminal Taxon: *Bitis arietans*)

Diagnosis: A group of snakes restricted to Africa and the Arabian Peninsula.

These are the terrestrial Puff Adders (*Bitis arietans*) and relatives. They are separated from all other vipers by the ability of members to use a characteristic threat display that involves inflating and deflating the body to a large degree while hissing and puffing loudly.

Size variation within this (super) genus is extreme, ranging from the very small *B. schneideri*, which grows to a maximum of 28 cm and is perhaps the world's smallest viperid, to the very large *B. gabonica*, which can attain a length of over 2 m and is the heaviest viper in the world.

All have a wide, triangular head with a rounded snout, distinct from the neck and covered in small, keeled, imbricate scales. The canthus is also distinct. A number of species have enlarged rostral or supraorbital scales that resemble horns. Their eyes are relatively small. They have large nostrils that are directed outwards and/or upwards. Up to six rows of small scales separate the rostral and nasal scales. All species have a well-developed supranasal sac. The fronts of the maxillary bones are very short, supporting only one pair of recurved fangs.

These snakes are moderately to extremely stout. Their bodies are covered with keeled scales that are imbricate with apical

pits. They have 21-46 dorsal mid body scale rows. Laterally, the dorsal scales may be slightly oblique. There are 112-153 large, rounded ventrals sometimes with slight lateral keels. The tails are relatively short. The anal is single. There are 16-37 paired subcaudals.

All are highly venomous.

Content: *Bitis* Gray, 1842 (including all defined subgenera).

Tribe Causini Cope, 1860

(Terminal Taxon: *Causus maculatus*)

Diagnosis: These snakes are fairly stout and small, rarely growing to more than 1 m in length.

In Causini the head is only be slightly distinct from the neck and covered with large symmetrical head shields or alternatively more viperine in appearance, ranging to distinct from the neck. Also, the eyes have pupils that are round, separating them from all other African vipers which have elliptical pupils. The rostral scale may be broad, sometimes pointed or upturned. The nostril is located between 2 nasals and an internasal. The frontal and supraocular scales are long. A loreal scale is usually present, separating the nasal and preoculars. The suboculars are separated from the supralabials. The mandible has splenial and angular elements.

Unlike other vipers there appears to be no hinge action where the prefrontal bone engages the frontal. However, since the maxillary bones rotate almost as far, the fangs can still be erected. The fangs themselves are relatively short compared to vipers in other tribes. A fine line, or suture, is also present along the length of the fang, representing the vestigial edge where the groove lips meet (from incomplete fang canal closure).

The body is cylindrical or slightly depressed and moderately slender. The dorsal scales are smooth or weakly keeled with apical pits. The ventral scales are rounded and the anal plate single. The tail is short and the subcaudals can be either single or paired. The tail is never prehensile.

In several species the venom glands are not confined to the temporal area as with most vipers, but are exceptionally long and extend well down the neck. These venom glands, located on either side of the spine, may be up to 10 cm in length, with long ducts connecting them to the fangs and the result is that venom tends to ooze out of the fangs rather than squirt.

There are also other internal differences that set the Causini apart: they have unusually long kidneys, a well-developed tracheal lung with two tracheal arteries, and the liver overlaps the tip of the heart.

Unusual for vipers, species within this tribe lay eggs.

They are distributed in sub-Saharan Africa.

Content: *Causus* Wagler, 1830.

Tribe Cerastini Tribe nov.

(Terminal Taxon: *Cerastes cerastes*)

Diagnosis: Separated from others in the similar looking Causini by the following suite of characters: Cerastini, monotypic for the genus *Cerastes* are small snakes, averaging less than 50 cm in length, but are relatively stout in appearance. Pupil elliptical. The head is broad, flat and distinct from the neck. The head is covered with tubercularly keeled scales, which usually number 15 or more across and a supraorbital horn may be present over each eye in some species. The snout is short and wide and the eyes, which are set well forward, are small to moderate in size. The body is short, stout and cylindrically depressed. The tail is short and tapers abruptly behind the vent. The dorsal scales are small, strongly keeled, in 23-35 rows at midbody, with the keels of the oblique lateral row being serrated, similar to seen in Tribe Echiini tribe nov..

Although *Cerastes* are often referred to as horned vipers, only the two larger species, *C. cerastes* and *C. gasperettii*, are known to have horns, and even these do not always have them. Individuals with and without horns occur within the same populations and even within the same litters (see Mallow et. al. 2003).

When present, each horn consists of a single long, spinelike scale that can be folded back into an indentation in the postocular scale. They fold back in response to direct stimulation, thus streamlining the head and easing passage through burrows. Horns occur more often in individuals from sandy deserts as opposed to stony deserts. Specimens without horns have a prominent brow ridge instead (Mallow et. al. 2003).

The purpose of the horns is the subject of much speculation. One theory is that they allow a buildup of sand above the eyes while keeping it out of the eyes themselves.

Another, more recent theory is simply that the horns serve to break up the outline of the head, making them harder for prey animals to spot (Spawls and Branch 1995).

Further detail about this tribe is covered by Schnurrenberger (1959), Sterer (1992) and Werner, et. al. (1991)

Content: *Cerastes Laurenti*, 1768.

Tribe Echiini Tribe nov.

(Terminal Taxon: *Echis carinatus*)

Diagnosis: Members of this tribe can be separated by their distinctive threat display, which involves forming a series of parallel C-shaped coils and rubbing them together to produce a sizzling sound, rather like water on a hot plate. The proper term for this is stridulation. As they become more agitated, this stridulating behavior becomes faster and louder. It is postulated that this display evolved as a means of limiting water loss, such as might occur when hissing. However, some authors describe this display as being accompanied by loud hissing. These snakes can be fierce and will strike from the position described above. When doing so, they may overbalance and end up moving towards their aggressor as a result. Approaching an aggressor is unusual in most other snakes.

These snakes are relatively small in size with adults never larger than about 90 cm (35 in.) in total length.

The head is short, wide, pear-shaped and distinct from the neck. The snout is short and rounded, while the eyes are relatively large and set well forward. The crown is covered with small, irregular, imbricate scales which may be either smooth or keeled.

The body is moderately slender and cylindrical. The dorsal scales are mostly keeled.

However, the scales on the lower flanks stick out at a distinct 45-degree angle and have a central ridge, or keel, that is serrated (hence the common name "saw-scaled vipers"), the serrated keels being uniquely diagnostic for this tribe in terms of all other non-pitted vipers. The tail is short and the subcaudals always single.

Content: *Echis* Merrem, 1820.

Tribe Pseudocerastini Tribe. Nov.

(Terminal Taxon: *Pseudocerastes persicus*)

Diagnosis: A tribe known only from two species, each monotypic for each genus and each quite different from one another and in terms of one another are best diagnosed at the species level.

Both species within this tribe have an elliptical pupil, raised supraocular, in one species forming a very distinct, horn-like projection, but diagnostic for the tribe is that the raised scales or horns are composed of numerous small supraciliary scales as opposed to being made of a single scale seen in other vipers (e.g. *Cerastes cerastes*).

Rarely if ever exceed a metre in total length.

Endemic to West Asia and the Middle East.

Females are the larger sex and male combat is not known.

Egg-layers.

Content: *Eristicophis* Alcock and Finn, 1897; *Pseudocerastes* Boulenger, 1896.

Subtribe Pseudocerastina Subtribe. nov.**(Terminal Taxon: *Pseudocerastes persicus*)**

Diagnosis: A monotypic tribe for the species *Pseudocerastes persicus*, monotypic for the genus, in turn comprised of two allopatric subspecies.

Often referred to as the "false horned viper" because of the hornlike structures above the eyes that are made up of numerous small scales. This is in contrast to the "true" horned viper, *Cerastes cerastes*, that has similar supraorbital horns that consist of a single elongated scale. The other member of this tribe *Eristicophis macmahonii*, (subtribe Eristicophina) lacks this well-developed horn-like structure.

The head is broad, flat, distinct from the neck and covered with small, imbricate scales. The snout is short and rounded. The nostrils are positioned dorsolaterally and have valves. The nasal scale is unbroken. The rostral scale is small and wide. The eyes are small to average in size. There are 15-20 interocular scales and 15-20 circumorbitals. The supraorbital hornlike structures above each eye consisting of small, imbricate scales and are also present in juveniles. There are 11-14 supralabials and 13-17 sublabials. 2-4 rows of small scales separate the supralabial scales from the suboculars.

The dorsal body is covered with weakly to strongly keeled scales. On many of these, the keel terminates before the end of the scale and forms a bump. Many others form a point. There are 21-25 mid-body scale rows, none of them oblique. There are 134-163 ventrals and 35-50 divided subcaudals. The tail is short.

Known from the following areas: The Sinai of Egypt, Israel, Jordan, northern Saudi Arabia, the mountains of Oman, northern and northwestern Iraq, possibly southern Syria, extreme southeastern Turkey, northwestern Azerbaijan, Iran and Pakistan to the borders of Afghanistan.

Content: *Pseudocerastes* Boulenger, 1896.

Monotypic for the species: *Pseudocerastes persicus*.

Subtribe Eristicophina Subtribe. nov.**(Terminal Taxon: *Eristicophis macmahonii*)**

Diagnosis: Separated from the subtribe *Pseudocerastina* by the lack of a distinct horn-like projection above the eye. The only species within the tribe is known variously as the McMahon's viper, Asian sand viper, Leaf-nosed viper or Whiskered viper.

The head is distinct from the neck and large, broad, flat and wedge-shaped. The eyes are of a moderate size. The crown of the head is covered with small scales. The nostrils are shaped like a pair of small slits. The rostral is wider than it is high, strongly concave and bordered above and to the sides by four much enlarged nasorostral scales arranged in a butterfly shape. There are 14-16 supralabials, which are separated from the suboculars by 3-4 rows of small scales. There are 16-19 sublabials. The circumorbital ring consists of 16-25 scales.

The body is dorsoventrally slightly depressed and appears moderately to markedly stout. The tail is short, tapering abruptly behind the vent. The skin feels soft and loose. The dorsal scales are short and keeled, in 23-29 midbody rows.

The ventrals have lateral keels, numbering 140-144 in males and 142-148 in females. The subcaudals are without keels: males have 33-36, females 29-31.

The dorsal color pattern consists of a reddish to yellowish brown ground color, overlaid dorso-laterally with a regular series of 20-25 dark spots, bordered partly or entirely with white scales. Posteriorly, these spots become more distinct. The white border areas often extend over the back as bands. The head has a white stripe that runs from the back of the eye to the angle of the mouth. The top of the head may have scattered dark flecks. The labials and throat are white, as is the belly. The tip of the tail is yellow with distinct crossbands.

Mallow et al. (2003) cite the taxon as occurring in Pakistan, Afghanistan, eastern and northwestern Baluchistan, southern

Iran and India in the Rajasthan Desert. It is limited to the Dast-i Margo Desert and nearby dune areas, from Seistan in the extreme east of Iran into Afghanistan south of the Helmand River. It also occurs in Baluchistan, between the Chagai Hills and Siahan Range, east to Nushki.

Content: *Eristicophis* Alcock and Finn, 1897.

Monotypic for the genus: *Eristicophis macmahonii*.

Tribe Proatherini Tribe nov.**(Terminal Taxon: *Proatheris superciliaris*)**

Diagnosis: The tribe only contains the single genus and species, namely, *Proatheris superciliaris*, commonly known under the following local common names: Lowland Viper, Swamp viper, Lowland Swamp Viper, Eyebrow Viper, Swamp Adder, Peter's Viper, Flood-plain Viper, Mozambique Viper, African Lowland Viper, Domino Viper.

It is separated from all other vipers (all subfamilies, tribes, etc.) by the following suite of characters: A small species that averages 40 to 50 cm in total length with a maximum recorded length of 61 cm. The head has a somewhat elongated appearance, the top of which is covered with small scales except for a pair of very distinct and large supraoculars which are almost twice as long as they are wide.

Physically similar in many respects to the Pseudocerastini, but they differ in having live young instead of laying eggs. While it is a terrestrial species the tail is somewhat prehensile.

The taxon is found generally in East Africa. More specifically the southern part of its range begins near Beira, in central Mozambique, extends up north over the Mozambique Plain to Quissanga, and through Malawi and as far north as the floodplains of southern Tanzania at the northern end of Lake Malawi. The type locality for the taxon in the original description is given as "Terra Querimba" (Quissanga mainland opposite Ilha, Quirimba, Mozambique).

Its range it apparently centered around the lower section of the Zambezi River and spreads out into the coastal plain of central Mozambique and the Shire Valley to Lake Chilwa and Malawi. However, other specimens have been found far from this region, such as in Cape Delgado Province, in north-eastern Mozambique, and Mwaya in south-western Tanzania. The snake is most commonly seen in low-lying marshes, floodplains and land frequently used for grazing cattle (Stevens 1973).

The females are slightly larger than the males.

Content: *Proatheris* Broadley, 1996.

The genus is monotypic for the species: *Proatheris superciliaris*.

Tribe Viperini Laurenti, 1768.**(Terminal Taxon: *Vipera aspis*)**

Diagnosis: Separated from other true vipers by the following suite of characters: pupil is elliptical, adults of the snakes are generally small (subtribes Viperina and Montiviperina) to medium or large (subtribe Maxhoserviperina) and more or less stoutly built. The head is distinct from the neck, of triangular shape, and covered with small scales in many species, although some have a few small plates on top. The dorsal scales are strongly keeled, the anal plate is divided, as are the subcaudals. Importantly this group are defined by the characteristic zig-zag pattern running down their back, more-or-less along the dorsal midbody line, this pattern sometimes becoming a series of blotches or spots running longitudinally along the body (as in the genus *Daboia*).

All are viviparous (live bearing).

They are distributed in Eurasia and adjacent parts of North Africa.

Content: *Daboia* Gray 1842; *Maxhoserviperina* Hoser, 2012 (see Hoser 2012e); *Macrovipera* Reuss, 1927; *Montivipera* Nilson et al., 1999; *Vipera* Laurenti 1768.

Subtribe Maxhoserviperina Subtribe nov.**(Terminal Taxon: *Maxhoservipera palaestinae*)****Diagnosis:** Separated from other subtribes by the following suite of characters: Medium to large size as adults, a lack of horns, raised scales or similar projections above the eye or snout.

Separated from the other subtribes by the fact that the snout or nose is noticeably more blunt in appearance, hence their occasional common name, "blunt nosed vipers".

The head is broad, flat, and very distinct from the neck. Found in North Africa, the Middle-east and Southern Asia.

Content: *Daboia* Gray, 1842; *Maxhoservipera* Hoser, 2012 (see 2012e).**Subtribe Montiviperina Subtribe nov.****(Terminal Taxon: *Montivipera xanthina*)****Diagnosis:** Separated from Viperina by the lack of medium to large scales above the eye. In this subtribe the relevant scales are small.

Separated from the subtribes Maxhoserviperina and Viperina by the fact that in this subtribe the majority of snakes invariably have small horns or raised scales above the eye or snout, not seen in the other subtribes.

Maxhoserviperina is separated from the other subtribes (including Montiviperina) by the fact that the snout or nose is noticeably more blunt in appearance, hence their occasional common name, blunt nosed vipers.

Found in Eurasia and the Middle-East

Content: *Macrovipera* Reuss, 1927; *Montivipera* Nilson et. al., 1999.**Subtribe Viperina Laurenti, 1768.****(Terminal Taxon: *Vipera aspis*)****Diagnosis:** Separated from other true vipers by the following suite of characters: as adults these snakes are small and more or less stoutly built. The head is distinct from the neck, of triangular shape, and covered with small scales in many species, although some have a few small plates on top. The dorsal scales are strongly keeled, the anal plate is divided, as are the subcaudals. Importantly this subtribe is defined by the characteristic zig-zag pattern running down their back, more-or-less along the dorsal midbody line, this pattern only being obscured in some melanistic specimens or other aberrant mutations.

The snout is not particularly blunt as seen in the subtribe Maxhoserviperina.

This tribe is separated from specimens within the subtribe Montiviperina by the lack of any horns or projections above the eye and the presence of medium sized scales above the eye.

They are distributed in Eurasia only.

Content: *Vipera* Laurenti, 1768.**SUBFAMILY CROTALINAE (PITVIPERS)****Diagnosis:** Vipers with an immediately recognisable heat sensitive pit between the nostril and the eye, sometimes called the loreal pit.

This diagnosis herein acts to separate all three subfamilies of the vipers as a combined diagnosis.

The Vipers are usually thickset snakes with large heads and keeled scales, giving the snakes an unmistakable appearance. They are further characterized by a pair of long, hollow, venom-injecting fangs attached to movable bones of the upper jaw (the maxillaries) that are folded back in the mouth when not in use. Their eyes usually have vertically elliptical pupils and the eyes are relatively large.

No other snakes possess this complete suite of characters.

Vipers are in turn split into two main subfamily groups, namely

the pitted (subfamily Viperinae) and pitless vipers (family Crotalinae). The pitless vipers (viperinae), are those lacking distinctive heat sensitive pits between the eye and the nostril. The pitvipers are those which possess the heat sensitive pits.

A third subfamily named Azemiopinae is a monotypic subfamily created for the monotypic genus, *Azemiops*, that contains the venomous viper species *Azemiops feae*, otherwise known as the Fea's viper, which in turn is monotypic for the genus.

It is separated from the other vipers by its smooth dorsal scales rather than keeled scales.

The snake has a reasonably sturdy body and a short tail. The head, which is slightly flattened and more elliptical in shape than triangular (like other vipers), is also not covered with numerous small scales like most other vipers, but with large symmetrical head shields like colubrids and the elapids. However this species does have a pair of hollow retracting fangs, although these are shorter than in true vipers and pitvipers.

