RECORDS OF THE WESTERN AUSTRALIAN MUSEUM 30 012–032 (2015) DOI: 10.18195/issn.0312-3162.30(1).2015.012-032

Taxonomic resolution of the *Aprasia repens* species-group (Squamata: Pygopodidae) from the Geraldton Sandplains: a description of a new species and additional mainland records of *A. clairae*

Brad Maryan[1,2], Mark Adams[3,4] and Ken P. Aplin[2]

[1] Biologic Environmental Survey, 50B Angove Street, North Perth, Western Australia 6006, Australia. Email: lerista.2@internode.on.net

[2] Research Associate, Department of Terrestrial Zoology, Western Australian Museum, 49 Kew Street, Welshpool, Western Australia 6106, Australia.

[3] Evolutionary Biology Unit, South Australian Museum, North Terrace, Adelaide, South Australia 5000, Australia.

[4] Australian Centre for Evolutionary Biology and Biodiversity, University of Adelaide, Adelaide, South Australia 5000, Australia.

ABSTRACT – The Australian pygopodid genus *Aprasia* is a group of morphologically conservative, worm-like fossorial lizards. Combined allozyme and morphological analyses revealed a previously unrecognised species, named herein as *A. wicherina* sp. nov., known from a small number of specimens from an area of elevated, ancient sandplains on the central west coast of Western Australia. The new species is a member of the *Aprasia repens* species-group, but it is genetically divergent and morphologically distinguishable from all other previously described members of this group, including the geographically proximate *A. clairae*, *A. haroldi*, *A. repens* and *A. smithi*. We also report additional specimens of *A. clairae* from the central west coastal mainland and we provide new information that supplements our original description of this species. Finally, we present preliminary allozyme evidence for additional candidate species in *A. repens*, thus highlighting the need for greater geographic sampling of this widespread taxon. Addition of *A. wicherina* sp. nov. to the Western Australian endemic *A. repens* species-group brings the known diversity to eight species, with the highest diversity on the Geraldton Sandplains. The discovery of yet another new and potentially rare vertebrate species from southwestern Australia underlines our lack of knowledge of the most developed part of the state.

KEYWORDS: worm lizard, taxonomy, *Aprasia wicherina* sp. nov., conservation, allozyme electrophoresis

INTRODUCTION

Aprasia Gray, 1839 is a genus of small, worm-like fossorial pygopodids, which currently includes 10 species in Western Australia. Preliminary investigations of the endemic *A. repens* species-group (which includes all Western Australian species other than *A. inaurita*, *A. pulchella* and *A. striolata*) suggested that species diversity had been significantly underestimated, especially along the west coast between Geraldton and the North West Cape (Aplin and Smith 2001: 70). These previous investigations initiated a combined molecular and morphological appraisal of taxa within the *A. repens* species-group as proposed by Storr et al. (1990). The first outcome of this work was the description of *A. clairae* from single localities on the Houtman Abrolhos islands and the adjacent mainland near Dongara (Maryan et al. 2013a). A second outcome was the description of *A. litorea* from the Lake MacLeod region, and the synonymising of *A. fusca* with *A. rostrata* (Maryan et al. 2013b). During these studies several other unresolved taxonomic issues were noted within the *A. repens* species-group, including the identity of morphologically distinctive specimens from localities at the northern edge of the range of *A. repens* (Maryan et al. 2013a). Previous treatments of *A. repens* have included specimens from as far north as Kalbarri (Storr et al. 1990; Wilson and Swan 2013), however the

http://www.zoobank.org/urn:lsid:zoobank.org:pub:B402B16D-1966-402B-A9DC-52C38F25B705

northernmost record is based on a single specimen of uncertain identity (Aplin and Smith 2001: 70).

In this contribution, our third on the *A. repens* species-group; we focus on the taxonomic identity of four distinctive specimens from an area of ancient, elevated sandplains on the central west coast of Western Australia. In general aspects of morphology, including the elongate body and protrusive rostral 'beak', these specimens resemble *A. rostrata* (*sensu* Maryan et al. 2013b); the most northerly distributed member of the *A. repens* species-group. However, the southern sandplains population differs from *A. rostrata* and all other members of the *A. repens* species-group on both molecular and morphological criteria. We herein diagnose this population as the eighth species in the *A. repens* species-group. Our expanded analyses also resulted in the recognition of additional mainland populations of the recently described *A. clairae* (Maryan et al. 2013a), and allow for an expanded account of the morphology, distribution and habitat associations of this geographically restricted species. Finally, our results provide further evidence for as yet unresolved taxonomic complexity within *A. repens sensu stricto*.

MATERIAL AND METHODS

ALLOZYME ANALYSIS

Liver samples of those specimens with tissues extracted are stored at -70°C at the Western Australian Museum, Perth (WAM) or Evolutionary Biology Unit, South Australian Museum, Adelaide (SAMA), including tissues from three of the four specimens of the putative new species (WAM R121129, WAM R146587, WAM R173106). These tissues were incorporated into an extended allozyme study that also included all previous analysed *Aprasia* tissues (Maryan et al. 2013a, 2013b) as well as some previously uncharacterised samples of the *A. repens* species-group tissues from the central west coast of Western Australia. The allozyme study also included exemplars of all other species of *Aprasia*, some of which were not included in previous studies. Notable among the latter was the only available tissue of *A. picturata*. Details of the 83 specimens used for the allozyme study are presented in the Appendix. Figure 1 shows the geographic origin of the *A. repens* species-group specimens used in the allozyme study.

Allozyme electrophoresis of liver homogenates was undertaken as described in Richardson et al. (1986) for the same suite of enzymes as previously employed (Maryan et al. 2013a, 2013b). As in our earlier studies, we first used an individual-based analytical procedure (stepwise Principal Coordinates Analysis: PCO), before subsequently undertaking taxon-based assessments of genetic affinities (Neighbour-joining tree). All procedural details for implementing these analyses are presented in these studies and discussed in more detail elsewhere (Hammer et al. 2007; Adams et al. 2014).

MORPHOLOGICAL ANALYSIS

The four individuals of the putative new species were compared to 17 specimens of the morphologically similar species, *A. rostrata*, from the North West Cape peninsula and offshore islands, and to the nearest geographical congeners comprising 7 specimens of *A. clairae* and 29 *A. repens* from between Perth and Geraldton (Appendix and type lists in Taxonomy section). All specimens are from the collections of the Western Australian Museum, Perth (WAM). Sex of individuals was determined by visual inspection of everted hemipenes and postcloacal spurs in males, presence of eggs in heavily gravid females or internal examination of gonads. Head scale definitions follow those used by Storr et al. (1990), and methods of scale counting and morphometric measurements follow those used by Maryan et al. (2013a, 2013b), with two additional measures: body width and body depth.

For the purpose of this study the following linear measurements reported in millimetres (mm) were taken with digital calipers or plastic ruler: snout-vent length measured from tip of snout to vent (SVL), head depth measured from a point immediately behind eyes (HD), head length measured from tip of snout to posterior margin of frontal scale (HL), head width measured from a point between eyes (HW), rostral length measured between anterior and posterior point of scale (RL), rostral width measured between lateral extremes of scale (RW), snout length measured from tip of snout to anterior margin of eye (SL), body width measured half way on body between lateral surfaces (BW) and body depth measured half way on body between dorsal and ventral surfaces (BD). Three meristic counts were taken: number of midbody scale rows counted half way around body (Mbs), number of ventrals counted from immediately behind mental scale to vent including precloacal scale (Vent) and number of vertebrals counted from immediately behind frontal scale to above vent (Vert). Specimens preserved in a circular or twisted position were straightened on a flat surface when measured for snout-vent length. We excluded tail length from our linear measurements and multivariate analysis of morphological variation, as the majority of tails in specimens were recently broken or obviously regenerated, as indicated by a clear break in colouration. In any case, x-rays are necessary to reliably distinguish between original and fully regenerated tails in pygopodid lizards (G. Shea, pers. comm.) and these were not taken during this study. In this study, we provide only tail length measured from tip of tail to vent in the designated holotype of the putative new species

for descriptive purposes only (type lists in Taxonomy section).

An index of body robustness (IBR) was calculated by dividing the SVL by the average of body width (BW) and body depth (BD), as follows: IBR = (SVL/ (BW + BD) /2).

For the two better represented taxa, we used T-tests (alpha = 0.05) to test for sexual dimorphism in each measurement and meristic scale count; these were calculated without prior assumption of equal variances. Statistical operations were implemented in Prism version 6.05. We also used T-tests to determine the statistical validity of observed interspecific contrasts in measurements and meristic values.

RESULTS

ALLOZYME ANALYSIS

The primary dataset resulting from the allozyme study comprised the genotypes of 83 *Aprasia* specimens at 38 presumptive allozyme loci. These data are summarised in Table 1 as allozyme frequencies by locus for each of the taxa as ultimately identified by stepwise PCO. Since a preliminary PCO of all specimens (not presented) clearly indicated a primary genetic dichotomy between members of the *A. repens* species-group (*sensu* Storr et al. 1990; Maryan et al. 2013a, 2013b) and all other outgroup species (i.e. *A. aurita*, *A. inaurita*, *A. parapulchella*, *A. pseudopulchella*, *A. pulchella*, and *A. striolata*), all subsequent PCOs were restricted to the 53 individuals representing the *A. repens* species-group.

Stepwise PCO of these 53 individuals (Figure 2) demonstrated the presence of nine genetic clusters that were diagnosable from one another by fixed differences (FDs) at multiple allozyme loci (range 2–12; mean 7.5; Table 2). Individually, these clusters were referrable to *A. clairae*, *A. haroldi*, *A. litorea*, *A. picturata*, two diagnosable lineages within *A. repens* (one 'coast' and the others with discrete 'south' and 'north' populations; Figure 1), *A. rostrata*, *A. smithi*, and lastly the three *A.* sp. individuals that prompted this study (referred to in Figure 1 and hereinafter as *A. wicherina* sp. nov.). Importantly, there are several instances where diagnosable taxa were collected either in near sympatry (*A. clairae* and *A. repens* 'north'; *A. repens* 'coast' and *A. repens* 'south'; Figure 1) or parapatry (*A. clairae*, *A. repens* 'north', and *A. wicherina* sp. nov.; Figure 1).

Aprasia wicherina sp. nov. shows multiple FDs with each of the geographically proximate species of the *A. repens* species-group (Table 2), as follows: four FDs with *A clairae*, five FDs with *A. haroldi*, four FDs with *A. repens* 'north' (six and five FDs with the *A. repens* 'coast' and 'south', respectively), ten FDs with *A. smithi*. It shows six FDs with *A. rostrata*. This finding effectively rules out the possibility that *A. wicherina* sp. nov. is of recent hybrid origin, although it does not deny the possibility of some genetic interaction with one or more of the regionally sympatric species, leading to limited introgression.

