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A long overdue refinement of the taxonomy of the Mallee Dragon Complex *Ctenophorus* (*Phthanodon*) *fordi* (Storr, 1965) *sensu lato* with the formal descriptions of four new subspecies.

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ABSTRACT

Since the original description of the putative species *Amphibolorus fordi* by Storr in 1965, better known as the Mallee Dragon, based on a specimen from the Goldfields in Western Australia, almost all Australian herpetologists have regarded all populations in arid southern Australia as belonging to a single species.

Exceptional to this were Wells and Wellington (1985) who formally described and named the easternmost population of southern inland New South Wales as *Phthanodon hawkeswoodi*, being placed in the genus they created in 1984 for a group of similar species.

In the 20 years following Wells and Wellington (1985), Hoser in 2015 was the first other author to formally recognized the validity of *Phthanodon hawkeswoodi* as a valid species, which was placed in the genus *Ctenophorus* Fitzinger, 1843, with *Phthanodon* relegated to being an appropriate subgenus.

More recently, Edwards *et al.* (2015) and then Sadlier *et al.* (2019) published papers following on from the work of Houston (1978) in recognizing at least six so-called races of *Ctenophorus fordi.*
Sadlier *et al.* (2019) engaged in taxonomic vandalism by improperly renaming *C. hawkeswoodi* as a new species, namely *C. spinodomus* Sadlier *et al.*, 2019.
However the four other unnamed divergent lineages remain unnamed.

The purpose of this paper is to formally recognize and name these as subspecies according to the rules of *the International Code of Zoological Nomenclature* (Ride *et al.* 1999).
Each lineage has a divergence from nearest common ancestor estimated at around 500,000 YBP (Edwards *et al.* 2015). The relevant populations are formally identified and named in order to aid further research and conservation of the said taxa, noting serious known threats to the long term survival of each subspecies as detailed by Hoser (2019a, 2019b).

Keywords: Taxonomy; nomenclature; lizards; dragons; Agamidae; *Amphibolurus*; *Ctenophorus*; *Phthanodon*; *fordi; hawkeswoodi; spinodomus*; Australia; New South Wales; Victoria; Western Australia; South Australia; new subspecies; *scottgranti*; *danielmani*; *scottyjamesi; maryannmartinekae*.

INTRODUCTION

As part of an ongoing audit of Australia's reptiles and frogs, the lizards within the putative genus *Phthanodon* Wells and Wellington, 1984, (herein treated as a subgenus), better known as the Mallee Dragons were examined with a view to confirming the taxonomy and nomenclature of relevant species or subspecies as being correct, or in the alternative being altered to reflect the biological reality.

Phthanodon was originally erected as a genus by Wells and Wellington (1984) and maintained by Wells and Wellington (1985), but the molecular evidence of Pyron *et al.* (2013) suggested that a more accurate placement of the relevant species was as a subgenus within the better-known *Ctenophorus* Fitzinger, 1843.

Hoser (2015g) was the first publishing herpetologist since Wells and Wellington (1985) to utilize the genus name *Phthanodon*, but in line with the results of Pyron *et al.* (2013) relegated the genus to a subgenus, within the genus *Ctenophorus.*

Hoser (2015g) was also the first publishing herpetologist in 20 years to formally recognize and accept the species *Ctenophorus* (*Phthanodon) hawkeswoodi* Wells and Wellington (1985) as a

valid species, being similar to but distinct from the better-known *C. fordi* (Storr, 1965), with which it had otherwise been confused.

Also in 2015, Edwards *et al.* (2015) provided further evidence to show that *C. hawkeswoodi* was a valid species, and Danielle Edwards also made it known to other herpetologists that she intended naming further species within the *C. fordi* group.

Due to knowledge of this alleged impending publication, Hoser (2015g) abstained from formally naming the four other well-known and obviously unnamed forms within the *C. fordi* group identified at that time, as it was ethical to allow Edwards priority name rights for the taxa.

However, four years have passed since then and the relatively easy task of naming the four unnamed forms has not yet been done, putting a potential bottleneck on research and conservation efforts by third parties.

While the recommendations of the *International Code of Zoological Nomenclature* (Ride *et al.* 1999), suggest a one year time frame to formally name a new taxon once identified, four years is well past that time frame.

Furthermore it is highly unethical for a person working as a zoologist to monopolize one or more species to prevent others from doing legitimate scientific work on those very same species.

As it is urgent for conservation reasons to formally identify and name new species or subspecies, especially dragon lizard species with potential extinction threats as identified by Hoser (2019a, 2019b), I have absolutely no hesitation at all in formally naming the four unnamed forms within the *C. fordi* species complex as new species in accordance with the rules of the *International Code of Zoological Nomenclature.*

Also of relevance is that Sadlier *et al.* (2019) published a paper in an "in house" online journal, formally naming a species within the *C. fordi* complex.

That species *C. spinodomus* Sadlier *et al.*, 2019 is however a subjective junior synonym of *C. hawkeswoodi* Wells and Wellington, 1985 and therefore the earlier name should be used in accordance with the rules of the *International Code of Zoological Nomenclature.*

I note that in their paper, Sadlier *et al.* (2019) wrote:
"Comments. Wells & Wellington described *Phthanodon hawkeswoodi sp. nov.* in 1985. The designated holotype is a specimen (AMS R.116983) from Glenlea central fire trail Yathong Nature Reserve, NSW (collector A. B. Rose and J. Brickhill, 14 March 1981). The diagnosis presented by Wells & Wellington amounts to an extended description of the holotype that failed to provide either a "… definition that states in words characters that are purported to differentiate the taxon" or a "… bibliographic reference to such a published statement… ", as required under Article 13(a)(i–ii) of the Third edition of the Code of Zoological Nomenclature applicable at that time. As such, the description of *Phthanodon hawkeswoodi* Wells & Wellington, 1985 is unavailable for application to the species described here as *C. spinodomus sp. nov.*"

However a reading of the original description of Wells and Wellington finds that the statement of Sadlier *et al.* (2019) is in fact incorrect, which is why this paper uses the correct earlier nomen for that taxon, as did Hoser (2015g).

