

Three new species of *Ctenotus* (Reptilia: Sauria: Scincidae) from the Kimberley region of Western Australia, with comments on the status of *Ctenotus decaneurus yampiensis*

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Abstract – Three new species of *Ctenotus* Storr, 1964 (Reptilia: Sauria: Scincidae), *C. halysis* sp. nov., *C. mesotes* sp. nov. and *C. vagus* sp. nov. are described. Previously confused with *C. decaneurus* Storr, 1970 or *C. alacer* Storr, 1970, *C. halysis* sp. nov. and *C. vagus* sp. nov. are members of the *C. atlas* species complex. *Ctenotus mesotes* sp. nov. was previously confused with *C. tantillus* Storr, 1975 and is a member of the *C. schomburgkii* species complex. The new taxa are terrestrial, occurring in woodland habitats on sandy soils in the Kimberley region of Western Australia and are distinguished from congeners by combinations of body patterns, mensural and meristic characteristics. Comments are provided on the taxonomic status of *C. yampiensis* Storr, 1975 which is considered, as in the original description, a subspecies of *C. decaneurus*. Re-descriptions of *C. d. decaneurus* and *C. d. yampiensis* are provided.

Keywords – *Ctenotus alacer*, *decaneurus*, *yampiensis*, *halysis*, *mesotes*, *tantillus*, *vagus*, morphology, new species, Kimberley region, Western Australia

INTRODUCTION

Ctenotus Storr, 1964 is the most species-rich genus of scincid lizards in Australia, with almost 100 taxa recognised (Horner 2007; Wilson and Swan 2008). They are distributed throughout the Australian continent, with one species also occurring in southern New Guinea.

With about 49 species recorded (Wilson and Swan 2008), the Australian arid zone (up to 70% of the continent) is the primary centre of *Ctenotus* diversity. However it is becoming increasingly apparent that diversity may be just as great in Australia's wet-dry tropical savanna regions, where approximately 36 known species occur in what is about 15% of the continent. Throughout their range *Ctenotus* species are commonly sympatric (pers. obs.), particularly in parts of the Great Victoria Desert in Western Australia where up to seven species can be found in a single, *Triodia* dominated, sand plain (Pianka 1986).

Typically diurnal, *Ctenotus* occupy a diverse array of habitats, ranging from arid deserts to temperate woodlands. Many species exhibit a high degree of habitat specificity and may have very restricted distributions (Horner 1995). Sharing a basic body plan, *Ctenotus* species are differentiated

by combinations of size, scale characteristics, body colour and patterns.

Examination of a series of *Ctenotus* specimens, from the Kimberley region of Western Australia, identified three forms with unusual body patterns. Comparison of these to known species of similar appearance, investigating morphology and nomenclatural histories, resulted in their recognition as undescribed taxa.

This paper, on morphological and distributional grounds, describes those three taxa as new species and examines the taxonomic status of populations referred to *C. decaneurus* Storr, 1970 and *C. yampiensis* Storr, 1975. Comparisons are made between the new taxa and those species with which they could be confused and features of their habitats are described, if known.

MATERIALS AND METHODS

A series of atypical *Ctenotus* specimens, held in collections of the Museum and Art Gallery of the Northern Territory (NTM) and the Western Australian Museum (WAM), were examined and assigned to three undescribed species. A detailed morphometric and meristic analysis was made

Table 1 Summary of mensural and meristic variables for *Ctenotus alacer*, *C. d. decaneurus*, *C. d. yampiensis* and *C. haly-sis* sp. nov. Presented are mean (± 1 SD), mode (meristics only) and range in parentheses.

Character	<i>C. alacer</i> (n=10)	<i>C. d. decaneurus</i> (n=28)	<i>C. d. yampiensis</i> (n=4)	<i>C. haly-sis</i> sp. nov. (n=10)
midbody scale rows	29.8 \pm 1.03, 30 (28–32)	25.5 \pm 1.29, 26 (24–28)	30.5 \pm 1.29, 0 (29–32)	29.0 \pm 1.15, 30 (27–30)
paravertebral scales	67.9 \pm 4.93, 70 (60–75)	58.5 \pm 5.10, 55 (50–67)	59.0 \pm 2.00, 60 (56–60)	59.6 \pm 4.22, 59 (52–67)
nuchal scales	7.7 \pm 1.16, 9 (6–9)	8.1 \pm 1.78, 8 (2–10)	7.0 \pm 1.83, (5–9)	8.6 \pm 1.07, 9 (6–10)
supralabial scales	8.3 \pm 0.48, 8 (8–9)	7.6 \pm 0.49, 8 (7–8)	8.0 \pm 0.00, 8 (8)	7.8 \pm 0.42, 8 (7–8)
infralabial scales	7.1 \pm 0.32, 7 (7–8)	6.6 \pm 0.49, 7 (6–7)	7.0 \pm 0.00, 7 (7)	7.0 \pm 0.00, 7 (7)
supraciliary scales	7.1 \pm 0.32, 7 (7–8)	8.2 \pm 0.53, 8 (7–9)	8.0 \pm 0.00, 8 (8)	8.0 \pm 0.67, 8 (7–9)
ciliary scales	10.0 \pm 0.67, 10 (9–11)	9.4 \pm 0.64, 9 (9–11)	10.7 \pm 0.96, 10 (10–12)	10.8 \pm 0.92, 10 (10–12)
ear lobules	3.9 \pm 0.74, 4 (3–5)	4.1 \pm 0.63, 4 (3–5)	4.2 \pm 0.50, 4 (4–5)	4.9 \pm 0.74, 5 (4–6)
subdigital lamellae (4 th finger)	14.3 \pm 0.67, 14 (13–15)	12.7 \pm 1.04, 12 (11–15)	14.0 \pm 0.82, 14 (13–15)	14.0 \pm 0.82, 14 (13–15)
supradigital lamellae (4 th finger)	10.3 \pm 0.48, 10 (10–11)	10.0 \pm 0.66, 10 (9–11)	10.0 \pm 0.00, 10 (10)	10.2 \pm 0.42, 10 (10–11)
subdigital lamellae (4 th toe)	26.6 \pm 2.07, 29 (23–29)	20.7 \pm 1.69, 21 (18–23)	21.0 \pm 1.41, 22 (19–22)	21.7 \pm 1.06, 21 (20–23)
supradigital lamellae (4 th toe)	17.0 \pm 1.41, 17 (15–20)	15.0 \pm 1.19, 15 (13–17)	14.7 \pm 1.26, 15 (13–16)	16.0 \pm 1.25, 15 (15–18)
snout-vent length (mm)	57.5 \pm 5.32 (47.6–67.4)	45.1 \pm 4.82 (35.3–54.5)	50.3 \pm 1.92 (48.8–53.1)	52.7 \pm 4.84 (44.9–58.5)
body length (%svl)	53.7 \pm 1.75 (51.5–57.5)	51.3 \pm 2.47 (46.1–56.1)	51.4 \pm 2.85 (48.4–54.8)	48.2 \pm 3.55 (42.3–54.3)
tail length (%svl)	195.3 \pm 10.22 (188.1–202.5) (n=2)	216.4 \pm 20.28 (183.1–251.1) (n=14)	0 (n=0)	205.7 \pm 23.23 (181.1–231.0) (n=4)
forelimb length (%svl)	29.7 \pm 1.50 (27.0–32.4)	28.1 \pm 2.36 (22.9–33.0)	29.0 \pm 0.48 (28.3–29.4)	28.8 \pm 2.16 (25.5–32.3)
hindlimb length (%svl)	51.3 \pm 3.49 (47.4–58.0)	43.4 \pm 3.77 (34.7–49.8)	46.4 \pm 2.41 (43.1–48.5)	46.7 \pm 2.54 (42.3–50.0)
forebody length (%svl)	38.4 \pm 1.32 (36.1–40.5)	39.7 \pm 1.93 (36.3–43.7)	39.3 \pm 0.84 (38.1–40.1)	40.5 \pm 2.28 (37.6–43.8)
head length (%svl)	20.1 \pm 1.05 (18.5–21.4)	20.2 \pm 1.14 (18.1–22.4)	20.3 \pm 0.42 (20.0–20.9)	20.8 \pm 1.01 (19.3–22.3)
head depth (%hl)	53.7 \pm 4.65 (47.5–61.1)	47.3 \pm 3.82 (39.8–58.9)	50.0 \pm 5.77 (41.4–53.7)	50.3 \pm 3.50 (45.8–57.0)
head width (%hl)	64.6 \pm 2.33 (60.7–67.6)	60.2 \pm 2.85 (52.2–67.3)	63.9 \pm 3.19 (61.3–68.4)	60.2 \pm 2.31 (56.3–63.9)
snout length (%hl)	42.8 \pm 1.61 (41.0–45.9)	43.8 \pm 2.24 (40.2–50.4)	44.5 \pm 1.76 (42.7–46.6)	44.5 \pm 2.74 (40.8–49.7)
supraocular (largest)	subequal 100%	second 57% subequal 43%	second 25% subequal 75%	second 40% subequal 60%
prefrontal (contact point)	separated 90% narrow contact 10%	contact 25% separated 75%	contact 50% separated 50%	contact 50% separated 50%
nasal (contact point)	narrow separation 80% broad contact 20%	contact 43% separated 57%	separated 100%	separated 100%
presubocular (presence)	present 100%	present 100%	present 100%	present 100%
subocular (supralabial)	6 th labial 70% 7 th labial 30%	5 th labial 36% 6 th labial 64%	6 th labial 100%	5 th labial 20% 6 th labial 80%
ear lobule (largest)	upper 10% mid 90%	upper 61% mid 39%	mid 100%	mid 100%
subdigital lamellae (condition)	callose 100%	callose 100%	callose 100%	callose 100%

Table 2 Summary of mensural and meristic variables for *Ctenotus vagus* sp. nov., *C. tantillus* and *C. mesotes* sp. nov. Presented are mean (± 1 SD), mode (meristics only) and range in parentheses.