A neighbour-joining tree assessing the genetic affinities of all *Aprasia* species and lineages is presented in Figure 3. The key outcomes of this analysis are: (1) modest support for the monophyly of all species currently assigned to the *A. repens* species-group (Storr et al. 1990; Maryan et al. 2013a, 2013b) (2) the placement of *A. wicherina* sp. nov. in this group as a possible sister species to *A. rostrata* (3) support for the two diagnosable lineages within *A. repens* being sister taxa (4) no allozyme evidence of any close phylogenetic relationship between *A. picturata* and *A. pulchella* (contra suggestions by Jennings et al. 2003 from analysis of mtDNA sequence data), and (5) reasonable concordance between the allozyme and mtDNA trees for all other jointly included species (note that *A. fusca* has now been synonymised with *A. rostrata*; Maryan et al. 2013b).

MORPHOLOGICAL ANALYSIS

Mensural and meristic data are summarised in Table 3 for each of *A. wicherina* sp. nov., *A. rostrata*, *A. clairae* and a sample of *A. repens* that includes representatives of all of the genetic sub-groups of this species. Data is presented separately for each sex in light of the fact that many pygopodids are sexually dimorphic in both metric and meristic attributes (e.g. Maryan et al. 2007).

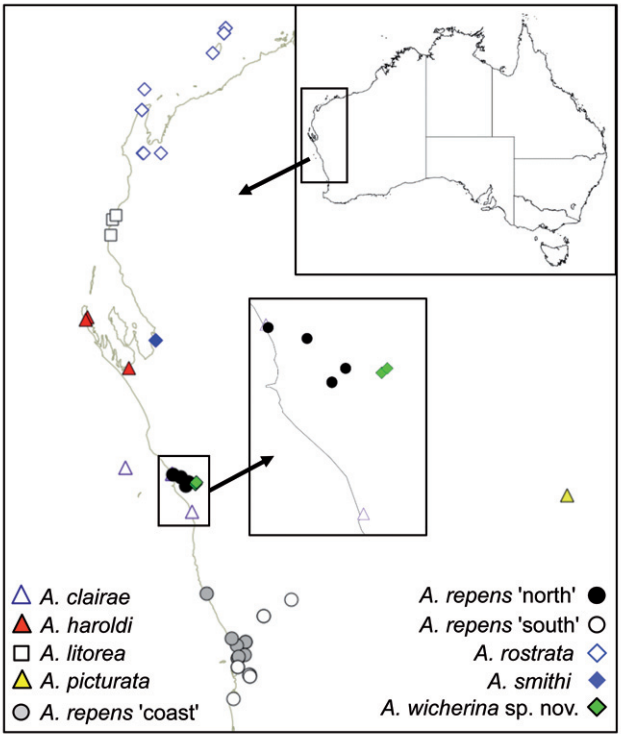

FIGURE 1 Map showing the location of the 53 *A. repens* species-group specimens included in the allozyme study.

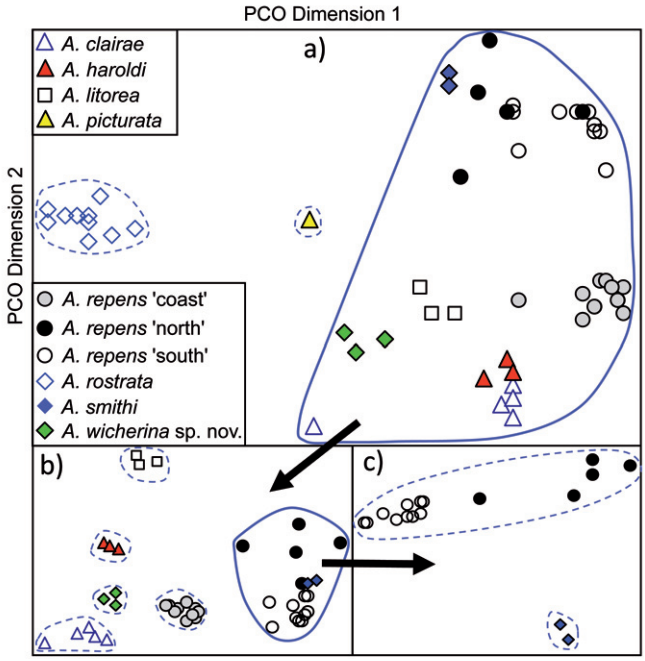

FIGURE 2 Stepwise Principal Coordinates analysis of the 53 specimens of the *A. repens* species-group included in the allozyme study. Each individual is identified by a symbol depicting its morphotype. PCO clusters that were ultimately diagnosable from all others by at least two fixed differences are encircled with a dotted line, while PCO clusters representing multiple taxa are encircled in a solid line. (a) Initial PCO of all 53 specimens. Relative PCO scores have been plotted for the first and second dimensions, which individually explained 29% and 13% respectively of the total multivariate variation present. (b) Follow up PCO of 41 individuals within the composite cluster comprising all species except *A. rostrata* and *A. picturata*. These dimensions accounted for 21% and 16% respectively of the total multivariate variation present. (c) Follow up PCO of individuals within a second composite cluster comprising the 'north' and 'south' lineages of *A. repens* (as defined in Figure 1) plus *A. smithi*. These dimensions accounted for 25% and 24% respectively of the total multivariate variation present.

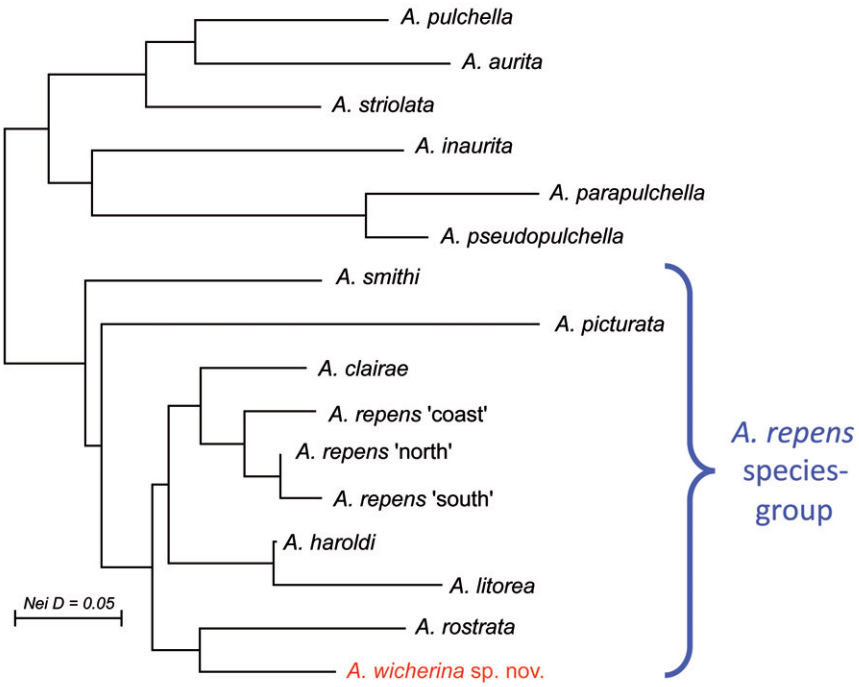

FIGURE 3 Neighbour-joining tree among 16 species and/or lineages of *Aprasia*, based on the pairwise unbiased Nei Distances (Table 2).

TABLE 1 Allozyme frequencies at all variable loci for 13 *Aprasia* species plus the three OTUs identified in *A. repens*. Species are labelled using the first two letters of their name. For polymorphic loci, the frequencies of all but the rarest allele is expressed as a percentage and shown as a superscript. Sample sizes are given in brackets. A dash (-) indicates there was insufficient enzyme activity to assign genotypes. The following loci were monomorphic: *Gapd*, *Ldh*, and *Mdh*.

Locus	AU (2)	IN (5)	PA (4)	PS (6)	PU (4)	ST (9)	CL (5)	HA (3)	LI (3)	PI (1)	RE coast (10)	RE north (5)	RE south (10)	RO (11)	SM (2)	WI (3)
Acon1	a	b	d	d	b	b^{83},c	d	d	b	f	d	b^{80},d	d	b^{90},c	f	d^{83},e
Acon2	f^{75},d	a^{90},f	f^{87},e	f	f	b^{28},k^{27}, f^{22},h^{17},c	i	i	m	m	i^{80}, l^{15},f	f^{80},i	i^{60},g^{25}, f^{10},d	m	j^{50},n	i
Acp	a	a	a	a	a^{75},b	a	a	a	a	a	a	a	a	a	a	a
Acyc	c	c	c	c	c	c	b	b	b	a^{50},b	b	b	b^{95},a	b	b	b
Ak1	a	a	a	a	a	a	a	a	a	b	a	a	a	a	a	a
Ak2	b	b	b	c^{58},b	b	b	b	b	b	b	b^{85},a	b^{90},d	b	b^{95},c	b	b
Dia	c^{50},d	b	g	g	d	a^{63},e	-	f^{50},g	-	g	-	e	e	-	-	-
Enol	b	b	b	b	c	b	b	a	a	c	a	c	c	c	c	b
Est	b	b	b	b	b	b^{56},d	b	b	b	b	b^{75}, a^{15},c	b	b	b	b	b^{83},c
Fum	c	c	d	c	c^{50}, b^{38},e	c	c^{90},f	c	c	c	c^{70},f	c^{90},a	f^{60},c	c	c	c
Gda	b	b	b	b	b	b	b	b	b	b	b	b^{67},c	b	a^{83},b	b	b^{83},a
Glo	c	d^{70}, e^{20},c	c	c	d	d^{94},b	d	d	d	d	d	c^{70},d	c^{90},a	d	c	d
Got1	c	c	a	a	c	c	c	b^{83},c	b	c	c	c^{80},d	c	c^{73},e	c	c
Got2	a	a^{50},c	a	a	a	a	a	a	a	b	a	a	a	a	a	a
Gpi	c	c^{90},b	c	c	c^{50},d	c^{78},b	a	a^{83},c	a	c	a	a	a	a	c	a
Gsr	d	b^{90},d	a	b	d	d	b^{40}, d^{40},c	b	b	d	b	b	b	c^{91},b	b	d^{67},e