In terms of application of the "Third edition of the Code of Zoological Nomenclature", Wells and Wellington (1985) did in fact provide evidence of comparative differences between the two relevant species (*C. hawkeswoodi* and *C. fordi*) including by way of referring to photos of specimens of each putative species in various texts, cited by them in the description, which in their own statement showed differences between each. This in effect satisfies the word "purport" and a viewing of the relevant photos of two obviously different taxa confirms this, as explicitly stated again in Hoser (2015g), at which time Hoser (2015g) noted the obvious differences in dorsal colour pattern.

Creative interpretations of the rules of the *International Code of Zoological Nomenclature,* for the purpose of attempting to strike out valid older names is not scientific or ethical and in fact hampers the scientific effort.

Confusion is caused by the creation of an unnecessary dual nomenclature. Valuable time of other scientists is wasted correcting the mess caused by those who seek to improperly rename species for their own self-gratification and ego-stoking.

The purpose of the preceding is not to defend the Wells and Wellington paper of (1985), or their description of *C. hawkeswoodi.* None of that is relevant!

What is relevant and of critical importance is that the name first placed on the relevant species by Wells and Wellington in 1985 was done wholly within the rules of the ICZN at the time and therefore must be used.

The ICZN also issued a ruling in favour of the Wells and Wellington papers of 1984 and 1985, including making sure that everyone knew that the names proposed within were legal and available in terms of the relevant and in force *International Code of Zoological Nomenclature* as cited in Hoser (2007).

Significantly, both Edwards *et al.* (2015) and Sadlier *et al.* (2019) expanded on the work of Houston (1978) to effectively recognize at least six divergent lineages within putative *C. fordi*, including the allegedly newly named form of Sadlier *et al.* (2019).

With type *C. fordi*, coming from Coolgardie, Western Australia, three unnamed forms became those with a distribution centred on the state of South Australia, the central part of the range for the species complex and all clearly closely associated with *C. fordi.* A fourth unnamed form from north-west Victoria, was in turn clearly associated with the eastern lineage, correctly named as *C. hawkeswoodi.* Specimens of all relevant species or subspecies (named and until now unnamed) were examined both live in the wild and via museum collections and their records, including all State and Territory Museums on mainland Australia over a time frame spanning more than 30 years. Furthermore photos and data with accurate locality data was also assessed, as was all relevant previously published scientific literature and the so-called grey literature in the form of popular mass-market books, internet sites, blogs, photo-sharing sites and the like.

Relevant specimens were examined and confirmed that each of these forms warranted recognition at the species or subspecies level, which is the main basis for publishing this paper. That is to formally name and make available names for the four until now unnamed taxa in the *C. fordi* species complex in accordance with the rules of the *International Code of Zoological Nomenclature* (Ride *et al.* 1999).

Edwards *et al.* (2015) claimed divergence of eastern and western *C. fordi sensu lato* (including *C. femoralis* (Storr, 1965) as part of the western group) at about 1.75 MYA, confirming the correctness of designating *C. hawkeswoodi* as a full species.

C. femoralis diverged from other western *C. fordi* at about 1.5 MYA, again confirming its recognition as a full species.

In terms of the other four regionally distinct populations, all diverged from their nearest named or unnamed population between 250 and 550 thousand years ago, making subspecies-level recognition appropriate for these populations as done within this paper.

MATERIALS, METHODS AND RESULTS

These are inferred in both the abstract and introduction and self evident in the descriptions that follow.

An audit of relevant species and subspecies within the *C. fordi* group *sensu lato* as defined by Hoser (2015g) confirmed the generic level assignment of species and validity of the relevant named forms as identified by Wells and Wellington (1985) as placed by Hoser (2015g) and/or in line with it.

Specimens of all relevant species (named and until now unnamed) were examined both live in the wild and via museum collections and their records, including all State and Territory Museums on mainland Australia. Furthermore photos and data with accurate locality data was also assessed, as was all

relevant previously published scientific literature and the so-called grey literature in the form of popular mass-market books, internet sites, blogs, photo-sharing sites and the like.

The final results of this audit found that within the so-called *C. fordi* group *sensu lato* as defined by Hoser (2015g), there were at least two putative species, these being *C. fordi*, and *C. hawkeswoodi*.

The four other unnamed regionally distinct forms are all found primarily in South Australia or nearby.

In summary the relevant unnamed subspecies are as follows:

1/ The population from the Eyre Peninsula in South Australia.

2/ The population found generally north-west of the Eyre Peninsula, extending northwest to the north of the Nullabor Plain and into far eastern Western Australia.

3/ The population found east and north of the north part of the Flinders Ranges in South Australia, including nearby parts of far north-west New South Wales and south-west Queensland.

4/ The population found in north-west Victoria, generally south of the Murray River.

The named species, are *C. fordi* (Storr, 1965) with a distribution wholly centred on the Goldfields region of south-east Western Australia and to which the first three forms are associated and made subspecies and *C. hawkeswoodi* (Wells and Wellington, 1985), with a distribution centred on Western New South Wales and nearby parts of south-east South Australia, mainly away from the coast and east of the Flinders Ranges, to which the fourth form from Victoria is assigned.

The literature relevant to the taxonomy and nomenclature of the *C. fordi* species group within the

subgenus *Phthanodon* as first defined by Wells and Wellington (1985) and redefined by Hoser (2015g) and herein, including the taxonomic and nomenclatural decisions herein include the following: Cogger (2014), Cogger *et al.* (1983), Edwards *et al.* (2015), Fitzinger (1843), Gray (1845), Günther (1875), Hoser (2015g), Houston (1978), Pianka (1969), Pyron *et al.* (2013), Ride *et al.* (1999), Sadlier *et al.* (2019), Storr (1965), Swan *et al.* (2017), Wells and Wellington (1984, 1985), Wilson (2015), Wilson and Knowles (1988), Wilson and Swan (2017) and sources cited therein.

FURTHER DISCUSSION RELEVANT TO THIS PUBLICATION

An illegal armed raid and theft of materials on 17 Aug 2011 effectively stopped the publication of a variant of this paper being published back then and a significant amount of materials taken in that raid was not returned. This was in spite of court orders telling the relevant State Wildlife officers to do so (Court of Appeal 2014, Victorian Civil and Administrative Tribunal 2015).