Character	<i>C. vagus</i> sp. nov. (n=2)	<i>C. tantillus</i> (n=38)	<i>C. mesotes</i> sp. nov. (n=11)
midbody scale rows	26.0 \pm 0.00, (26)	27.0 \pm 1.33, 28 (24–28)	29.4 \pm 1.29, 30 (28–32)
paravertebral scales	59.0 \pm 2.83, (57–61)	60.8 \pm 3.45, 61 (53–68)	63.0 \pm 3.32, 63 (57–68)
nuchal scales	8.0 \pm 0.00, (8)	7.8 \pm 1.47, 8 (5–10)	7.2 \pm 1.17, 6 (6–9)
supralabial scales	8.0 \pm 0.00, (8)	7.0 \pm 0.16, 7 (7–8)	7.1 \pm 0.30, 7 (7–8)
infralabial scales	7.0 \pm 0.00, (7)	6.6 \pm 0.54, 7 (6–8)	6.0 \pm 0.00, 6 (6)
supraciliary scales	8.0 \pm 0.00, (8)	7.9 \pm 0.39, 8 (7–9)	8.1 \pm 0.54, 8 (7–9)
ciliary scales	9.5 \pm 0.71, (9–10)	9.3 \pm 0.75, 9 (8–11)	10.1 \pm 0.54, 10 (9–11)
ear lobules	4.0 \pm 0.00, (4)	2.9 \pm 0.52, 3 (2–4)	2.9 \pm 0.30, 3 (2–3)
subdigital lamellae (4 th finger)	14.0 \pm 0.00, (14)	12.7 \pm 1.07, 12 (11–15)	13.6 \pm 0.82, 14 (12–15)
supradigital lamellae (4 th finger)	10.0 \pm 0.00, (10)	10.1 \pm 0.49, 10 (9–11)	10.1 \pm 0.70, 10 (9–11)
subdigital lamellae (4 th toe)	23.0 \pm 1.41, (22–24)	22.0 \pm 1.32, 22 (19–26)	22.4 \pm 1.37, 22 (20–25)
supradigital lamellae (4 th toe)	15.5 \pm 0.71, (15–16)	14.8 \pm 1.14, 14 (12–17)	15.4 \pm 0.93, 16 (14–17)
snout-vent length (mm)	43.8 \pm 0.01 (43.8–43.9)	39.2 \pm 3.18 (32.5–46.4)	37.7 \pm 4.67 (25.7–41.5)
body length (%svl)	50.2 \pm 2.98 (48.0–52.3)	53.5 \pm 3.24 (46.2–60.2)	52.4 \pm 2.01 (48.9–54.9)
tail length (%svl)	246.5 \pm 0.00 (246.5) (n=1)	202.6 \pm 15.53 (167.1–230.8) (n=19)	211.3 \pm 6.30 (206.8–218.5) (n=3)
forelimb length (%svl)	30.8 \pm 0.44 (30.5–31.2)	28.4 \pm 1.92 (24.2–32.5)	29.9 \pm 2.09 (27.3–34.6)
hindlimb length (%svl)	51.1 \pm 2.79 (49.2–53.1)	44.8 \pm 3.00 (38.1–52.3)	48.1 \pm 1.83 (44.7–50.4)
forebody length (%svl)	42.6 \pm 1.13 (41.8–43.4)	39.3 \pm 2.12 (34.8–43.0)	40.0 \pm 2.24 (36.7–44.8)
head length (%svl)	20.8 \pm 0.47 (20.5–21.1)	21.5 \pm 1.02 (19.3–23.6)	21.7 \pm 1.05 (20.5–23.7)
head depth (%hl)	52.8 \pm 1.65 (51.7–54.0)	53.1 \pm 4.39 (44.7–62.8)	46.8 \pm 4.51 (40.2–55.5)
head width (%hl)	61.5 \pm 1.85 (60.2–62.8)	62.6 \pm 3.64 (56.0–70.7)	59.9 \pm 3.80 (55.1–67.0)
snout length (%hl)	42.6 \pm 1.45 (41.5–43.6)	41.6 \pm 2.20 (38.4–46.5)	44.1 \pm 1.87 (41.1–47.7)
supraocular (largest)	subequal 100%	second 97% subequal 3%	second 91% subequal 9%
prefrontal (contact point)	separated 100%	separated 100%	separated 100%
nasal (contact point)	narrow separation 50% broad contact 50%	narrow contact 8% broad contact 92%	narrow contact 73% broad contact 27%
presubocular (presence)	present 100%	present 100%	present 100%
subocular (supralabial)	6 th labial 100%	5 th labial 97% 6 th labial 3%	5 th labial 91% 6 th labial 9%
ear lobule (largest)	upper 100%	upper 100%	upper 100%
subdigital lamellae (condition)	callose 100%	keeled 100%	keeled 100%

of these and of species with which they could be easily confused.

Mensural and meristic data were recorded from preserved material and are summarised in Tables 1 and 2. Morphometric characters were measured, under an illuminated magnifying lens, with electronic digital callipers to the nearest 0.1 mm. Unless noted otherwise, condition of bilaterally present characters was recorded from the right side. Status of tails as original or regrown was determined by assessment of caudal scalation and colouration. Sex was determined through a mid-ventral incision, made in the posterior quarter of body. Primary colouration and body pattern of each specimen was also recorded. Nomenclature for

scalation and body pattern follows that of Horner (1991). Definition of measurements and counts taken follow those given in Horner (1991) and Horner and Fisher (1998) with the exception of nuchal scales, which are given as a total number rather than those in one of two series.

Small sample sizes, lack of a comprehensive phylogeny and unavailability of genetic samples for some of the new taxa, precluded detailed statistical or molecular analyses.

TAXONOMY

Employing the generic diagnoses provided by Storr (1964) and Cogger (2000), specimens examined were assigned to the scincid genus

Table 3 Content of two *Ctenotus* species-groups, giving generalised distribution for each taxon. Note addition of *C. rawlinsoni*, previously considered a member of the *C. lesueurii* group (Wilson and Knowles 1988) or *C. australis* group (Storr *et al.* 1999), but which also fits criteria for the *C. atlas* species-group.

Taxa	Primary distribution (Wilson and Swan 2008)
<i>Ctenotus atlas</i> species-group	
<i>C. alacer</i> Storr, 1970	central Australia, north-west Qld
<i>C. ariadnae</i> Storr, 1969	central Australia
<i>C. atlas</i> Storr, 1969	arid southern Australia
<i>C. decaneurus decaneurus</i> Storr, 1970	far northern WA and NT, north-west Qld
<i>C. decaneurus yampiensis</i> Storr, 1975	Kimberley region, WA
<i>C. duricola</i> Storr, 1975	mid-west coast of WA
<i>C. dux</i> Storr, 1969	central Australia
<i>C. halysis</i> sp. nov.	Kimberley region, WA
<i>C. iapetus</i> Storr, 1975	mid-west coast of WA
<i>C. impar</i> Storr, 1969	south-west WA
<i>C. piankai</i> Storr, 1969	arid north WA, western NT, north-west SA
<i>C. quattuordecimlineatus</i> (Sternfeld, 1919)	arid central WA, south-west NT, north-west SA
<i>C. rawlinsoni</i> Ingram, 1979	north-east Qld
<i>C. storri</i> Rankin, 1978	northern NT
<i>C. vagus</i> sp. nov.	Kimberley region, WA
<i>C. xenopleura</i> Storr, 1981	south-west WA
<i>C. zasticus</i> Storr, 1984	mid-west coast of WA
<i>Ctenotus schomburgkii</i> species-group	
<i>C. allotropis</i> Storr, 1981	central NSW, mid-south Qld
<i>C. brooksi</i> (Loveridge, 1933)	arid central and western Australia
<i>C. euclae</i> Storr, 1971	south-east WA, south-west SA
<i>C. mesotes</i> sp. nov.	Kimberley region, WA
<i>C. pallescens</i> Storr, 1970	central NT, east Kimberley WA
<i>C. schomburgkii</i> (Peters, 1863)	arid central and western Australia
<i>C. strauchii strauchii</i> (Boulenger, 1887)	north-east Qld, north-west NSW, south-east SA
<i>C. strauchii varius</i> Storr, 1981	central Australia
<i>C. taeniatus</i> (Mitchell, 1949)	east-central Australia, western Vic, south-east SA
<i>C. tantillus</i> Storr, 1975	Kimberley region WA, north-west NT

Ctenotus Storr, 1964 on the following external morphological characters: parietal scales in contact behind interparietal; lower eyelids moveable and scaly; limbs pentadactyl; supranasal scales absent; nasal scale undivided; body scales smooth; lower secondary temporal scales overlapping upper temporal scale; colour pattern containing dorsal and lateral longitudinal stripes; and anterior ear lobules usually present.