Locus	AU (2)	IN (5)	PA (4)	PS (6)	PU (4)	ST (9)	CL (5)	HA (3)	LI (3)	PI (1)	RE coast (10)	RE north (5)	RE south (10)	RO (11)	SM (2)	WI (3)
Guk	c	c	c	c	c	b[69],c[25],a	c	c	c	c	c	b[83],c	c	c	c	b[83],c
Idh1	b	b	b	b	a[63],b	b	b	b	b	b	b	b	b	b	b	b
Idh2	d[75],b	d[90],a	e	d	d	d	d	f[75],d	d	d	d	d[80], b[10],f	d	g[55], d[36],f	c[50],d	d
Lap	a	b	b	b	b	b	b	b	b	b	b	b	b	b	b	b
Me	d[50], c[25],e	a[50],d[30],c[10],f	d[63],e	c[92],d	f	c[50],e[33],b	e[50],f	b[50],d	d	d	a[85],e	d	d[80],a	e[91],g	b	d
Mpi	d	b[90],d	e	e[83],c	b	e[94],b	g	f	f	d	f	f	f[95],a	f	f	f
Ndpk	a	a	a	a	a	a	a	a[83],b	a	a	a	a	a	a	a	a
PepA1	h[75],f	g[90],b	g	g	d	e	c	c[75],a	a	c	c	c	c	c	c	c
PepA2	f	b	a	a	f	f[94],g	f[80],e	f	f	-	f	f	f[75],d[20],e	c	f	c
PepB	f	a[50],e	f	f[92],d	f	f[89],g	f[87],d	f	f[67],b	h	g[95],e	g[80],f	g[85], f[10],c	b[68],f	g	f
PepC	c	b	b	b	c	c[89],b	c	c	c	c	c	c	c[75],a	a	b	a
6Pgd	b	b	c	c	b	b	b	b[83],c	c	a	b	b	b	b	b	b
Pgk	b	b	b	b	b	b	b[50],c	b	b	b	b	b	b[95],a	b	b	b
Pgm	b	a	b	b	b	b[94],d	c	c	c	c	c[95],e	c	c[95],e	c	c	c
Pk	b	a	a	a	b	a	a	a	a	c	a	a	a	a	a	a
Sod	d	a	a	a[92],b	c	c	a	a	a	a	a	a	a	a	a	a
Sordh	c[75],d	d[80],c	d	d	d	b[81],e[13],d	d	b	d	-	d	d	d[94],f	a	a[50],d	d
Tpi	b	b	b	b	b	b	b	b	b	b	b	b[90],a	b	b	b	b
Ugpp	a	b	a	a	a	a	a	a	a	-	a	a	a	a	a	a

TABLE 2 Pairwise genetic distance values among 16 species and lineages of *Aprasia*, based on the allozyme data. Lower left-hand triangle = number of loci displaying a fixed allozyme difference; upper right-hand triangle = unbiased Nei distance.

Taxon	AU	IN	PA	PS	PU	ST	CL	HA	LI	PI	RE coast	RE north	RE south	RO	SM	WI
AU	-	0.49	0.47	0.42	0.29	0.29	0.42	0.52	0.56	0.54	0.53	0.48	0.49	0.67	0.48	0.50
IN	15	-	0.46	0.36	0.45	0.39	0.39	0.52	0.45	0.54	0.41	0.45	0.46	0.51	0.38	0.43
PA	14	14	-	0.11	0.58	0.47	0.49	0.54	0.53	0.72	0.59	0.58	0.52	0.69	0.50	0.52
PS	12	11	4	-	0.52	0.40	0.42	0.47	0.45	0.66	0.48	0.49	0.45	0.65	0.41	0.48
PU	8	13	16	14	-	0.26	0.38	0.53	0.47	0.56	0.46	0.43	0.48	0.55	0.50	0.50
ST	9	12	12	10	7	-	0.33	0.40	0.45	0.56	0.42	0.39	0.47	0.50	0.45	0.37
CL	11	12	14	12	10	9	-	0.16	0.26	0.42	0.12	0.20	0.15	0.30	0.30	0.14
HA	14	13	14	12	13	10	4	-	0.15	0.46	0.12	0.22	0.20	0.32	0.27	0.22
LI	15	13	15	13	13	13	8	3	-	0.44	0.20	0.20	0.24	0.32	0.36	0.30
PI	15	15	18	17	14	15	11	10	12	-	0.45	0.44	0.44	0.44	0.40	0.44
RE coast	14	12	16	14	13	11	3	3	7	12	-	0.13	0.08	0.30	0.22	0.20
RE north	12	12	14	12	10	10	3	3	5	11	2	-	0.07	0.27	0.17	0.19
RE south	13	14	16	14	14	13	5	5	8	12	2	0	-	0.28	0.15	0.19
RO	16	14	17	16	13	12	7	8	9	11	8	6	8	-	0.31	0.23
SM	14	12	15	12	13	11	9	7	11	11	7	5	5	9	-	0.34
WI	13	12	14	13	13	12	4	5	9	11	6	4	5	6	10	-

Sexual dimorphism can only be examined statistically in each of *A. repens* and *A. rostrata* (see Table 4). Our sample of *A. repens* was not significantly sexually dimorphic in body size or proportions, or in any measurement or meristic count. However, the two longitudinal scale counts Vent and Vert both come close to attaining statistical significance, with females having higher mean values as well as higher minima and maxima for both parameters. By contrast, *A. rostrata* is significantly sexually dimorphic in SVL, in Vent and Vert, and in two head measurements (HL and HD, nearly so in HW). By contrast, it is monomorphic in rostral dimensions, snout length and in body robustness (IBR).

In *A. wicherina* sp. nov. the single available female has a larger SVL than any of the three males (92 *v* 59–82 mm); however, the female meristic counts fall within the male range (Vent: 154 *v* 146–162; Vert: 150 *v* 142–156). As in *A. repens*, sexual dimorphism in *A. wicherina* sp. nov. is either absent or subtly expressed. By contrast, *A. clairae* appears to be strongly sexually dimorphic in ventral and vertebral scale counts, and potentially also in overall body size, with the two available females being slightly larger (93–103 mm) than any of the five recorded males (64–90 mm) and having appreciably higher Vent and Vert counts (182–188 *v* 152–164 and 168 *v* 138–156, respectively. Unfortunately, too few individuals are available to support statistical testing; however, at least for Vent and Vert counts, the degree of distinction exceeds that observed in other pygopodid populations without sexual dimorphism.

The IBR values distinguish three elongate, slender-bodied taxa, *A. wicherina* sp. nov. (IBR = 38.6–41.7; mean 40.5), *A. rostrata* (35.4–42.1; mean 39.6), and *A. clairae* (31.9–46.2; mean 37.7) from the stockier-bodied *A. repens* (26.8–39.6; mean 32.5).

Midbody scale row counts appear to be invariant within each species but they differ between them. *Aprasia repens* has 12 scale rows at midbody while each of *A. rostrata*, *A. clairae* and *A. wicherina* sp. nov. have 14 scale rows. All four taxa have four preanal scales.

Head form varies noticeably within the group. *Aprasia wicherina* sp. nov. and *A. rostrata* share a protrusive rostral 'beak' and a strongly angular snout in lateral profile (Figure 5 B). By contrast, *A. clairae* and *A. repens* share a less protrusive, rounded rostral and a moderately angular snout in lateral profile (Figure 9 B).

TABLE 3 Descriptive statistics of the measurements and counts for the four main *Aprasia* species discussed in this paper. See material and methods for abbreviations of measurements and counts. Values are mean ± standard deviation (*S.D.*) and range. Sample sizes are shown at the head of each column; where this varies the secondary value is identified by an asterisk.

	A. repens		*A. rostrata*		*A. clairae*		*A. wicherina* sp. nov.	
SEX	♂, N: 16, 15*	♀, N: 13, 11*	♂, N: 13, 12*	♀, N: 4	♂, N: 5	♀, N: 2	♂, N: 3	♀, N: 1
SVL	86.1±9.3	87.6±17.1	94.1±9.9	107±3	79.6±8.8	98	72±9.6	92
	(63–104)	(50–103)	(72–108)	(104–112)	(64–90)	(93–103)	(59–82)	
HD	2±0.2	1.9±0.2	1.8±0.1	2.1±0.2	1.7±0.1	1.8	1.7±0.2	1.8
	(1.6–2.4)	(1.4–2.4)	(1.6–2.1)	(1.9–2.4)	(1.4–1.9)	(1.8–1.8)	(1.4–2)	
HL	3±0.3	3.1±0.3	2.6±0.1	2.9±0.1	2.5±0.5	2.6	2.6±0.2	2.6
	(2.2–3.4)	(2.2–3.5)	(2.4–2.9)	(2.8–3.1)	(2.4–2.6)	(2.6–2.7)	(2.3–2.8)	
HW	2.2±0.2	2.1±0.2	1.9±0.1	2±0.1	1.8±0.5	1.8	1.6±0.1	1.7
	(1.7–2.6)	(1.6–2.6)	(1.5–2.1)	(1.9–2.2)	(1.6–1.9)	(1.6–1.9)	(1.3–1.7)	
RL	0.6±0.1*	0.6±0	0.7±0.1	0.8±0.1	0.6±0.5	0.6	0.7±0	0.7
	(0.4–0.9)	(0.5–0.8)	(0.6–1.2)	(0.7–1.0)	(0.5–0.7)	(0.5–0.8)	(0.6–0.8)	
RW	0.7±0.1*	0.7±0.1	0.6±0	0.7±0	0.7±0.5	0.7	0.7±0	0.8
	(0.5–0.9)	(0.5–1)	(0.5–0.7)	(0.6–0.7)	(0.5–0.7)	(0.7–0.8)	(0.6–0.8)	
SL	1.7±0.1	1.8±0.2	1.6±0.1*	1.8±0.1	1.5±0.5	1.5	1.4±0.1	1.6
	(1.3–2)	(1.2–2.1)	(1.3–2)	(1.6–1.9)	(1.5–1.7)	(1.5–1.5)	(1.3–1.6)	
BW	2.6±0.3	2.7±0.4*	2.3±0.4	2.6±0.2	2.3±0.2	2.3	1.8±0.2	2.1
	(2.1–3.6)	(2–3.5)	(1.7–3.2)	(2.3–2.9)	(1.8–2.5)	(2–2.5)	(1.5–2.1)	
BD	2.6±0.3	2.8±0.6*	2.4±0.2	2.8±0.2	2.1±0.3	2.2	1.7±0.1	2.3
	(1.8–3.2)	(1.5–3.8)	(2.1–2.8)	(2.5–3.1)	(1.4–2.5)	(1.9–2.5)	(1.5–1.9)	
Vent	143.8±7.6	149.6±8.4	180.3±6.2	188.5±2.1	156.4±4.8	185	153.3±6.6	154
	(125–162)	(134–164)	(172–194)	(186–192)	(152–164)	(182–188)	(146–162)	
Vert	143.5±9.3	149.8±9.4	175±4.8	183.5±2.1	146.4±5.8	168	148.6±5.7	150
	(120–158)	(136–164)	(168–184)	(180–186)	(138–156)	(168–168)	(142–156)	
IBR	32.6±3.1	32.2±2.9*	39.7±3.9	39±2	36±2.8	43.4	40.1±1.2	41.3
	(27.7–39.6)	(26.8–37.6)	(34.9–47.8)	(36.1–41.4)	(31.9–39.2)	(40.7–46.2)	(38.6–41.7)	

TABLE 4 Results of t-tests for sexual dimorphism in each of *A. rostrata* and *A. repens* and for interspecific differences between *A. wicherina* sp. nov. (pooled sexes) and each of *A. rostrata* (males only) and *A. repens* (pooled sexes) for selected variables only. See material and methods for abbreviations of measurements and counts. Results that satisfy the $p < 0.05$ criterion for statistical significance are in bold.