Rather than run the risk of species or subspecies becoming threatened or extinct due to non-recognition of them as shown in Hoser (2019a, 2019b), I have instead opted to publish this paper in its current form, even though a significant amount of further data was intended to be published and is not.

Naming of taxa is perhaps the most important step in their ultimate preservation and it is with this motivation in mind (protection of biodiversity) that I have chosen to publish this paper.

Until now, no new (and generally recognized) taxa within the so-called *Ctenophorus fordi* (Storr, 1965) complex of species has been formally identified or named since the paper of Wells and Wellington (1985).

In stating this, I am ignoring the taxonomic vandalism of Sadlier *et al.* (2019).

INFORMATION RELEVANT TO THE FORMAL DESCRIPTIONS THAT FOLLOW

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

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

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

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

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

Material downloaded from the internet and cited anywhere in this paper was downloaded and checked most recently as of 1 March 2020, unless otherwise stated and were accurate in terms of the context cited herein as of that date.

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

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

Each newly named subspecies is readily and consistently separable from their nearest congener and that which until now it has been previously treated as.

Delays in recognition of these subspecies could jeopardise the long-term survival of these taxa as outlined by Hoser (2019a, 2019b) and sources cited therein.

Therefore attempts by taxonomic vandals like the Wolfgang Wüster gang via Kaiser (2012a, 2012b, 2013, 2014a, 2014b) and Kaiser *et al.* (2013) (as frequently amended) to unlawfully suppress the recognition of these taxa on the basis they have a personal dislike for the person who formally named it/them should be resisted (Dubois *et al.* 2019).

Claims by the Wüster gang against this paper and the descriptions herein will no doubt be no different to those the gang have made previously, all of which were discredited long ago as outlined by Dubois *et al.* (2019), Hoser, (2007, 2009, 2012a, 2012b, 2013a, 2015a-f, 2019a, 2019b) and sources cited therein.

Formal descriptions of the four relevant subspecies follow.

Information relevant to conservation of Australian reptiles in Hoser (1989, 1991, 1993 and 1996) applies to the newly named taxa herein as do the relevant comments of Hoser (2019a, 2019b).

In line with the Australian Federal Government's "Big Australia" policy, that being to increase the human population of 25 million (2020), from 13 million in around 1970, to over 100 million within 100 years "so that we can tell China what to do", as stated by the former Prime Minister, Kevin Rudd in 2019 (Zaczek 2019), the human pressure on the relevant ecosystems has increased in line with the human populations nearby and will clearly continue to do so.

CTENOPHORUS* (*PHTHANODON*) *FORDI SCOTTGRANTI SUBSP. NOV.

LSIDurn:lsid:zoobank.org:act:CACB2D11-13F4-4DFA-B21F-75FD2F586081

Holotype: A preserved specimen at the South Australian Museum, Adelaide, South Australia, Australia, specimen number R36493 collected 4.5 km north-west of Courtabie, South Australia, Australia, Latitude -33.1791 S., Longitude 134.8222 E.

This facility allows access to its holdings.

Paratype: A preserved specimen at the South Australian Museum, Adelaide, South Australia, Australia, specimen number R36494 collected 4.5 km north-west of Courtabie, South Australia, Australia, Latitude -33.1791 S., Longitude 134.8222 E.

Diagnosis: *Ctenophorus fordi* (Storri, 1965), is herein regarded as a complex of two species and a total of six subspecies, including nominate subspecies and excluding the associated Western Australian species *C. maculatus* (Gray, 1831) and the four associated subspecies as identified on page 713 of Cogger (2014), one of which *C. dualis* (Storr, 1965) is treated herein as a full species based on divergence as shown by Edwards *et al.* (2015) and the species *C. femoralis* (Storr, 1965) of Western Australia, associated with the western species *C. fordi*, being more closely related to that taxon than the eastern species *C. hawkeswoodi* Wells and Wellington, 1985 and the associated subspecies.

The diagnosis of *Ctenophorus spinodomus* Sadlier, Colgan, Beatson and Cogger, 2019 is vastly superior to that of *C. hawkeswoodi* Wells and Wellington, probably due to the significantly greater available resources for the later authors.

While the name *C. spinodomus* is a junior subjective synonym of *C. hawkeswoodi* Wells and Wellington, 1985, this in effect means that the diagnosis of Sadlier *et al.* (2019) can be formally adopted for *C. hawkeswoodi* and this is done herein.

The subgenus *Phthanodon* Wells and Wellington is diagnosed in Hoser (2015g) on pages 47-48 and this is wholly adopted herein.

C. fordi and *C. hawkeswoodi* including all subspecies are separated from all other species within *Phthanodon* by the following unique set of characters: more than 32 pores and extending more than halfway along the thigh, but not as far as the knee (versus to the knee in *C. maculatus*); males at least have black on the throat (versus none in *C. femoralis*), but it is not in the form of a solid black chevron (as in *C. maculatus*).

The diagnosis for *C. dualis* (Storr, 1965) as a subspecies of *C. maculatus* is in Storr (1965).

All subspecies of *C. hawkeswoodi* and *C. fordi* are of similar colouration and markings, although these vary between species and sex and can be used to diagnose and define each species. A full colour description effectively incorporating all subspecies under the name *Ctenophorus fordi* (Storr, 1965) is in Cogger (2014) at page 711, or alternatively in Houston (1978) at pages 34-35.

The species *C. hawkeswoodi* is readily separated from all forms of *C. fordi* by the spotted gular pattern in males.

The nominate subspecies *C. hawkeswoodi hawkeswoodi* is separated from *C. hawkeswoodi maryannmartinekae subsp. nov.* by having a strongly reddish-brown colouration in adult females, versus rich chocolate brown in *C. hawkeswoodi maryannmartinekae subsp. nov.,* thereby being a means to separate the newly recognized Victorian subspecies.

Adult male *C. hawkeswoodi maryannmartinekae subsp. nov.* are separated from adult male *C. hawkeswoodi hawkeswoodi* by having a dorsal pattern incorporating well-defined and thick dorsolateral stripes and well defined yellow spots on grey background on the upper flanks, versus thinner dorsolateral stripes and ill-defined white flecks on the upper flanks.

Adult male *C. hawkeswoodi maryannmartinekae subsp. nov.* have significant whitening on the upper labials and snout, versus little on *C. hawkeswoodi hawkeswoodi.* Sadlier *et al.* (2019) give further statistical differences between the two subspecies.