The fangs have a ridge at the tip lateral to the discharge orifice, as well as a blade-like structure on the ventral surface otherwise seen only in some opisthogyphous and atractaspis snakes. The venom glands are relatively small (Mebs et. Al. 1994). Finally, unlike most vipers, Fea's viper is oviparous. The largest known total maximum length recorded for the taxa is 78 cm (Liem, et. Al. 1971). Long believed to be primitive in terms of the other viperids (Liem et. al. 1971), this position has been confirmed through studies of mitochondrial DNA, (Pyron et. al. 2010).

Vipers range in adult length from less than 25 cm (10 inches) in the Namaqua dwarf viper (*Bitis schneideri*) (a pitless viper) of southern Africa (a true viper) to more than 3 metres (10 feet) in the bushmaster (*Lachesis muta*) (a pitviper) of the Amazon basin and Central America. However it should be noted that both pitvipers and pitless ones average similar sizes and range between similar maximums and minimums.

There are considerably more species of pitvipers than pitless ones.

All pitvipers have a vertically elliptical pupil in the eye.

Pitvipers found in the New World as well as most Asia, from the edge of the Caspian Sea, eastward.

Tribe Adelynhoserserpenini Tribe nov.**(Terminal Taxon: *Adelynhoserserpenae nummifer*)****Diagnosis:** Separated from all other pitvipers in the Western hemisphere by the following suite of characters: The tail does not terminate in a rattle or button, the tail is not strongly prehensile, the distal portion is not curving strongly down in life or preservative, there is no conspicuous supraocular spine or horn, the distal subcaudals are single or paired, usually fewer than 200 ventrals and 31 dorsal mid-body rows, most or all subcaudals are undivided, the head is not covered with about nine large plates (and occasionally a few smaller scales as well).**Content:** *Adelynhoserserpenae* Hoser, 2012 (see Hoser 2012a); *Atropoides* Werman, 1992; *Cerrophodion* Campbell and Lamar, 1992; *Porthidium* Cope, 1871.**Subtribe Porthidiumina Subtribe nov.****(Terminal Taxon: *Porthidium ophryomegas*)****Diagnosis:** Separated from all other pitvipers in the Western hemisphere by the following suite of characters: The tail does not terminate in a rattle or button, the tail is not strongly prehensile, the distal portion is not curving strongly down in life or preservative, there is no conspicuous supraocular spine or horn, the distal subcaudals are single or paired, usually fewer than 200 ventrals and 31 dorsal mid-body rows, most or all subcaudals are undivided, the chinshields and preventrals are separated by only 2-3 gulars (as opposed to four or more), the dorsal pattern of a pale mid dorsal line offset by alternate or opposite blotches on either side (rarely patternless); rostral usually distinctly higher than wide; snout may or may not be elevated (Genus *Porthidium*).

Content: *Porthidium* Cope, 1871.

Subtribe Cerrophidionina Subtribe nov.

(Terminal Taxon: *Cerraphodion godmanni*)

Diagnosis: The diagnosis for this tribe is incorporated here as a diagnosis for both subtribes *Adelynhoserserpenina* subtribe nov. and *Cerrophidionina* subtribe nov. as it separates all of the component genera in the single diagnosis.

Separated from all other pitvipers in the Western hemisphere by the following suite of characters: The tail does not terminate in a rattle or button, the tail is not strongly prehensile, the distal portion is not curving strongly down in life or preservative, there is no conspicuous supraocular spine or horn, the distal subcaudals are single or paired, usually fewer than 200 ventrals and 31 dorsal mid-body rows, most or all subcaudals are undivided.

If the chinshields and preventrals are separated by only 2-3 gulars (as opposed to four or more), the dorsal pattern is of a pale mid-dorsal line offset by alternate or opposite blotches on either side (rarely pattenless); rostral usually distinctly higher than wide; snout may or may not be elevated the snake is in the genus *Porthidium* and subtribe *Porthidiumina*.

To be within this tribe (*Cerrophidionina*) the chinshields and preventrals are separated by 4 or more gulars, the dorsal pattern is of mid-dorsal blotches or crossbands (sometimes only extending to the mid-dorsum, but no pale mid-dorsal line present), rostral variable, usually broader than high or only slightly higher than wide, snout unelevated, the head is not covered with about nine large plates (sometimes with a few smaller scales as well), if there are more than 138 ventrals the snake is in this subtribe. If there are less than 138 ventrals the snake is in the subtribe *Adelynhoserserpenina* Subtribe nov..

Content: *Cerraphodion* Campbell and Lamar, 1992; *Atropoides* Werman, 1992.

Subtribe Adelynhoserserpenina Subtribe nov.

(Terminal Taxon: *Adelynhoserserpenae nummifer*)

Diagnosis: The species within this subtribe used to be placed in the genus *Atropoides*.

The diagnosis for this tribe is incorporated here as a diagnosis for all both subtribes *Adelynhoserserpenina* subtribe nov. and *Cerrophidionina* subtribe nov. as it separates all of the component genera in the single diagnosis.

Separated from all other pitvipers in the Western hemisphere by the following suite of characters: The tail does not terminate in a rattle or button, the tail is not strongly prehensile, the distal portion is not curving strongly down in life or preservative, there is no conspicuous supraocular spine or horn, the distal subcaudals are single or paired, usually fewer than 200 ventrals and 31 dorsal mid-body rows, most or all subcaudals are undivided.

If the chinshields and preventrals are separated by only 2-3 gulars (as opposed to four or more), the dorsal pattern is of a pale mid dorsal line offset by alternate or opposite blotches on either side (rarely pattenless); rostral usually distinctly higher than wide; snout may or may not be elevated the snake is in the genus *Porthidium* and subtribe *Porthidiumina*.

To be within this tribe the chinshields and preventrals are separated by 4 or more gulars, dorsal pattern of mid-dorsal blotches or crossbands (sometimes only extending to the mid-dorsum, but no pale mid-dorsal line present), rostral variable, usually broader than high or only slightly higher than wide, snout unelevated, the head is not covered with about nine large plates (sometimes with a few smaller scales as well), if there are more than 138 ventrals the snake is in the subtribe *Cerrophidionina*. If there are less than 138 ventrals the snake is in the subtribe *Adelynhoserserpenina* subtribe nov..

Content: *Adelynhoserserpenae* Hoser, 2012 (See Hoser 2012a).

Tribe Agkistrodonini Tribe Nov.

(Terminal Taxon *Agkistrodon contortrix*)

Diagnosis: Known as the Moccasins, including the Cantils, Copperhead and Cottonmouth, these snakes are separated from all other vipers in the Western Hemisphere by the following suite of characters: The tail does not terminate in a rattle or button, the tail is not strongly prehensile, the distal portion is not curving strongly down in life or preservative, there is no conspicuous supraocular spine or horn, the distal subcaudals are single or paired, usually fewer than 200 ventrals and 31 dorsal mid-body rows, most or all subcaudals are undivided.

If the chinshields and preventrals are separated by only 2-3 gulars (as opposed to four or more), the dorsal pattern of a pale mid dorsal line offset by alternate or opposite blotches on either side (rarely pattenless); rostral usually distinctly higher than wide; snout may or may not be elevated the snake is in the genus *Porthidium* and subtribe *Porthidiumina* (see above). To be within this tribe the chinshields and preventrals are separated by 4 or more gulars, dorsal pattern is of mid-dorsal blotches or crossbands (sometimes only extending to the mid-dorsum, but no pale mid-dorsal line present), rostral variable, usually broader than high or only slightly higher than wide, snout unelevated, the head is covered with about nine large plates (sometimes with a few smaller scales as well), the dorsal colour consists of crossbands or may be uniformly coloured, lacunolabial is present.

Content: *Agkistrodon* Palisot de Beauvois, 1799.

Tribe Calloselasma Tribe Nov.

(Terminal taxon: *Calloselasma rhodostoma*)

Diagnosis: The tribe consists of two distinct genera and they are defined herein separately as a composite diagnosis for the tribe and it's contents.

The species taxon, *Calloselasma rhodostoma*, monotypic for the genus is the only Asian pit viper with large crown scales and smooth dorsal scales.

There are three species within the genus *Hypnale*. All are readily identified by their more-or-less upturned snouts that produce a sort of hump-nosed effect (hence the common name "Hump-nosed Vipers"). This separates them from all other vipers.

All taxon within this group are moderately stout snakes.

The Malayan Pitviper, *Calloselasma rhodostoma* is found in Southeast Asia from Thailand to northern Malaysia and on the island of Java. Attains an average total body length of 76 cm, with females being slightly larger than males. The largest recorded length is 91 cm. The species is oviparous (lays eggs).

The three species of *Hypnale* occur in South-west India and island Sri Lanka. Members of this genus grow to a maximum total length of 55 cm (for *H. hypnale*). The tail length accounts for 14-18% of the total body length in males, 11-16% in females.

The snout is more or less upturned, with two species having a wart-like protuberance at the tip that is covered with tiny scales. The anterior head shields are strongly fragmented, but the frontal scale, supraoculars and parietals are complete and quite large. The nasal scale is single, but it may have a groove that extends towards its upper edge. There are two preoculars and 2-4 postoculars. The loreal scale is single, but extends across the canthus rostralis so that it can be seen from above. The supralabials and sublabials both number 7-9. Bordering the supralabials are 3-4 enlarged temporal scales, above which are 3-5 irregular rows of temporal scales. There is one pair of chin shields, each of which is slightly longer than it is wide.

There are 17 dorsal mid-body scale rows, which are weakly keeled. Apical pits are present, but very difficult to see. The keels are lacking or may be entirely absent on the first two scale rows bordering the ventrals. There are 120-158 ventrals and 28-48 mainly divided subcaudals.

Content: *Calloselasma* Cope, 1860; *Hypnale* Fitzinger, 1843.

Tribe Crotalini Gray, 1825**(Terminal Taxon *Crotalus horridus*)**

Diagnosis: Separated from all other snakes on the planet, including other vipers, by the possession of a rattle on an unbroken tail, or in the case of one species and neonates an obvious pre-button.

They are generally medium to large species with strongly keeled scales, stout build and a large head distinct from the neck.

This tribe is herein restricted to include only the true Rattlesnakes and no other pit vipers.

Content: *Aechmophrys* Coues, 1875; *Caudisona* Laurenti, 1768; *Crotalus* Linnaeus, 1758; *Cummingea*, Hoser 2009; *Hoserea* Hoser, 2009; *Matteoa* Hoser, 2009; *Piersonus* Hoser, 2009; *Sistrurus* Garman, 1883; *Uropsophus* Wagler, 1830.

Note: There are now also 8 named and defined subgenera within this group (see Hoser 2012b). These are: *Cottonus* Hoser, 2009; *Crutchfieldus* Hoser, 2009; *Edwardsus* Hoser, 2009; *Mullinsus* Hoser, 2009; *Pillotus* Hoser, 2009; *Rattlewellsus* Hoser, 2012; *Sayersus* Hoser, 2009; *Smythus* Hoser, 2009.

Subtribe Crotalina Subtribe nov.**(Terminal Taxon *Crotalus horridus*)**

Diagnosis: Includes all rattlesnake taxa excluding *Piersonus ravidus*, which is placed in the monotypic subtribe *Piersonina*.

Piersonus (subtribe *Piersonina* subtribe nov.) is separated from all other rattlesnakes (this tribe) by the following suite of characteristics. In common with the two species in the genus *Sistrurus*, it has nine (usually) large head plates. The other rattlesnakes all have smaller and irregular head shields. *Piersonina* is separated from the the genus *Sistrurus* by the fact that the upper preocular is not in contact with the postnasal, the rostral is curved over the snout; canthus rostralis is rounded, dorsal body blotches are longer than wide unless the snake is melanistic (black) and often in distinct diamond shapes; body pattern commences from the neck; by contrast in *Sistrurus*, the upper preocular is in contact with the postnasal; rostral is not curved over the snout; the canthus rostralis is sharply angled and the dorsal body blotches are square or wider than long, body pattern commences from the head proper.

In all rattlesnakes of the genus *Sistrurus* (the two species being *S. catenatus* and *S. milliaris*), the hemipenis has a gradual transition from spines to calyces. However in all other rattlesnakes including in the subtribe *Piersonina* the hemipenis has an abrupt transition from spines to fringes at the point of bifurcation of the lobes.

Content: *Aechmophrys* Coues, 1875; *Caudisona* Laurenti, 1768; *Crotalus* Linnaeus, 1758; *Cummingea*, Hoser 2009; *Hoserea* Hoser, 2009; *Matteoa* Hoser, 2009; *Sistrurus* Garman, 1883; *Uropsophus* Wagler, 1830.

Note: There are now also 8 named and defined subgenera within this group (see Hoser 2012b). These are: *Cottonus* Hoser, 2009; *Crutchfieldus* Hoser, 2009; *Edwardsus* Hoser, 2009; *Mullinsus* Hoser, 2009; *Pillotus* Hoser, 2009; *Rattlewellsus* Hoser, 2012; *Sayersus* Hoser, 2009; *Smythus* Hoser, 2009.

Subtribe Piersonina Subtribe nov.**(Terminal Taxon *Piersonus ravidus*)**

Diagnosis: This subtribe is monotypic for the genus and species *Piersonus ravidus*.

This is separated from all other rattlesnakes by the following suite of characteristics. In common with the two species in the genus *Sistrurus*, it has (usually) nine large head plates. The other rattlesnakes all have smaller and irregular head shields.

Piersonina is separated from the genus *Sistrurus* by the fact that the upper preocular is not in contact with the postnasal, the rostral is curved over the snout; canthus rostralis is rounded, dorsal body blotches are longer than wide unless the snake is melanistic (black) and often in distinct diamond shapes; body pattern commences from the neck; by contrast in *Sistrurus*, the

upper preocular is in contact with the postnasal; rostral is not curved over the snout; the canthus rostralis is sharply angled and the dorsal body blotches are square or wider than long, body pattern commences from the head proper.

In all rattlesnakes of the genus *Sistrurus* (the two species being *S. catenatus* and *S. milliaris*), the hemipenis has a gradual transition from spines to calyces. However in all other rattlesnakes including in the subtribe *Piersonina* the hemipenis has an abrupt transition from spines to fringes at the point of bifurcation of the lobes.

Piersonus ravidus is only found in the mountains of central and southern Mexico, like the highlands of Morelos, Puebla and Oaxaca. Vertical distribution is estimated between 1500 – 3000m above sea level. Rarely does it exceed 70 cm in total body length.

P. ravidus inhabits primarily forests of the temperate zones, especially pine-oak forests. They can also be found in temperate grasslands, cloud forest, high altitude thorn scrub and tropical deciduous forest.

Its common name is the Mexican Pygmy Rattlesnake.

Content: *Piersonus* Hoser, 2009.

Tribe Jackyhoserini tribe nov.**(Terminal Taxon: *Jackyhoserea pictus*)**

Diagnosis: A large tribe of live-bearing pitvipers found in the New World whose centre of distribution is South America.

Separated from all other pitvipers by the following suite of characteristics: Live bearing. No rattle or similar unbroken pre-button on the end of the unbroken tail. The tail is not prehensile, the rostral is wider than high, the supracephalic scales are either small and keeled although in some species there may be some smallish platelike scales, no supraocular spines, the supracephalic scales may be either mostly flat, with small keels or sometimes strongly keeled, the rostral is wider than high to slightly higher than wide, 21-29 dorsal mid-body rows, 124-254 ventrals, 30-91 usually divided subcaudals, tail may or may not be prehensile, the tail spine is relatively long, the body may be slender to moderately stout, the distal portion of the hemipenes have proximal calyces, papillate or spinulate, usually smooth distally.

Content: *Bothriopsis* Peters, 1861; *Bothrocophias* Cutberlet and Cambell, 2001; *Bothropoides* Fenwick, et. al., 2009; *Bothrops* Wagler, 1824; *Jackyhoserea* Hoser, 2012 (See Hoser 2012c); *Rhinocerophis* Garman, 1881.

Subtribe Bothropina Subtribe nov.**(Terminal Taxon: *Bothrops lanceolatus*)**

Diagnosis: Separated from all other pitvipers in the tribe Jackyhoserini tribe nov. and all other pitvipers in the Western Hemisphere by the following suite of characters: Tail does not terminate in a button or rattle; if the tail is strongly prehensile, the distal portion curves strongly downward in life or preservative, with a relatively long tail spine and usually divided subcaudals (Genus *Bothriopsis*): if the tail is not prehensile, the distal portion does not curve strongly downward in life or preservative, there is no conspicuous supraocular spine or horn, the distal subcaudals are either single or paired, there are usually fewer than 200 ventrals and 31 dorsal mid-body scale rows; most or all subcaudals are divided, there's no distinct series of pale spots or bars on the infralabials; dorsals are often strongly keeled but not tubercular; intersupraoculars are usually keeled, skull narrow, distance across frontal bones are less than the width of the skull at the anterior end of the supratemporals; Dorsal pattern consisting of dark vertebral rhomboids bordered by paler lines (genus *Bothrops*); Jackyhoserina Subtribe nov. (see below) are separated from all species within the genus *Bothrops* (defined above and forming a part of this description), by the following suite of characters: The canthus does not curve upwards, there is a dorsal pattern of small blotches, many of

which are located mid-dorsally or fused to form a zig-zag stripe, occasionally trapezoidal or triangular that alternate or meet mid-dorsally; 3-10 intersupraoculars; 8-11 supralabials with the second, third or none fused with the prelacanal; 10-12 infralabials; 21-25 (usually 23) dorsal mid body rows, 157-186 ventrals in males, 165-186 ventrals in females, 37-63 all divided subcaudals in males and 33-58 all or mostly divided subcaudals in females.

Content: *Bothriopsis* Peters, 1861; *Bothrops* Wagler, 1824.

Subtribe Bothropoidina Subtribe nov.