	A. rostrata male *v* female	*A. repens* male *v* female	*A. wicherina* sp. nov. *v* male *A. rostrata*	*A. wicherina* sp. nov. *v A. repens*
SVL	**t = 2.381, d.f. = 15 p = 0.028**	t = 0.274, d.f. = 27 p = 0. 788	**t = 2.683, d.f. = 15 p = 0.017**	t = 1.352, d.f. = 31 p = 0.186
HD	**t = 2. 819, d.f. = 15 p = 0.013**	t = 0.582, d.f. = 27 p = 0. 566	-	-
HL	**t = 2.973, d.f. = 15 p = 0.010**	t = 0.217, d.f. = 27 p = 0. 833	-	-
HW	t = 1.909, d.f. = 15 p = 0.076	t = 0.390, d.f. = 27 p = 0. 700	-	-
RL	t = 0.635, d.f. = 15 p = 0.535	t = 0.101, d.f. = 27 p = 0. 920	-	-
RW	t = 0.801, d.f. = 15 p = 0.436	t = 0.426, d.f. = 27 p = 0. 674	-	-
SL	t = 1.539, d.f. = 15 p = 0.146	t = 0.780, d.f. = 27 p = 0. 445	-	-
Vent	**t = 2.429, d.f. = 15 p = 0.028**	t = 1.857, d.f. = 27 p = 0. 074	**t = 7.213, d.f. = 15 p < 0.0001**	t = 1.563, d.f. = 31 p = 0.128
Vert	**t = 3.151, d.f. = 15 p = 0.007**	t = 1.751, d.f. = 27 p = 0. 091	**t = 8.735, d.f. = 15 p < 0.0001**	t = 0.512, d.f. = 31 p = 0.612
IBR	t = 0.326, d.f. = 15 p = 0.749	t = 0.272, d.f. = 27 p = 0. 788	t = 0.467, d.f. = 19 p = 0.566	**t = 5.003, d.f. = 29 p < 0.0001**

The generally conservative morphology and low number of head scales in *Aprasia* tends to preclude high levels of intraspecific variation. All examined specimens of *A. repens*, *A. rostrata*, *A. clairae* and *A. wicherina* sp. nov. have five supralabial scales with the third positioned below the eye. By contrast, *A. haroldi* has only four supralabial scales with the second below the eye. *Aprasia haroldi* is also unusual in having the postocular fused to the third upper labial rather than to the fourth as in the other members of the *A. repens* species-group. In *A. wicherina* sp. nov. the posterior margin of the mental scale intercepts the oral margin posterior to the suture between the first and second supralabial scales. This condition is also observed in some *A. repens*; however, most *A. repens* and all *A. clairae*, *A. rostrata* and *A. litorea* have the posterior margin of the mental scale aligned with the suture between the first and second supralabial scales.

Another variable feature concerns the relations of the nasal suture. This feature shows interspecific variation within *Aprasia* (Kluge, 1974; Storr et al. 1990) as well as intraspecific variation among members of the *A. repens* species-group (Maryan et al. 2013a, 2013b) and it is similarly variable in *A. wicherina* sp. nov., with the following observed conditions: suture contacts the prefrontal bilaterally in WAM R173106, R146587 and R121132; contacts the second upper labial bilaterally in WAM R121129.

Body colouration and patterning displays subtle but consistent variation within the *A. repens* species-

group (Maryan et al. 2013a, 2013b). *Aprasia wicherina* sp. nov. and *A. rostrata* share the characteristic of four broken lines of dashes on the dorsal surface, with the laterodorsal line more pronounced than the paravertebral line, and a well-developed series of lateral lines, each consisting of broken dashes. By contrast, *A. clairae* has only two laterodorsal series of dashes. *Aprasia wicherina* sp. nov. and *A. clairae* have dark flecking under the head and along the ventral surface (Figures 5 C; 9 C), while *A. rostrata* typically has more intense ventral patterning ranging to almost entirely dark (Maryan et al. 2013b). The venter in *A. repens* is paler overall, sometimes with diffuse lines of short dashes. The head colouration of these species is strikingly different to the two black-headed members of the *A. repens* species group, *A. picturata* and *A. smithi*.

TAXONOMIC CONCLUSIONS

The case for recognition of the Wicherina *Aprasia* population as a distinct species is strong, with robust support from both genetic and morphological evidence. Both datasets identify the Wicherina species as a member of the *A. repens* species-group. However, beyond this, they fail to identify an immediate sibling species. Rather, they identify to a number of approximately equally-distinct affinities, namely *A. rostrata*, *A. clairae*, *A. haroldi*, *A. litorea*, and *A. repens* with its various genetic sub-groups. Despite their overt morphological conservatism, all species of this group are strongly differentiated genetically, with multiple fixed allozymic differences observed between each pair of species.

Morphological comparisons of the Wicherina *Aprasia* also demonstrate that this population is distinguishable from all other described species within the *A. repens* species-group. The overall closest resemblance is with *A. rostrata* but the two species are clearly distinguished by longitudinal meristic counts which are considerably higher in *A. rostrata* than in the Wicherina species, and additionally in body size.

In the following section we begin with a revised characterisation of the genus *Aprasia* and of the *A. repens* species-group. We then describe *A. wicherina* sp. nov. as a new member of the *A. repens* species-group, and document new material of *A. clairae* that provides additional information on its colouration, morphometric features, habitat associations, and geographic distribution on the Western Australian mainland.

TABLE 5 Measurements in mm and meristic counts for the type series of *A. wicherina* sp. nov. and seven available specimens of *A. clairae*. See material and methods for abbreviations of measurements and counts.

WAM #	SEX	SVL	HD	HL	HW	RL	RW	SL	BW	BD	Mbs	Vent	Vert
Aprasia wicherina sp. nov.													
121129	♀	82	1.6	2.8	1.7	0.8	0.8	1.4	2.1	1.9	14	152	148
121132	♀	59	1.4	2.3	1.3	0.6	0.6	1.3	1.5	1.5	14	146	142
146587	♀	75	2.0	2.7	1.6	0.7	0.7	1.6	1.7	1.8	14	162	156
173106	♀	92	1.8	2.6	1.7	0.7	0.8	1.6	2.1	2.3	14	154	150
Aprasia clairae													
127527	♀	64	1.4	2.4	1.6	0.6	0.5	1.5	1.8	1.6	14	152	138
156892	♀	80	1.8	2.6	1.8	0.6	0.7	1.5	2.4	1.9	14	152	146
156901	♀	90	1.9	2.5	1.9	0.5	0.7	1.7	2.3	2.2	14	154	144
165699	♀	93	1.8	2.6	1.6	0.5	0.7	1.5	2.0	1.9	14	188	168
166868	♀	78	1.7	2.5	1.9	0.6	0.7	1.5	2.5	2.3	14	160	148
173107	♀	103	1.8	2.7	1.9	0.8	0.8	1.5	2.5	2.5	14	182	168
173108	♀	86	1.8	2.5	1.8	0.7	0.7	1.5	2.5	2.5	14	164	156

TAXONOMY

Genus *Aprasia* Gray, 1839

Aprasia Gray, 1839: 331.

TYPE SPECIES

Aprasia pulchella Gray, 1839, by monotypy.

DIAGNOSIS

Aprasia differs from all other pygopodid genera in possessing the following combination of character states: head scales very large, few in number; parietal scales absent; ring of ocular tissue not completely separated into distinct scales; external auditory meatus reduced (small opening present beneath scale in *A. aurita*) or absent (all other species); scales smooth; precloacal pores absent; almost always one hind limb scale; snout very short; body diameter small relative to body length; tail very short.

INCLUDED SPECIES

Aprasia aurita Kluge, 1974, *A. clairae* Maryan, How and Adams, 2013, *A. haroldi* Storr, 1978, *A. inaurita* Kluge, 1974, *A. litorea* Maryan, Bush and Adams, 2013, *A. parapulchella* Kluge, 1974, *A. picturata* Smith and Henry, 1999, *A. pseudopulchella* Kluge, 1974, *A. pulchella* Gray, 1839, *A. repens* (Fry, 1914), *A. rostrata* Parker, 1956, *A. smithi* Storr, 1970, *A. striolata* L□tken, 1863, *A. wicherina* sp. nov.

Aprasia repens species-group

DIAGNOSIS

This group, originally proposed by Storr et al. (1990), now contains eight species, all endemic to Western Australia: *A. clairae*, *A. haroldi*, *A. litorea*, *A. picturata*, *A. repens*, *A. rostrata*, *A. smithi* and *A. wicherina* sp. nov.. Members of this group differ from all other *Aprasia* spp. in having a more slender body, a longer, more angular snout profile, and a postocular that is almost always fused to the fourth upper labial.

Aprasia wicherina sp. nov.

Wicherina Worm Lizard

Figures 4–6

http://zoobank.org/NomenclaturalActs/72C52442-FD0F-4B44-805B-210AD19B0D71

MATERIAL EXAMINED

Holotype

Australia: *Western Australia*: WAM R173106, female collected by R. Lloyd and B. Maryan on 1 August 2013, from Wicherina Water Reserve (28°43′02″S, 115°01′11″E).

Paratypes

Australia: *Western Australia*: WAM R121129, WAM R121132, WAM R146587, males, all from Wicherina Water Reserve (28°44′S, 115°00′E).

Referred specimen

Australia: *Western Australia*: BMNH 1955.1.4.28, male, Eradu (28°42′S, 115°02′E). This specimen was collected in 1934 and is held in the Natural History Museum, London.

DIAGNOSIS

A small (SVL to 92 mm) and very slender, elongate-bodied member of the *A. repens* species-group that lacks overt sexual dimorphism and has 14 midbody scale rows; 146–162 ventral scales; 142–156 vertebral scales; five upper labials with first anteriorly fused to nasal; nasal suture variably contacting prefrontal or second upper labial; postocular fused with fourth upper labial; and simple colouration of longitudinal lines of brownish streaks on a yellowish-brown dorsum with a densely flecked ventral surface.