C. hawkeswoodi (both subspecies) and *C. fordi scottgranti subsp. nov.* are separated from all other subspecies of *C. fordi* by having 34-40 pores extending about three quarters the length of the thigh, versus 24-32 and extending about two thirds the length of the thigh in the other subspecies.

C. fordi scottgranti subsp. nov. are separated from all other subspecies of *C. fordi* by colouration in that all (both sexes) are generally dull grey-brown dorsally with well-developed black spots which often fuse and the gular lines and chest band of males is boldly developed. The flanks are generally greyish black with numerous white flecks. Upper limbs are also grey and heavily flecked with white.

C. fordi danielmani subsp. nov. are separated from all other subspecies of *C. fordi* by having an orangeish dorsal colouration (both sexes), with only small and discrete black spots on the body and only a feebly developed gular and chest pattern. White spots on the upper back between the dorsolateral lines merge to form a reticulated pattern of semi-distinct irregularly-shaped lines, running across the back.

C. fordi scottyjamesi subsp. nov. of both sexes are separated from all other subspecies of *C. fordi* by having a strongly reddish dorsal surface without any black spots. These have instead become blurred patches of indistinct darker patches formed by peppering, rather than as a coloured spot or blotch. Gular and chest pattern is usually absent, or rarely apparent in a feeble way. The dorsolateral stripes are present and distinct, but on the back between these lines are widely scattered tiny yellow spots and these do not in any way merge to form lines.

C. fordi fordi of both sexes are readily separated from all other subspecies by having an orange dorsal colouration incorporating a pattern including the dorsolateral stripes and between these and on the flanks a series of elongate bright yellow spots and patches giving the appearance of yellow bars also running across the body.

This unique patterning also continues onto the anterior upper surface of the tail. The pattern of this species therefore appears to be somewhat reticulated. *C. fordi fordi* is further separated from all other subspecies by having dark brown and light or white scales on the upper and lower labials giving them a barred appearance.

C. fordi fordi (Storr, 1965) in life is seen in Brown (2014) on page 751 at bottom right and Storr *et al.* (1983) at plate 5, top right.
C. fordi scottgranti subsp. nov. in life is seen online at:
http://www.wildherps.com/travels/Australia2015/8_Southern_Eyre.html
(online as of 1 March 2020).
C. fordi danielmani subsp. nov. in life is seen online at:
https://www.flickr.com/photos/shaneblackfnq/23938445988/in/album-72157646539084048/
(online as of 1 March 2020), and
https://www.flickr.com/photos/nieminski/34364042180/in/album-72157680859542984/
(online as of 1 March 2020).

C. fordi scottyjamesi subsp. nov. in life is seen in Brown (2014) on page 751 on bottom left and Wilson (2015) on page 193 bottom right.

C. hawkeswoodi hawkeswoodi (Wells and Wellington, 1985) in life is seen in Cogger (2014) on page 711 top right and Sadlier *et al.* (2019) at page 209 (identified as "*Ctenophorus spinodomus sp. nov.*").

C. hawkeswoodi maryannmartinekae subsp.nov. in life is seen in Brown (2014) on page 751 third row down (2 images) or online at:
http://www.arod.com.au/arod/reptilia/Squamata/Agamidae/Ctenophorus/fordi
(online as of 1 March 2020), or:
http://www.gondwanareptileproductions.com/agamidarticle.html
(online as of 1 March 2020).

Distribution: *C. fordi scottgranti subsp. nov*. is confined to the Eyre Peninsula of South Australia.

Etymology: *C. fordi scottgranti subsp. nov*. is named in honour of Scott Grant who as of 2020 was living in Whyalla, South Australia, Australia and was owner and manager of the Whyalla Fauna Park, in recognition of various contributions to wildlife conservation in Australia.

CTENOPHORUS* (*PHTHANODON*) *FORDI DANIELMANI SUBSP. NOV.

LSID urn:lsid:zoobank.org:act:48C1AF23-E8FB-4B75-BABE-DAF73B0C9759

Holotype: A preserved specimen in the South Australian Museum, Adelaide, South Australia, Australia, specimen number R32225, collected from 44 km south-west of Halinor Lake, South Australia, Australia, Latitude -29.49 S. Longitude 130.16 E. This government-owned facility allows access to its holdings.

Paratypes: Four preserved specimens in the South Australian Museum, Adelaide, South Australia, Australia, specimen numbers R32226, R32229, R32231 and R32238 all collected from 44 km south-west of Halinor Lake, South Australia, Australia, Latitude -29.49 S. Longitude 130.16 E.

Diagnosis: *Ctenophorus fordi* (Storri, 1965), is herein regarded as a complex of two species and a total of six subspecies, including nominate subspecies and excluding the associated Western Australian species *C. maculatus* (Gray, 1831) and the four associated subspecies as identified on page 713 of Cogger (2014), one of which *C. dualis* (Storr, 1965) is treated herein as a full species based on divergence as shown by Edwards *et al.* (2015) and the species *C. femoralis* (Storr, 1965) of Western Australia, associated with the western species *C. fordi*, being more closely related to that taxon than the eastern species *C. hawkeswoodi* Wells and Wellington, 1985 and the associated subspecies.

The diagnosis of *Ctenophorus spinodomus* Sadlier, Colgan, Beatson and Cogger, 2019 is vastly superior to that of *C. hawkeswoodi* Wells and Wellington, probably due to the significantly greater available resources for the later authors.

While the name *C. spinodomus* is a junior subjective synonym of *C. hawkeswoodi* Wells and Wellington, 1985, this in effect means that the diagnosis of Sadlier *et al.* (2019) can be formally adopted for *C. hawkeswoodi* and this is done herein.

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C. fordi and *C. hawkeswoodi* including all subspecies are separated from all other species within *Phthanodon* by the following unique set of characters: more than 32 pores and extending more than halfway along the thigh, but not as far as the knee (versus to the knee in *C. maculatus*); males at least have black on the throat (versus none in *C. femoralis*), but it is not in the form of a solid black chevron (as in *C. maculatus*).

The diagnosis for *C. dualis* (Storr, 1965) as subspecies of *C. maculatus* is in Storr (1965).