(Terminal Taxon: *Bothropoides neuwiedi*)

Diagnosis: Separated from all other pitvipers in the tribe Jackyhoserini tribe nov. and all other pitvipers in the Western Hemisphere by the following suite of characters: Tail does not terminate in a button or rattle; if the tail is strongly prehensile, the distal portion curves strongly downward in life or preservative, with a relatively long tail spine and usually divided subcaudals (Genus *Bothriopsis*) (see above subtribe Bothropina); if the tail is not prehensile, the distal portion does not curve strongly downward in life or preservative, there is no conspicuous supraocular spine or horn, the distal subcaudals are either single or paired, there are usually fewer than 200 ventrals and 31 dorsal mid-body scale rows; most or all subcaudals are divided, there's no distinct series of pale spots or bars on the infralabials; dorsals are often strongly keeled but not tubercular; intersupraoculars are usually keeled, skull narrow, distance across frontal bones are less than the width of the skull at the anterior end of the supratemporals; Dorsal pattern not consisting of dark kidney-shapes, Dorsal head lacking a well-defined pattern (*Bothropoides*).

Content: *Bothropoides* Fenwick, et. al. 2009.

Subtribe Rhinocerophiina Subtribe nov.

(Terminal Taxon: *Rhinocerophis nasus*)

Diagnosis: Separated from all other pitvipers in the tribe Jackyhoserini tribe nov. and all other pitvipers in the Western Hemisphere by the following suite of characters: Tail does not terminate in a button or rattle; if the tail is strongly prehensile, the distal portion curves strongly downward in life or preservative, with a relatively long tail spine and usually divided subcaudals (Genus *Bothriopsis*) (see above subtribe Bothropina); if the tail is not prehensile, the distal portion does not curve strongly downward in life or preservative, there is no conspicuous supraocular spine or horn, the distal subcaudals are either single or paired, there are usually fewer than 200 ventrals and 31 dorsal mid-body scale rows; most or all subcaudals are divided, there's no distinct series of pale spots or bars on the infralabials; dorsals are often strongly keeled but not tubercular; intersupraoculars are usually keeled, skull narrow, distance across frontal bones are less than the width of the skull at the anterior end of the supratemporals; Dorsal pattern consisting of large brown kidney-shapes; Dorsal head with well-defined pattern. Mostly dark with four or five large brown patches separated by very thin pale lines (Genus: *Rhinocerophis*).

Content: *Rhinocerophis* Garman, 1881.

Subtribe Jackyhoserina Subtribe nov.

(Terminal Taxon: *Jackyhoserea pictus*)

Diagnosis: Separated from all other pitvipers in the tribe Jackyhoserini tribe nov. and all other pitvipers in the Western Hemisphere by the following suite of characters: Tail does not terminate in a button or rattle; if the tail is strongly prehensile, the distal portion curves strongly downward in life or preservative, with a relatively long tail spine and usually divided subcaudals (Genus *Bothriopsis*) (see above subtribe Bothropina); if the tail is not prehensile, the distal portion does not curve strongly downward in life or preservative, there is no conspicuous supraocular spine or horn, the distal subcaudals are either single or paired, there are usually fewer than 200

ventrals and 31 dorsal mid-body scale rows; most or all subcaudals are divided, there's no distinct series of pale spots or bars on the infralabials; dorsals are often strongly keeled but not tubercular; intersupraoculars are usually keeled, skull narrow, distance across frontal bones are less than the width of the skull at the anterior end of the supratemporals; Dorsal pattern consisting of dark vertebral rhomboids bordered by paler lines (genus *Bothrops*); Jackyhoserina Subtribe nov. are separated from all species within the genus *Bothrops* (defined above and forming a part of this description), by the following suite of characters: The canthus does not curve upwards, there is a dorsal pattern of small blotches, many of which are located mid-dorsally or fused to form a zig-zag stripe, occasionally trapezoidal or triangular that alternate or meet mid-dorsally; 3-10 intersupraoculars; 8-11 supralabials with the second, third or none fused with the prelacanal; 10-12 infralabials; 21-25 (usually 23) dorsal mid body rows, 157-186 ventrals in males, 165-186 ventrals in females, 37-63 all divided subcaudals in males and 33-58 all or mostly divided subcaudals in females.

Content: *Jackyhoserea* Hoser, 2012 (See Hoser 2012c).

Genus content: *J. pictus* (type species), *J. andianus*, *J. barnetti*, *J. lojanus*, *J. roedingeri*.

Note: Subgenus *Daraninus* Hoser 2012 is monotypic for the species taxon, *J. andianus*.

Subtribe Bothrocophiina Subtribe nov.

(Terminal Taxon: *Bothrocophias hypopora*)

Diagnosis: Separated from all other pitvipers in the tribe Jackyhoserini tribe nov. and all other pitvipers in the Western Hemisphere by the following suite of characters: Tail does not terminate in a button or rattle; if the tail is strongly prehensile, the distal portion curves strongly downward in life or preservative, with a relatively long tail spine and usually divided subcaudals (Genus *Bothriopsis*) (see above subtribe Bothropina); if the tail is not prehensile, the distal portion does not curve strongly downward in life or preservative, there is no conspicuous supraocular spine or horn, the distal subcaudals are either single or paired, there are usually fewer than 200 ventrals and 31 dorsal mid-body scale rows; most or all subcaudals are divided, there is a distinct series of pale spots or bars on the infralabials; dorsal keels are tubercular; intersupraoculars are smooth or keeled, skull is broad, distance across the frontal bones equals the width of the skull at the anterior end of the supratemporals (Genus: *Bothrocophias*).

Content: *Bothrocophias* Cutberlet and Cambell, 2001,

Tribe Lachesini Cope, 1900.

(Terminal Taxon *Lachesis muta*)

Diagnosis: The following diagnosis can be also used to separate the two subtribes, namely Bothriechisina subtribe nov. and Lachesina subtribe nov. These snakes are diagnosed and separated from all other vipers in the Western Hemisphere by the following characteristics: Tail does not end in a button or rattle, if the tail is strongly prehensile where the distal portion curves down in life or in preservative, then it will have a short and blunt spine and the subcaudals will be undivided (Genus *Bothriechis*, subtribe Bothriechisina subtribe nov.). If the tail is not strongly prehensile and the distal portion does not curve strongly downward in life or preservative and there is a conspicuous supraocular spine or horn, then the genus is *Ophryacus* (within subtribe Lachesina subtribe nov.). If the tail is not strongly prehensile and the distal portion does not curve strongly downward in life or preservative and there is not a conspicuous supraocular spine or horn and the distal subcaudals are divided into more than 2 scales, there's 200 or more ventrals, 31-39 dorsal mid-body scale rows then the snake is of the genus *Lachesis* (within subtribe Lachesina subtribe nov.).

Content: *Bothriechis* Peters, 1859; *Lachesis* Daudin, 1803; *Ophryacus* Cope, 1887.

Subtribe Bothriechisina Subtribe nov.**(Terminal Taxon *Bothriechis nigroviridis*)**

Diagnosis: The following diagnosis can be also used to separate the two subtribes within tribe Lachesini tribe nov., namely Bothriechisina subtribe nov. and Lachesina subtribe nov. These snakes are diagnosed and separated from all other vipers in the Western Hemisphere by the following characteristics: Tail does not end in a button or rattle, if the tail is strongly prehensile where the distal portion curves down in life or in preservative, then it will have a short and blunt spine and the subcaudals will be undivided (Genus *Bothriechis*, subtribe Bothriechisina subtribe nov.). If the tail is not strongly prehensile and the distal portion does not curve strongly downward in life or preservative and there is a conspicuous supraocular spine or horn, then the genus is *Ophryacus* (within subtribe Lachesina subtribe nov.). If the tail is not strongly prehensile and the distal portion does not curve strongly downward in life or preservative and there is not a conspicuous supraocular spine or horn and the distal subcaudals are divided into more than 2 scales, there's 200 or more ventrals, 31-39 dorsal mid-body scale rows then the snake is of the genus *Lachesis* (within subtribe Lachesina subtribe nov.).

Content: *Bothriechis* Peters, 1859.

Tribe Lachesina Cope, 1900.**(Terminal Taxon *Lachesis muta*)**

Diagnosis: The following diagnosis can be also used to separate the two subtribes within tribe Lachesini tribe nov., namely Bothriechisina subtribe nov. and Lachesina subtribe nov. These snakes are diagnosed and separated from all other vipers in the Western Hemisphere by the following characteristics: Tail does not end in a button or rattle, if the tail is strongly prehensile where the distal portion curves down in life or in preservative, then it will have a short and blunt spine and the subcaudals will be undivided (Genus *Bothriechis*, subtribe Bothriechisina subtribe nov.). If the tail is not strongly prehensile and the distal portion does not curve strongly downward in life or preservative and there is a conspicuous supraocular spine or horn, then the genus is *Ophryacus* (within subtribe Lachesina subtribe nov.). If the tail is not strongly prehensile and the distal portion does not curve strongly downward in life or preservative and there is not a conspicuous supraocular spine or horn and the distal subcaudals are divided into more than 2 scales, there's 200 or more ventrals, 31-39 dorsal mid-body scale rows then the snake is of the genus *Lachesis* (within subtribe Lachesina subtribe nov.).

Content: *Lachesis* Daudin, 1803; *Ophryacus* Cope, 1887.

Tribe Trimeresurusini Tribe Nov.**(Terminal Taxon: *Trimeresurus gramineus*)**

Diagnosis: An Asian tribe of pitvipers, it includes all species from Asia and adjacent areas, except those from the genera *Calloselasma* and *Hypnale*, defined under their elsewhere in this account.

In terms of the pitvipers outside this tribe they are as follows:

The species taxon, *Calloselasma rhodostoma*, monotypic for the genus is the only Asian pit viper with large crown scales and smooth dorsal scales.

There are three species within the genus *Hypnale*. All are readily identified by their more-or-less upturned snouts that produce a sort of hump-nosed effect (hence the common name Hump-nosed Vipers). This separates them from all other vipers.

The size and shape of the vipers in the tribe Trimeresurusini Tribe nov. varies, but the greatest number are smallish and arboreal. The greatest degree of diversity is in the region of continental south-east Asia.

In the period between 1990 and 2012, numerous new genera have been described and generally recognised, the majority of species taxa being formerly assigned to the genus *Trimeresurus*.

12 genera are listed as being the content of this tribe below, although further generic names have been proposed.

Coincident with this taxonomic work at the genus level, has been the descriptions of numerous species taxa, most restricted in known distribution to small areas, often associated with mountains or other "island" habitats.

Content: *Cryptelytrops* Cope, 1860; *Gloydus* Hoge and Romano-Hoge, 1981; *Himalayophis* Malhorta and Thorpe, 2004; *Ovophis* Burger, 1981; *Oxyus* Hoser, 2012; *Parias* Gray, 1849; *Popeia* Malhorta and Thorpe, 2004; *Protobothrops* Hoge and Romano-Hoge, 1983; *Triceratolepidophis* Ziegler et al., 2000; *Trimeresurus* Lacépède, 1804; *Viridovipera* Malhorta and Thorpe, 2004; *Zhaoermia* Zhang, 1993.

Tribe Tropidolaemusini Tribe Nov.**(Terminal taxon: *Tropidolaemus wagleri*)**

Diagnosis: A tribe of Asian pitvipers consisting of three genera and herein defined by each genus.

Deinagkistrodon is a monotypic genus for the species *D. acutus*, found in in southern China (Chekiang, Fukien, Hunan, Hupeh, Kwantung), Taiwan, northern Vietnam, and possibly Laos. It's commonly known as the Sharp-nosed Viper.

It is separated from other Asian pitvipers by the following suite of characters:

The back is light brown or greyish brown, with a series of dark brown lateral triangles on each side. The two pointed tops of the two opposite triangles meet each other at the mid-line, forming a series of about twenty light brown, squarish blotches on the back. A row of large black spots extends along each side near the belly. The top and upper sides of the head are uniformly black, with a black streak from the eye to the angle of the mouth; yellowish below, spotted with dark brown. The young are much lighter than the adults with essentially the same pattern. The head is large, triangular, with an upturned snout. The body is very stout. The tail is short, ending in a compressed, pointed slightly curved cornified scale. The top of the head is covered with nine large plates. Dorsal scales are strongly and tubercularly keeled. Subcaudals mainly divided, some anterior are single. Ranges from 0.8 to 1.0 metre (2.6 and 3.3 ft) in total length, with the longest recorded length being a male of 61 inches or 1.549 metres (5.08 ft).

Garthius is monotypic for the species *chaseni*, known as *Chasen's mountain pit viper*.

It's a small, stocky terrestrial pitviper, not exceeding a metre. Dorsally it's brownish with irregular blackish, light-edged blotches which become transverse bands posteriorly. The belly is yellow with grey specks. There's an oblique black stripe behind the eye bordered below with white.

Currently known only from Mt. Kinabalu, Borneo (Indonesia).

Garthius is separated from other Asian Pitvipers by the following suite of characters: Scalation includes 15-19 dorsal mid-body scale rows, 130-143 ventrals, 20-30 divided subcaudals and 6 supralabials with the third being the highest.

Tropidolaemus is a genus of five currently described species, commonly known as the Temple Vipers. The genus is separated from other Asian pitvipers including the superficially similar *Trimeresurus* by the following suite of characters: absence of a nasal pore, the upper surfaces of the snout and head are covered with distinctly covered small scales, strongly keeled gular scales, second supralabial not bordering the anterior margin of the loreal pit and topped by a prefoveal, and a green colour in juveniles that may or may not change with age.

Content: *Deinagkistrodon* Gloyd, 1979; *Garthius* Malhorta and Thorpe, 2004; *Tropidolaemus* Wagler, 1830.

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SUMMARY OF CURRENT VIPER CLASSIFICATION (HOSER 2012)

FAMILY VIPERIDAE

SUBFAMILY AZEMIOPINAE

Content: *Azemiops* Boulenger, 1888.

Tribe Azemiopini Liem, Marx and Rabb 1971.

(Terminal Taxon: *Azemiops feae*)

Content: *Azemiops* Boulenger, 1888.

SUBFAMILY VIPERINAE (PITLESS VIPERS)

Content: See for each tribe.

Tribe Atherini Groombridge 1986

(Terminal Taxon: *Atheris chlorechis*)

Content: *Adenorhinos* Marx and Rabb, 1965; *Atheris* Cope, 1862; *Montatheris* Broadley, 1996; *Proatheris* Broadley, 1996.

Tribe Bitisini Tribe nov.

(Terminal Taxon: *Bitis arietans*)

Content: *Bitis* Gray, 1842 (including all defined subgenera).

Tribe Causini Cope 1860

(Terminal Taxon: *Causus maculatus*)

Content: *Causus* Wagler, 1830.

Tribe Cerastini Tribe nov.

(Terminal Taxon: *Cerastes cerastes*)

Content: *Cerastes* Laurenti, 1768.

Tribe Echiini Tribe nov.

(Terminal Taxon: *Echis carinatus*)

Content: *Echis* Merrem, 1820.

Tribe Proatherini Tribe nov.

(Terminal Taxon: *Proatheris superciliaris*)

Content: *Proatheris* Broadley, 1996.

The genus is monotypic for the species:

Proatheris superciliaris.

Tribe Pseudocerastini Tribe. Nov.

(Terminal Taxon: *Pseudocerastes persicus*)

Content: *Eristicophis* Alcock and Finn, 1897; *Pseudocerastes* Boulenger, 1896.

Subtribe Pseudocerastina Subtribe. nov.

(Terminal Taxon: *Pseudocerastes persicus*)

Content: *Pseudocerastes* Boulenger, 1896.

Subtribe Eristicophina Subtribe. nov.

(Terminal Taxon: *Eristicophis macmahonii*)

Content: *Eristicophis* Alcock and Finn, 1897.

Tribe Viperini Laurenti, 1768.

(Terminal Taxon: *Vipera aspis*)

Content: *Daboia* Gray 1842; *Maxhoservipera* Hoser, 2012 (see Hoser 2012e); *Macrovipera* Reuss, 1927; *Montivipera* Nilson et. al., 1999; *Vipera* Laurenti 1768.

Subtribe Maxhoserviperina Subtribe nov.

(Terminal Taxon: *Maxhoservipera palaestinae*)

Content: *Daboia* Gray, 1842; *Maxhoservipera* Hoser, 2012 (see Hoser 2012e).

Subtribe Montiviperina Subtribe nov.

(Terminal Taxon: *Montivipera xanthina*)

Content: *Macrovipera* Reuss, 1927; *Montivipera* Nilson et. al., 1999.

Subtribe Viperina Laurenti, 1768.

(Terminal Taxon: *Vipera aspis*)

Content: *Vipera* Laurenti 1768.

SUBFAMILY – CROTALINAE (PITVIPERS)

Content: See for each tribe.

Tribe Adelynhoserserpenini Tribe nov.

(Terminal Taxon: *Adelynhoserserpenae nummifer*)

Content: *Adelynhoserserpenae* Hoser, 2012 (See Hoser 2012a); *Atropoides* Werman, 1992; *Cerrophodion* Campbell and Lamar, 1992; *Porthidium* Cope, 1871.

Subtribe Porthidiumina Subtribe nov.

(Terminal Taxon: *Porthidium ophryomegas*)

Content: *Porthidium* Cope, 1871.

Subtribe Cerrophodionina Subtribe nov.

(Terminal Taxon: *Cerrophodion godmanni*)

Content: *Cerrophodion* Campbell and Lamar, 1992; *Atropoides* Werman, 1992.

Subtribe Adelynhoserserpenina Subtribe nov.

(Terminal Taxon: *Adelynhoserserpenae nummifer*)

Content: *Adelynhoserserpenae* Hoser, 2012 (See Hoser 2012a).