DESCRIPTION

Holotype

Head elongate, gradually narrowing anteriorly and of equal width as body posteriorly; no obvious tympanic aperture, snout long and rounded in dorsal profile with strongly protrusive rostral ‘beak’ forming a weak ‘trilobed’ appearance, strongly angular in lateral profile, but not sharp-edged, forming very distinct undershot lower jaw; eyes noticeably large and positioned above third upper labial; nostril positioned anteriorly in nasal; body and tail very slender of equal width and round in cross-section; hindlimb remnants visible as very small rounded scales at lateral extremes of vent; tail short, tapering very gradually distally to a round tip.

Head scales smooth, shiny, non-imbricate and heterogeneous; large rostral scale rounded anteriorly, slightly wider than long, visible from above with posterior point projecting between nasals; nasals large and in broad contact, angled posteromedially behind rostral; nasal fused anteriorly and forming suture posteriorly with first upper labial; nasal suture originates from anterior border of prefrontal bilaterally, angled downwards anteroventrally to terminate at centre of nostril, forming short contact with first upper labial, nostril and nasal suture visible from below; prefrontals large, and in broad contact medially, and in narrow contact with first upper labial and broad contact with second upper labial; large frontal, longer than wide, triangular anteriorly and rounded posteriorly; a single large supraocular extending across full width of eyes, in contact with preocular; a small preocular, much higher than wide, in broad contact with second upper labial and in short contact with third upper labial; five upper labials, second slightly higher than third, but of equal width, fourth fused to postocular and fifth the smallest; mental large, wider than long, rounded posteriorly

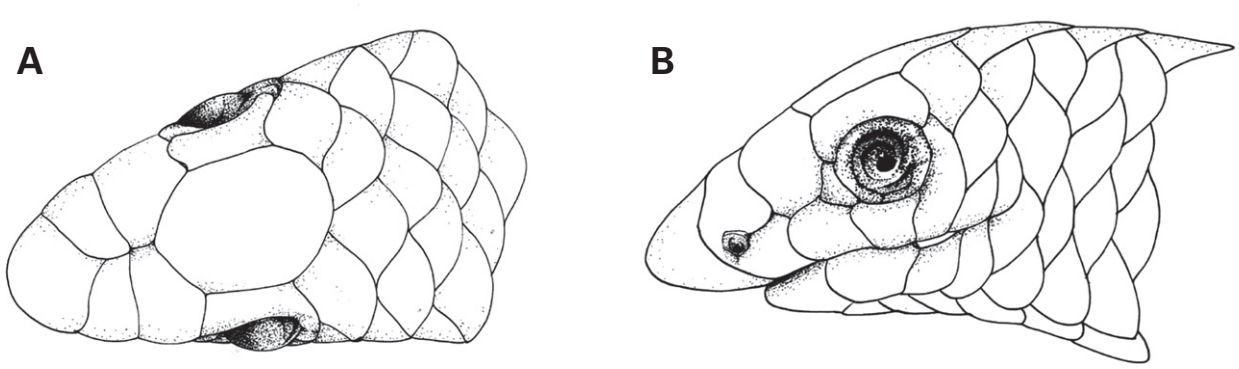

FIGURE 4 Head scalation of *Aprasia wicherina* sp. nov. holotype (WAM R173106) in (A) dorsal and (B) lateral views.

and suture with first lower labial and postmental aligned with suture between first and second upper labials. General form of head and details of scalation is illustrated in Figure 4.

Body scales, smooth and shiny, non-imbricate, homogeneous, and arranged in parallel longitudinal rows; ventral scales not noticeably wider than the adjacent body scales. Tail length measured 69 mm (75% of SVL).

Colouration

In life (Figure 5), head yellowish-brown anterior to level of eyes, variegated with dark brown, labials and base of rostrum distinctly light yellow. Light yellowish-brown from behind head to level of vent on dorsal surface. Two vague, longitudinal lines of brownish smudges (passing through centres of paravertebral scales) extend from behind head to vent. Two outermost lines of laterodorsal streaks are more continuous and clearly demarcated from a white to silvery-grey lateral surface, each lateral scale centrally streaked with dark brown to black. All dorsal and lateral lines of smudges and streaks become more continuous, forming multiple (10) brownish lines on dorsal surface of light yellow tail and indistinct smudges laterally towards tail-tip. Ventral surface silvery-grey moderately flecked with black from behind head to vent, without flecks on ventral surface of tail.

In preservative after several months (Figure 6), head becomes light grey turning in to creamy white on dorsal surface. Dark pigment on lateral and ventral surfaces, including lines of streaks along tail, is more prominent. The light yellow wash on some head scales and tail is retained. Ventral surface becomes light grey with light brown flecks.

VARIATION

Individual measurements in mm and meristic values of the type series of *A. wicherina* sp. nov. are presented in Table 5.

Colouration

WAM R146587 was similarly coloured to the holotype in life and subsequently in preservative. After 10 years in preservative, WAM R121129 and WAM R121132 have a light grey dorsal and ventral surface, with dark pigment on lateral and ventral surfaces, including lines of streaks along tail, fading to light brown.

Scalation

Variation in the relations of the nasal suture was noted above. The posterior border of the mental scale intercepts the oral margin posterior to the suture between the first and second supralabial scales in all four specimens; in WAM R121132 the point of intercept is further behind the supralabial suture than in the remaining specimens.

REMARKS

The referred specimen BMNH 1955.1.4.28 (formerly WAM R5064) from Eradu was listed by Parker (1956: 383), Kluge (1974: 63) and Smith and Henry (1999: 75) as *A. repens*. It is more slender bodied than typical *A. repens* and has a prominent rostral 'beak' and 14 midbody scales. Despite the desiccated and faded condition of the specimen, examination by J. Turpin at the Natural History Museum, London confirmed its identity as *A. wicherina* sp. nov..

ETYMOLOGY

The species name refers to the area of Wicherina, where all the type material is known from, and a local indigenous word meaning water hole (S. Heriot, pers. comm.). The epithet is to be used as a noun in apposition.

DISTRIBUTION AND SYMPATRY

Aprasia wicherina sp. nov. is currently known only from the Wicherina Water Reserve (2246ha), approximately 40 km east of Geraldton (Figure 7) but it is likely to occur in the adjoining Eradu Nature

FIGURE 5 Holotype (WAM R173106) of (A) *Aprasia wicherina* sp. nov. (B) lateral view of head and (C) ventral surface, photographed in life. [Images by B. Maryan (A); R. Lloyd (B, C)].

FIGURE 6 Preserved holotype of *Aprasia wicherina* sp. nov. (WAM R173106).

Reserve (2,275 ha). Management of these areas is vested with the Water Corporation (Wicherina) and Department of Parks and Wildlife (Eradu). The Wicherina Water Reserve has been recognised as having high conservation and eco-recreational value, including the presence of declared flora (Water Corporation 2004). Outside these areas the entire region is heavily developed for agriculture, with very few areas set aside for the conservation of flora and fauna. Further surveys are required at favourable times for capture in other nature reserves and remnant bushland with similar habitat to determine whether this species is distributed more widely in the area. The referred specimen from the Eradu area is in the same vicinity as Wicherina; therefore it is possible this specimen could also have come from the Water Reserve.

To date, there are no recorded instances of interspecific syntopy of *A. wicherina* sp. nov. with other *Aprasia* species. However, *A. repens* is known to occur in the vicinity of the Wicherina Water Reserve, based on specimens WAM R1730 from Newmarracarra and WAM R165951–52 from Kojarena. These recent collections of *A. repens* from the Kojarena area are approximately 12 km west of the Wicherina Water Reserve (Figure 7).

Aprasia haroldi and *A. litorea* are both allopatric to *A. wicherina* sp. nov. (Figure 7). *Aprasia wicherina* sp. nov. and *A. rostrata* are widely allopatric with a minimum separation distance > 800 km (Figure 7).

HABITAT

The holotype was captured after it was raked (using a 3-prong cultivator) from within a sand embankment beside a firebreak on sandplain (Figure 8). The Wicherina area is located on ancient, elevated sandplains dissected by the Greenough River and Wicherina Brook. The habitat in the adjoining Eradu Nature Reserve is comparable to the Wicherina Water Reserve, comprising Mallee heath of *Actinostrobus arenarius*, *Allocasuarina campestris*, *Banksia*, *Eucalyptus jucunda* and *Xylomelum* over a very diverse shrub layer and ground cover understorey. The paratypes were pit-trapped in this habitat. There is no habitat information associated with the referred specimen from Eradu.

COMPARISONS WITH OTHER SPECIES

Aprasia wicherina sp. nov. is compared first with *A. rostrata*, the species that it is most similar to in general aspects of morphology, colouration and scalation. It is then compared with the geographically nearest congeners, *A. clairae* and *A. repens*, and finally with each of the other members of the *A. repens* species-group.

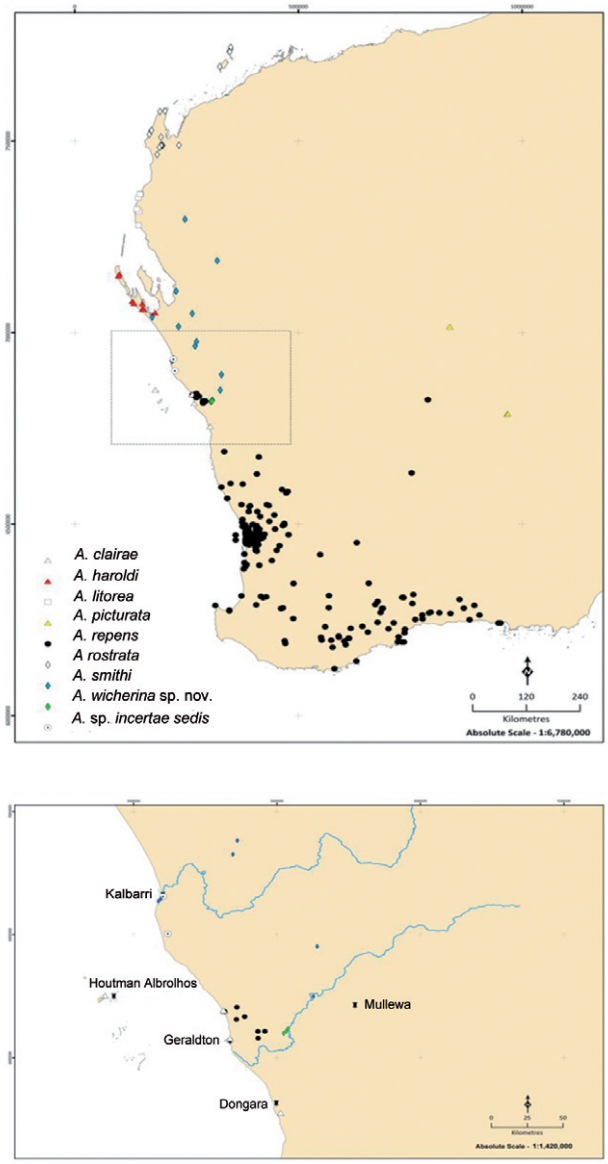

FIGURE 7 Map of Western Australia showing distribution of species of the *A. repens* species-group. Inset shows the detailed distribution of species on the central west coast including the two specimens from Kalbarri and 32 km S of Kalbarri regarded as *A.* sp. *incertae sedis* pending further field survey and analysis.