All subspecies of *C. hawkeswoodi* and *C. fordi* are of similar colouration and markings, although these vary between species and sex and can be used to diagnose and define each species. A full colour description effectively incorporating all subspecies under the name *Ctenophorus fordi* (Storr, 1965) is in Cogger (2014) at page 711, or alternatively in Houston (1978) at pages 34-35.

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Adult male *C. hawkeswoodi maryannmartinekae subsp. nov.* are separated from adult male *C. hawkeswoodi hawkeswoodi* by having a dorsal pattern incorporating well-defined and thick dorsolateral stripes and well defined yellow spots on grey background on the upper flanks, versus thinner dorsolateral stripes and ill-defined white flecks on the upper flanks.

Adult male *C. hawkeswoodi maryannmartinekae subsp. nov.* have significant whitening on the upper labials and snout, versus little on *C. hawkeswoodi hawkeswoodi.* Sadlier *et al.* (2019) give further statistical differences between the two subspecies.

C. hawkeswoodi (both subspecies) and *C. fordi scottgranti subsp. nov.* are separated from all other subspecies of *C. fordi* by having 34-40 pores extending about three quarters the length of the thigh, versus 24-32 and extending about two thirds the length of the thigh in the other subspecies.

C. fordi scottgranti subsp. nov. are separated from all other subspecies of *C. fordi* by colouration in that all (both sexes) are generally dull grey-brown dorsally with well-developed black spots which often fuse and the gular lines and chest band of males is boldly developed. The flanks are generally greyish black with numerous white flecks. Upper limbs are also grey and heavily flecked with white.

C. fordi danielmani subsp. nov. are separated from all other subspecies of *C. fordi* by having an orangeish dorsal colouration (both sexes), with only small and discrete black spots on the body and only a feebly developed gular and chest pattern. White spots on the upper back between the dorsolateral lines merge to form a reticulated pattern of semi-distinct irregularly-shaped lines, running across the back.

C. fordi scottyjamesi subsp. nov. of both sexes are separated from all other subspecies of *C. fordi* by having a strongly reddish dorsal surface without any black spots. These have instead become blurred patches of indistinct darker patches formed by peppering, rather than as a coloured spot or blotch. Gular and chest pattern is usually absent, or rarely apparent in a feeble way. The dorsolateral stripes are present and distinct, but on the back between these lines are widely scattered tiny yellow spots and these do not in any way merge to form lines.

C. fordi fordi of both sexes are readily separated from all other subspecies by having an orange dorsal colouration incorporating a pattern including the dorsolateral stripes and between these and on the flanks a series of elongate bright yellow spots and patches giving the appearance of yellow bars also running across the body. This unique patterning also continues onto the anterior upper surface of the tail. The pattern of this species therefore appears to be somewhat reticulated. *C. fordi fordi* is further separated from all other subspecies by having dark brown and light or white scales on the upper and lower labials giving them a barred appearance.

C. fordi fordi (Storr, 1965) in life is seen in Brown (2014) on page 751 at bottom right and Storr *et al.* (1983) at plate 5, top right.
C. fordi scottgranti subsp. nov. in life is seen online at:
http://www.wildherps.com/travels/Australia2015/8_Southern_Eyre.html
(online as of 1 March 2020).
C. fordi danielmani subsp. nov. in life is seen online at:
https://www.flickr.com/photos/shaneblackfnq/23938445988/in/album-72157646539084048/
(online as of 1 March 2020), and
https://www.flickr.com/photos/nieminski/34364042180/in/album-72157680859542984/
(online as of 1 March 2020).

C. fordi scottyjamesi subsp. nov. in life is seen in Brown (2014) on page 751 on bottom left and Wilson (2015) on page 193 bottom right.

C. hawkeswoodi hawkeswoodi (Wells and Wellington, 1985) in life is seen in Cogger (2014) on page 711 top right and Sadlier *et al.* (2019) at page 209 (identified as "*Ctenophorus spinodomus sp. nov.*").

C. hawkeswoodi maryannmartinekae subsp.nov. in life is seen in Brown (2014) on page 751 third row down (2 images) or online at:
http://www.arod.com.au/arod/reptilia/Squamata/Agamidae/Ctenophorus/fordi
(online as of 1 March 2020), or:
http://www.gondwanareptileproductions.com/agamidarticle.html
(online as of 1 March 2020).

Distribution: *C. fordi danielmani subsp. nov.* is found generally north-west of the Eyre Peninsula, extending northwest to the north of the Nullabor Plain and into far eastern Western Australia, being the region of the Great Victoria Desert.

Etymology: *C. fordi danielmani subsp. nov.* is named in honour of Daniel Man, an accountant from Mitcham, Victoria, Australia in recognition for his services to wildlife conservation spanning three decades, including by managing the financial affairs of Snakebusters: Australia's best reptiles wildlife displays and snake catcher services.

CTENOPHORUS* (*PHTHANODON*) *FORDI SCOTTYJAMESI SUBSP. NOV.

LSID urn:lsid:zoobank.org:act:91E0C45F-1995-41BD-A63D-984434C35407

Holotype: A preserved specimen at the Australian Museum, Sydney, New South Wales, Australia, specimen number R.158938, collected 5.7 km west (by road) along Whitecatch Gate road, Sturt National Park, New South Wales, Australia, Latitude -29.13 S., Longitude 141.15 E. This government-owned facility allows access to its holdings.

Paratype: A preserved specimen at the Australian Museum, Sydney, New South Wales, Australia, specimen number R.155491, collected at 21.7 km (by road) west of Binerah Downs Homestead on Middle Road, Sturt National Park, New South Wales, Australia, Latitude 29.03 S., Longitude 141.37 E.

Diagnosis: *Ctenophorus fordi* (Storri, 1965), is herein regarded as a complex of two species and a total of six subspecies, including nominate subspecies and excluding the associated Western Australian species *C. maculatus* (Gray, 1831) and the four associated subspecies as identified on page 713 of Cogger (2014), one of which *C. dualis* (Storr, 1965) is treated herein as a full species based on divergence as shown by Edwards *et al.* (2015) and the species *C. femoralis* (Storr, 1965) of Western Australia, associated with the western species *C. fordi*, being more closely related to that taxon than the eastern species *C. hawkeswoodi* Wells and Wellington, 1985 and the associated subspecies.