Storr (1981; Storr *et al.* 1999) separated Western Australian *Ctenotus* into ten species-groups. Based on morphological similarity, these species-groups are not necessarily natural but function in clustering similar species together. Following Storr's lead, Wilson and Knowles (1988) recognised 12 species-groups to encompass all Australian *Ctenotus*. Of the three taxa described in this work, two were placed in Storr's *C. atlas* species-group (Table 3) by the following five character states in combination: small to medium size; digits compressed; subdigital lamellae with an obtuse keel or narrow to moderately wide callus; second supraocular not much wider than first or third and simple body pattern of dark ground colour with 6–20 whitish longitudinal stripes (upper lateral zone spotted in a few taxa). The remaining new taxon was placed in Storr's *C. schomburgkii* species-group (Table 3) by having the following combination of character states: very small and slender; digits strongly compressed; subdigital lamellae with a fine keel ending in a mucron; long, narrow snout; dark vertebral stripe narrow or absent; usually a dark laterodorsal stripe enclosing, or interrupted by, pale spots, short dashes or transverse bars; dark upper lateral zone enclosing pale dots, spots or short dashes or interrupted by pale, squarish, window-like marks.

Status of *Ctenotus decaneurus yampiensis* Storr, 1975

Some detail is required to resolve uncertainty that surrounds the taxonomic status and nomenclature of *Ctenotus decaneurus yampiensis*. Storr's original description of *C. d. yampiensis* was based on three specimens from Wotjulum Mission Station, Western Australia (Storr 1975). In a later publication, and without formal comment, Storr *et al.* (1981) gave revised meristic data from the same three specimens (Smith 2002) and elevated the taxon to specific status.

Inadvertently, as determined by Smith (2002), Storr's (1975) description sourced data from a composite series of six specimens representing two distinct taxa, namely colour and body pattern from *C. d. yampiensis* (WAM R11740–2) and measurements from *C. militaris* (WAM R11795–7). These two taxa were described in the same volume (Storr 1975), with the description of *C. militaris* preceding



Figure 1 Neotype of *Ctenotus decaneurus yampiensis* Storr, 1975. WAM R11741, Wotjulum, Kimberley region, Western Australia, 16°14'S 123°38'E. Scale bar = 10 mm.

that of *C. d. yampiensis* by four pages and having taxonomic priority. Confusion with *C. d. yampiensis* nomenclature resulted from Storr (1975) designating WAM R11795 as holotype and R11796–7 as paratypes. Unfortunately, these numbers belong to specimens of *C. militaris* (Smith 2002) and rendered Storr's new subspecific name a junior synonym of *C. militaris*.

When this error was recognised Smith (2002), to stabilise nomenclature, proposed designation of a neotype for *C. yampiensis*. Subsequently the International Commission on Zoological Nomenclature (ICZN), in Opinion 2090 (ICZN 2004), set aside previous type fixations and designated specimen number WAM R11741 (Figure 1) (sometime labelled by Storr as the 'type of *Ctenotus yampiensis*') as neotype for *C. yampiensis*. Since 1975, only one additional specimen (WAM R166899) has been confidently identified as *C. yampiensis*.

Comparison of variables recorded from each of the four known *C. yampiensis* and a comparative series of 28 *C. decaneurus* (Table 1) identified divergence in snout-vent length (SVL) (\bar{x} 51.4 vs 45.1 mm), midbody scale rows (\bar{x} 30.5 vs 25.5),

ciliary scales (\bar{x} 10.7 vs 9.4) and fourth finger subdigital lamellae (\bar{x} 14.0 vs 12.7). Of these, substantial overlap existed in SVL (range 48.8–53.1 vs 35.3–54.5 mm), ciliary scales (range 10–12 vs 9–11) and fourth finger subdigital lamellae (range 13–15 vs 11–15) and body colour and patterning were indistinguishable.

In literature *C. decaneurus* is usually cited as having a midbody scale row count of up to 26 (Horner 1991; Storr *et al.* 1999; Wilson and Swan 2008), where a higher range of 24–32 is given (Cogger 2000) *C. yampiensis* had been included in the description as a subspecific component of *C. decaneurus*. Although populations of *C. decaneurus* from north-west Queensland were not examined for this study, eastern-most Northern Territory specimens (NTM R13837, R17896, R27867) have low midbody counts of 24 and Queensland specimens are therefore expected to conform to the range given (Table 1). Also in literature (Wilson and Swan 2008), *C. yampiensis* is recorded from Mount Elizabeth Station, Western Australia, located approximately 200 km from its known range (Storr 1975; this study). Those Mount Elizabeth records are herein determined to be representatives of a new taxon described in this study, not *C. yampiensis*.

In summary, the only character which reliably distinguished *C. yampiensis* from *C. decaneurus* was a higher midbody scale row count (range 29–32 vs 24–28). Having an obviously close morphological relationship, but apparently disjunct distributions and some morphological differentiation, *C. yampiensis* is herein considered (as in the original description) an incipient biological species and a subspecific component of the polytypic taxon *C. decaneurus*.

Ctenotus Storr, 1964

Type species

Lacerta taeniolata Shaw, 1790 (= *Ctenotus taeniolatus* [White, 1790]), by original designation.

Ctenotus decaneurus Storr, 1970

Ctenotus decaneurus Storr, 1970: 104

Ctenotus decaneurus yampiensis Storr, 1975: 235

Diagnosis

A moderately small member (SVL to 54.5 mm) of the *C. atlas* species-group, distinguished from congeners by having three of four supraoculars in contact with frontal, frontoparietals paired, prefrontals usually separated, eight supralabials, laterally compressed toes with callose subdigital lamellae, prominent pale mid-lateral stripe, black ground colour with usually ten pale stripes on

body, dark vertebral stripe, unpatterned dark upper lateral zone, pale paravertebral stripes not fused posteriorly.

Subspecies

Ctenotus decaneurus is a polytypic taxon comprised of two subspecies: *C. d. decaneurus* Storr, 1970 and *C. d. yampiensis* Storr, 1975.

Ctenotus decaneurus decaneurus Storr, 1970

Ten-lined *Ctenotus*

Figures 2,3, Table 1

Description

Prefrontal scales usually in contact (75%). Nasal scales in contact (57%) or separated by rostral and frontonasal scales. Frontoparietal scales paired. Interparietal scale distinct. Loreal scales two, second usually larger than first. Upper and lower preocular scales present. Presubocular scale present. Nuchal scales 2–10 (\bar{x} 8.1). Supraciliary scales 7–9 (\bar{x} 8.2), median three or four much smaller than first three and final scale in series. Ciliary scales 9–11 (\bar{x} 9.4). Supralabial scales 7–8 (\bar{x} 7.6), sixth usually under eye (64%), occasionally fifth. Infralabial scales 6–7 (\bar{x} 6.6). Ear lobules 3–5 (\bar{x} 4.1), central lobule usually largest in series. Midbody scale rows 24–28 (\bar{x} 25.5). Paravertebral scales 50–67 (\bar{x} 58.5). Subdigital lamellae moderately callose (100%), 11–15 below fourth finger (\bar{x} 12.7), 18–23 below fourth toe (\bar{x} 20.7). Supradigital scales above fourth finger 9–11 (\bar{x} 10.0), above fourth toe 13–17 (\bar{x} 15.0) (Table 1).

SVL to 54.5 mm (\bar{x} 45.1 mm). Percentages of SVL: Body length 46.1–56.1% (\bar{x} 51.3%); tail length 183.1–251.1% (\bar{x} 216.4%, $n = 14$); forelimb length 22.9–33.0% (\bar{x} 28.1%); hindlimb length 34.7–49.8% (\bar{x} 43.4%); forebody length 36.3–43.7% (\bar{x} 39.7%); head length 18.1–22.4% (\bar{x} 20.2%). Percentages of head length: head depth 39.8–58.9% (\bar{x} 47.3%); head width 52.2–67.3% (\bar{x} 60.2%); snout length 40.2–50.4% (\bar{x} 43.8%) (Table 1).

Sex ratio favoured males (18:9) and was significantly different from parity ($X^2 = 3.00$).

Colour and pattern (in spirit)

A black *Ctenotus* with longitudinally aligned, simple body pattern of 8–10 narrow pale stripes (Figure 2). Examined specimens conformed to the following description.

Dorsal ground colour black. Back patterned with six narrow, whitish stripes (paired paravertebrals, dorsals and dorsolaterals). Back stripes equal in width, about one quarter as wide as a mid-paravertebral scale. Paravertebral stripes extend from parietal region onto tail, dorsal stripes from fourth supraocular to base of tail and dorsolateral



Figure 2 Holotype of *Ctenotus decaneurus decaneurus* Storr, 1970. WAM R23130, 21 miles WNW of Newry Station, Northern Territory, Australia, 15°59'S 129°00'E. Scale bar = 10 mm.

stripes from over eye onto tail. Lateral surfaces of body black, patterned with whitish midlateral and lower lateral stripes. Midlateral stripe (most prominent in body pattern), about as wide as a mid-lateral scale, extends from upper ear, over limbs and onto tail. Lower lateral stripe, similar in width to mid-lateral stripe, extends from lower ear through forelimb to groin. In some specimens the lower lateral stripe lacks a lower dark margin and merges seamlessly with ventral surface, giving a body pattern of eight rather than ten stripes. No specimen examined had more than ten body stripes.

Head brownish, patterned with dark mottling and pale subocular stripe from loreals to upper ear (continuous with midlateral stripe). Tail brownish, patterned with continuations of major body

stripes. Limbs black dorsally, patterned with two (forelimbs) or three (hindlimbs) pale stripes. Ventral surfaces immaculate white, underside of limbs and tail creamish.