Aprasia wicherina sp. nov. and *A. rostrata* share a protrusive rostral 'beak', strongly angular snout and typically the presence of four lines of streaks on the dorsal surface. However, *A. wicherina* sp. nov. differs from *A. rostrata* in averaging significantly smaller in SVL and in both Vent and Vert counts, even when comparison is made only to males of *A. rostrata* in which these values are lower than females (Table 4) and in lacking overt sexual dimorphism in body size, ventral and vertebral scale counts, and head dimensions.

FIGURE 8 Mallee heath on sandplains at Wicherina Water Reserve, Western Australia, the type locality for *Aprasia wicherina* sp. nov. (Image by B. Maryan).

Aprasia wicherina sp. nov. and *A. clairae* are similar in body size (Table 3) and agree in most details of head and body scalation. *Aprasia wicherina* sp. nov. differs from *A. clairae* in having a longer head featuring a more protrusive rostral 'beak' and a snout that is strongly angular in lateral profile (Table 3; Figure 5 B). In *A. clairae* the rostral is less protrusive, more rounded in dorsal view, and the snout is moderately angular in lateral profile (Figure 9 B). Ventral and vertebral counts in both sexes of *A. wicherina* sp. nov. broadly overlap the values recorded in male *A. clairae* (Table 3) but fall well below those of the two available female *A. clairae*. The presence of overt sexual dimorphism in *A. clairae* represents an important point of distinction between this species and the essentially monomorphic *A. wicherina* sp. nov..

Body pattern and colouration also distinguish *A. wicherina* sp. nov. and *A. clairae*. Most conspicuously, in *A. wicherina* sp. nov. the dorsal surface bears four rather than two weakly-developed longitudinal streaks. Another subtle but consistent difference concerns the relationship between the outermost lines of the dorsal streaks and the lateral pattern. In *A. wicherina* sp. nov. there is a clear gap between the outermost of the four dorsal streaks and the uppermost of the well-defined longitudinal lines that comprise the lateral pattern; by contrast, in *A. clairae* the single (outer) dorsal streak on each side is closely approximated to the uppermost of the lateral lines. *Aprasia wicherina* sp. nov. also differs from *A. clairae* in its overall paler colouration on the head, dorsum and ventral surface (Figures 5 A–C; 9 A–C).

Aprasia wicherina sp. nov. differs from *A. repens* in having 14 midbody scale rows (*v* 12), having a more protrusive rostral 'beak' (*v* rounded rostral), a smaller recorded maximum SVL (to 92 mm *v* to 126 mm; Storr et al. 1990), and a consistently more slender body form (IBR 38.6–41.7 *v* 26.8–39.6; Tables 3, 4). They also differ in aspects of colouration, the most obvious being the flecking under the head and along the ventral surface in *A. wicherina* sp. nov., contrasting with a typically paler ventral surface in *A. repens*, occasionally with lines of short dashes. *Aprasia wicherina* sp. nov. differs from *A. haroldi* in having 5 upper labials (*v* 4) and from *A. litorea* in having 14 midbody scale rows (*v* 12). *Aprasia wicherina* sp. nov. differs from the remaining members of the *A. repens* species-group, *A. picturata* and *A. smithi*, by not having a black head.

REMARKS

Bush et al. (2007: 4) illustrate the male *A. wicherina* sp. nov. WAM R146587, paratype collected in October. This specimen has enlarged testes, with clearly visible tubules and highly convoluted efferent ducts (K. Aplin, pers. comm.), a condition that is consistent with the timing of reproduction recorded in *A. repens* (Webb and Shine 1994).

Aprasia clairae Maryan, How and Adams, 2013

Batavia Coast Worm Lizard

Figure 9

Aprasia clairae Maryan et al. 2013: 30–43.

MATERIAL EXAMINED

Australia: ***Western Australia:*** WAM R165699, female, Geraldton (28°46′S, 114°37′E); WAM R166868, male, Oakajee (28°33′43″S, 114°34′49″E); WAM *R173107–08, female, male, Coronation Beach, Oakajee (28°33′43″S, 114°34′49″E). *Also included in the allozyme study.

REVISED DIAGNOSIS

A small (SVL of males to 90 mm; of females to 103 mm), slender-bodied (IBR 31.9–46.2; of males (n = 5) 31.9–39.2; of females (n = 2) 40.7–46.2), sexually dimorphic member of the *A. repens* species-group with 14 midbody scale rows, 152–188 ventral scales (of males 152–164; of females 182–188), 138–168 vertebral scales (of males 138–156; of females 168), five upper labials with first anteriorly fused to nasal, condition of nasal suture variably contacting prefrontal or second upper labial, postocular fused with fourth upper labial, and simple colouration of longitudinal lines of brown to black streaks on a yellowish-brown to light brown dorsum with a densely flecked greyish ventral surface.

VARIATION

Individual measurements in mm and meristic values of all available specimens of *A. clairae* are presented in Table 5.

Aprasia clairae is now known from seven specimens with an updated recorded maximum SVL to 103 mm, due to the collection of the adult female specimens WAM R165699 and WAM R173107. Female *Aprasia* are known to attain larger body sizes than conspecific males in *Aprasia* species (Webb and Shine 1994). The smallest recorded male specimen (WAM R127527, with a SVL of 64 mm) has mature, developed testes.

Colouration

The single previously available specimen from the mainland (WAM R127527) was considerably darker than the specimens from East Wallabi Island in the

FIGURE 9 Specimen (WAM R173108) of (A) *Aprasia clairae* (B) lateral view of head and (C) ventral surface, photographed in life. [Images by B. Maryan (A); R. Lloyd (B, C)].

Houtman Abrolhos. The additional mainland material reported here confirms this distinction between the two populations. A revised description of colouration and patterning in the mainland population of *A. clairae* follows, based on the expanded sample.

In life, head light brown with darker brown variegations on rostrum and crown with light grey smudges on sides including labial scales; in general appearance the head is almost uniform dark brown (see Figure 9 and Maryan et al. 2013a: Figure 5). Dorsal surface yellowish to light brown with two vague to distinct, longitudinal lines of brownish streaks or spots (passing through paravertebral series) extending from behind head (sometimes forming continuous lines on nape) to vent, becoming more continuous and, forming multiple blackish lines on dorsal surface of tail. Uppermost laterodorsal line of continuous brown streaks is not clearly demarcated from a dark brown lateral surface (more silvery-grey on tail), each lateral scale with a light grey streak. Ventral surface, including under head, light grey with dense dark brown to black flecks, and with a light yellow wash under tail.

In preservative, the yellowish to light brown colouration on dorsal surface becomes a light to silvery-grey. Dark pigment on dorsum, flanks and ventral surface remains prominent as does the yellow wash on both original and regenerated tails.

Scalation

Maryan et al. (2013a) recorded the nature of the nasal suture originating from the second upper labial in WAM R127527 and WAM R156901, and from the suture between the first and second upper labials in WAM R156892. Contact with the second upper labial bilaterally is also present in WAM R165699 and WAM R166868, while WAM R173107–08 have the suture contacting the second upper labial and prefrontal scales on opposite sides of the head.

DISTRIBUTION AND SYMPATRY

Aprasia clairae is known from Turtle Bay on East Wallabi Island in the Houtman Abrolhos, and on the mainland extending north to Geraldton and Coronation Beach at Oakajee, and south to near Dongara (Figure 7).

The additional mainland specimens reported here substantially enlarge the known geographic range of *A. clairae*. However, unlike the Houtman Abrolhos islands, which are 'A'-class Nature Reserves, none of the known mainland populations are protected in areas set aside for the conservation of flora and fauna. Further surveys are required at favourable times to the north and south of the known collection sites to determine whether this species is distributed more widely in the area. The collection sites for this species indicate a coastal distribution, which is comparable to some other members of the *A. repens* species-group that occupy other biogeographical regions in Western Australia (Figure 7; see Discussion).

Two specimens from coastal localities further north of the known *A. clairae* records, one identified by Storr et al. (1990: 110) as *A. repens*, warrant special mention. Specimens WAM R86892 from Kalbarri and WAM R130495 from 32 km S of Kalbarri (Figure 7) are confirmed here as members of the *A. repens* species-group due to their shared presence of a slender body with an elongate, angular snout, and a postocular that is fused to the fourth upper labial. They differ from *A. repens* and resemble *A. clairae* in having 14 midbody scales and in general appearance including aspects of colouration. However, until the identity of these populations can be confirmed with genetic analysis, we hesitate to include them within this species. We note that northern Geraldton Sandplains, including the iconic Kalbarri National Park (Maryan 2005; Department of Parks and Wildlife 2014), have not been subject to comprehensive fauna surveys. For the present, we recommend that the Kalbarri populations be treated as *Aprasia* sp. *incertae sedis*.

To date, there are no recorded instances of interspecific syntopy of *A. clairae* with other *Aprasia* species. However, *A. repens* has been collected in near sympatry with the Coronation Beach population of *A. clairae*, the nearest records coming from Bella Vista Nature Reserve (approximately 15 km east of Coronation Beach; WAM R134308, WAM R137160) and from 5 km N of White Peak (approximately 5 km south of Coronation Beach; WAM R144049). These specimens represent the most northerly records for *A. repens* (Figure 7).

HABITAT

The mainland paratype of *A. clairae* (WAM R127527) was collected in a broad interdune adjacent to near-coastal dunes, with low scrub and dense thickets of *Acacia rostellifera* (Maryan et al. 2013a). The newly collected specimens all come from similar habitats. WAM R165699 was found inside a house situated adjacent to *A. rostellifera* scrub in coastal dunes. WAM R166868 and WAM R173107–08 came from a ridge parallel to the ocean and adjacent to near coastal dunes. The dominant vegetation at this site is *Melaleuca cardiophylla* and *Grevillea argyrophylla* scrub with emergent mallee *Eucalyptus dolichocera*, and the habitat includes numerous limestone outcrops (Ecologia Environment 2010; see Figure 10). WAM R166868 was found beneath a limestone slab in a gully and WAM R173107–08 (a female and male, respectively) were raked out together from beneath a small, embedded stump.

By comparison to the insular habitat (Maryan et al. 2013a: Figure 8), the soils at these mainland localities are generally darker through humic enrichment. This probably accounts for the slightly darker overall colouration of the mainland population of *A. clairae*; substrate matching appears to be a common phenomenon among these highly fossorial lizards, with other examples noted by Maryan et al. (2013b) in *A. rostrata* and *A. smithi*.