Tribe Akistrodonini Tribe Nov.**(Terminal Taxon *Agkistrodon contortrix*)****Content:** *Agkistrodon* Palisot de Beauvois, 1799.**Tribe Calloselasma Tribe Nov.****(Terminal taxon: *Calloselasma rhodostoma*)****Content:** *Calloselasma* Cope, 1860; *Hypnale* Fitzinger, 1843.**Tribe Crotalini Gray, 1825****(Terminal Taxon *Crotalus horridus*)****Content:** *Aechmophrys* Coues, 1875; *Caudisona* Laurenti, 1768; *Crotalus* Linnaeus, 1758; *Cummingea*, Hoser 2009; *Hoserea* Hoser, 2009; *Matteoa* Hoser, 2009; *Piersonus* Hoser, 2009; *Sistrurus* Garman, 1883; *Uropsophus* Wagler, 1830.**Subtribe Crotalina Subtribe nov.****(Terminal Taxon *Crotalus horridus*)****Content:** *Aechmophrys* Coues, 1875; *Caudisona* Laurenti, 1768; *Crotalus* Linnaeus, 1758; *Cummingea*, Hoser 2009; *Hoserea* Hoser, 2009; *Matteoa* Hoser, 2009; *Sistrurus* Garman, 1883; *Uropsophus* Wagler, 1830.**Subtribe Piersonina Subtribe nov.****(Terminal Taxon *Piersonus ravidus*)****Content:** *Piersonus* Hoser, 2009.**Tribe Jackyhoserini tribe nov.****(Terminal Taxon: *Jackyhoserea pictus*)****Content:** *Bothriopsis* Peters, 1861; *Bothrocophias* Cutberlet and Cambell, 2001; *Bothropoides* Fenwick, et. al., 2009; *Bothrops* Wagler, 1824; *Jackyhoserea* Hoser, 2012 (See Hoser 2012c); *Rhinocerothis* Garman, 1881.**Subtribe Bothropina Subtribe nov.****(Terminal Taxon: *Bothrops lanceolatus*)****Content:** *Bothriopsis* Peters, 1861; *Bothrops* Wagler, 1824.**Subtribe Bothropoidina Subtribe nov.****(Terminal Taxon: *Bothropoides neuwiedi*)****Content:** *Bothropoides* Fenwick, et. al. 2009.**Subtribe Rhinocerothisina Subtribe nov.****(Terminal Taxon: *Rhinocerothis nasus*)****Content:** *Rhinocerothis* Garman, 1881.**Subtribe Jackyhoserea Subtribe nov.****(Terminal Taxon: *Jackyhoserea pictus*)****Content:** *Jackyhoserea* Hoser, 2012 (See Hoser 2012c).**Subtribe Bothrocophiasina Subtribe nov.****(Terminal Taxon: *Bothrocophias hyopora*)****Content:** *Bothrocophias* Cutberlet and Cambell, 2001.**Tribe Lachesini Cope, 1900.****(Terminal Taxon *Lachesis muta*)****Content:** *Bothriechis* Peters, 1859; *Lachesis* Daudin, 1803; *Ophryacus* Cope, 1887.**Subtribe Bothriechisina Subtribe nov.****(Terminal Taxon *Bothriechis nigroviridis*)****Content:** *Bothriechis* Peters, 1859.**Tribe Lachesina Cope 1900.****(Terminal Taxon *Lachesis muta*)****Content:** *Lachesis* Daudin, 1803; *Ophryacus* Cope, 1887.**Tribe Trimeresurusini Tribe Nov.****(Terminal Taxon: *Trimeresurus gramineus*)****Content:** *Cryptelytrops* Cope, 1860; *Gloydia* Hoge and Romano-Hoge, 1981; *Himalayophis* Malhorta and Thorpe, 2004; *Ovophis* Burger, 1981; *Oxyus* Hoser, 2012 (see Hoser 2012d); *Parias* Gray, 1849; *Popeia* Malhorta and Thorpe, 2004; *Protobothrops* Hoge and Romano-Hoge, 1983; *Triceratolepidophis* Ziegler et al., 2000; *Trimeresurus* Lacépède, 1804; *Viridovipera* Malhorta and Thorpe, 2004; *Zhaoermia* Zhang, 1993.**Tribe Tropidolaemusini Tribe Nov.****(Terminal taxon: *Tropidolaemus wagleri*)****Content:** *Deinagkistrodon* Gloyd, 1979; *Garthius* Malhorta and Thorpe, 2004; *Tropidolaemus* Wagler, 1830.



A REASSESSMENT OF THE HIGHER TAXONOMY OF THE ELAPIDAE.

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ABSTRACT

This paper reviews recent phylogenetic studies of the elapids to revisit the higher taxonomy of the group, specifically with reference to the level between family and genus.

As a result, the various tribes are redefined, diagnosed and named when there are no pre-existing valid names as determined by the ICZN rules current from year 2000.

Besides utilizing and redefining previously diagnosed tribes, this paper names 20 new tribes and a further 13 new subtribes within the elapidae to present a new classification that better reflects the known phylogeny within the group.

A new family, Homoroselapidae is also erected and diagnosed for African snakes of the genus *Homoroselaps*, as well as a single component tribe.

Keywords: Taxonomy; Nomenclature; snake; elapid; family; tribe; subtribe; genera; genus; phylogeny; Homoroselapidae; Dendroaspini; Elapsoidini; Ophiophagini; Demansiini; Denisonini; Furinini; Hemiaspini; Hulimkini; Hydrelapini; Maticorini; Micropechiini; Notopseudonajini; Oxyuranini; Parapistocalamini; Pseudechini; Pseudonajini; Simoselapini; Sutini; Vermicellini; Acanthophiina; Aspidomorphina; Ephalophina; Hemachatusina; Hoplocephalina; Hydrophiina; Loveridgelapina; Micropechiina; Najina; Notechiina; Parahydrophina; Pelamiina; Toxicocalamina; Homoroselapini; *Homoroselaps*.

INTRODUCTION

In the period 1975 to present (2012), there have been a large number of studies published in relation to the phylogeny of the extant (living) elapid snakes.

These published studies include the data and findings of Kelly et al. (2009), Keogh (1999), Pyron et al. (2010), Wallach (1985), and others (including those cited within).

Within many of the papers published, authors have also ventured their own views in terms of the taxonomy within the group, including for example Cogger (1975, et. seq.), Cogger, et al. (1983), Slowinski, et al. (2001), Slowinski, Keogh, Shine and Donnellan (1998), Knight and Rooney (1997), Smith, et al. (1977), Wells and Wellington (1983 and 1985), (as well as those papers cited within).

Ecological studies, like that of Sine and Keogh (1996) have provided alternative means by which to deduce relationships between elapid genera.

Some authors, in particular Wells and Wellington and later Wells (alone) have tended to split larger genera into ever greater numbers of smaller ones; see for example, Wells (2002) in terms of elapid genus *Pseudonaja*, or most recently Wells (2012) for skink genus *Lerista*.

While there is usually a strong reluctance of others to accept such classifications, the fact remains that over time, a sizeable proportion of these generic level splits are accepted by most publishing herpetologists and so the new names move into general usage.

As a result, there is an ever increasing number of genera which often identify an ever increasing number of species.

One only needs to look at the output of journals such as *Zootaxa*, or the more wide-ranging *Zoological Record* to get an indication of the rate at which new genera and species are being formally named on an annual basis.

Modern molecular methods have shown that snakes in particular are conservative in body design, with seemingly similar species often being distantly related.

This relationships have become better understood with the advent of various new diagnostic methods and techniques.

While taxonomists over the last 20 years have been efficient at diagnosing species and to a lesser extent dividing genera into groups of similar species, the mid-level taxonomy and nomenclature of the elapids in particular seems to have been overlooked, even though the relationships between species groups themselves have now been resolved for the majority.

As genera become more finely defined, as do species, there has been a shift "downward" leaving an ever-increasing gap between the family and genus level.

While genus groups are often defined as such, or alternatively as clades, these are not actual terms of use in the current Zoological code.

Within the level between genus and family, is the relatively under-used level of "tribe".

In 1977, Smith, et. al, presented "A Summary of Snake Classification (Reptilia, Serpentes)", which defined all extant groups of snakes down to tribe level.

In the main he used pre-existing names that had been appropriately used under the code.

For the elapids (and others) he named a number of tribes under the heading "(new name)", for various genera, but did not define these groups in any way.

Smith referred to a work by McDowell "in prep" which one presumes was to properly define the tribes he tentatively named in accordance with the Zoological code of the time in what was in effect a very brief summary.

McDowell published a paper in 1987, (McDowell 1987) but in that failed to define the elapid tribes. In an earlier paper McDowell had referred to the groups of elapids as groups or series.

Other authors (such as Mengden 1983) have referred to the tribes named in Smith et. al. 1977 as "presumed" because they were never actually named or defined and diagnosed in words or characters according to the ICZN code of the time and hence were still *nomen nudem*.

While many of the tribe names used by Smith et. al. are used herein, the ones he first used are herein defined as new (.nov) as they have never previously been defined according to the code and were therefore to this point in time *nomen nudem*.

THE ACTUAL FINDINGS AND PLACEMENT OF GROUPS

Relying on the data of Wallach (1985), Pryon et. al. (2010) and other similar studies since that have had findings more-or-less in line with these papers, the number of elapid tribes is expanded both for Australian and non-Australian elapids, (including sea snakes), the latter of which have been subject of interest by a number of authors, including for example Lukoschek and Keogh (2006), Rasmussen, et. al. (2011) and Wells (2007), although I do not necessarily adopt the exact classifications used therein.

In terms of non-Laticaudid sea snakes, the classification herein reflects the currently accepted phylogeny of the group, in that their origins fit within the Australasian elapid radiation and so they are not treated as a subfamily as had been done by a number of other authors. However each major genus group is treated as a tribe.

For the Laticaudid sea snakes, the subfamilial classification is

retained.

It should be noted however that if it is indeed later found that the Laticaudid snakes have in fact relatively recently derived from one of the other subfamilial elapid stocks, then it may be better to not recognise the subfamily and instead subsume it within another and continue to use the tribe level as applied herein.

By and large what is shown here in this paper is a conservative and consensus position that sits broadly within the middle position of other recent authors.

I have used the results of Slowinski, Knight and Rooney (1997) to erect and define tribes for several groups within the subfamily Bungarinae, although contrary to their evidence I have retained use of the subfamily Elapinae Boie 1827, pending further evidence to support those author's conclusions.

In any event, the ultimate merging of Elapinae and Bungarinae (into a single Elapinae) would not have any effect on the use of the tribe levels defined in the list that follows.

It is noted herein that Wells (2007) has sought to place Australasian elapids within their own subfamily, namely Oxyuranidae, presumably on the basis that links between this clade and the Afro-Asian-American elapids is too distant to warrant both groups being placed in a single family. His currently "outsider" view may in the fullness of time become the consensus position, but is not adopted here as a reflection of the prevailing view of most other authors.

Of note is that the placement of the terrestrial Melanesian elapids has been difficult due to the conflicting evidence of various recent publications.

Parapistocalamus has been placed in a tribe of it's own (Parapistocalamini Tribe Nov.), while recognising that it is probably closely related to the other snakes placed in the tribe Maticorni Tribe nov. (including genera *Calliophis*, *Hemibungarus*, *Maticora*, *Sinomicrurus*).

As a result, this paper presents for the first time a comprehensive diagnosis and classification for the extant (living) elapids, down to tribe (or subtribe) level, with each tribe being defined in accordance with the current ICZN rules (Ride 1999).

In the case of the tribes or subtribes containing several genera, they have been named in accordance with the recommendations of the ICZN code. Noting that in the majority of cases, relevant genera are well-known, the newly named tribes or subtribes have been assigned names on the basis of the genus containing the largest number of recognised species or what I have determined to be the best known genus in the tribe.

The diagnosis of each tribe (or subtribe) should also be read in conjunction with those for the other identified tribes (or subtribes) herein in order to further separate component genera and species from one another.

Names of tribes have been determined according to the relevant sections of the code including, articles 29.2, 35.1, and 62 and any corrections or changes made to earlier authors works where information was either not given or ambiguous, is made according to the code as "first reviser".

In terms of listing component genera within families, subfamilies, tribes, subtribes, I have used the names of recognised genera as accepted by most recently published authors.

In some cases, where genera have been either recently erected or elevated from synonymy of better known genera, I have used these names where I believe the placements are either generally accepted, or likely to become so on the basis of recently published evidence in terms of the relationships of the relevant species.

Some genus names in use for given species, regarded as synonyms of other better-known ones (with different type species) have not been adopted and used here pending further resolution of the evidence one way or other by other authors. Non-use of those names, should not be taken here as a

wholesale rejection of them in terms of factual basis or merit. Rather the use of the chosen genus names herein is for the purpose of accurately clarifying the component groups within each formally named tribe and to remove any ambiguity.

African coral snakes or Harlequin Snakes (*Homoroselaps*) have at times in the past been placed within the family elapidae.

Some authors have placed them within other families and in my view they should be placed in a family of their own, due to their clearly basal origin to other previously defined families or subfamilies (see for example the results of Pyron et. al. 2010).

While non-elapids are generally beyond the scope of this paper and the listing as published herein, it is appropriate that *Homoroselaps* is dealt with properly herein.

Homoroselaps is therefore herein placed within its own Family, Homoroselapidae Fam. Nov. as explained and defined herein according to the current Zoological code.

Recent papers, including those cited at the rear of this paper, have indicated that these snakes are thought to represent primitive basal elapid stock with affinities or similarities to Colubridae, Atractaspidinae (in particular) and Elapidae.

In terms of the Atractaspidinae, they are understudied group and two species (*Atractaspis microlepidota* Günther, 1866 and the closely related *A. andersonii* Boulenger, 1905 (long regarded as a subspecies of the former) have been identified by myself as quite divergent from all others and have been placed in a newly erected genus by myself in another paper (see Hoser 2012a).

But in spite of the above view, Kelly et. al. 2004 and other more recent studies have failed to provide convincing evidence to place *Homoroselaps* within either the Elapidae or Atractaspidinae.

As it is not regarded as being tenable to merge Atractaspidinae with Elapidae (at the family level) based on general recognitions and definitions of each group and it is not tenable to safely place *Homoroselaps* within either as it sits basal to them, or at least the Atractaspidinae, it is herein placed within its own new family.

The family Homoroselapidae Fam. Nov. is diagnosed below (after the elapids listed here).

For completeness a tribe named Homoroselapini Tribe Nov. is also diagnosed herein, even though as it stands here it is monotypic for the genus *Homoroselaps*.

In the event that later workers seek to transfer *Homoroselaps* to another family grouping, the tribe will remain to separate it from all other (clearly dissimilar) genera that should as a matter of course be placed in other tribes.

Sea snakes are generically defined within this paper as elapid taxa with a paddle-shaped tail.

FAMILY ELAPIDAE BOIE, 1827

Diagnosis: Elapidae are a family of venomous snakes found globally on all major continental masses and nearby islands, except those permanently ice-bound or (historically) recently so, but they most numerous in terms of species diversity in Australasia, Asia, Africa, and the middle Americas. Water-dwelling and marine species are found in the Indian/Pacific Oceans and regions joining the them.

Known as Proteroglyphs (Proteroglypha Jan 1857), they are characterized by hollow, fixed fangs at the front of the mouth through which they inject venom. This separates them from other kinds of venomous snakes which either have fangs at the rear of the mouth (as seen in some members of the composite (as recognised) family Colubridae) or the Solenoglyphs (Solenoglypha Jan 1857), which have movable fangs situated at the front of the mouth (the snakes of the family Viperidae).

McDowell (1970) split the elapid snakes into two main groups, based on based on the morphology and inferred movements of their palatine bone during prey transport (swallowing).

In the group he called the "palatine erectors", the palato-

pterygoid joint flexes ventrally during upper jaw protraction.

By contrast in the group he called the "palatine draggers" the palato-ptyergoid joint flexes laterally with maxillary rotation when the mouth opens and the jaw apparatus is protracted and slightly ventrally during mouth closing.

In draggers, the anterior end of the palatine also projects rostrally during protraction, unlike the stability of the anterior end seen in erectors. Palatine draggers differ from palatine erectors in four structural features of the palatine and its relationships to surrounding elements (Deufel and Cundall 2010).

Palatine draggers include all Australasian elapids and sea snakes, including hydrophiines, with the exception of the monotypic *Parapistocalamus hedigeri* from Bougainville island New Guinea.

Palatine erectors includes all elapids from Africa, continental Eurasia and the Americas as well as *Parapistocalamus*.

McDowell's split of the elapids into the above two groups has been strongly supported by molecular and other data from other authors.

Subfamily Bungarinae Eichwald, 1831 (Cobras)

Diagnosis: Separated from all other "palatine erectors" elapids by the fact that the body is not slender and cylindrical, with a cylindrical and relatively small and short tail, although in terms of this trait, it is variable, but never long in other palatine erectors.

Content: See within each tribe.

Tribe Bungarini Eichwald, 1831 (Asiatic Cobras)

(Terminal Taxon: *Bungarus candidus*)

Diagnosis: Separated from all other "palatine erectors" elapids by the following suite of characters: Large and highly venomous snakes, known generally as "Kraits", they are covered in smooth glossy scales that are arranged in bold striped patterns of alternating dark and light-colored areas, or a similar configuration of coloured stripes or blotches; the scales along the mid-dorsal line of the back are enlarged and hexagonal; the head is relatively slender and the eyes have round pupils although this is usually hard to determine in life due to the colour of the eye; distinctive of these snakes is the pronounced dorso-lateral flattening with an often highly triangular cross section; the tail tapers to a thin point; 7 supralabials, with numbers 3-4 or 3-5 in contact with the eye, the frontal shield is either as broad as is long, or longer than wide, 200-230 ventrals, single anal and 40-54 subcaudals, anterior single, posterior divided.

These snakes don't have the ability to flare their neck to create a "Hood" as seen in tribes Najini or Ophiophagini Tribe nov.

Egg-layers, restricted to the Indian Subcontinent and south-east Asia.