Comparison with other species

Ctenotus d. decaneurus is distinguished from most congeners by being medium sized, having compressed digits, callose subdigital lamellae and a simple body pattern of dark ground colour with 10 whitish longitudinal stripes. In combination these characters place it among the 17 members of the *C. atlas* species-group (Table 3). From most species-group co-members it may be distinguished by disjunct distribution and number of pale stripes. Only *C. d. yampiensis*, *C. halysis* sp. nov., *C. vagus* sp. nov. and *C. piankai* share a Kimberley region distribution and only *C. atlas*, *C. d. yampiensis* and *C. vagus* sp. nov. share ten pale stripes and an unspotted upper lateral zone.

Further distinguished from *C. alacer*, *C. ariadnae*, *C. halysis* sp. nov. and *C. xenopleura* by lack of pale spotting in upper lateral zone and number of midbody scale rows (26 instead of 28 or more). From *C. atlas*, *C. dux* and *C. quattuordecimlineatus* by fewer midbody scale rows (26 instead of 28 or more) and usually separated nasal scales. From *C. impar* and *C. storri* by fewer infralabial scales (seven instead of eight), more midbody scale rows (26 instead of 24 in *C. storri*) and dark vertebral stripe (pale in *C. impar*). From *C. rawlinsoni*, *C. iapetus* and *C. zastictus* by fewer fourth toe subdigital lamellae (23 or less instead of 24 or more). From *C. duricola* by fewer midbody scale rows (26 instead of 28 or more). From *C. piankai* by usually having prefrontals separated (instead of in contact) and black, instead of brown, ground colour.

Ctenotus d. decaneurus is easily confused with *C. vagus* sp. nov., but is distinguished by having well defined pale dorsal stripes (between pale paravertebral and dorsolateral stripes), by having fewer fourth toe subdigital lamellae (usually 21 instead of 23) and shorter hindlimbs (usually 43.4% of SVL, instead of 51.1%).

Distinguished from conspecific *C. d. yampiensis* by fewer midbody scale rows (usually 26 instead of 30).

Distribution

Kimberley region of northern Western Australia to the Top End of the Northern Territory (Figure 3), with an apparently disjunct population in arid western Queensland.

Ecology and habits

Prefers rocky habitats such as stony hills and ranges, where it shelters under small rocks and vegetation (Horner 1991).

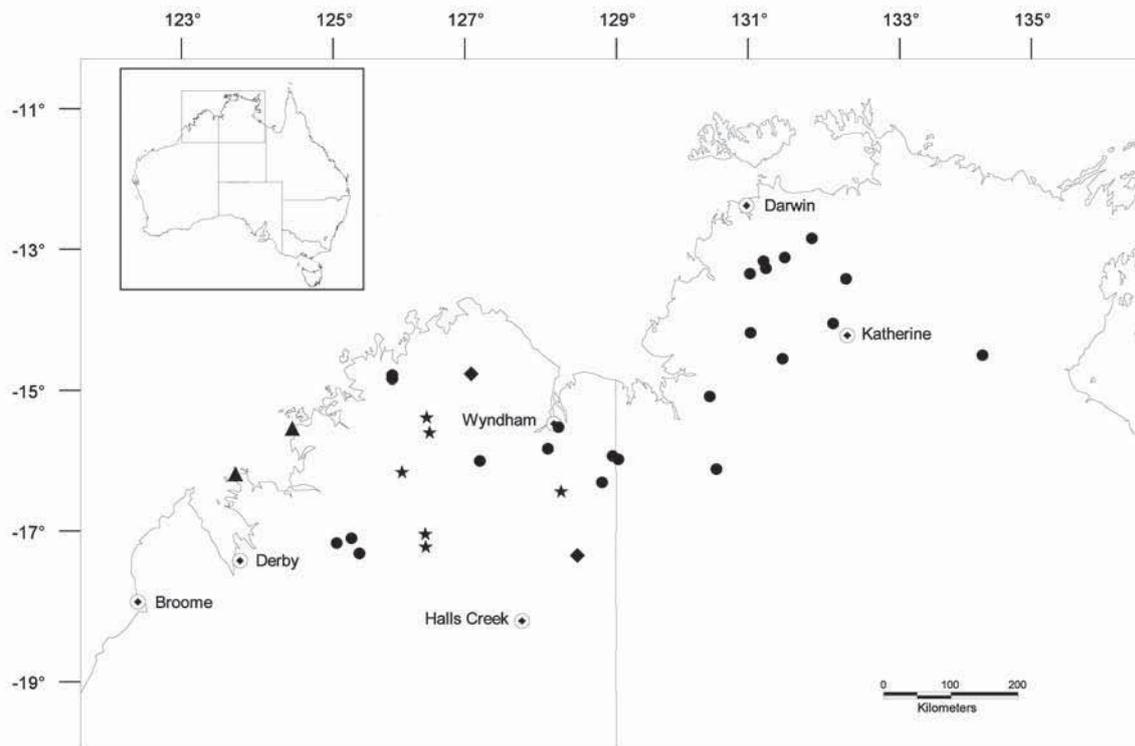


Figure 3. Map of north-western Australia showing distributions of *Ctenotus d. decaneurus* (circles), *C. d. yampiensis* (triangles), *C. halysis* sp. nov. (stars) and *C. vagus* sp. nov. (diamonds).

Ctenotus decaneurus yampiensis Storr, 1975

Yampi *Ctenotus*

Figures 1,3, Table 1

Description

Prefrontal scales in contact or separated. Nasal scales separated by rostral and frontonasal scales. Frontoparietal scales paired. Interparietal scale distinct. Loreal scales two, second usually larger than first. Upper and lower preocular scales present. Presubocular scale present. Nuchal scales 5–9 (\bar{x} 7.0). Supraciliary scales 8, median three or four much smaller than first three and final scale in series. Ciliary scales 10–12 (\bar{x} 10.7). Supralabial scales 8, sixth under eye. Infralabial scales 7. Ear lobules 4–5 (\bar{x} 4.2), central lobule usually largest in series. Midbody scale rows 29–32 (\bar{x} 30.5). Paravertebral scales 56–60 (\bar{x} 59.0). Subdigital lamellae moderately callose, 13–15 below fourth finger (\bar{x} 14.0), 19–22 below fourth toe (\bar{x} 21.0). Supradigital scales above fourth finger 10, above fourth toe 13–16 (\bar{x} 14.7) (Table 1).

SVL to 53.1 mm (\bar{x} 50.3 mm). Percentages of SVL: Body length 48.4–54.8% (\bar{x} 51.4%); tail length unknown; forelimb length 28.3–29.4% (\bar{x} 29.0%); hindlimb length 43.1–48.5% (\bar{x} 46.4%); forebody length 38.1–40.1% (\bar{x} 39.3%); head length 20.0–20.9%

(\bar{x} 20.3%). Percentages of head length: head depth 41.4–53.7% (\bar{x} 50.0%); head width 61.3–68.4% (\bar{x} 63.9%); snout length 42.7–46.6% (\bar{x} 44.5%) (Table 1).

Colour and pattern (in spirit)

A black *Ctenotus* with longitudinally aligned, simple body pattern of 8–10 narrow pale longitudinal stripes (Figure 1). Examined specimens did not significantly differ from the colour and pattern given for the nominate subspecies.

Comparison with other species

Comparison given for conspecific *C. d. decaneurus* applies equally to this taxon, except for those taxa which share a high midbody scale row count (*C. alacer*, *C. ariadnae*, *C. atlas*, *C. duricola*, *C. dux*, *C. halysis* sp. nov., *C. quattuordecimlineatus* and *C. xenopleura*).

Distinguished from *C. alacer*, *C. ariadnae*, *C. halysis* sp. nov. and *C. xenopleura* by lack of pale spotting in upper lateral zone and from *C. atlas*, *C. duricola*, *C. dux* and *C. quattuordecimlineatus* by usually separated nasal scales (instead of in contact).

Distinguished from conspecific *C. d. decaneurus* by more midbody scale rows (usually 30 instead of 26).

Distribution

Vicinity of Collier Bay, west coast of the Kimberley region of Western Australia (Figure 3). Recorded from Wotjulum and Wilson Point (south of Kuri Bay).

Ecology and habits

Unknown, although presumed similar to that of nominate subspecies. As illustrated in Figure 3, the distribution of *C. d. yampiensis* is apparently disjunct to that of *C. d. decaneurus*.

Ctenotus halysis sp. nov.

Chained Ctenotus

Figures 4–8, Table 1

Holotype

Australia: Western Australia: WAM R166157, an adult male (Figure 4), Cuckoo Hill, Doongan Station, Kimberley region, Western Australia, 15°23'18"S 126°20'15"E. Collected by J. Reside on 10 August 2006. Found under rocks in woodland over grasses.

Measurements (mm) and scale counts: SVL 54.9; tail length 105.3; body length 26.9; forelimb length 14.9; hindlimb length 25.0; head width 6.5; head depth 5.5; snout length 4.7; head length 10.9; forelimb to snout length 21.5; nasals broadly separated; prefrontals broadly contacting; supraciliaries seven; ciliaries 12; supralabials eight; infralabials seven; nuchal scales nine; ear lobules four, second from top lobule largest in series; subdigital lamellae under fourth finger 15, under fourth toe 23; supradigital scales above fourth finger 10, above fourth toe 16; midbody scale rows 28; paravertebral scales 61.