FIGURE 10 The mainland habitat of *Aprasia clairae*, thickets of *Melaleuca* and *Grevillea* with emergent Mallee on low ridge with limestone outcrops at Coronation Beach, Oakajee, Western Australia (Image by B. Maryan).

DISCUSSION

DIVERSITY AND UNRESOLVED ISSUES

The present study has defined another new species of the *A. repens* species-group and provided additional information on mainland Western Australian populations of the recently described *A. clairae* (Maryan et al. 2013a). *Aprasia wicherina* sp. nov. is currently known from a small area of ancient, elevated sandplain habitat in the Wicherina/Eradu area, while *A. clairae* occurs in coastal sand dune habitats, often associated with limestone outcrops. *Aprasia wicherina* sp. nov. is most similar morphologically to *A. rostrata* of the North West Cape peninsula with outlying populations on Barrow Island and the Monte Bello Islands (Maryan et al. 2013b). However, *A. rostrata* and *A. wicherina* sp. nov. are strongly differentiated genetically and are also distinguishable on body size and meristic variables.

Despite recent progress on taxonomic diversity within the *A. repens* species-group, knowledge of the group remains incomplete. In particular, our genetic analyses have demonstrated that there are at least two allozymically diagnosable lineages within the widespread taxon *A. repens* as currently defined. Preliminary morphological studies of genotyped specimens suggest that these lineages may be morphologically diagnosable and further studies of this widespread and historically well-collected (> 500 specimens) taxon are currently underway. In addition, we suspect that additional fieldwork in poorly surveyed areas of southwestern Australia will turn up additional species of *Aprasia*, including other members of the *A. repens* species-group.

BIOGEOGRAPHY

The *A. repens* species-group is endemic to Western Australia and includes 8 of the 13 known members of the genus (Maryan et al. 2013a, 2013b; this study). The species-group is particularly diverse in habitats on coastal sands and adjacent sandplains between Perth and the North West Cape, with a local ‘hotpsot’ in the Geraldton Sandplains bioregion (Thackway and Cresswell 1995) located on the central west coast.

Based on current knowledge, four species of the *A. repens* species-group occur in the Geraldton Sandplains bioregion. *Aprasia clairae* and *A. wicherina* sp. nov. appear to have near-parapatric distributions, the former confined to the coast, and the latter found on inland sandplains; the nearest records are separated by only a short distance (□ 40 km) of intervening country. Both

species are also regionally sympatric with *A. repens* (sensu lato) which occurs throughout southwestern Western Australia in a variety of habitats (Bush et al. 2007) and which reaches its northernmost geographic extent in the Geraldton Sandplains bioregion. In addition to this, another member of the *A. repens* species-group, the uniquely coloured *A. smithi*, also occurs in the same general area on both soft and hard soils (Wilson and Swan 2013). All of these species are very similar in body proportions, meristics and in relative head shape and they may be weakly differentiated ecologically and subject to mutual competitive exclusion.

The morphologically similar *A. wicherina* sp. nov. and *A. rostrata* are widely allopatric with a distributional gap of > 800 km. In this case, the intervening area is occupied by other members of the *A. repens* species-group (e.g. *A. haroldi*, *A. litorea*). The complex biogeographic history involving a combination of geological activity and changes in sea level has played a major role in shaping the extensive sandy areas along the west coast of the continent (e.g. Hocking et al. 1987; Rabosky et al. 2004). The significant levels of genetic divergence among members of the *A. repens* species-group could be related to habitat specialisation, which has formed patterns of isolation and subsequent genetic differences. This hypothesis seems plausible in light of the parallel divergence seen in other frogs and reptiles inhabiting sandy habitats along the west coast (e.g. *Lerista* skinks: Storr et al. 1999; *Arenophryne* frogs: Doughty and Edwards 2008; *Ctenophorus* dragons Melville et al. 2008).

CONSERVATION STATUS

For rare or secretive reptiles such as small fossorial species, it often requires a considerable length of time conducting trapping programs simply to reveal their presence (How and Shine 1999). Without substantial sampling effort, it is difficult to establish exact distributions and life histories, and virtually impossible to estimate population size and trends. These difficulties clearly hinder effective wildlife conservation and the development of appropriate protective legislation (Ehmann and Cogger 1985; Harvey 2002).

It is now abundantly clear that Australia harbours an exceedingly high number of narrowly distributed small frog and reptile species (Cogger 2014; Wilson and Swan 2013). For example, 24 of the 91 species of *Lerista* occupy areas of less than 5,000 km^2, which constitutes one of the IUCN criteria for recognition as an endangered species (Amey and Worthington Wilmer 2014). These species and others would also qualify as 'short range endemics' based on their naturally small ranges of less than 10, 000 km^2 (Harvey 2002).

Each of *A. clairae* and *A. wicherina* sp. nov. are restricted to parts of the Geraldton Sandplains that are subject to heavy anthropogenic disturbance, most notably clearing for winter cereal crop and pasture production (Gibson et al. 2004). The linear distance between the known northern and southern most locality records for *A. clairae* on the mainland is approximately 100 km in an area that also encompasses the densely populated and growing City of Geraldton. In addition to this, the unique population of *A. clairae* on East Wallabi Island is under threat from considerations for a major resort development. Interestingly, this development is supported by the Conservation Council of Western Australia due to the preferred location, ideal sandy substrates for construction and space for infrastructure to be built to manage wildlife (http://www.abc.net.au/news/conservation council backs resort move plan). These plans will need to take into account the potentially unique requirements of the fossorial worm lizard *A. clairae*.

Based on current knowledge, *A. wicherina* sp. nov. has one of the smallest distributions of any Australian pygopodid, with only two locations known within small patches of remnant sandplain habitat surrounded by extensive agricultural lands. Despite the proclamation of the Wicherina Water Reserve for the purpose of protecting the public drinking water source for Geraldton, no priority classification areas for source protection have been assigned to the reserve (Water Corporation 2004).

Our studies along with those of others (e.g. Melville et al. 2008; Kay and Keogh 2012) on cryptic vertebrate groups in southwestern Australia, provide awareness of the high levels of endemism in these vanishing habitats, and highlight the importance of assessing the conservation status of these poorly known species.

ACKNOWLEDGEMENTS

We thank R. Lloyd for allowing use of his excellent photographs. We thank C. Stevenson for doing the head drawing of the holotype. We very much appreciate the assistance of A. Heidrich in preparing the distribution map and figures. For allowing access to specimens we thank P. Doughty and L. Umbrello at the Western Australian Museum, and Patrick Campbell at the Natural History Museum, London. We thank A. Desmond, G. Harold, S. Heriot, R. Lloyd and J. Turpin who each collected important specimens crucial for this study. We further thank A. Desmond for providing habitat information and J. Turpin for examining the referred specimen BMNH 1955.1.4.28 held in the Natural History Museum, London. We thank Paul Doughty and Glenn Shea for their helpful comments on drafts of the manuscript.

REFERENCES

Adams, M., Raadik, T.A., Burridge, C. and Georges, A. (2014). Global biodiversity assessment and hyper-cryptic species complexes: more than one species of elephant in the room? *Systematic Biology* **63**: 518–533.

Amey, A.P. and Worthington Wilmer, J. (2014). Morphological diversity and genetic structure within *Lerista kalumburu* Storr, 1976 (Squamata: Scincomorpha: Sphenomorphidae) – taxonomic implications. *Zootaxa* **3821**: 239–252.

Aplin, K.P. and Smith, L.A. (2001). Checklist of the frogs and reptiles of Western Australia. *Records of the Western Australian Museum* Supplement **63**: 51–74.

Bush, B., Maryan, B., Browne-Cooper and Robinson, D. (2007). *Reptiles and Frogs in the bush: Southwestern Australia*. University of Western Australia Press: Perth.

Cogger, H.G. (2014). *Reptiles & Amphibians of Australia*. *Seventh Edition*. CSIRO Publishing: Collingwood.

Department of Parks and Wildlife (2014). *Kalbarri National Park draft management plan 2014*. Department of Parks and Wildlife: Perth.

Doughty, P. and Edwards, D. (2008). A new species of *Arenophryne* (Anura: Myobatrachidae) from the central coast of Western Australia. *Records of the Western Australian Museum* **24**: 121–131.

Ecologia Environment (2010). *Oakajee Port and Rail Oakajee Terrestrial Port Development Terrestrial Vertebrate Fauna Assessment*. Unpublished report prepared for Oakajee Port and Rail.

Ehmann, H. and Cogger, H. (1985). Australia's endangered herpetofauna: a review of criteria and policies. Pp 435–447 in G. Grigg, R. Shine and H. Ehmann (eds.) *Biology of Australian Frogs and Reptiles*. Royal Zoological Society of NSW: Sydney.

Gibson, N., Keighery, G.J., Lyons, M.N. and Webb, A. (2004). Terrestrial flora and vegetation of the Western Australian wheatbelt. Pp 139–189 in G. J. Keighery, S. A. Halse, N. L. McKenzie and M. Harvey (eds.) *A biodiversity survey of the Western Australian agricultural zone*. *Records of the Western Australian Museum* Supplement **67**. Western Australian Museum: Welshpool.

Gray, J.E. (1839). Catalogue of the slender-tongued saurian, with descriptions of many new genera and species (continued). *Annals and Magazine of Natural History* **2**: 331–337.

Hammer, M.P., Adams, M., Unmack, P.J. and Walker, K.F. (2007). A rethink on *Retropinna*: conservation implications of new taxa and significant genetic sub-structure in Australian smelts (Pisces: Retropinnidae). *Marine and Freshwater Research* **58**: 1–15.

Harvey, M.S. (2002). Short-range endemism among the Australian fauna: some examples from non-marine environments. *Invertebrate Systematics* **16**: 555–570.

Hocking, R.M., Moors, H.T. and Van de Graaff, W.J.E. (1987). *Geology of the Carnarvon Basin, Western Australia,* 289 pp. Geological Survey of Western Australia: Perth.

How, R.A. and Shine, R. (1999). Ecological traits and conservation biology of five fossorial 'sand-swimming' snake species (*Simoselaps*: Elapidae) in south-western Australia. *Journal of the Zoological Society of London* **249**: 269–282.

Jennings, W.B., Pianka, E.R. and Donnellan, S. (2003). Systematics of the lizard family Pygopodidae with implications for the diversification of Australian temperate biotas. *Systematic Biology* **52**: 757–780.

Kay, G.M. and Keogh, J.S. (2012). Molecular phylogeny and morphological revision of the *Ctenotus labillardieri* (Reptilia: Squamata: Scincidae) species group and a new species of immediate conservation concern in the southwestern Australian biodiversity hotspot. *Zootaxa* **3390**: 1–18.