Content: *Bungarus* Daudin 1803.

Tribe Dendroaspini Tribe nov.

(Terminal Taxon: *Dendroaspis polylepis*)

Diagnosis: Separated from all other "palatine erectors" elapids by the following suite of characters: Scales smooth and glossy with 17-25 mid-body rows, 200-281 ventrals, divided anal and 99-132 divided subcaudals. 7-10 supralabials, the third or fourth entering the eye, 9-14 infralabials, 3-4 preoculars and 2-5 (usually 3 or 4) postoculars, temporals are usually variable but usually 2+3; easily separated from all other elapids in the "palatine erectors" by the distinctive elongate coffin-shaped head, defined by the ridge running from the upper nostril above the eye to the temple; has a limited ability to flatten its neck (hood) when agitated or alarmed.

Commonly known as the Mambas these snakes are dangerously venomous.

Adults of over 2 metres in total length are common and specimens over 4 metres are known for the largest species, the Black Mamba (*D. polylepis*).

While of gracile appearance, large specimens do become quite

heavy due to the weight of the mid-section. Strongly diurnal with a round pupil.

Oviparous with clutches of 16-17 eggs reported.

Found in Africa.

Monotypic for the genus *Dendroaspis* Schlegel 1848.

Content: *Dendroaspis* Schlegel 1848.

Tribe Elapsoidini Tribe nov.

(Terminal Taxon: *Elapsoidea sunderwallii*)

Diagnosis: Separated from all other "palatine erectors" elapids by the following suite of characters: Small to medium-sized burrowing elapids with a noticeably small head relative to the body, and just 13 (rarely 15) mid-body rows, 130-180 ventrals, single anal plate and usually paired subcaudals (some rarely single); 7 supralabials with the third and fourth entering the eye; 7 infralabials, 1-2 preoculars and 2 postoculars; scales are smooth and glossy and the snakes are often of bright colours and patterns, usually in the form of cross-bands; these snakes do not spread a hood when agitated.

Endemic to sub-saharan Africa, these snakes are known as African Garter Snakes.

Egg layers.

Content: *Elapsoidea* Bocage 1866.

Tribe Najini Bonaparte, 1838 (Afroasian Cobras)

(Terminal Taxon: *Naja naja*)

Diagnosis: Separated from all other "palatine erectors" elapids by the following suite of characters: Generally large and stocky snakes that as a rule actively forage and seek prey, when threatened they can raise their forebody and spread a characteristic hood known generally as the "Cobra hood", created by an expansion of the ribs and done to a degree far in excess of all other tribes (excluding Ophiophagini Tribe nov.) as well as an ability to maintain an upright or near upright stance from anywhere between a third to half way down the body (and sometimes even more); single anal plate and all subcaudals are paired; with the exception of genus *Hemachatus*, for all species, scales are smooth and glossy, there are solid teeth on the maxilla, and all are egg-layers; for genus *Hemachatus* the scales are heavily keeled, there are no solid teeth on the maxilla and all are live-bearers.

Separated from Asiatic King Cobras (Ophiophagini Tribe nov.) by the fact that in Ophiophagini Tribe nov. the hood is of even width along the length of the anterior part of the snake's body, as opposed to wide at the back of the neck and narrowing as one moves posterior down the body as seen in Najini snakes. The hood in Ophiophagini Tribe nov. is also proportionately longer and yet proportionately narrower than that seen in snakes of tribe Najina.

Found in Africa (mainly) and also Asia. Miocene fossil records from Europe.

Content: *Aspidelaps* Fitzinger 1843, *Boulengerina* Dollo 1886, *Hemachatus* Fleming 1822, *Naja* Laurenti 1768, *Pseudohaje* Günther 1858, *Spracklandus* Hoser 2009, *Uraeus* Wagler 1830, *Walterinnesia* Lataste 1887.

Subtribe Najina Subtribe nov.

(Terminal Taxon: *Naja naja*)

Diagnosis: Separated from all other "palatine erectors" elapids by the following suite of characters: Generally large and stocky snakes that as a rule actively forage and seek prey, when threatened they can raise their forebody and spread a characteristic hood known generally as the "Cobra hood", created by an expansion of the ribs and done to a degree far in excess of all other tribes (excluding Ophiophagini Tribe nov.) as well as an ability to maintain an upright or near upright stance from anywhere between a third to half way down the body (and sometimes even more); single anal plate and all subcaudals are

paired; for all species, scales are smooth and glossy, there are solid teeth on the maxilla, and all are egg-layers. Separated from the genus *Hemachatus* (Hemachatusina Tribe nov.) by that fact in *Hemachatus*, the scales are heavily keeled, there are no solid teeth on the maxilla and all are live-bearers.

Separated from Asiatic King Cobras (Ophiophagini Tribe nov.) by the fact that in Ophiophagini Tribe nov. the hood is of even width along the length of the anterior part of the snake's body, as opposed to wide at the back of the neck and narrowing as one moves posterior down the body as seen in Najini snakes. The hood in Ophiophagini Tribe nov. is also proportionately longer and yet proportionately narrower than that seen in snakes of tribe Najina.

Found in Africa (mainly) and also Asia. Miocene fossil records from Europe.

Content: *Aspidelaps* Fitzinger 1843, *Boulengerina* Dollo 1886, *Naja* Laurenti 1768, *Pseudohaje* Günther 1858, *Spracklandus* Hoser 2009, *Uraeus* Wagler 1830, *Walterinnesia* Lataste 1887.

Subtribe Hemachatusina Subtribe nov.

(Terminal Taxon: *Hemachatus Heamachatus*)

Diagnosis: Separated from all other "palatine erectors" elapids by the following suite of characters: Generally large and stocky snakes that as a rule actively forage and seek prey, when threatened they can raise their forebody and spread a characteristic hood known generally as the "Cobra hood", created by an expansion of the ribs and done to a degree far in excess of all other tribes (excluding Ophiophagini Tribe nov.) as well as an ability to maintain an upright or near upright stance from anywhere between a third to half way down the body (and sometimes even more); single anal plate and all subcaudals are paired; for all species the dorsal scales are heavily keeled, there are no solid teeth on the maxilla and all are live-bearers; this contrasts with all others in the tribe Najini (subtribe Najina subtribe nov.) where for all species, scales are smooth and glossy, there are solid teeth on the maxilla, and all are egg-layers; separated from Asiatic King Cobras (Ophiophagini Tribe nov.) by the fact that in Ophiophagini Tribe nov. the hood is of even width along the length of the anterior part of the snake's body, as opposed to wide at the back of the neck and narrowing as one moves posterior down the body as seen in Najini snakes; the hood in Ophiophagini Tribe nov. is also proportionately longer and yet proportionately narrower than that seen in snakes of tribe Najina.

Common name is Rhinkal and is endemic to southern Africa.

Content: *Hemachatus* Fleming 1822

Ophiophagini Tribe nov.

(Terminal Taxon: *Ophiophagus hannah*)

Diagnosis: Separated from all other "palatine erectors" elapids by the following suite of characters: Body proportionate to length, head is wider than neck, in addition to other head shields, these snakes possess a pair of occipital shields just posterior to the parietals on the upper surface of the head; 7 supralabials with the third in contact with both the nasal scale and the eye; Scales smooth with 15 mid body rows, 240-254 ventrals, 84-104 subcaudals, all divided except for the first 5-7 anterior ones; colour is both geographically variable and also changes with age; oviparous; in Asiatic King Cobras (Ophiophagini Tribe nov.) the hood is of even width along the length of the anterior part of the snake's body, as opposed to wide at the back of the neck and narrowing as one moves posterior down the body as seen in tribe Najini snakes; the hood in Ophiophagini Tribe nov. is also proportionately longer and yet proportionately narrower than that seen in snakes of tribe Najina.

These snakes, known as "King Cobra" are the largest elapids in the world, averaging 3-4 metres and reputedly attaining over 5 metres. Restricted to southern Asia.

The genus name *Ophiophagus* refers to this taxon's habits of feeding on other snakes.

As of 2012 most authorities regard *Ophiophagus* as a monotypic genus. However it is my considered view that several species are involved.

Content: *Ophiophagus* Günther 1864.

Subfamily Elapinae Boie, 1827 (Coral Snakes)

Diagnosis: Separated from all other "palatine erectors" elapids by the following suite of characters: Slender and cylindrical body; oviparous, 13-17 mid-body rows; unable to flare the neck into a hood.

Content: *Calliophis* Gray 1834, *Hemibungarus* Peters 1862, *Leptomicrourus* Schmidt 1937, *Maticora* Gray 1834, *Micruroides* Schmidt 1928, *Micrurus* Wagler 1824, *Parapistocalamus* Roux 1934, *Sinomicrurus* Slowinski *et al.*, 2001.

Tribe Elapini Boie, 1827 (North American-North Asiatic Coral Snakes)

(Terminal Taxon: *Micrurus spixii*)

Diagnosis: Separated from all other tribes in the subfamily elapinae by elimination of the two tribes Maticorni tribe nov. and Parapistocalamini Tribe Nov. as diagnosed below; but most easily separated by the fact they have 15-17 mid body rows versus 13-15 mid body rows in tribes Maticorini Tribe Nov. and Parapistocalamini Tribe Nov..

Oviparous, with small eyes and round pupils, two or four pairs of chinshields in all snakes, 159-382 ventrals and 12-62 subcaudals; most have the third or fourth supralabials in contact with the eye; most have a colour pattern of some combination of red, yellow or white and black, usually in rings; usually a pale parietal or occipital ring is followed by a black nuchal ring.

The genus *Micrurus* as generally recognised as of start 2012 is clearly paraphyletic (refer to Campbell and Lamar (2004).

As a result, in a separate paper (published at the same time as this one), a new genus *Hoserelapidea* gen. nov. has been erected and diagnosed. Within that genus, subgenera *Binghamus* and *Troianous* have also been erected and diagnosed.

Content: *Leptomicrourus* Schmidt 1937, *Micruroides* Schmidt 1928, *Micrurus* Wagler 1824, *Hoserelapidea* gen. nov. (see paper by Hoser 2012b).

Tribe Maticorini Tribe Nov. (South Asiatic Coral Snakes)

(Terminal Taxon: *Calliophis intestinalis*)

Diagnosis: Separated from all other "palatine erectors" elapids by the following suite of characters: round pupil, shiny smooth scales, usually with bright markings or colour, including often with a bright mid-vertebral stripe and bright coloured posterior including the tail, flash colours on the venter in the form of well-defined alternating bands or blotches, slightly flattened head and somewhat cylindrical body, divided anal, 13 mid-body rows, single anal, 190-280 ventrals, 15-40 divided subcaudals, no loreal; venom gland apparatus apparently breaches the back of the head to run into the neck.

Oviparous.

Content: *Calliophis* Gray 1834, *Hemibungarus* Peters 1862, *Maticora* Gray 1834, *Sinomicrurus* Slowinski *et al.*, 2001.

Tribe Parapistocalamini Tribe Nov.

(Terminal Taxon: *Parapistocalamus hedigeri*)

Diagnosis: Separated from all other Australasian and Papuan elapids (subfamily Hydrophiinae) by the presence of a maxillary diastema (toothless gap) behind the fangs. Separated from all others in the subfamilies Elapinae and Bungainae by the following suite of characters: Small (under 60 cm total length, with a head slightly distinct from the neck, small eye and round pupil; while the head and body are a unicolour brownish a thick light cross-band may be present on the rear of the head or neck,

most commonly only including the parietals (dorsally) and other scales laterally, both lip and lowest dorsal scales are lighter, ventrally yellow or light brown, while the tail is similar or suffused with grey; scalation is smooth and glossy with 15 mid-body rows, 159-169 ventrals, single or divided anal, 32-35 paired subcaudals, no loreals or suboculars, usually 6 supralabials with the third and fourth in contact with the eye, no preocular, or if present either in contact with the nasal scale or prevented from contact by a downward process of the prefrontal and a single postocular.

Known only from Bougainville with one species *P. hedigeri* formally described and recognised.

Content: *Parapistocalamus* Roux 1934.

Subfamily Hydrophiinae Werner, 1890 (Palatine draggers)

Diagnosis: McDowell (1970) split the elapid snakes into two main groups, based on based on the morphology and inferred movements of their palatine bone during prey transport (swallowing).

In the group he called the "palatine erectors", the palato-ptyergoid joint flexes ventrally during upper jaw protraction.

By contrast in the group he called the "palatine draggers" the palato-ptyergoid joint flexes laterally with maxillary rotation when the mouth opens and the jaw apparatus is protracted and slightly ventrally during mouth closing.

In draggers, the anterior end of the palatine also projects rostrally during protraction, unlike the stability of the anterior end seen in erectors. Palatine draggers differ from palatine erectors in four structural features of the palatine and its relationships to surrounding elements (Deufel and Cundall 2010).

Palatine draggers include all Australasian elapids and sea snakes (this subfamily), with the exception of the monotypic *Parapistocalamus hedigeri* from Bougainville Island (north of New Guinea) which is within the subfamily Elapinae as defined within this paper.

Palatine erectors includes all elapids from Africa, continental Eurasia and the Americas as well as *Parapistocalamus*.

Content: See lists for each tribe.

Tribe Acanthophiini Dowling, 1967

(Terminal Taxon: *Acanthophis antarcticus*)

Diagnosis: Live bearing, medically significant elapids, with adults ranging from dangerous to highly dangerous to humans.

These snakes are separated from all other land-dwelling (non-sea snake) elapids by either of the following: 1/ The presence of a soft spine on the end of the tail and subocular scales (genus *Acanthophis*). 2/ Single subcaudals and heavily keeled scales (*Tropidechis*), or single subcaudals, more-or-less smooth scales, single anal plate, 13-21 mid-body rows, ventrals either keeled or unkeeled and the lateral scales adjoining the ventrals are noticeably enlarged.

Content: *Acanthophis* Daudin 1803, *Austrelaps* Worrell 1963, *Echiopsis* Fitzinger 1843, *Hoplocephalus* Wagler 1830, *Notechis* Boulenger 1896, *Tropidechis* Gunther 1863.

Subtribe Acanthophiina Subtribe nov.

(Terminal Taxon: *Acanthophis antarcticus*)

Diagnosis: The only Australian elapid snake which possesses a then rat-like tail that ends in a soft spine. It is also the only Australian elapid with subocular scales.

The tail, which often ends in a block of scales one colour (such as black, white or yellow) is used as a caudal lure.

All are stout in build, with a flattened head, these snakes usually having an ambush predator feeding strategy. Large fangs.

While most have at least some slightly keeled scales, the various species range from smooth-bodied snakes to highly rugose.

19-23 mid body rows, 100-160 ventrals (most species around 120-122), 35-65 subcaudals of which the anterior are single and posterior divided.

In habit, these snakes typically rest in a horse-shoe position or similar with the tail resting near the head.

Separated from other Australian elapids by the characters described for the tribe Acanthophiini.

Content: *Acanthophis* Daudin 1803.

Subtribe Hoplocephalina Subtribe nov.

(Terminal Taxon: *Hoplocephalus bungaroides*)

Diagnosis: Separated from all others in the tribe Acanthophiini by the strongly keeled or notched ventrals. Also has 19-21 mid body rows and more than 190 ventrals (versus well below 190 ventrals in all others in the tribe).

Separated from other Australian elapids by the characters described for the tribe Acanthophiini.

Content: *Hoplocephalus* Wagler 1830.

Subtribe Notechiina Subtribe nov.

(Terminal Taxon: *Notechis scutatus*)

All subcaudals single.

Separated from Hoplocephalina by having less than 190 ventrals and unkeeled ventrals.

Separated from Acanthophiina by having no divided subcaudals or soft tail spine.

Separated from other Australian elapids by the characters described for the tribe Acanthophiini.

Content: *Austrelaps* Worrell 1963, *Echiopsis* Fitzinger 1843, *Notechis* Boulenger 1896, *Tropidechis* Gunther 1863.

Tribe Aipysurini Tribe nov.

(Terminal taxon: *Aipysurus laevis*)

Diagnosis: In common with all sea snakes, they are identified by the presence of a vertically flattened, paddle-shaped tail, valvular nostrils and a lingual fossa (which is a depressed area that may appear on the lingual surface of selected anterior teeth).

These are moderate to large sea snakes, known mainly from the Australian region, including New Guinea and the Coral Sea east to New Caledonia.

Separated from all other sea snakes by the following suite of characters; large ventral scales, each at least three times as large as the adjacent body scales, nasals in contact, six or more supralabials, posterior chin shields are usually reduced and separated by one or more small scales and a preocular scale is present, 120-195 ventrals.

Alternatively, (in the case of *Emydocephalus*), the genus is separated from all other sea snakes by the possession of only three supralabials, the second being very elongated and below the eye.

The tribe contains the following described genera, *Aipysurus* (including other sometimes recognised genera *Oceanius*, *Pelagophis*, *Smithohydrophis*, *Stephanohydra*, *Tomogaster*), and *Emydocephalus*.

Content: *Aipysurus* Lacépède 1804, (including other sometimes recognised genera *Oceanius* Wells 2007, *Pelagophis* Peters and Doria 1878, *Smithohydrophis* Kharin 1981, *Stephanohydra* Tschudi 1837, *Tomogaster* Gray 1849), *Emydocephalus* Krefft 1869.

Tribe Apistocalamini Dowling, 1967

(Terminal taxon: *Ogmodon vitianus*)

Diagnosis: A small snake of medium build, with an elongate head and rounded snout.

The tail is relatively short.

Very large symmetrical head shields, including two extremely

large parietals not seen in any other elapids. Juveniles have a white crown running across the posterior two thirds of the parietals which fades with age. The colouration is normally shiny.

Juveniles are also darker than adults, almost black compared with a smokey-grey. Lays a small number of eggs (2-5 reported).

The venom toxicity is unknown, but not thought medically significant.