The diagnosis of *Ctenophorus spinodomus* Sadlier, Colgan, Beatson and Cogger, 2019 is vastly superior to that of *C. hawkeswoodi* Wells and Wellington, probably due to the significantly greater available resources for the later authors.

While the name *C. spinodomus* is a junior subjective synonym of *C. hawkeswoodi* Wells and Wellington, 1985, this in effect means that the diagnosis of Sadlier *et al.* (2019) can be formally adopted for *C. hawkeswoodi* and this is done herein.

The subgenus *Phthanodon* Wells and Wellington is diagnosed in Hoser (2015g) on pages 47-48 and this is wholly adopted herein.

C. fordi and *C. hawkeswoodi* including all subspecies are separated from all other species within *Phthanodon* by the following unique set of characters: more than 32 pores and extending more than halfway along the thigh, but not as far as the knee (versus to the knee in *C. maculatus*); males at least have black on the throat (versus none in *C. femoralis*), but it is not in the form of a solid black chevron (as in *C. maculatus*).

The diagnosis for *C. dualis* (Storr, 1965) as subspecies of *C. maculatus* is in Storr (1965).

All subspecies of *C. hawkeswoodi* and *C. fordi* are of similar colouration and markings, although these vary between species and sex and can be used to diagnose and define each species. A full colour description effectively incorporating all subspecies under the name *Ctenophorus fordi* (Storr, 1965) is in Cogger (2014) at page 711, or alternatively in Houston (1978) at pages 34-35.

The species *C. hawkeswoodi* is readily separated from all forms of *C. fordi* by the spotted gular pattern in males.

The nominate subspecies *C. hawkeswoodi hawkeswoodi* is separated from *C. hawkeswoodi maryannmartinekae subsp. nov.* by having a strongly reddish-brown colouration in adult females, versus rich chocolate brown in *C. hawkeswoodi maryannmartinekae subsp. nov.,* thereby being a means to separate the newly recognized Victorian subspecies.

Adult male *C. hawkeswoodi maryannmartinekae subsp. nov.* are separated from adult male *C. hawkeswoodi hawkeswoodi* by having a dorsal pattern incorporating well-defined and thick dorsolateral stripes and well defined yellow spots on grey background on the upper flanks, versus thinner dorsolateral stripes and ill-defined white flecks on the upper flanks.

Adult male *C. hawkeswoodi maryannmartinekae subsp. nov.* have significant whitening on the upper labials and snout, versus little on *C. hawkeswoodi hawkeswoodi.* Sadlier *et al.* (2019) give further statistical differences between the two subspecies.

C. hawkeswoodi (both subspecies) and *C. fordi scottgranti subsp. nov.* are separated from all other subspecies of *C. fordi* by having 34-40 pores extending about three quarters the length of the thigh, versus 24-32 and extending about two thirds the length of the thigh in the other subspecies.

C. fordi scottgranti subsp. nov. are separated from all other subspecies of *C. fordi* by colouration in that all (both sexes) are generally dull grey-brown dorsally with well-developed black spots which often fuse and the gular lines and chest band of males is boldly developed. The flanks are generally greyish black with numerous white flecks. Upper limbs are also grey and heavily flecked with white.

C. fordi danielmani subsp. nov. are separated from all other subspecies of *C. fordi* by having an orangeish dorsal colouration (both sexes), with only small and discrete black spots on the body and only a feebly developed gular and chest pattern. White spots on the upper back between the dorsolateral lines merge to form a reticulated pattern of semi-distinct irregularly-shaped lines, running across the back.

C. fordi scottyjamesi subsp. nov. of both sexes are separated from all other subspecies of *C. fordi* by having a strongly reddish dorsal surface without any black spots. These have instead become blurred patches of indistinct darker patches formed by peppering, rather than as a coloured spot or blotch. Gular and chest pattern is usually absent, or rarely apparent in a feeble way. The dorsolateral stripes are present and distinct, but on the back between these lines are widely scattered tiny yellow spots and these do not in any way merge to form lines.

C. fordi fordi of both sexes are readily separated from all other subspecies by having an orange dorsal colouration incorporating a pattern including the dorsolateral stripes and between these and on the flanks a series of elongate bright yellow spots and patches giving the appearance of yellow bars also running across the body. This unique patterning also continues onto the anterior upper surface of the tail. The pattern of this species therefore appears to be somewhat reticulated. *C. fordi fordi* is further separated from all other subspecies by having dark brown and light or white scales on the upper and lower labials giving them a barred appearance.

C. fordi fordi (Storr, 1965) in life is seen in Brown (2014) on page 751 at bottom right and Storr *et al.* (1983) at plate 5, top right.

C. fordi scottgranti subsp. nov. in life is seen online at: http://www.wildherps.com/travels/Australia2015/8_Southern_Eyre.html

(online as of 1 March 2020).

C. fordi danielmani subsp. nov. in life is seen online at: https://www.flickr.com/photos/shaneblackfnq/23938445988/in/album-72157646539084048/

(online as of 1 March 2020), and

https://www.flickr.com/photos/nieminski/34364042180/in/album-72157680859542984/

(online as of 1 March 2020).

C. fordi scottyjamesi subsp. nov. in life is seen in Brown (2014) on page 751 on bottom left and Wilson (2015) on page 193 bottom right.

C. hawkeswoodi hawkeswoodi (Wells and Wellington, 1985) in life is seen in Cogger (2014) on page 711 top right and Sadlier *et*

al. (2019) at page 209 (identified as "*Ctenophorus spinodomus sp. nov*.").

C. hawkeswoodi maryannmartinekae subsp.nov. in life is seen in Brown (2014) on page 751 third row down (2 images) or online at:
http://www.arod.com.au/arod/reptilia/Squamata/Agamidae/Ctenophorus/fordi
(online as of 1 March 2020), or:
http://www.gondwanareptileproductions.com/agamidarticle.html
(online as of 1 March 2020).

Distribution: *C. fordi scottyjamesi subsp. nov*. is found east and north of the north part of the Flinders Ranges in South Australia, including nearby parts of far north-west New South Wales and south-west Queensland.