Paratypes

Australia: Western Australia: NTM R27626, R27627, north of Drysdale River turn-off on Kalumburu Road, 15°36'21"S 126°21'26"E; WAM R58099–100, 129 km south of Wyndham, 16°25'S 128°13'E; WAM R83679, 30 km north-west of Mount Elizabeth, 16°09'S 125°58'E; WAM R163237, 1 km east of Dora Creek, Mornington Station, 17°11'56"S 126°18'20"E; WAM R163238–9, Dora Creek, Mornington Station, 17°00'36"S 126°18'03"E; WAM R166158, Doongan Station, 15°23'18"S 126°20'15"E.

Diagnosis

A moderately small member (SVL to 58.5 mm) of the *C. atlas* species group, distinguished from congeners by having three of four supraoculars in contact with frontal, frontoparietals paired, eight supralabials, laterally compressed toes with callose subdigital lamellae, prominent pale mid-lateral stripe, black ground colour with ten or more pale



Figure 4 Holotype of *Ctenotus halysis* sp. nov., WAM R166157, Cuckoo Hill, Doongan Station, Kimberley region, Western Australia, 15°23'18"S 126°20'15"E. Scale bar = 10 mm.

stripes on body, dark vertebral stripe, dark upper lateral zone patterned with longitudinal series of narrow pale streaks.

Description

Prefrontal scales in contact or separated. Nasal scales broadly to narrowly separated by rostral and frontonasal scales. Frontoparietal scales paired. Interparietal scale distinct. Loreal scales two, second usually larger than first. Upper and lower preocular scales present. Presubocular scale present. Nuchal scales 6–10 (\bar{x} 8.6). Supraciliary scales 7–9 (\bar{x} 8.0), median three or four much smaller than first three and final scale in series. Ciliary scales 10–12 (\bar{x} 10.8). Supralabial scales 7–8 (\bar{x} 7.8), sixth usually under orbit (80%), occasionally fifth (20%). Infralabial scales 7 (100%). Ear lobules 4–6 (\bar{x} 4.9), central lobules largest in series. Midbody scale rows 27–30 (\bar{x} 29.0). Paravertebral scales 52–67 (\bar{x} 59.6). Subdigital lamellae moderately callose (100%), 13–15 below fourth finger (\bar{x} 14.0), 20–23 below fourth toe (\bar{x} 21.7). Supradigital scales above fourth finger 10–11 (\bar{x} 10.2), above fourth toe 15–18 (\bar{x} 16.0) (Table 1).

SVL to 58.5 mm (\bar{x} 52.7 mm). *Percentages of SVL:* Body length 42.3–54.3% (\bar{x} 48.2%); tail length 181.1–231.0% (\bar{x} 205.7%, $n = 4$); forelimb length 25.5–32.3% (\bar{x} 28.8%); hindlimb length 42.3–50.0% (\bar{x} 46.7%); forebody length 37.6–43.8% (\bar{x} 40.5%); head length 19.3–22.3% (\bar{x} 20.8%). *Percentages of head length:* head depth 45.8–57.0% (\bar{x} 50.3%); head width 56.3–63.9% (\bar{x} 60.2%); snout length 40.8–49.7% (\bar{x} 44.5%) (Table 1).

Colour and pattern (in spirit)

A blackish *Ctenotus* with longitudinally aligned, complex body pattern dominated by 10–12 narrow pale longitudinal stripes and bilateral series of longitudinally aligned, chain-like series of pale streaks in upper lateral zones (Figures 4–8). Examined specimens conformed to the following description.

Dorsal ground colour black to blackish brown. Back patterned with six narrow, creamish white stripes (paired paravertebrals, dorsals and dorsolaterals). Back stripes equal in width, about one third as wide as a mid-paravertebral scale and extend from parietal region to base of tail. Lateral surface of body blackish brown, patterned with whitish midlateral and one or two lower lateral stripes. Upper lateral zone patterned with longitudinally aligned, chain-like, series of whitish streaks and spots, extending from temporal region to groin. In some specimens the upper lateral spots may merge posteriorly, forming a narrow pale stripe. Prominent midlateral stripe is about half as wide as a midlateral scale, extends from ear, over forelimb and onto tail. Lower lateral zone is about two thirds as wide as upper lateral zone, and patterned with one, occasionally two, narrow continuous whitish stripes extending from neck to groin. Lower lateral zone coalesces into pale venter.

Head brownish, patterned with dark mottling and obscure pale subocular stripe. Tail brownish, patterned with continuations of major body stripes. Limbs dark brown dorsally, patterned with darker blotches and stripes. Ventral surfaces immaculate white, underside of limbs and tail creamish.

In life, large adults (Figure 6) are less intensely patterned than juveniles and subadults. The latter commonly have the head and anterior half of body



Figure 5 Paratype of *Ctenotus halysis* sp. nov. in life. NTM R27626, north of Drysdale River turn-off on Kalumburu Road, Kimberley region, Western Australia, 15°36'21"S 126°21'26"E.



Figure 6 Paratype of *Ctenotus halysis* sp. nov. in life. WAM R163238, Dora Creek, Mornington Station, Kimberley region, Western Australia, 17°00'36"S 126°18'03"E. Photo by Ray Lloyd.

suffused with russet (Figures 5 and 7). This is most intense on the head and nape, virtually replacing the blackish ground colour.

Comparison with other species

Ctenotus halysis sp. nov. is distinguished from most congeners by being medium sized, having compressed digits, callose subdigital lamellae and a simple body pattern of dark ground colour with 10–12 whitish longitudinal stripes. In combination, these characters place it in the *C. atlas* species-group (Table 3). Distinguished from most species-group co-members by distribution and body pattern. Only *C. d. decaneurus*, *C. d. yampiensis*, *C. piankai* and *C. vagus* sp. nov. share a Kimberley region distribution and only *C. xenopleura* shares ten pale stripes and a spotted upper lateral zone.

Further distinguished from *C. ariadnae*, *C. atlas*, *C. duricola*, *C. iapetus*, *C. piankai*, *C. quattuordecimlineatus*, *C. storri*, and *C. zasticus* by having nasal scales in contact rather than separated. From *C. d. decaneurus* and *C. d. yampiensis* by having more ciliary scales (12 instead of 10 or less), more supradigital scales over the fourth toe (18 instead of 15) and a deeper head (51.3% of SVL instead of 50.0% or less). From *C. impar* by having a dark (instead of pale) vertebral stripe, from *C. rawlinsoni* by having more ciliary scales (10–12 instead of 8–9) and fewer ear lobules (4–5 instead of 7–8) and from *C. vagus* sp. nov. by more midbody scale rows (usually 30 instead of 26). From *C. dux* by having fewer pale stripes (12 instead of 18 or more), more supraciliary scales (8 instead of 7) and separated nasal scales (instead of usually in contact). From *C. xenopleura* by having more supralabial (8 instead of 7), supraciliary (8 instead of 7) and ciliary scales (12 instead of 9), and by having 2 or 3 narrow pale lateral stripes rather than 1 or 2 broad stripes.



Figure 7 Juvenile of *Ctenotus halysis* sp. nov. in life. Mornington Station, Kimberley region, Western Australia. Photo by Ray Lloyd.

Ctenotus halysis sp. nov. is most easily confused with *C. alacer* but is distinguished by having fewer paravertebral scale rows (59 instead of 70) and fourth toe subdigital lamellae (22 instead of 29), more supraciliary scales (8 instead of 7) and a narrower head (60.2% instead of 64.6% of head length). Further differs by having one or two distinct pale lower lateral stripes rather than a blotched or immaculate lower lateral zone and having a slender series of upper lateral pale streaks and spots instead of large elongate spots and blotches.

Distribution

Central to eastern Kimberley region, northern Western Australia (Figure 3). Recorded from Doongan Station, Mornington Wildlife Sanctuary, Drysdale River Station, 30 km north-west of Mount Elizabeth and 129 km south of Wyndham.

Ecology and habits

Largely unknown. Ray Lloyd (pers. comm.) records specimens from Mornington Wildlife Sanctuary as occurring on sandy loam/gravel among low rocky hills, primarily in rocky areas with a sparse cover of spinifex (*Triodia*) and Snappy gums (*Eucalyptus brevifolia*). Lloyd also notes activity mostly occurs early morning and late afternoon, shelter is taken in small, shallow holes excavated in sand beneath rocks and specimens are abundant where they occur. Drysdale River specimens were also found under rocks embedded in sandy loam/gravel in low open woodland amongst low rocky hills (pers. obs.).

Etymology

From the Greek noun *halysis*, meaning chain; in reference to the chain-like string of upper lateral streaks prominent in this taxon.

Ctenotus vagus sp. nov. Uneven-striped *Ctenotus* Figures 9–10, Table 2

Holotype

Australia: Western Australia: WAM R103008, adult female (Figure 9), Purnululu (Bungle Bungle) National Park, Western Australia, 17°19'00"S 128°27'00"E. Collected by N. Gambold on 16 June 1989.