Content: *Ogmodon* Peters 1864.

Tribe Demansini Tribe nov.

(Terminal Taxon: *Demansia psammophis*)

Diagnosis: Separated from all other Australasian land dwelling (non-sea snake) elapids by the following suite of characters.

Adults have an eye that has a diameter far greater than its distance from the mouth (jaw-line), smooth scales, 15 mid-body rows, nasal and pre-ocular scales in contact, 35 or more all divided subcaudals, divided anal, no suboculars and 7-14 solid maxillary teeth following the fang.

These are fast-moving whip-like diurnal snakes. One or more species is usually found in most parts of Australia and New Guinea, with the exception of the coldest parts, including Tasmania. As a rule these snakes have a strong dietary preference for skinks.

Egg-layers.

Content: *Demansia* Gray 1842.

Tribe Denisonini Tribe nov.

(Terminal Taxon: *Denisonia maculata*)

Diagnosis: Separated from all other Australasian land dwelling (non-sea snake) elapids by the following suite of characters. Smooth-scalation with preocular in contact with the nasal, frontal longer than broad, at least one and a half times as broad as the supraocular, internasals present, suboculars absent, two large triangular parietals joined for three quarters of their length, 3-5 small, solid maxillary teeth follow the fang, 17 mid body rows, 120-150 ventrals, single anal, usually less than 40 all single subcaudals.

These are small to medium cryptozoic snakes found in the eastern half of continental Australia, usually associated with watercourses and floodplains or alternatively found in moist or riparian habitats.

All are usually nocturnal, being found by day sheltering under hard cover at ground level and especially fond of sheets of tin and other man-made cover.

Live-bearing.

Content: *Denisonia* Krefft 1869, *Drysdalia* Worrell 1961.

Tribe Ephalophini Burger and Natsuno, 1975

(Terminal taxon: *Ephalophis greyi*)

Diagnosis: In common with all sea snakes, they are identified by the presence of a vertically flattened, paddle-shaped tail, valvular nostrils and a lingual fossa (which is a depressed area that may appear on the lingual surface of selected anterior teeth).

Separated from all other sea snakes by the following suite of characters; wide ventral scales 3-5 times as wide as the adjacent body scales, fewer than 30 rows at the mid-body large posterior chin shields bordering on the mental groove, separated by a small scale and a pre-ocular scale is present.

Spine-like keels in *Ephalophis*. Smooth body scales in *Parahydrophis*.

Content: *Ephalophis* Smith 1931, *Parahydrophis* Burger and Natsuno 1934.

Subtribe Ephalophina Subtribe nov.

(Terminal taxon: *Ephalophis greyi*)

Diagnosis: In common with all sea snakes, they are identified

by the presence of a vertically flattened, paddle-shaped tail, valvular nostrils and a lingual fossa (which is a depressed area that may appear on the lingual surface of selected anterior teeth).

Separated from all other sea snakes by the following suite of characters; wide ventral scales 3-5 times as wide as the adjacent body scales, fewer than 30 rows at the mid-body large posterior chin shields bordering on the mental groove, separated by a small scale and a pre-ocular scale is present.

Separated from Parahydrophina by having spine-like keels on the scales.

Content: *Ephalophis* Smith 1931.

Subtribe Parahydrophina Subtribe nov.

(Terminal taxon: *Parahydrophis mertoni*)

Diagnosis: In common with all sea snakes, they are identified by the presence of a vertically flattened, paddle-shaped tail, valvular nostrils and a lingual fossa (which is a depressed area that may appear on the lingual surface of selected anterior teeth).

Separated from all other sea snakes by the following suite of characters; wide ventral scales 3-5 times as wide as the adjacent body scales, fewer than 30 rows at the mid-body large posterior chin shields bordering on the mental groove, separated by a small scale and a pre-ocular scale is present.

Separated from Ephalophina by having smooth body scales.

Content: *Parahydrophis* Burger and Natsuno 1934.

Tribe Furinini Tribe nov.

(Terminal Taxon: *Furina diadema*)

Diagnosis: Separated from all other Australasian land dwelling (non-sea snake) elapids by the following suite of characters: shiny smooth scales, 15-21 mid-body rows, divided anal plate, 25-70 all divided subcaudals, divided or undivided nasal that's widely separated from the preocular, no suboculars; the head is invariably darker than the body; there is also one of the following: 1/ a contrasting red, orange, yellowish or pale cream patch across the nape, especially in younger specimens (Genera *Furina* and *Glyphodon*) or; 2/ a characteristic yellow or whitish band at least partly encircling the top of the head, often incorporating a narrow to broad post-crainal nape (Genus *Cacophis*); seven or more solid maxillary teeth follow the fang, ventrally the colour is an immaculate white or cream; never exceeds a metre in total length, as a rule most species attain less than half this length.

Oviparous, with recorded clutches under 10 eggs that are usually elongate in shape.

Known as skink feeders, diet may include other small vertebrates.

Content: *Cacophis* Günther 1863, *Furina* Duméril 1853, *Glyphodon* Günther 1858

Tribe Hemiaspini Tribe Nov.

(Terminal Taxon: *Hemiaspis signata*)

Diagnosis: Separated from all other Australasian land dwelling (non-sea snake) elapids by the following suite of characters: These are moderately built snakes, the tail does not end in a soft spine, all subcaudals are undivided, the scales are smooth, the anal is normally divided and the subcaudals all single.

Further identified and separated by the following characters: Blunt snout, smooth scales with 17 mid-body rows, internasals present, no suboculars, 3-5 small solid maxillary teeth following the fang. The dorsal colouration is usually olive to brown, although both albinos and melanistic individuals are known. Normally, there is black pigment between the scales. Eye large and pupil round.

Only two described species within the one genus within this tribe.

Usually if not always diurnal in the case of *H. signata*, although *H. damelli* becomes crepuscular to nocturnal in warm weather.

The snakes are generally under 60 cm in total length, but rarely females of *Hemiaspis signata* may exceed this. Restricted to coastal and inland eastern Australia.

Live bearing with recorded litter sizes to 20, but less than half this number is more common.

Occupies a range of habitats where they occur, but in drier inland areas, invariably associated with watercourses. These snakes are especially partial to man-made rubbish such as car doors, sheets of tin and the like as found at rubbish tips.

Diet seems to consist mainly of skinks and small frogs.

While the bites from these snakes are not regarded as medically significant, there are reports of herpetologists bitten becoming quite ill and being taken to hospital, when bitten by large specimens of *H. signata*. It should be noted that most specimens found by snake collectors in Australia are "free handled" and rarely if ever bite.

Content: *Hemiaspis* Fitzinger 1860.

Content of genus *Hemiaspis*: *H. damelli* (Günther 1876), *H. signata* (Jan 1859)

Tribe Hulimkini Tribe Nov.

(Terminal taxon: *Hulimkai fasciata*)

Diagnosis: Separated from all other Australasian and Melanesian land dwelling (non-sea snake) elapids by the following suite of characters: No suboculars or curved tail spine at the end of the tail; the scalation is smooth and shiny with 17 (rarely 19) mid body rows; 140-185 ventrals that are not in any way keeled or notched; no suboculars; frontal longer than broad and more than one and half times as broad as the supraocular; no barring of the labials; internasals present; 20-40 all single subcaudals, single anal; 3-7 small solid maxillary teeth follow the fang; eye is of a medium size, the latter trait separating this snake from all other species of the genera (*Cryptophis* Worrell 1961, *Parasuta* Worrell 1961, *Rhinoplocephalus* Müller 1885, *Suta* Worrell 1961, *Unechis* Worrell 1961)(known herein as Tribe Sutini Tribe Nov.)(refer to elsewhere in this paper); further separated from snakes within Tribe Sutini Tribe Nov. by the fact that snakes (one species only) within this tribe have a well-defined dorsal pattern consisting of dark (near black) and lighter (usually brown) blotches on the dorsal surface forming a general patterned appearance not seen in the species within Tribe Sutini Tribe Nov..

A western Australian endemic, it is further separated from Tribe Sutini Tribe Nov. snakes by its proportionately longer body.

Note the relevant taxon identified here is seen in most texts under the name *Suta fasciata* (e.g. Cogger 2000) or *Denisonia fasciata* (e.g. Shine 1985), but was placed in a new genus *Hulimkai* gen. nov. in a paper published simultaneously with this.

Content: *Hulimkai* gen. nov. (see Hoser 2012c)

Content Genus *Hulimkai* gen. nov.: *Hulimkai fasciata* (Rosen 1905).

Tribe Hydrelapini Tribe nov.

(Terminal taxon: *Hydrelaps darwinensis*)

Diagnosis: In common with all sea snakes, they are identified by the presence of a vertically flattened, paddle-shaped tail, valvular nostrils and a lingual fossa (which is a depressed area that may appear on the lingual surface of selected anterior teeth).

Separated from all other sea snakes by the following suite of characters; large ventrals, at least three times wide as the adjacent body scales, numbering 163-172, anal divided, 27-39 usually single subcaudals, but occasionally some anterior ones are divided, no preocular scale, nasal scales in broad contact, six or more supralabials, posterior chin shields at least as large as the anterior chin shields which are separated by the mental

groove. Scales are smooth and imbricate, with 25-30 mid body rows. Fangs are followed by 3-6 solid maxillary teeth.

Colouration is cream or yellowish above, the body having 35-45 dark rings or cross-bands, each roughly twice as broad as the paler interspaces and usually complete on the belly. Sometimes the bands are displaced on the vertebral line. 5-8 complete dark rings on the tail.

The subcaudals are sometimes completely black. The head is blackish, with cream or yellow variegations. The head shields are enlarged and regular. Preocular scales are absent, the prefrontal borders the eye.

The single known species *Hydrelaps darwinensis* Boulenger 1896 is commonly encountered on mudflats associated with mangroves.

Content: *Hydrelaps* Boulenger 1896.

Tribe Hydrophiini Fitzinger, 1843

(Terminal taxon: *Hydrophis gracilis*)

Diagnosis: In common with all sea snakes, they are identified by the presence of a vertically flattened, paddle-shaped tail, valvular nostrils and a lingual fossa (which is a depressed area that may appear on the lingual surface of selected anterior teeth).

In the absence of features that would place sea snakes another tribe, the sea snake must be within this tribe.

Diagnoses of other tribes follows herein as part of this diagnosis as their exclusions from this tribe forms part of the diagnosis of this tribe.

Tribe Aipysurini Tribe nov. are separated by the following characteristics. These are moderate to large sea snakes, known mainly from the Australian region, including New Guinea and the Coal Sea east to New Caledonia.

Separated from all other sea snakes by the following suite of characters; large ventral scales, each at least three times as large as the adjacent body scales, nasals in contact, six or more supralabials, posterior chin shields are usually reduced and separated by one or more small scales and a preocular scale is present, 120-195 ventrals.

Alternatively, (in the case of *Emydocephalus*), the genus is separated from all other sea snakes by the possession of only three supralabials, the second being very elongated and below the eye.

Tribe Ephalophini is separated from all other sea snakes by the following suite of characters; wide ventral scales 3-5 times as wide as the adjacent body scales, fewer than 30 rows at the mid-body large posterior chin shields bordering on the mental groove, separated by a small scale and a pre-ocular scale is present.

Spine-like keels in *Ephalophis*. Smooth body scales in *Parahydrophis*.

Tribe Hydrelapini Tribe nov. is separated from all other sea snakes by the following suite of characters; large ventrals, at least three times wide as the adjacent body scales, numbering 163-172, anal divided, 27-39 usually single subcaudals, but occasionally some anterior ones are divided, no preocular scale, nasal scales in broad contact, six or more supralabials, posterior chin shields at least as large as the anterior chin shields which are separated by the mental groove. Scales are smooth and imbricate, with 25-30 mid body rows. Fangs are followed by 3-6 solid maxillary teeth.

Colouration is cream or yellowish above, the body having 35-45 dark rings or cross-bands, each roughly twice as broad as the paler interspaces and usually complete on the belly. Sometimes the bands are displaced on the vertebral line. 5-8 complete dark rings on the tail.

The subcaudals are sometimes completely black. The head is blackish, with cream or yellow variegations. The head shields

are enlarged and regular. Preocular scales are absent, the prefrontal borders the eye.

Subfamily Laticaudinae (and tribe Laticaudini) are separated from all other sea snakes by the following suite of characters: imbricate body scales, body with numerous black cross bands, broad ventral scales that are more than half the width of the body, laterally placed nostrils, nasals separated by internasals and the maxillary bone extends beyond the palatine bone.

Unlike all other sea snakes that give birth to live young, these return to land to lay eggs.

These snakes are partly terrestrial, often being found in rocky or coral crevices along shorelines, in mangrove swamps and similar, sometimes a sizeable distance from water.

Aggregations on land are commonly seen.

Content: *Acalyptophis* Boulenger 1896, *Astrotia* Fischer 1856, *Chitulia* Gray 1849, *Disteira* Lacépède 1804, *Enhydrina* Gray 1849, *Hydrophis* Sonnini and Latrielle 1802, *Kerilia* Gray 1849, *Kolpophis* Smith 1926, *Pelamis* Daudin 1803, *Lapemis* Gray 1835, *Leiodelasma* Lacépède 1804, *Microcephalophis* Lesson 1832, *Polyodontognathus* Wall 1921, *Praescutata* Wall 1921, *Thalassophis* Schmidt 1852.

Subtribe Hydrophiina subtribe nov.

(Terminal taxon: *Hydrophis gracilis*)

Diagnosis: Diagnosis for this subtribe is as for the above tribe and by exclusion from the subtribe Pelamiina Subtribe Nov. below.

Subtribe Pelamiina Subtribe nov. is separated from Subtribe Hydrophiina subtribe nov. by the following suite of characters; large head, not particularly distinct from the thick but slightly narrower neck and a robust body form, small to very small scales. The ventrals are small, rarely much larger than the adjacent body scales and often barely recognisable posteriorly. The head shields are enlarged and regular. Body scales are juxtaposed.

Tribe Aipysurini Tribe nov. are separated by the following characteristics. These are moderate to large sea snakes, known mainly from the Australian region, including New Guinea and the Coal Sea east to New Caledonia.

Separated from all other sea snakes by the following suite of characters; large ventral scales, each at least three times as large as the adjacent body scales, nasals in contact, six or more supralabials, posterior chin shields are usually reduced and separated by one or more small scales and a preocular scale is present, 120-195 ventrals.

Alternatively, (in the case of *Emydocephalus*), the genus is separated from all other sea snakes by the possession of only three supralabials, the second being very elongated and below the eye.

Tribe Ephalophini is separated from all other sea snakes by the following suite of characters; wide ventral scales 3-5 times as wide as the adjacent body scales, fewer than 30 rows at the mid-body large posterior chin shields bordering on the mental groove, separated by a small scale and a pre-ocular scale is present.

Spine-like keels in *Ephalophis*. Smooth body scales in *Parahydrophis*.

Tribe Hydrelapini Tribe nov. is separated from all other sea snakes by the following suite of characters; large ventrals, at least three times wide as the adjacent body scales, numbering 163-172, anal divided, 27-39 usually single subcaudals, but occasionally some anterior ones are divided, no preocular scale, nasal scales in broad contact, six or more supralabials, posterior chin shields at least as large as the anterior chin shields which are separated by the mental groove. Scales are smooth and imbricate, with 25-30 mid body rows. Fangs are followed by 3-6 solid maxillary teeth.

Colouration is cream or yellowish above, the body having 35-45 dark rings or cross-bands, each roughly twice as broad as the paler interspaces and usually complete on the belly. Sometimes the bands are displaced on the vertebral line. 5-8 complete dark rings on the tail.

The subcaudals are sometimes completely black. The head is blackish, with cream or yellow variegations. The head shields are enlarged and regular. Preocular scales are absent, the prefrontal borders the eye.

Subfamily Laticaudinae (and tribe Laticaudini) are separated from all other sea snakes by the following suite of characters: imbricate body scales, body with numerous black cross bands, broad ventral scales that are more than half the width of the body, laterally placed nostrils, nasals separated by internasals and the maxillary bone extends beyond the palatine bone.

Unlike all other sea snakes that give birth to live young, these return to land to lay eggs.

These snakes are partly terrestrial, often being found in rocky or coral crevices along shorelines, in mangrove swamps and similar, sometimes a sizeable distance from water.

Aggregations on land are commonly seen.

Content: *Acalyptophis* Boulenger 1896, *Astrotia* Fischer 1856, *Chitulia* Gray 1849, *Disteira* Lacépède 1804, *Enhydrina* Gray 1849, *Hydrophis* Sonnini and Latrielle 1802, *Kerilia* Gray 1849, *Leioselasma* Lacépède 1804, *Microcephalophis* Lesson 1832, *Polyodontognathus* Wall 1921, *Thalassophis* Schmidt 1852.

Subtribe Pelamiina Subtribe nov.

(Terminal taxon: *Pelamis platurus*)

Diagnosis: In common with all sea snakes, they are identified by the presence of a vertically flattened, paddle-shaped tail.

Subtribe Pelamiina Subtribe nov. is separated from Subtribe Hydrophiina Subtribe nov. by the following suite of characters; large head, not particularly distinct from the thick but slightly narrower neck and a robust body form, small to very small scales. The ventrals are small, rarely much larger than the adjacent body scales and often barely recognisable posteriorly. The head shields are enlarged and regular. Body scales are juxtaposed.

Pelamis is not like any other sea snake. The monotypic genus, who's sole species has a unique colouration among sea snakes which consists of a large dark brown stripe running along the mid dorsal line, with wider areas of yellow or paler brown on the flanks.

The posterior and tail is yellowish with darker blotches reducing to finer spots.

Content: *Pelamis* Daudin 1803, *Kolpophis* Smith 1926, *Lapemis* Gray 1835, *Praescutata* Wall 1921.

Tribe Micropechiini Tribe nov.