Etymology: *C. fordi scottyjamesi subsp. nov*. is named in honour of Scotty James of Warrandyte, Victoria, Australia, in recognition for his services for snowboarding worldwide. He was the flag bearer for Australia at the 2018 Winter Olympics, where he won a bronze medal in halfpipe. He has won numerous titles since and has inspired countless young people to get out of their homes and to enjoy the outdoor environment in sport, which in turn encourages people to want to do what is needed to preserve and enhance the world's natural assets.

CTENOPHORUS* (*PHTHANODON*) *HAWKESWOODI MARYANNMARTINEKAE SUBSP. NOV.

LSID urn:lsid:zoobank.org:act:A2B76FDF-075C-45C6-8AE8-C5CE21C500A0

Holotype: A preserved specimen in the Australian Museum, Sydney, New South Wales, Australia, specimen number R.53878 collected from 15 miles west of Annuello, Victoria, Australia, Latitude -34.78 S., Longitude 142.57 E. This government-owned facility allows access to its holdings.

Paratypes: Six preserved specimens in the Australian Museum, Sydney, New South Wales, Australia, specimen numbers R.68785-90 collected at Hattah, Victoria, Australia, Latitude -34.77 S., Longitude 142.27 E.

Diagnosis: *Ctenophorus fordi* (Storri, 1965), is herein regarded as a complex of two species and a total of six subspecies, including nominate subspecies and excluding the associated Western Australian species *C. maculatus* (Gray, 1831) and the four associated subspecies as identified on page 713 of Cogger (2014), one of which *C. dualis* (Storr, 1965) is treated herein as a full species based on divergence as shown by Edwards *et al.* (2015) and the species *C. femoralis* (Storr, 1965) of Western Australia, associated with the western species *C. fordi*, being more closely related to that taxon than the eastern species *C. hawkeswoodi* Wells and Wellington, 1985 and the associated subspecies.

The diagnosis of *Ctenophorus spinodomus* Sadlier, Colgan, Beatson and Cogger, 2019 is vastly superior to that of *C. hawkeswoodi* Wells and Wellington, probably due to the significantly greater available resources for the later authors.

While the name *C. spinodomus* is a junior subjective synonym of *C. hawkeswoodi* Wells and Wellington, 1985, this in effect means that the diagnosis of Sadlier *et al.* (2019) can be formally adopted for *C. hawkeswoodi* and this is done herein.

The subgenus *Phthanodon* Wells and Wellington is diagnosed in Hoser (2015g) on pages 47-48 and this is wholly adopted herein.

C. fordi and *C. hawkeswoodi* including all subspecies are separated from all other species within *Phthanodon* by the following unique set of characters: more than 32 pores and extending more than halfway along the thigh, but not as far as the knee (versus to the knee in *C. maculatus*); males at least have black on the throat (versus none in *C. femoralis*), but it is not in the form of a solid black chevron (as in *C. maculatus*).

The diagnosis for *C. dualis* (Storr, 1965) as subspecies of *C. maculatus* is in Storr (1965).

All subspecies of *C. hawkeswoodi* and *C. fordi* are of similar colouration and markings, although these vary between species and sex and can be used to diagnose and define each species. A full colour description effectively incorporating all subspecies under the name *Ctenophorus fordi* (Storr, 1965) is in Cogger (2014) at page 711, or in Houston (1978) at pages 34-35.
The species *C. hawkeswoodi* is readily separated from all forms of *C. fordi* by the spotted gular pattern in males.

The nominate subspecies *C. hawkeswoodi hawkeswoodi* is separated from *C. hawkeswoodi maryannmartinekae subsp. nov.* by having a strongly reddish-brown colouration in adult females, versus rich chocolate brown in *C. hawkeswoodi maryannmartinekae subsp. nov.,* thereby being a means to separate the newly recognized Victorian subspecies.

Adult male *C. hawkeswoodi maryannmartinekae subsp. nov.* are separated from adult male *C. hawkeswoodi hawkeswoodi* by having a dorsal pattern incorporating well-defined and thick dorsolateral stripes and well defined yellow spots on grey background on the upper flanks, versus thinner dorsolateral stripes and ill-defined white flecks on the upper flanks.

Adult male *C. hawkeswoodi maryannmartinekae subsp. nov.* have significant whitening on the upper labials and snout, versus little on *C. hawkeswoodi hawkeswoodi.* Sadlier *et al.* (2019) give further statistical differences between the two subspecies.

C. hawkeswoodi (both subspecies) and *C. fordi scottgranti subsp. nov*. are separated from all other subspecies of *C. fordi* by having 34-40 pores extending about three quarters the length of the thigh, versus 24-32 and extending about two thirds the length of the thigh in the other subspecies.
C. fordi scottgranti subsp. nov. are separated from all other subspecies of *C. fordi* by colouration in that all (both sexes) are generally dull grey-brown dorsally with well-developed black spots which often fuse and the gular lines and chest band of males is boldly developed. The flanks are generally greyish black with numerous white flecks. Upper limbs are also grey and heavily flecked with white.

C. fordi danielmani subsp. nov. are separated from all other subspecies of *C. fordi* by having an orangeish dorsal colouration (both sexes), with only small and discrete black spots on the body and only a feebly developed gular and chest pattern. White spots on the upper back between the dorsolateral lines merge to form a reticulated pattern of semi-distinct irregularly-shaped lines, running across the back.

C. fordi scottyjamesi subsp. nov. of both sexes are separated from all other subspecies of *C. fordi* by having a strongly reddish dorsal surface without any black spots. These have instead become blurred patches of indistinct darker patches formed by peppering, rather than as a coloured spot or blotch. Gular and chest pattern is usually absent, or rarely apparent in a feeble way. The dorsolateral stripes are present and distinct, but on the back between these lines are widely scattered tiny yellow spots and these do not in any way merge to form lines.

C. fordi fordi of both sexes are readily separated from all other subspecies by having an orange dorsal colouration incorporating a pattern including the dorsolateral stripes and between these and on the flanks a series of elongate bright yellow spots and patches giving the appearance of yellow bars also running across the body. This unique patterning also continues onto the anterior upper surface of the tail. The pattern of this species thus appears to be somewhat reticulated. *C. fordi fordi* is further separated from all other subspecies by having dark brown and light or white scales on the upper and lower labials giving them a barred appearance.