Measurements (mm) and scale counts: SVL 43.8; tail length 108.1; body length 21.1; forelimb length 13.7; hindlimb length 23.3; head width 5.6; head depth 4.8; snout length 3.7; head length 9.0; forelimb to snout length 19.0; nasals in broad contact; prefrontals broadly separated; supraciliaries eight; ciliaries ten; supralabials eight; infralabials seven; nuchal scales eight; ear lobules four, uppermost

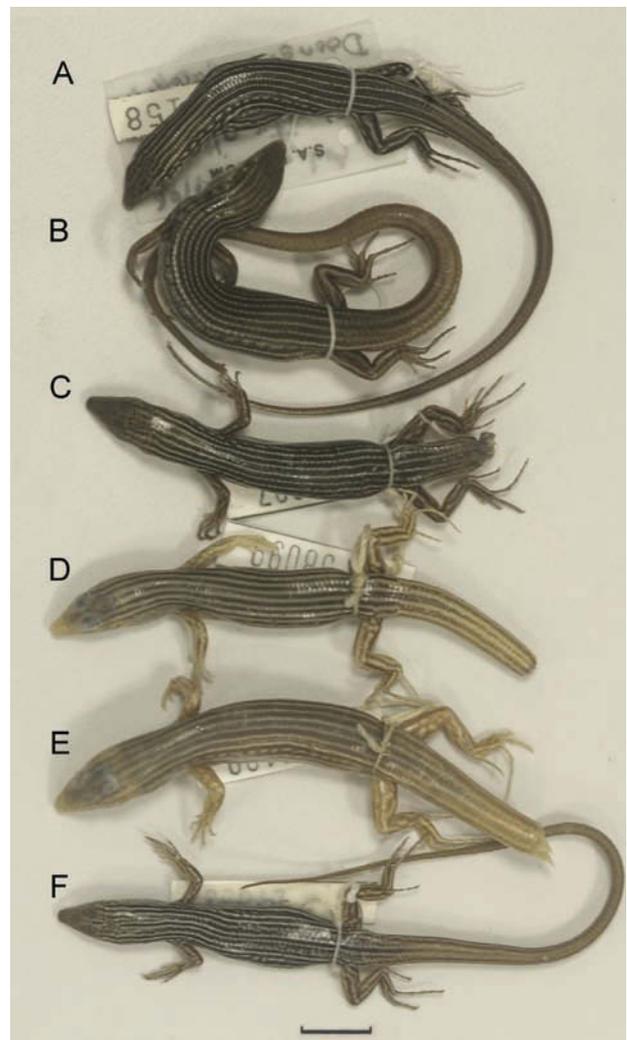


Figure 8 Specimens of *Ctenotus halysis* sp. nov., illustrating the range of variation seen in body patterning. From A-F: WAM R166158, WAM R163239, NTM R27627, WAM R58099, WAM R58100 and NTM R27626. Scale bar = 10 mm.

largest in series; subdigital lamellae under fourth finger 14, under fourth toe 22; supradigital scales above fourth finger 10, above fourth toe 15; midbody scale rows 26; paravertebral scales 61.

Paratype

Australia: Western Australia: WAM R50505, Drysdale River National Park, 14°48'00"S 126°57'00"E.

Diagnosis

A moderately small member (SVL to 43.9 mm) of the *C. atlas* species group, distinguished from congeners by having three of four supraoculars in



Figure 9 Holotype of *Ctenotus vagus* sp. nov., WAM R103008, Purnululu (Bungle Bungle) National Park, Western Australia, 17°19'00"S 128°27'00"E. Scale bar = 10 mm.

contact with frontal, frontoparietals paired, eight supralabials, laterally compressed toes with callose or obtusely keeled subdigital lamellae, prominent pale mid-lateral stripe, dark ground colour with ten or more pale stripes on body, dark vertebral stripe, unpatterned dark upper lateral zone and poorly defined dorsal stripes.

Description

Prefrontal scales separated. Nasal scales in contact or separated by rostral and frontonasal scales. Frontoparietal scales paired. Interparietal scale distinct. Loreal scales two, second usually larger than first. Upper and lower preocular scales present. Presubocular scale present. Nuchal scales 8. Supraciliary scales 8, median three or four much smaller than first three and final scale in series. Ciliary scales 9–10 (\bar{x} 9.5). Supralabial scales 8, sixth under orbit. Infralabial scales 7. Ear lobules 4, uppermost largest in series. Midbody scale rows 26. Paravertebral scales 57–61 (\bar{x} 59.0). Subdigital lamellae moderately callose, 10 below fourth finger, 22–24 below fourth toe (\bar{x} 23.0). Supradigital scales above fourth finger 10, above fourth toe 15–16 (\bar{x} 15.5) (Table 2).

SVL to 43.9 mm (\bar{x} 43.8 mm). *Percentages of SVL:* Body length 48.0–52.3% (\bar{x} 50.2%); tail length 246.5% ($n = 1$); forelimb length 30.5–31.2% (\bar{x} 30.8%); hindlimb length 49.2–53.1% (\bar{x} 51.1%); forebody length 41.8–43.4% (\bar{x} 42.6%); head length 20.5–21.1% (\bar{x} 20.8%). *Percentages of head length:* head depth 51.7–54.0% (\bar{x} 52.8%); head width 60.2–62.8% (\bar{x} 61.5%); snout length 41.5–43.6% (\bar{x} 42.6%) (Table 2).

Colour and pattern (in spirit)

A dark brown *Ctenotus* with longitudinally aligned, simple body pattern of 8–10 narrow pale longitudinal stripes (Figure 10). Examined specimens conform to the following description.

Dorsal ground colour dark brown. Back patterned with six or eight narrow pale stripes (paired paravertebrals, dorsals, laterodorsals and dorsolaterals). Whitish paravertebral and dorsolateral stripes are prominent, about half as wide as mid paravertebral scale, and extend from parietal region onto tail. Pale brown dorsal (and laterodorsal when present) stripes are narrower than paravertebral stripes and extend from parietal region to rump. Dorsal stripes are occasionally discontinuous with ragged edges and, when paired with similarly ragged laterodorsal stripes, may appear as a broad brown dorsal zone with dark brown central mottling. Lateral surface of body dark brown, patterned with whitish midlateral and lower lateral stripes. Midlateral stripe, about as wide as a mid-lateral scale, extends from ear, over limbs onto tail. Lower lateral stripe indistinct,

usually extends from axilla to groin. Lower lateral zone coalesces into pale venter.

Head light brown with paler snout, dorsally patterned with dark mottling and laterally with pale temporal blotches and pale subocular stripe. Tail brownish, patterned with continuations of major body stripes. Limbs brown dorsally, patterned with three (forelimbs) or four (hindlimbs) dark brown stripes. Ventral surface immaculate white, underside of limbs and tail creamish.

Comparison with other species

Ctenotus vagus sp. nov. is distinguished from most congeners by being medium sized, having compressed digits, callose subdigital lamellae and a simple body pattern of dark ground colour with 10–12 whitish longitudinal stripes. In combination, these characters place it in the *C. atlas* species-group (Table 3). From most species group co-members it may be distinguished by body pattern and disjunct distribution. Only *C. atlas*, *C. d. decaneurus*, *C. d. yampiensis*, *C. iapetus* and *C. impar* share 10–12 pale stripes and an unspotted upper lateral zone and only *C. d. decaneurus*, *C. d. yampiensis*, *C. halysis* sp. nov. and *C. piankai* share a Kimberley region distribution.

Further distinguished from *C. ariadnae*, *C. atlas*, *C. dux*, *C. iapetus*, *C. piankai* and *C. quattuordecimlineatus* by having prefrontal shields separated rather than in contact. Also differs from *C. ariadnae*, *C. atlas* and *C. dux* by having fewer midbody scale rows (26 instead of 28 or more) and from *C. iapetus* by having fewer fourth toe subdigital lamellae (22–24 instead of 25–28). From *C. alacer*, *C. halysis* sp. nov., *C. xenopleura* and *C. zasticus* by having an unpatterned upper lateral

zone instead of an upper lateral series of spots or streaks. Also differs from *C. alacer*, *C. halysis* sp. nov. and *C. xenopleura* by having fewer midbody scale rows (26 instead of 28 or more). From *C. rawlinsoni* by having fewer fourth toe subdigital lamellae (22–24 instead of 33–34). From *C. duricola* by having fewer midbody scale rows (26 instead of 28 or more). From *C. storri* by having more supralabial scales (8 instead of 6–7) and from *C. impar* by having a dark rather than pale vertebral stripe and by having more supralabial scales (8 instead of 7).

Ctenotus vagus sp. nov. is most easily confused with *C. decaneurus*, but is distinguished from both *C. d. decaneurus* and *C. d. yampiensis* by brown rather than black ground colour and less defined body pattern, in which the pale dorsal and laterodorsal stripes are relatively narrow and indistinct, brownish-cream rather than white and less continuous. Further differs from *C. d. decaneurus* by having more fourth toe subdigital lamellae (23 instead of 21) and longer hindlimbs (51.1% instead of 43.4% of SVL) and from *C. d. yampiensis* by having fewer midbody scale rows (26 instead of 28) and more fourth toe subdigital lamellae (23 instead of 21).

Distribution

Northern and south-eastern Kimberley region, northern Western Australia (Figure 3). Recorded from Drysdale River and Purnululu National Parks.

Ecology and habits

Largely unknown. Gambold (1992) records the holotype (as *C. piankai*) as being associated with the Buchanan upland land unit, prefers the *Acacia-Triodia* floristic group and occurs on red sands with spinifex.

Etymology

From the Latin adjective *vāgus*, meaning inconstant, unsteady or vague; in reference to the condition of this taxon's pale dorsal and laterodorsal stripes which, in relation to adjacent pale paravertebral and dorsolateral stripes, are poorly defined.