(Terminal Taxon: *Micropechis ikaheka*)

Diagnosis: Separated from all other Australasian and Melanesian land dwelling (non-sea snake) elapids by the following suite of characters: One of the following: 1/ Relatively stocky in build with a relatively short tail, head narrow and only slightly broader and distinct from the neck, eyes very small and with a round pupil; scales are glossy and smooth with 15 mid body rows, 178-223 ventrals, divided anal, 37-55 all paired subcaudals, 6 supralabials with the third and fourth contacting the eye and temprolabial between the fifth and sixth, no loreal or suboculars; while colour is highly variable the head is usually light or dark grey and separated from the neck which has cream or yellow colouration, sometimes tipped with darker pigment; by mid-body the darker pigment becomes a series of darker edged cross-bands or similar markings, increasing in width and frequency as one moves down the snake's body, with this increasing to the tail region which is usually dark or black; ventrally the colour is creamish yellow, edged with black or

brown; labials, throat and chin may be yellow; 2/ alternatively the colour may be strongly banded along the entire body with dark pigment on the snout and a mainly white or light coloured head; alternatively the colour may be more-or-less plain dorsally (although scales may be dark etched) with some specimens showing the partial formation of cross-bands forming from the lower flanks, with a differing scale combination including occasionally a small loreal present, and both single and divided subcaudals; 3/ alternatively, with a slender cylindrical body, narrow flattened head, usually uniform dorsal colouration (except in juveniles (adults rarely), that may have one of the following three; a pale prefrontal band across the snout anterior to the eyes; a pale parietal band across the head posterior to the eyes, or a pale nuchal band across the neck behind the head and variable scalation that may include both divided and undivided anal plate and subcaudals.

Content: *Aspidomorphus* Fitzinger 1843, *Loveridgelaps* McDowell 1970, *Micropechis* Boulenger 1896, *Salomonelaps* McDowell 1970, *Toxicocalamus* Boulenger 1896.

Subtribe Aspidomorphina Subtribe nov.

(Terminal Taxon: *Aspidomorphus muelleri*)

Diagnosis: Separated from all other Australasian and Melanesian land dwelling (non-sea snake) elapids and others in the tribe Micropechiini by the following suite of characters: Snakes of moderate to slender build, usually around 400 mm in total length as adults and never more than 650 mm as adults; head flattened and slightly distinct from the neck which is noticeably narrower but not unduly narrow; shortish tail, small to medium sized eye with a vertically elliptical pupil, although this is hard to determine in specimens by day, colouration is highly variable, but always includes a white bar running from the snouth, below (but joining) the eye and posterior to the neck, where it fuses to the dorsal ventral colour change; dorsally colouration is usually a ground colour and the lighter venter is usually one colour, scalation is smooth and shiny with 15 mid body rows, 138-182 ventrals, divided anal plate, 19-41 subcaudals, no loreal, 6 supralabials, with the third and fourth in contact with the eye, a single preocular in contact with the nasal and second supralabial, 1-2 postoculars and 7 infralabials; known as "Crowned snakes", this is because many individuals have a distinct lighter coloured crown on the top of the head and near neck region, often broken with darker pigment with a wide dark band running on either side of the head broadly in line with the eye and widening posteriorly; when a crown is not present there is usually a change in colour intensity in the scales in the same regions of the head.

Known to inhabit forests to an elevation of at least 1,500 metres.

Content: *Aspidomorphus* Fitzinger 1843.

Subtribe Loveridgelapina Subtribe nov.

(Terminal Taxon: *Loveridgelaps elapoides*)

Diagnosis: Separated from all other Australasian and Melanesian land dwelling (non-sea snake) elapids and others in the tribe Micropechiini by the following suite of characters: a snake of medium (average build), the colour may be strongly banded along the entire body, with bands that may or may not run under the ventral surface; dark pigment on the front of the snout and a mainly white or light coloured head, ending just beyond the back of the skull where an orangeish band commences; alternatively the colour may be more-or-less plain dorsally (although scales may be dark etched) with some specimens showing the partial formation of cross-bands forming from the lower flanks; the scales are smooth and glossy with 17 mid-body rows, 193-218 ventrals, single anal plate, 31-38 all divided subcaudals, no loreal or suboculars, divided or single nasals, usually 7 supralabials, with the third and fourth in contact with the eye, single pre-ocular and 1-2 postoculars.

Large specimens exceeded a metre in total length. Known only from the Solomon Islands. Most commonly seen in rainforests in

proximity to streams.

Content: *Loveridgelaps* McDowell 1970, *Salomonelaps* McDowell 1970.

Subtribe Micropechiina Subtribe nov.

(Terminal Taxon: *Micropechis ikaheka*)

Diagnosis: Separated from all other Australasian and Melanesian land dwelling (non-sea snake) elapids and others in the tribe Micropechiini by the following suite of characters: Relatively stocky in build with a relatively short tail, head narrow and only slightly broader and distinct from the neck, eyes very small and with a round pupil; scales are glossy and smooth with 15 mid body rows, 178-223 ventrals, divided anal, 37-55 all paired subcaudals, 6 supralabials with the third and fourth contacting the eye and temporolabial between the fifth and sixth, no loreal or suboculars; while colour is highly variable the head is usually light or dark grey and separated from the neck which has cream or yellow colouration, sometimes tipped with darker pigment; by mid-body the darker pigment becomes a series of darker edged cross-bands or similar markings, increasing in width and frequency as one moves down the snake's body, with this increasing to the tail region which is usually dark or black; ventrally the colour is creamish yellow, edged with black or brown; labials, throat and chin may be yellow.

Content: *Micropechis* Boulenger 1896.

Subtribe Toxicocalamina Subtribe nov.

(Terminal Taxon: *Toxicocalamus longissimus*)

Diagnosis: Separated from all other Australasian and Melanesian land dwelling (non-sea snake) elapids and others in the tribe Micropechiini by the following suite of characters: Slender cylindrical body, narrow flattened head, usually uniform dorsal colouration (except in juveniles (adults rarely), that may have one of the following three; 1/ a pale prefrontal band across the snout anterior to the eyes; 2/ a pale parietal band across the head posterior to the eyes, 3/ or a pale nuchal band across the neck behind the head; regardless of other colouration or markings the vertebral scale row is generally darker than the adjacent scale rows resulting in the appearance of a darker vertebral stripe, although this is not visible in some individuals; ventral surfaces, throat, supralabials and lowest 2-3 dorsal scale rows are often an immaculate yellow or whitish colour; sometimes a dark median longitudinal stripe is visible running through each lower dorsal row, and a pair of similar stripes may be present on the ventrals continuing to the subcaudals, which are often darker than the more anterior ventrals; the scalation smooth and glossy, with scale counts variable, with anal plate and subcaudals being either divided or single; never more than a metre in total length and usually about half this as adults; oviparous. Unusual among Australasian elapids in having a diet consisting largely of soft bodied invertebrates including earthworms and fly pupae. Fossorial species known to occur in a range of habitats including forests (both lowland and montane), kunai grass and gardens.

Content: *Toxicocalamus* Boulenger 1896.

Tribe Notopseudonajini Tribe nov.

(Terminal Taxon: *Notopseudonaja modesta*)

Diagnosis: Separated from all other Australasian land dwelling (non-sea snake) elapids by the following suite of characters: Shiny smooth scales, 17 mid-body rows, 145-175 ventrals, anal divided, 35-55 divided subcaudals, nasal and pre-ocular scales in contact, no suboculars, 7-12 solid maxillary teeth following the fang; never exceeds a total length of 60 cm.

In common with snakes in the tribes Pseudonajini Tribe nov. and Oxyuranini Tribe nov. these snakes usually have distinct to indistinct markings on the venter (at least the forebody) which are yellow, orange or brown in colour over a lighter whiteish or cream background colour.

Notopseudonajini is separated from the tribes Pseudonajini Tribe nov. (Genera: *Dugitophis*, *Euprepiosoma*, *Placidaserpens*, *Pseudonaja*) and Oxyuranini Tribe nov. by the fact that all species within those tribes/genera have in excess of 175 ventrals.

Further separated from Oxyuranini Tribe nov. by the lack of keeling on the dorsal mid neck scales and the presence of a divided anal.

Oviparous.

Found in most drier parts of Australia, except the south-east.

Most authorities recognise the genus *Notopseudonaja* as containing the single species taxon *N. modesta*. However a notable exception to this is Wells (2002) who recognised three species within the nominal taxon (namely adding *ramsayi* and *sutherlandi*) a view dissented by W. Wüster (see Uetz 2012).

I have seen two series of images of two snakes referable to *N. modesta*, one from western Queensland and one from the Pilbara in West Australia, both of which appear quite clearly to be of different species, the images supplied by Scott Eipper (now of Brisbane, Queensland). As of 2012, he is investigating the taxonomy of *N. modesta* with a view to resolving the species composition of the currently identified (single) taxon.

Content: *Notopseudonaja* Wells 2002.

Tribe Oxyuranini Tribe nov.

(Terminal Taxon: *Oxyuranus scutellus*)

Diagnosis: Separated from all other Australasian and Melanesian land dwelling (non-sea snake) elapids by the following suite of characters; Shiny smooth scales, with slightly keeled scales on the neck (not seen in tribes Notopseudonajini and Pseudonajini) and further separated from those tribes by the fact that the frontal shield is slightly longer than wide as opposed to being more-or-less square in Notopseudonajini and Pseudonajini; suboculars absent, 21-23 mid body rows, 220-250 ventrals, single anal (versus divided in Notopseudonajini and Pseudonajini), 45-80 divided subcaudals; ventral colouration is usually lightish in colour and may include, darker orange, brown or grey, flecks, squiggles, spots, other markings (especially towards the forebody and mid-body) or alternatively be plain and one colour; dorsal colour either uniform above or alternatively may have flecks, bands or combinations thereof, including sometimes blotches.

Oviparous.

Found in the northern 2/3 of continental Australia and also New Guinea.

Content: *Oxyuranus* Kinghorn 1923, *Parademansia* Kinghorn 1955 (the two genera have been merged by many authorities).

Tribe Pseudechini Tribe nov.

(Terminal Taxon: *Pseudechis porphyriacus*)

Diagnosis: Separated from all other Australasian and Melanesian land dwelling (non-sea snake) elapids by the following suite of characters: Smooth shiny scales with 17-19 mid-body rows, and no suboculars; usually but not always, anterior subcaudals are single, giving way to divided ones, however both extremes of all divided and all single are found within the tribe; the anal is usually but not always divided, but when not divided is invariably either partially divided or with a prominent line running down the middle, and by treating it as such, this may be taken to separate these snakes from the physically similar Oxyuranini Tribe Nov.; separated from the physically similar snakes within the tribes Pseudonajini Tribe nov. and Notopseudonajini Tribe nov. by the fact that there are two temporal scales between the fifth upper labial and the parietal scale/s, versus a single one in this position for Pseudonajini Tribe nov. and Notopseudonajini Tribe nov.; further separated from snakes in the tribe Oxyuranini Tribe Nov. by the absence of any scale keeling on the dorsal neck region; thick-set build with wide ventral scales, large eye and round pupil;

adults may exceed 2 metres in total length.

Oviparous (all genera except *Pseudechis*), viviparous (genus *Pseudechis*).

Large diurnal snakes found throughout most parts of continental Australia and southern New Guinea, including nearby islands, except the coldest parts of the southeast and Tasmania.

In warm weather some species may become crepuscular or nocturnal.

Content: *Cannia* Wells and Wellington 1983, *Pailsus* Hoser 1998, *Panacedechis* Wells and Wellington 1985, *Pseudechis* Wagler 1830 (all interpreted variously by different authorities, with the current extreme being all merged into a single genus *Pseudechis*).

Tribe Pseudonajini Tribe nov.

(Terminal Taxon: *Pseudonaja nuchalis*)

Diagnosis: Separated from all other Australasian and Melanesian land dwelling (non-sea snake) elapids by the following suite of characters: Shiny smooth scales, 17-21 mid-body rows, 175-235 ventrals, anal divided, 45-75 divided subcaudals (rarely a few anterior ones single for the taxon *Pseudechis textilis bicucullata*), nasal and preocular scales in contact, no suboculars, 7-12 solid maxillary teeth following the fang; round pupil; adults may exceed a total length of 60 cm, at times adults exceeding 2 metres; in common with snakes in the tribes Pseudonajini Tribe nov. and Oxyuranini Tribe nov. these snakes usually have distinct to indistinct markings on the venter (at least the forebody) which are yellow, orange or brown in colour over a lighter whiteish or cream background colour; Notopseudonajini is separated from the tribes Pseudonajini Tribe nov. (Genera: *Dugitophis*, *Euprepiosoma*, *Placidaserpens*, *Pseudonaja*) and Oxyuranini Tribe nov. by the fact that all species within those tribes/genera have in excess of 175 ventrals; Pseudonajini is separated from Oxyuranini Tribe nov. by the lack of keeling on the dorsal mid neck scales and a divided anal as opposed to single in Oxyuranini Tribe nov..

Oviparous.

These are mainly diurnal snakes, that often chase live prey during daylight hours.

Found in most parts of Australia and New Guinea.

Content: *Dugitophis* Wells 2002, *Euprepiosoma* Fitzinger 1860, *Placidaserpens* Wells 2002, *Pseudonaja* Günther, 1858.

Tribe Simoselapini Tribe nov.

(Terminal Taxon: *Simoselaps bertholdi*)

Diagnosis: Separated from all other Australasian and Melanesian land dwelling (non-sea snake) elapids by the following suite of characters: Body with or without cross-bands, but if unbanded the belly is immaculate white or cream, all have a distinctive pair of black bars on the head, one between and including the eyes and a broader one across the nape; scalation is smooth and shiny with 21 or less mid-body rows, less than 240 ventrals, divided anal, less than 35 subcaudals, with at least some divided; a relatively short tail not ending in a spine of any sort; internasals present; no suboculars separate the eye from the labials; the nasal and preocular scales may be in contact or separated and the rostrum is almost as long as broad, in some species with a sharp anterior shovel-shaped edge; never exceeding 60 cm in total length.

Oviparous.

Found in most drier parts of Australia and the tropics. These snakes are burrowing species usually found on the surface on warm nights.

Content: *Simoselaps* Jan 1859 (includes *Neelaps* Günther 1863).

Tribe Sutini Tribe nov.

(Terminal Taxon: *Suta suta*)

Diagnosis: Separated from all other Australasian and Melanesian land dwelling (non-sea snake) elapids by the following suite of characters: No suboculars or curved tail spine at the end of the tail; the scalation is smooth and shiny with 15 mid body rows (in genera *Cryptophis* and *Rhinoplocephalus*), or 15-21 mid body rows (in genera *Parasuta*, *Suta* and *Unechis*); frontal longer than broad; internasals or supranasals present; no barring of the labials; 20-65 all single subcaudals, single anal; 2-7 small solid maxillary teeth follow the fang; eye ranges from small to medium.

Usually under 60 cm in total length, but one species *Cryptophis nigrescens* has been recorded in excess of 1 metre. It should be noted that *Cryptophis nigrescens* as recognised herein and in current texts (like Cogger 2000) is a composite of species.

Live bearing.

The taxon *Denisonia fasciata* Rosen 1905, placed most recently by most authors in the genus *Suta*, has been formally removed from that genus and placed in a monotypic genus by this author, formally named for the first time (see paper published simultaneously to this in Hoser 2012c). That genus is formally named as *Hulimkai* gen. nov. and it is easily separated from all other snakes in this tribe by both its considerably larger eye size, proportionately longer body and the fact that it is the only taxon among the group with a well-defined dorsal pattern. It is also quite different behaviourally from all others within this tribe.

As a result of these differences, that taxon is placed in a separate tribe defined within this paper, namely Hulimkini Tribe Nov..

Some authors, including Cogger 2000, have merged the genera within this tribe as listed below into two, namely *Rhinoplocephalus* (incorporating *Cryptophis* and *Rhinoplocephalus*) and *Suta* (incorporating *Parasuta*, *Suta* and *Unechis*). However the Cogger 2000 position is opposed by Wells (various papers) and others including Wilson and Swan (2003).

Content: *Cryptophis* Worrell 1961, *Parasuta* Worrell 1961, *Rhinoplocephalus* Müller 1885, *Suta* Worrell 1961, *Unechis* Worrell 1961.

Tribe Vermicellini Tribe nov.

(Terminal Taxon: *Vermicella annulata*)

Diagnosis: Separated from all other Australasian and Melanesian land dwelling (non-sea snake) elapids by the fact that the body colour pattern consists of alternate black and white bands.

Further separated by the following suite of characters: head relatively indistinct from neck, cylindrical build and of relatively even thickness throughout the entire body length, except near the rear of the body and tail; very short tails with less than 35 subcaudals, all of which are divided, smooth glossy scales, with 15 mid-body rows and no suboculars, 180-290 ventrals, divided anal plate.

These snakes rarely if ever bite humans. Most are found crossing roads at night and they occur in most parts of continental Australia. The only genus in the tribe *Vermicella* has had several species described, but not all are currently recognised within the herpetological community, indicating the need for further research to determine the status of the various forms.

Content: *Vermicella* Günther 1858.

Subfamily Laticaudinae Cope 1879 (Sea Kraits)

(Terminal taxon: *Laticauda laticaudata*)

Diagnosis: In common with all sea snakes, they are identified by the presence of a vertically flattened, paddle-shaped tail.

They are separated from all other sea snakes by the following suite of characters: imbricate body scales, body with numerous black cross bands, broad ventral scales that are more than half the width of the body, laterally placed nostrils, nasals separated by internasals and the maxillary bone extends beyond the

palatine bone.

Unlike all other sea snakes that give birth to live young, these return to land to lay eggs.

These snakes are partly terrestrial, often being found in rocky or coral crevices along shorelines, in mangrove swamps and similar, sometimes a sizeable distance from water.