C. fordi fordi (Storr, 1965) in life is seen in Brown (2014) on page 751 at bottom right and Storr *et al.* (1983) at plate 5, top right.
C. fordi scottgranti subsp. nov. in life is seen online at:
http://www.wildherps.com/travels/Australia2015/8_Southern_Eyre.html
(online as of 1 March 2020).
C. fordi danielmani subsp. nov. in life is seen online at:
https://www.flickr.com/photos/shaneblackfnq/23938445988/in/

album-72157646539084048/

(online as of 1 March 2020), and

https://www.flickr.com/photos/nieminski/34364042180/in/album-72157680859542984/

(online as of 1 March 2020).

C. fordi scottyjamesi subsp. nov. in life is seen in Brown (2014) on page 751 on bottom left and Wilson (2015) on page 193 bottom right.

C. hawkeswoodi hawkeswoodi (Wells and Wellington, 1985) in life is seen in Cogger (2014) on page 711 top right and Sadlier *et al.* (2019) at page 209 (identified as "*Ctenophorus spinodomus sp. nov.*").

C. hawkeswoodi maryannmartinekae subsp.nov. in life is seen in Brown (2014) on page 751 third row down (2 images) or online at:

http://www.arod.com.au/arod/reptilia/Squamata/Agamidae/Ctenophorus/fordi

(online as of 1 March 2020), or:

http://www.gondwanareptileproductions.com/agamidarticle.html

(online as of 1 March 2020).

Distribution: Based on the publications of Edwards *et al.* (2015) and Sadlier *et al.* (2019) *C. hawkeswoodi maryannmartinekae subsp.nov.* is restricted to a region in Victoria in the north-west of that State where suitable habitat in the form of sand dunes occur, being bound in the North by the Murray River and in the south by unsuitable wetter or hilly habitats, extending to immediately adjacent parts of south-east South Australia.

Etymology: Named in honour of Maryann Martinek of Bendigo, Victoria, Australia, formerly of Richmond, Victoria, Australia in recognition of her services to wildlife conservation over a 20 year period. She also played a critically important role in exposing the fraud involving a water drinking Koala, marketed to the world as "Sam the Koala". "Sam the Koala" was used a Trojan horse to run an effectively fake wildlife charity and scam hundreds of thousands of dollars from well-meaning people as detailed by Hoser (2010).

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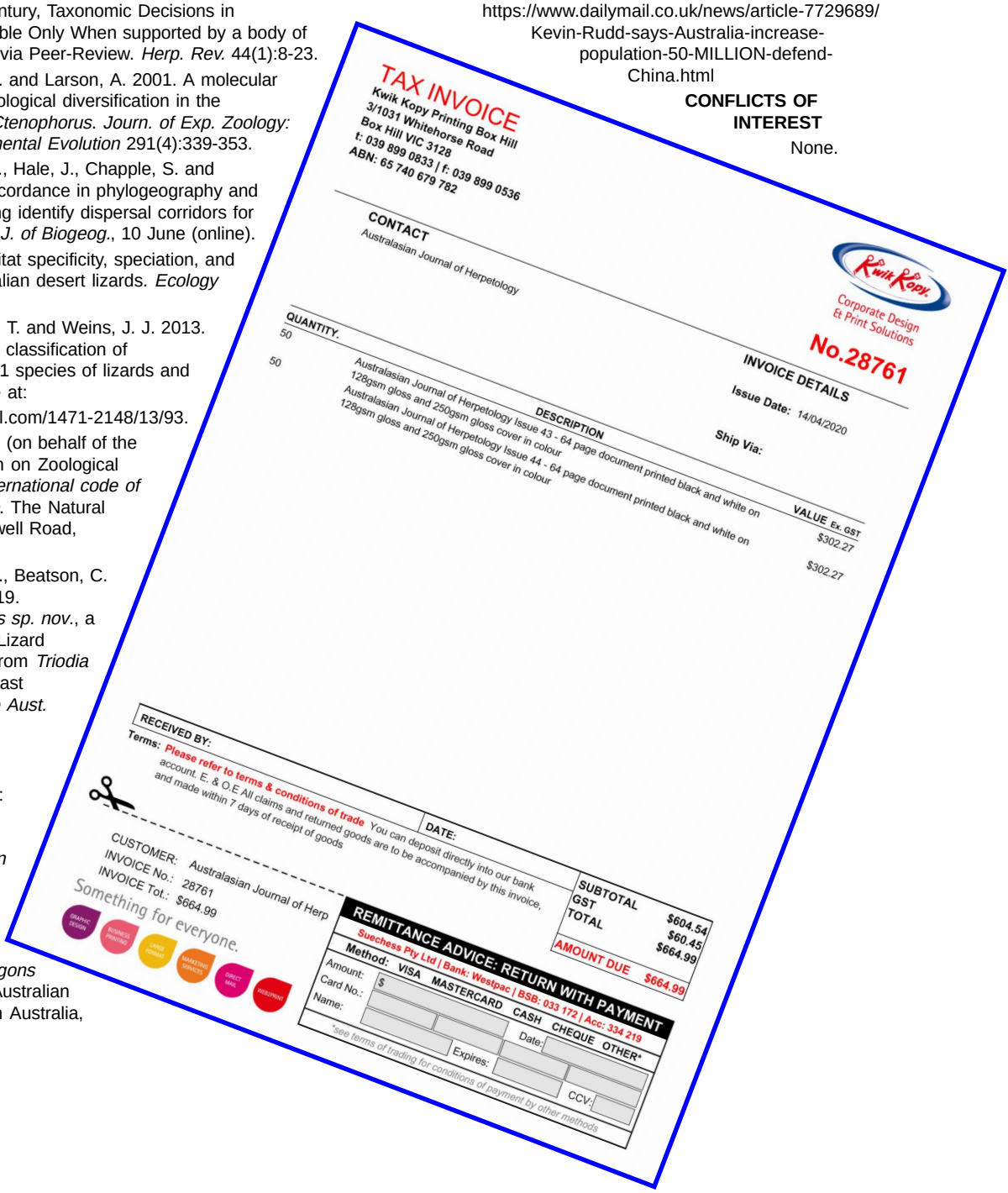
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CONFLICTS OF INTEREST

None.