Ctenotus mesotes sp. nov. Median-striped *Ctenotus*

Figures 11–14, Table 2

Holotype

Australia: Western Australia: WAM R165943, adult female (Figure 11), Truscott, Kimberley region, Western Australia, 14°06'07"S 126°24'01"E. Collected by P. Doughty and C. Stevenson on 11 August 2006. Found in tall woodland. Tail tip missing.



Figure 10 Type specimens of *Ctenotus vagus* sp. nov. illustrating the range of variation seen in body patterning. From A-B: WAM R50505 (paratype) and WAM R103008 (holotype). Scale bar = 10 mm.



Figure 11 Holotype of *Ctenotus mesotes* sp. nov., WAM R165943, Truscott, Kimberley region, Western Australia, 14°06'07"S 126°24'01"E. Scale bar = 10 mm.

Measurements (mm) and scale counts: SVL 41.9; tail incomplete; body length 22.7; forelimb length 11.6; hindlimb length 18.7; head width 5.1; head depth 3.6; snout length 3.7; head length 8.5; forelimb to snout length 15.2; nasals in narrow contact; prefrontals broadly separated; supraciliaries nine; ciliaries 11; supralabials seven; infralabials six; nuchal scales six; ear lobules two, uppermost largest in series; subdigital lamellae under fourth finger 14, under fourth toe 24; supradigital scales above fourth finger 10, above fourth toe 16; midbody scale rows 30; paravertebral scales 60.

Paratypes

Australia: Western Australia: WAM R44062, (also paratype of *C. tantillus*), Sir Graham Moore Island, 13°53'S 126°31'E; WAM R131657, Kalumburu area, 14°12'28"S 126°38'43"E; WAM R131659, Kalumburu area, 14°12'S 126°38'E; WAM R151832–833, R151861, R152013, Sir Graham Moore Island, 13°53'S 126°31'E; WAM R165940, R165942, Truscott, 14°05'02"S 126°26'34"E; WAM R165944, Truscott, 14°05'S 126°22'E.

Diagnosis

A very small member (SVL to 41.5 mm) of the *C. schomburgkii* species-group, distinguished from congeners by having three of four supraoculars in contact with frontal, two presuboculars, frontoparietals paired, laterally compressed toes with finely keeled subdigital lamellae, nasals in contact, 2–3 ear lobules with uppermost largest, usually 30 midbody scale rows, usually 14 subdigital lamellae under fourth finger, mean hindlimb length of 48.1% of SVL and a complex body pattern of stripes and spots, with dark stripes terminating at the rump.

Description

Prefrontal scales separate. Nasal scales usually in narrow contact (73%), occasionally in broad contact.

Frontoparietal scales paired. Interparietal scale distinct. Loreal scales two, second usually larger than first (82%) occasionally subequal. Upper and lower preocular scales present. Presubocular scale present. Nuchal scales 6–9 (\bar{x} 7.2). Supraciliary scales 7–9 (\bar{x} 8.1), median three or four much smaller than first three and final scale in series. Ciliary scales 9–11 (\bar{x} 10.1). Supralabial scales 7–8 (\bar{x} 7.1), fifth usually under orbit (91%), occasionally sixth. Infralabial scales 6. Ear lobules 2–3 (\bar{x} 2.9), modally 3, uppermost largest in series. Midbody scale rows 28–32 (\bar{x} 29.4). Paravertebral scales 57–68 (\bar{x} 63.0). Subdigital lamellae finely keeled, 12–15 below fourth finger (\bar{x} 13.6), 20–25 below fourth toe (\bar{x} 22.4). Supradigital scales above fourth finger 9–11 (\bar{x} 10.1), above fourth toe 14–17 (\bar{x} 15.4) (Table 2).

SVL to 41.5 mm (\bar{x} 37.7 mm). *Percentages of SVL:* Body length 48.9–54.9% (\bar{x} 52.4%); tail length 206.8–218.5% (\bar{x} 211.3%, $n = 3$); forelimb length 27.3–34.6% (\bar{x} 29.9%); hindlimb length 44.7–50.4%



Figure 12 Paratype of *Ctenotus mesotes* sp. nov. in life. WAM R165944, Truscott, Kimberley region, Western Australia, 14°05'S 126°22'E. Photo by Paul Doughty.

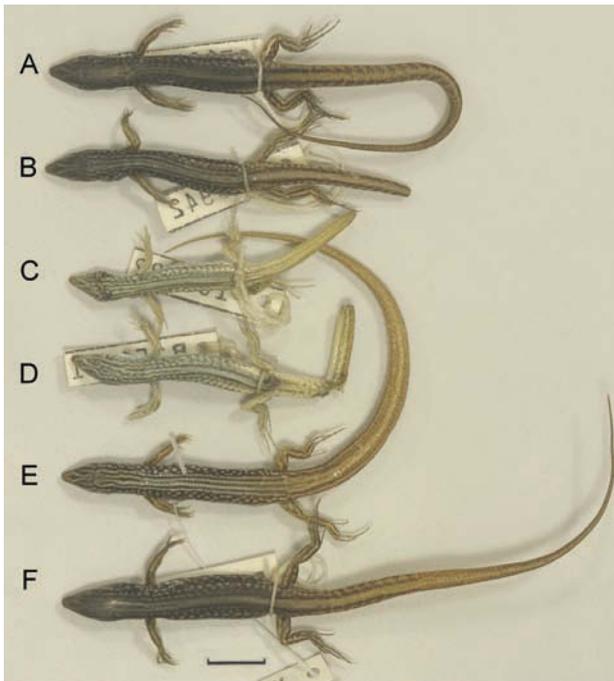


Figure 13 Specimens of *Ctenotus mesotes* sp. nov., illustrating the range of variation seen in body patterning. From A-F: WAM R165944, WAM R131657, WAM R151861, WAM R151832, WAM R165942 and WAM R165940. Scale bar = 10 mm.

(\bar{x} 48.1%); forebody length 36.7–44.8% (\bar{x} 40.0%); head length 20.5–23.7% (\bar{x} 21.7%). Percentages of head length: head depth 40.2–55.5% (\bar{x} 46.8%); head width 55.1–67.0% (\bar{x} 59.9%); snout length 41.1–47.7% (\bar{x} 44.1%) (Table 2).

Colour and pattern (in spirit)

A blackish or greyish *Ctenotus* with longitudinally aligned, complex body pattern dominated by broad pale vertebral stripe and bilateral series of numerous random pale spots and dots (Figures 12–13). Specimens from Sir Graham Moore Island diverge from those on the adjoining Kimberley mainland in intensity of ground colour, being much paler (Figure 13C,D). Examined specimens conform to the following description.

Dorsal ground colour blackish brown to pale grey. Back patterned with four narrow, creamish white stripes (paired paravertebrals and dorsolaterals), which extend from parietal region onto tail. In most specimens the pale paravertebral stripes merge, reducing any dark vertebral stripe to a narrow indistinct line on neck and forebody. Back stripes are about half width of a mid-paravertebral scale, except for merged pale paravertebral stripes which together form a broad pale vertebral stripe. Many specimens have discontinuous pale dorsolateral stripes, these being represented by longitudinal

series of pale streaks and spots. Lateral surface of body blackish brown to greyish, patterned with numerous, random pale spots and streaks. Whitish midlateral stripe may be present posteriorly, but is usually represented by a discontinuous series of pale streaks and blotches. Lower lateral zone coalesces into pale venter. Most specimens feature discontinuous pale dorsolateral and midlateral stripes, presenting a densely spotted pattern relieved only by a broad pale vertebral stripe.

Head pale brown with a lighter snout, patterned with dense dark mottling and obscure pale subocular stripe. Tail brownish, patterned with continuations of pale body stripes. Limbs brown dorsally, patterned with three (forelimbs) or four (hindlimbs) dark brown stripes. Ventral surfaces immaculate white, underside of limbs and tail creamish.

Comparison with other species

Ctenotus mesotes sp. nov. is distinguished from most congeners by being very small in size, having compressed digits, finely keeled subdigital lamellae, dark upper lateral zones enclosing numerous pale spots and a dorsal pattern dominated by longitudinal stripes. In combination, these characters place it among the ten members of the *C. schomburgkii* species-group (Table 3). From most species-group co-members it may be distinguished by details of body pattern and disjunct distribution. The broad pale vertebral stripe of *C. mesotes* sp. nov. is unique within the species-group and only *C. pallescens* and *C. tantillus* share a Kimberley region distribution.

Further distinguished from *C. allotropis* and both subspecies of *C. strauchii* by having more midbody scale rows (30 instead of 28), fourth toe subdigital lamellae (22 instead of 20 or less) and longer hindlimbs (48% instead of 45% or less of SVL). From *C. brooksi*, *C. euclae* and *C. taeniatus* by having more midbody scale rows (30 instead of 26 or less), presubocular scale present (rather than absent), prefrontal shields separated instead of usually in contact and smaller maximum size (41.5 instead of 50.5 mm or more). From *C. pallescens* and *C. schomburgkii* by having more midbody scale rows (30 instead of 28 or less) and nasal scales in contact instead of separate. Also distinguished from *C. pallescens* by having more supraciliary scales (8 instead of 7).

Ctenotus mesotes sp. nov. is most easily confused with *C. tantillus*, but is distinguished by having more midbody scale rows (30 instead of 28), fewer infralabial scales (6 instead of 7), more ciliary scales (10 instead of 9) and fourth finger subdigital lamellae (14 instead of 12), longer hindlimbs (48.1% instead of 44.8% of SVL) and by usually having nasal scales in narrow instead of broad contact.