Aggregations on land are common.

Content: *Laticauda* Laurenti 1768, *Pseudolaticauda* Kharin 1984.

Tribe Laticaudini Cope 1879

(Terminal taxon: *Laticauda laticaudata*)

Diagnosis: See as for subfamily (above).

In common with all sea snakes, they are identified by the presence of a vertically flattened, paddle-shaped tail.

They are separated from all other sea snakes by the following suite of characters: imbricate body scales, body with numerous black cross bands, broad ventral scales that are more than half the width of the body, laterally placed nostrils, nasals separated by internasals and the maxillary bone extends beyond the palatine bone.

Unlike all other sea snakes that give birth to live young, these return to land to lay eggs.

These snakes are partly terrestrial, often being found in rocky or coral crevices along shorelines, in mangrove swamps and similar, sometimes a sizeable distance from water.

Aggregations on land are common.

Content: *Laticauda* Laurenti 1768, *Pseudolaticauda* Kharin 1984.

FAMILY: HOMOROSELAPIDAE FAMILY NOV.

(Terminal Taxon: *Homoroselaps lacteus*)

Diagnosis: Separated from all other Elapids, Colubrids and Atractaspididae by the following suite of characters: Never more than 65 cm total length as an adult, usually averaging 20-40 cm; very thin with a build bordering on cylindrical with body thickness being very thin and very similar along the entire length of the body to near the tail; head small, relatively short and marginally distinct from the neck; 15 mid body rows, 160-239 ventrals, divided anal plate, 22-43 paired subcaudals, tail medium to short in length; 6 Upper labials, numbers 3 and 4 entering the eye, 5-6 lower labials, as well as one pre-ocular and one post-ocular, temporals are either 0+1 or 1+1; while colour is somewhat variable, the pattern and configuration is quite unlike any other snake; it invariably is glossy and blackish on top, with orange running along the mid dorsal line either broken or unbroken, often running on top of a dorsal pattern of large black blotches etched with thick yellow reticulations, the pattern sometimes being reduced to black with a white spot in the centre of each scale, or somewhere between the two configurations listed, or alternatively mainly black dorsally with a thick yellow or orange line running along the spine, commencing at the snout and yellow or orange along the flanks, separated from the black by a well-defined boundary on the mid flanks; in all cases the yellow or orange mid-dorsal line commences on the head from in front of the eye, even if broken by black; possesses fangs and venom; oviparous, with clutches up 16 eggs recorded, although less than half this number is more common; recorded diet consists exclusively of smaller reptiles.

Of immediate note to anyone who sees these snakes is their extremely small size. While they live and feed at ground level, they are not regarded as burrowers.

Comments: These snakes are commonly called the African Harlequin Snakes, or less often African Coral Snakes. The venom is not regarded as being of medical significance and due to the tiny size of the snake, it's extremely small gape and reluctance to bite, bites are not common. In 2009 I was bitten by an adult *Homoroselaps lacteus* in Cape Town South Africa

(after pushing the snake's limits of patience by tormenting it for filming and photography for some time) and suffered nothing more than extremely minor pain, even though both fangs penetrated the skin.

Reports of pain suffered from bites from these snakes may be exaggerated by persons bitten, including those with little expertise with snakes and great fears about the consequences of a bite.

Based on the fact that these snakes remain common in built up areas, they cannot be regarded as under any known threat of extinction. They appear to be endemic to South Africa.

The specimen I found in Cape Town in 2009 was found in mid winter on a sunny day under a car tyre next to a fence on the side of the main N2 highway near the general vicinity of Mfuleni, (adjacent to the only partially demolished brick house surrounded by grassed area near the road in the area between Cape Town airport and Sir Lowry's Pass). The nearby area was disused land with sandy soil and numerous man made dirt mounds in the area. It was inactive, but fast moving due to it's basking under a piece of exposed cover. While this snake would wriggle to escape, this action would reduce or cease if the snake was balled-up and held within enclosed hands. Two and a half week's of intensive collecting around Cape Town and environs, including in optimal habitat such as that around rubbish dumps in sandy habitat near Mitchells Plain failed to yield any other specimens of this taxon.

Marias 2004, reports that the species *lacteus* is sometimes locally common and that it's only cogener *dorsalis*, from the east of South Africa is rare and seldom seen.

In terms of *dorsalis*, the apparent rarity may be due to secretive behaviour of the snake rather than a genuine lack of specimens in the wild.

Content: *Homoroselaps* Jan 1858.

TRIBE HOMOROSELAPIINI

(Terminal Taxon: *Homoroselaps lacteus*)

Diagnosis: Separated from all other elapids, colubrids and Atractaspididae by the following suite of characters: Never more than 65 cm as an adult, usually averaging 20-40 cm; very thin with a build bordering on cylindrical with body thickness very similar along the entire length of the body to near the tail; head small, relatively short and marginally distinct from the neck; 15 mid body rows, 160-239 ventrals, divided anal plate, 22-43 paired subcaudals, tail medium to short in length; 6 Upper labials, numbers 3 and 4 entering the eye, 5-6 lower labials, as well as one pre-ocular and one post-ocular, temporals are either 0+1 or 1+1; while colour is somewhat variable, the pattern and configuration is quite unlike any other snake; it invariably is glossy and blackish on top, with orange running along the mid dorsal line either broken or unbroken, often running on top of a dorsal pattern of large black blotches etched with thick yellow reticulations, the pattern sometimes being reduced to black with a white spot in the centre of each scale, or somewhere between the two configurations listed, or alternatively mainly black dorsally with a thick yellow or orange line running along the spine, commencing at the snout and yellow or orange along the flanks, separated from the black by a well-defined boundary on the mid flanks; in all cases the yellow or orange mid-dorsal line commences on the head from in front of the eye, even if broken by black; possesses fangs and venom; oviparous, with clutches up 16 eggs recorded, although less than half this number is more common; recorded diet consists exclusively of smaller reptiles.

Of immediate note to anyone who sees these snakes is their extremely small size. While they live and feed at ground level, they are not regarded as burrowers.

While venomous, the bites are not of medical significance.

Content: *Homoroselaps* Jan 1858.

Genus content *Homoroselaps* Jan 1858: *H. lacteus* (Linnaeus 1758), *H. dorsalis* (Smith 1849).

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SUMMARY OF CURRENT ELAPID CLASSIFICATION (HOSER 2012)

FAMILY ELAPIDAE BOIE, 1827

Subfamily Bungarinae Eichwald, 1831 (Cobras)

Content: See within each tribe.

Tribe Bungarini Eichwald, 1831 (Asiatic Cobras)

(Terminal Taxon: *Bungarus candidus*)

Content: *Bungarus* Daudin 1803.

Tribe Dendroaspini Tribe nov.

(Terminal Taxon: *Dendroaspis polylepis*)

Content: *Dendroaspis* Schlegel 1848.

Tribe Elapsoidini Tribe nov.

(Terminal Taxon: *Elapsoidea sunderwallii*)

Content: *Elapsoidea* Bocage 1866.

Tribe Najini Bonaparte, 1838 (Afroasian Cobras)

(Terminal Taxon: *Naja naja*)

Content: *Aspidelaps* Fitzinger 1843, *Boulengerina* Dollo 1886, *Hemachatus* Fleming 1822, *Naja* Laurenti 1768, *Pseudohaje* Günther 1858, *Spracklandus* Hoser 2009, *Uraeus* Wagler 1830, *Walterinnesia* Lataste 1887.

Subtribe Najina Subtribe nov.

(Terminal Taxon: *Naja naja*)

Content: *Aspidelaps* Fitzinger 1843, *Boulengerina* Dollo 1886, *Naja* Laurenti 1768, *Pseudohaje* Günther 1858, *Spracklandus* Hoser 2009, *Uraeus* Wagler 1830, *Walterinnesia* Lataste 1887.

Subtribe Hemachatusina Subtribe nov.

(Terminal Taxon: *Hemachatus Heamachatus*)

Content: *Hemachatus* Fleming 1822

Ophiophagini Tribe nov.

(Terminal Taxon: *Ophiophagus hannah*)

Content: *Ophiophagus* Günther 1864.

Subfamily Elapinae Boie, 1827 (Coral Snakes)

Content: *Calliophis* Gray 1834, *Hemibungarus* Peters 1862, *Leptomicrourus* Schmidt 1937, *Maticora* Gray 1834, *Micruroides* Schmidt 1928, *Micrurus* Wagler 1824, *Parapistocalamus* Roux 1934, *Sinomicrurus* Slowinski et al., 2001.

Tribe Elapini Boie, 1827 (North American-North Asiatic Coral Snakes)

(Terminal Taxon: *Micrurus spixii*)

Content: *Leptomicrourus* Schmidt 1937, *Micruroides* Schmidt 1928, *Micrurus* Wagler 1824, *Hoserelapidea* gen. nov. (see paper by Hoser 2012b).

Tribe Maticorini Tribe Nov. (South Asiatic Coral Snakes)

(Terminal Taxon: *Calliophis intestinalis*)

Content: *Calliophis* Gray 1834, *Hemibungarus* Peters 1862, *Maticora* Gray 1834, *Sinomicrurus* Slowinski et al., 2001.

Tribe Parapistocalamini Tribe Nov.

(Terminal Taxon: *Parapistocalamus hedigeri*)

Content: *Parapistocalamus* Roux 1934.

Subfamily Hydrophiinae Werner, 1890 (Palatine draggers)

Content: See lists for each tribe.

Tribe Acanthophiini Dowling, 1967

(Terminal Taxon: *Acanthophis antarcticus*)

Content: *Acanthophis* Daudin 1803, *Austrelaps* Worrell 1963, *Echiopsis* Fitzinger 1843, *Hoplocephalus* Wagler 1830, *Notechis* Boulenger 1896, *Tropidechis* Günther 1863.

Subtribe Acanthophiina Subtribe nov.

(Terminal Taxon: *Acanthophis antarcticus*)

Content: *Acanthophis* Daudin 1803.

Subtribe Hoplocephalina Subtribe nov.

(Terminal Taxon: *Hoplocephalus bungaroides*)

Content: *Hoplocephalus* Wagler 1830.

Subtribe Notechiina Subtribe nov.

(Terminal Taxon: *Notechis scutatus*)

Content: *Austrelaps* Worrell 1963, *Echiopsis* Fitzinger 1843, *Notechis* Boulenger 1896, *Tropidechis* Günther 1863.

Tribe Aipysurini Tribe nov.

(Terminal taxon: *Aipysurus laevis*)

Content: *Aipysurus* Lacépède 1804, (including other sometimes recognised genera *Oceanius* Wells 2007, *Pelagophis* Peters and Doria 1878, *Smithohydrophis* Kharin 1981, *Stephanohydra* Tschudi 1837, *Tomogaster* Gray 1849), *Emydocephalus* Krefft 1869.

Tribe Apistocalamini Dowling, 1967

(Terminal taxon: *Ogmodon vitianus*)

Content: *Ogmodon* Peters 1864.

Tribe Demansiini Tribe nov.

(Terminal Taxon: *Demansia psammophis*)

Content: *Demansia* Gray 1842.

Tribe Denisonini Tribe nov.

(Terminal Taxon: *Denisonia maculata*)

Content: *Denisonia* Krefft 1869, *Drysdalia* Worrell 1961.

Tribe Ephalophini Burger and Natsuno, 1975

(Terminal taxon: *Ephalophis greyi*)

Content: *Ephalophis* Smith 1931, *Parahydrophis* Burger and Natsuno 1934.

Subtribe Ephalophina Subtribe nov.

(Terminal taxon: *Ephalophis greyi*)

Content: *Ephalophis* Smith 1931.

Subtribe Parahydrophina Subtribe nov.

(Terminal taxon: *Parahydrophis mertonii*)

Content: *Parahydrophis* Burger and Natsuno 1934.

Tribe Furinini Tribe nov.

(Terminal Taxon: *Furina diadema*)

Content: *Cacophis* Günther 1863, *Furina* Duméril 1853, *Glyphodon* Günther 1858

Tribe Hemiaspini Tribe Nov.**(Terminal Taxon: *Hemiaspis signata*)****Content:** *Hemiaspis* Fitzinger 1860.**Content of genus *Hemiaspis*:** *H. damelli* (Gunther 1876), *H. signata* (Jan 1859)**Tribe Hulimkini Tribe Nov.****(Terminal taxon: *Hulimkai fasciata*)****Content:** *Hulimkai* gen. nov. (see Hoser 2012c)**Content Genus *Hulimkai* gen. nov.:** *Hulimkai fasciata* (Rosen 1905).**Tribe Hydrelapini Tribe nov.****(Terminal taxon: *Hydrelaps darwinensis*)****Content:** *Hydrelaps* Boulenger 1896.**Tribe Hydrophiini Fitzinger, 1843****(Terminal taxon: *Hydrophis gracilis*)****Content:** *Acalyptophis* Boulenger 1896, *Astrotia* Fischer 1856, *Chitulia* Gray 1849, *Disteira* Lacépède 1804, *Enhydrina* Gray 1849, *Hydrophis* Sonnini and Latrielle 1802, *Kerilia* Gray 1849, *Kolpophis* Smith 1926, *Pelamis* Daudin 1803, *Lapemis* Gray 1835, *Leioselasma* Lacépède 1804, *Microcephalophis* Lesson 1832, *Polyodontognathus* Wall 1921, *Praescutata* Wall 1921, *Thalassophis* Schmidt 1852.**Subtribe Hydrophiina subtribe nov.****(Terminal taxon: *Hydrophis gracilis*)****Content:** *Acalyptophis* Boulenger 1896, *Astrotia* Fischer 1856, *Chitulia* Gray 1849, *Disteira* Lacépède 1804, *Enhydrina* Gray 1849, *Hydrophis* Sonnini and Latrielle 1802, *Kerilia* Gray 1849, *Leioselasma* Lacépède 1804, *Microcephalophis* Lesson 1832, *Polyodontognathus* Wall 1921, *Thalassophis* Schmidt 1852.**Subtribe Pelamiina Subtribe nov.****(Terminal taxon: *Pelamis platurus*)****Content:** *Pelamis* Daudin 1803, *Kolpophis* Smith 1926, *Lapemis* Gray 1835, *Praescutata* Wall 1921.**Tribe Micropechiini Tribe nov.****(Terminal Taxon: *Micropechis ikaheka*)****Content:** *Aspidomorphus* Fitzinger 1843, *Loveridgelaps* McDowell 1970, *Micropechis* Boulenger 1896, *Salomonelaps* McDowell 1970, *Toxicocalamus* Boulenger 1896.**Subtribe Aspidomorphina Subtribe nov.****(Terminal Taxon: *Aspidomorphus muelleri*)****Content:** *Aspidomorphus* Fitzinger 1843.**Subtribe Loveridgelapina Subtribe nov.****(Terminal Taxon: *Loveridgelaps elapoides*)****Content:** *Loveridgelaps* McDowell 1970, *Salomonelaps* McDowell 1970.**Subtribe Micropechiina Subtribe nov.****(Terminal Taxon: *Micropechis ikaheka*)****Content:** *Micropechis* Boulenger 1896.**Subtribe Toxicocalamina Subtribe nov.****(Terminal Taxon: *Toxicocalamus longissimus*)****Content:** *Toxicocalamus* Boulenger 1896.**Tribe Notopseudonajini Tribe nov.****(Terminal Taxon: *Notopseudonaja modesta*)****Content:** *Notopseudonaja* Wells 2002.**Tribe Oxyuranini Tribe nov.****(Terminal Taxon: *Oxyuranus scutellus*)****Content:** *Oxyuranus* Kinghorn 1923, *Parademansia* Kinghorn 1955 (the two genera have been merged by many authorities).**Tribe Pseudechini Tribe nov.****(Terminal Taxon: *Pseudechis porphyriacus*)****Content:** *Cannia* Wells and Wellington 1983, *Pailsus* Hoser 1998, *Panacedechis* Wells and Wellington 1985, *Pseudechis* Wagler 1830 (all interpreted variously by different authorities, with the current extreme being all merged into a single genus *Pseudechis*).**Tribe Pseudonajini Tribe nov.****(Terminal Taxon: *Pseudonaja nuchalis*)****Content:** *Dugitophis* Wells 2002, *Euprepisoma* Fitzinger 1860, *Placidaserpens* Wells 2002, *Pseudonaja* Günther, 1858.**Tribe Simoselapini Tribe nov.****(Terminal Taxon: *Simoselaps bertholdi*)****Content:** *Simoselaps* Jan 1859 (includes *Neelaps* Günther 1863).**Tribe Sutini Tribe nov.****(Terminal Taxon: *Suta suta*)****Content:** *Cryptophis* Worrell 1961, *Parasuta* Worrell 1961, *Rhinoplocephalus* Müller 1885, *Suta* Worrell 1961, *Unechis* Worrell 1961.**Tribe Vermicellini Tribe nov.****(Terminal Taxon: *Vermicella annulata*)****Content:** *Vermicella* Günther 1858.**Subfamily Laticaudinae Cope 1879 (Sea Kraits)****(Terminal taxon: *Laticauda laticaudata*)****Content:** *Laticauda* Laurenti 1768, *Pseudolaticauda* Kharin 1984.**Tribe Laticaudini Cope 1879****(Terminal taxon: *Laticauda laticaudata*)****Content:** *Laticauda* Laurenti 1768, *Pseudolaticauda* Kharin 1984.**FAMILY: HOMOROSELAPIDAE FAMILY NOV.****(Terminal Taxon: *Homoroselaps lacteus*)****Content:** *Homoroselaps* Jan 1858.**Tribe Homoroselapiini****(Terminal Taxon: *Homoroselaps lacteus*)****Content:** *Homoroselaps* Jan 1858.**Genus content *Homoroselaps* Jan 1858:** *H. lacteus* (Linnaeus 1758), *H. dorsalis* (Smith 1849).