Kluge, A.G. (1974). A taxonomic revision of the lizard family Pygopodidae. *Miscellaneous Publications of the Museum of Zoology*, *University of Michigan* No. **152**: 1–72.

Maryan, B. (2005). A herpetofauna hotspot, the central west coast of Western Australia. *The Western Australian Naturalist Journal* **25**: 1–24.

Maryan, B., Aplin, K.P. and Adams, M. (2007). Two new species of the *Delma tincta* group (Squamata: Pygopodidae) from northwestern Australia. *Records of the Western Australian Museum* **23**: 273–305.

Maryan, B., How, R.A. and Adams, M. (2013a). A new species of the *Aprasia repens* species-group (Squamata: Pygopodidae) from Western Australia. *Records of the Western Australian Museum* **28**: 30–43.

Maryan, B., Bush, B.G. and Adams, M. (2013b). Morphological and molecular assessment of *Aprasia fusca* and *A. rostrata* (Squamata: Pygopodidae), with a description of a new species from the Lake MacLeod region, Western Australia. *Records of the Western Australian Museum* **28**: 144–163.

Melville, J., Shoo, L.P. and Doughty, P. (2008). Phylogenetic relationships of the heath dragons (*Rankinia adelaidensis* and *R. parviceps*) from the south-western Australian biodiversity hotspot. *Australian Journal of Zoology* **56**: 1–13.

Parker, H.W. (1956). The lizard genus *Aprasia*: its taxonomy and temperature-correlated variations. *Bulletin British Museum* (*Natural History*) *Zoology* **3**: 365–385.

Rabosky, D.L., Aplin, K.P., Donnellan, S.C. and Hedges, S.B. (2004). Molecular phylogeny of blindsnakes (*Ramphotyphlops*) from Western Australia and resurrection of *Ramphotyphlops bicolor* (Peters 1857). *Australian Journal of Zoology* **52**: 531–548.

Richardson, B.J., Baverstock, P.R. and Adams, M. (1986). *Allozyme electrophoresis*: *a handbook for animal systematics and population studies*. Academic Press: Sydney.

Smith, L.A. and Henry, J. (1999). *Aprasia picturata* (Squamata: Pygopodidae), a new legless lizard from the interior of Western Australia. *Journal of the Royal Society of Western Australia* **82**: 75–77.

Storr, G.M., Smith, L.A. and Johnstone, R.E. (1990). *Lizards of Western Australia III Geckos & pygopods*. Western Australian Museum: Perth.

Storr, G.M., Smith, L.A. and Johnstone, R.E. (1999). *Lizards of Western Australia I Skinks*. Revised Edition. Western Australian Museum: Perth.

Thackway, R. and Cresswell, I.D. (1995). *An interim biogeographic regionalisation for Australia: a framework for setting priorities in the National Reserves System Cooperative Program* Version 4.0 Canberra: Australian Nature Conservation Agency, Reserves Systems Unit, 1995.

Water Corporation (2004). *Wicherina Water Reserve Drinking Water Source Protection Assessment, Wicherina Groundwater Scheme.*

Webb, J.K. and Shine, R. (1994). Feeding habits and reproductive biology of Australian pygopodid lizards of the genus *Aprasia*. *Copeia* **1994**: 390–398.

Wilson, S. and Swan, G. (2013). *A Complete Guide to Reptiles of Australia*. Fourth Edition. New Holland Publishers: Chatswood.

MANUSCRIPT RECEIVED 26 SEPTEMBER 2014; ACCEPTED 18 FEBRUARY 2015.

APPENDIX Additional material examined. All localities are in Western Australia unless otherwise indicated: SA =South Australia, VIC = Victoria, ACT = Australia Capital Territory. Legend for museum registration numbers: WAM = Western Australian Museum, SAMA = South Australian Museum, MV: Museum Victoria (R and D prefixes have been omitted for all specimens). *Also included in the allozyme study. ^Allozyme study only.

Aprasia aurita SAMA: ^43054 Wathe Fauna Reserve VIC (35°33′S, 142°25′E); ^49602 16.9 km N of Millicent SA (37°26′12″S, 140°19′03″E).

Aprasia clairae WAM: *127527 paratype (male), 10 km SSE of Dongara (29°19′S, 114°58′E); *156892 paratype, *156901 holotype (males), Turtle Bay, East Wallabi Island (28°25′55″S, 113°44′08″E).

Aprasia haroldi WAM: ^135496 11 km NE of Tamala Homestead (26°37′S, 113°47′E); ^163614 Dirk Hartog Island (25°43′51″S, 112°59′34″E); ^163615 Dirk Hartog Island (25°41′17″S, 113°00′41″E).

Aprasia inaurita SAMA: ^43055 Wathe Fauna Reserve VIC (35°33′S, 142°25′E); ^45254 Karte Conservation Park SA (35°07′32″S, 140°43′28″E); ^47087 Saint Peter Island SA (32°15′S, 133°35′E); ^49132 1 km W of Iron Duchess South SA (33°16′12″S, 137°06′08″E); ^54697 14 km ENE of Gluepot Homestead SA (33°45′04″S, 140°16′29″E).

Aprasia litorea WAM: ^116614 9 km NE of Cape Cuvier (24°11′S, 113°27′E); ^116656 0.5 km S of Gnaraloo Homestead (23°49′S, 113°32′E); ^116660 7 km SSW of Gnaraloo Homestead (23°54′S, 113°29′E).

Aprasia parapulchella SAMA: ^39799–00 Shepherds Lookout ACT (35°15′S, 148°57′E); MV: ^66569, ^66573 Bendigo Whipstick Forest VIC (36°46′S, 144°17′E).

Aprasia picturata WAM: ^131647 3.5 km S of Minara Homestead (28°27′S, 121°48′E).

Aprasia pseudopulchella SAMA: ^41116–17 3.2 km SSE of Old Belcunda Homestead SA (33°05′S, 139°01′E); ^42592 Cobbler Creek Reserve SA (34°47′S, 138°42′E); ^43085 Para Wirra Conservation Park SA (34°40′S, 138°50′E); ^44657, ^44663 Mount Brown Conservation Park SA (32°28′S, 138°01′E).

Aprasia pulchella WAM: ^80000 Jarrahdale (32°20′S, 116°04′E); ^132803 Chittering (31°28′S, 116°06′E); ^135130–31 Mundijong (32°18′S, 115°59′E).

Aprasia repens WAM: *113330 (female), Bold Park (31°55′S, 115°47′E); *115079 (male), Bold Park (31°56′S, 115°46′E); *119919 (male), Wembley Downs (31°54′S, 115°47′E); *125986 (female), 20 km E of Geraldton (28°46′S, 114°49′E); *126079 5 km S of Byford (32°16′02″S, 116°00′44″E); *127681 Cardup (32°16′08″S, 116°00′44″E); *127685 Cardup Reserve (32°14′53″S, 115°59′08″E); *127686 Brickwood Reserve (32°14′02″S, 116°00′07″E); *129543 Lake Mealup (32°41′S, 115°42′E); *133179 (male), Bold Park (31°56′28″S, 115°46′00″E); 134308 (male), Bella Vista Nature Reserve (28°32′15″S, 114°40′14″E); *135145–46 Manning Lake (32°06′S, 115°46′E); 137160 (female), Bella Vista Nature Reserve (28°32′15″S, 114°40′14″E); *137457 (male), Cervantes area (30°45′04″S, 115°12′10″E); *141972 (female), Morley (31°53′S, 115°54′E); *144049 (female), 5 km N of White Peak, Oakajee (28°34′S, 114°35′E); *144612 (female), Burns Beach (31°42′57″S, 115°45′57″E); *151695 (female), Muchea Air Weapons Range (31°38′29″S, 115°55′03″E); *151696 (male), Muchea Air Weapons Range (31°38′32″S, 115°55′03″E); *153967–68 Bindoon Military Training Area (31°10′14″S, 116°15′38″E); *157835 5 km NE of Wongan Hills (30°52′S, 116°45′E); *165951–52 (male, female), Kojarena (28°43′S, 114°52′E); *165961 (male), Eglinton (31°34′56″S, 115°40′29″E); *168645 (male), Yetna (28°36′24″S, 114°43′29″E); 173503–04 (female, male), Moresby Conservation Park (28°37′37″S, 114°39′55″E).

Aprasia rostrata WAM: 13861 (male), Hermite Island (20°29′S, 115°31′E); 61077 (male), 3 km NW of Bullara (22°40′S, 114°02′E); 74951 (female), Bullara Homestead (22°41′S, 114°02′E); 110662 (male), Learmonth Air Weapons Range (22°25′04″S, 113°45′50″E); ^116651 (female), 1 km NW of Bullara Homestead (22°41′S, 114°03′E); ^116672 (female), 2 km W of Bullara Homestead (22°41′S, 114°01′E); ^116882 (female), 21 km N of Bullara Homestead (22°29′S, 114°01′E); ^116914 (female), 2 km W of Bullara Homestead (22°41′S, 114°01′E); 141583 (male), 2 km W of Bullara Homestead (22°40′20″S, 114°00′52″E); 151725–27 (female, male, male), 1.5 km W of Bullara Homestead (22°41′S, 114°01′E); *153827–28 (male, female), 2 km NW of Yardie Homestead Caravan Park (21°52′57″S, 114°00′16″E); 153829 (female), Bullara Station (22°53′26″S, 113°55′25″E); 153830 (male), Bullara Station (22°43′35″S, 113°58′32″E); *165984–85 (males), Trimouille Island (20°23′12″S, 115°33′04″E); *165986–87 (males), Hermite Island (20°29′36″S, 115°31′40″E); *173456 (male), Barrow Island (20°50′18″S, 115°18′44″E).

Aprasia smithi WAM: ^116574, ^116657 11 km NE of Carbla Homestead (26°07′S, 114°16′E).

Aprasia striolata WAM: ^127524 10 km E of Ravensthorpe (33°35′25″S, 120°09′00″E); ^127528 10 km E of Ravensthope (33°35′20″S, 120°09′15″E); SAMA: ^39790 Flinders Chase National Park SA (35°58′S, 136°40′E); ^45106 Venus Bay Conservation Park SA (33°13′S, 134°36′E); ^45137 12.8 km ENE of Salt Creek SA (36°04′24″S, 139°45′46″E); ^45921 Wedge Island SA (35°11′20″S, 136°28′40″E); ^49598 16.7 km W of Snuggery SA (37°39′58″S, 140°14′29″E); ^49618 11.6 km ENE of Mount Benson SA (37°00′19″S, 139°56′10″E).

Aprasia sp. *incertae sedis* WAM: 86892 (male), Kalbarri (27°43′S, 114°10′E); 130495 (male), 32 km S of Kalbarri (27°59′26″S, 114°11′35″E).