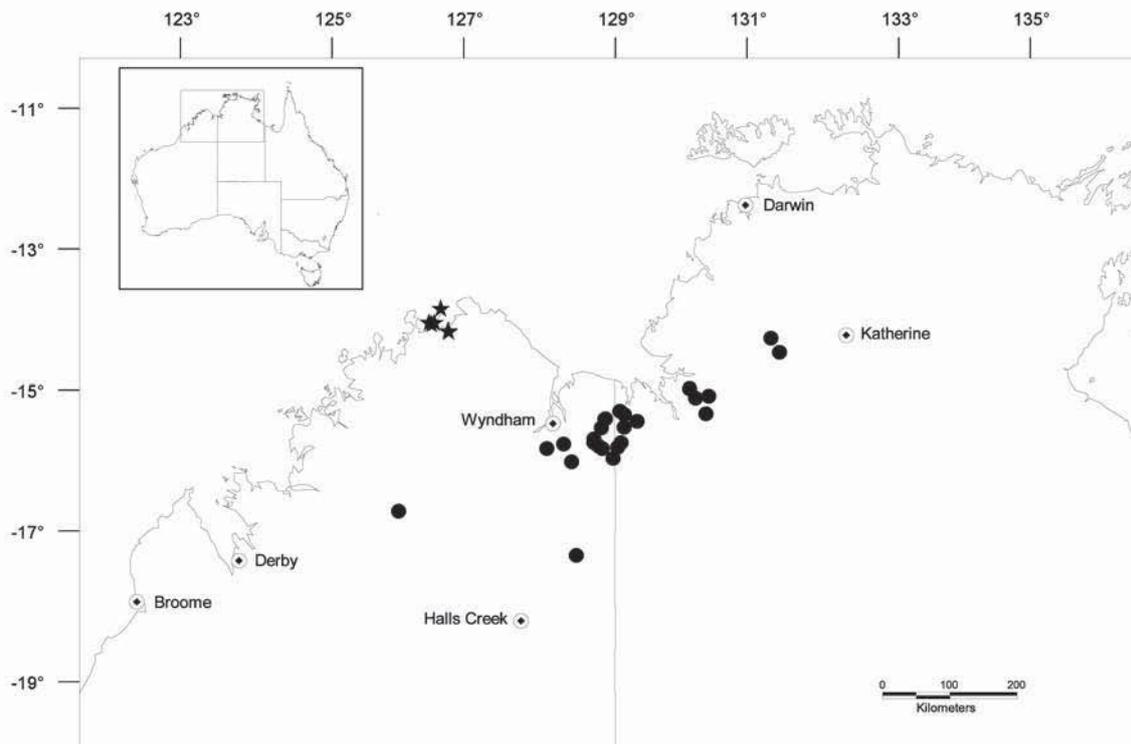


Figure 14 Map of northwestern Australia showing distributions of: *Ctenotus mesotes* sp. nov. (stars) and *C. tantillus* (circles).

Distribution

Central far northern coast of the Kimberley region, northern Western Australia (Figure 14). Recorded from Truscott, Kalumburu and Sir Graham Moore Island.

Geographic variation

As previously noted, specimens from Sir Graham Moore Island diverge from adjoining mainland populations in intensity of ground colour, being greyish rather than blackish.

Ecology and habitats

Truscott specimens were collected from *Eucalyptus herbertiana* woodland, associated with skeletal soils on exposed sandstone and from *E. tetradonta*-*E. miniata* woodland on deep yellow sands and lateritic podsols (P. Doughty, pers. comm.).

Etymology

From the Greek adjective *mesotês*, meaning a middle or central position; in reference to the prominent pale vertebral stripe that features in this taxon.

DISCUSSION

With recognition of *C. halysis*, *C. mesotes* and *C. vagus*, *Ctenotus* is represented in the

Kimberley region of northern Western Australia by 16 recognised taxa: *C. burbridgei* Storr, 1975; *C. d. decaneurus*; *C. d. yampiensis*; *C. ehmanni* Storr, 1985; *C. halysis*; *C. inornatus* (Gray, 1845); *C. mastigura* Storr, 1975; *C. mesotes*; *C. militaris*; *C. pallescens* Storr, 1970; *C. pantherinus* (Peters, 1866); *C. piankai*; *C. rimacola* Horner and Fisher, 1998; *C. robustus* Storr, 1970; *C. tantillus* and *C. vagus* (Wilson and Swan 2008; this work). Many of these taxa are sympatric or even syntopic, and most show a strong fidelity to certain topography and habitat types.

Distributions of the new species, within the Kimberley region, are variable. *Ctenotus halysis* and *C. vagus* have relatively broad ranges, whilst *C. mesotes* (and *C. d. yampiensis*) appear restricted to a small geographic area. Concomitantly, as the type series of *C. tantillus* is now considered composite (paratype WAM R44062 is also a paratype of *C. mesotes*) its known distribution in the Kimberley appears more restricted (Figure 14). However, distribution of reptile species in this region is poorly known and systematic surveys are required to determine their actual distributions.

In such a diverse taxon as *Ctenotus*, where morphological differences between species are often subtle and difficult to discern on single individuals, cryptic and/or undescribed species often fail to be recognised and misidentifications

are commonplace. This is exemplified by published records of *C. alacer* Storr, 1970 from the Kimberley region (Storr *et al.* 1999; Wilson and Swan 2008) that were based on specimens now referred to *C. halysis* sp. nov. Interestingly, aside from morphological and geographical differences, *C. halysis* shows ecological divergence to *C. alacer*, preferring sandy/loam substrates rather than stony hills.

Confusion of *C. halysis* with *C. alacer* brings into question records of certain other *Ctenotus* species in the Kimberley region. *Ctenotus pallelescens* and *C. piankai* are typically arid adapted species, as is *C. alacer*, and the possibility exists that records of these from the monsoonal Kimberley are similarly based on undescribed species. Further work, including molecular as well as detailed meristic and mensural analyses, is needed to clarify the status of these taxa.

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APPENDIX

Comparative specimens scored for morphological characters

Ctenotus alacer

Northern Territory: NTM R00899, Alice Springs, 23°42'S 133°52'E; NTM R01553, Mount Doreen, 22°02'S 131°20'E; NTM R05374, 5.5 km north of Alice Springs, 23°40'S 133°55'E; NTM R12714, Colymer Creek, ca. 10 km north of Alice Springs, 23°35'S 133°52'E; NTM R13715, Alice Springs, 23°42'S 133°52'E; NTM R14388, Paddy's Valley, Loves Creek Station, 23°31'S 134°40'E; NTM R17660, Ewaninga, 40 km south of Alice Springs, 24°00'S 133°54'E; NTM R18146, Harts Range. Rex Mine, 23°04'S 134°58'E; NTM R18179, Harts Range, Mt Riddock Station, 23°05'S 134°36'E; NTM R31863, Simpsons Gap, 23°40'S 133°43'E.

Ctenotus decaneurus decaneurus

Northern Territory: WAM R23130 (Holotype), 21 mi WNW of Newry, 15°59'S 129°00'E; NTM R1275, Mount Carr, Adelaide River, 13°14'S 131°05'E; NTM R2053, Berry Springs Reserve, 13°14'S 131°05'E; NTM R8827, 7mi S of Adelaide River Town, 13°20'S 131°07'E; NTM R13837, Kakadu National Park,

Kakadu National Park, 13°29'S 132°15'E; NTM R17896, Yinberrie Hill, 14°06'S 132°04'E; NTM R21164, Gregory National Park, 16°07'S 130°25'E; NTM R21511, Mt Bunday Station, 12°55'S 131°46'E; NTM R22189, Litchfield National Park, Litchfield National Park, 13°24'31"S 130°53'29"E; NTM R24239, Little Fitzmaurice River, Bradshaw Station, 15°06'22"S 130°19'22"E; NTM R24433, Upper Daly River, 14°35'28"S 131°21'06"E; NTM R27064, Fish River, Daly River Basin, 14°14'S 130°54'E; NTM R27867, Urapunga Station, Roper River, 14°32'27"S 134°10'48"E; NTM R29137, Mount Ringwood Station, 13°11'S 131°23'E.

Western Australia: NTM R27514, 30km NE of Napier Downs T/off, Gibb River Road, 17°08'39"S 125°02'50"E; NTM R27622, 8 km west of Durack River Crossing, Gibb River Road, 16°00'11"S 127°04'19"E; WAM R43152, R43188, R43247, R43526, Mitchell Plateau, 14°52'S 125°50'E; WAM R70160, R70161, 8.8km at 121degrees from Wyndham, 15°32'S 128°11'E; WAM R77023, Mitchell Plateau, 14°49'S 125°50'E; WAM R83366, Lake Argyle, 16°18'S 128°48'E; WAM R91147, 32km SE of Kununurra, 15°56'S 128°57'E; WAM R99768, Silent Grove, 17°04'40"S 125°15'20"E; WAM R99772, 8km north of Mount Broome, 17°17'15"S 125°22'05"E; WAM R119683, Emma Gorge, Cockburn Range, 15°50'S 128°02'E.

Ctenotus decaneurus yampiensis

Western Australia: WAM R11741 (Neotype), Wotjulium, west Kimberley, 16°14'S 123°38'E; WAM R11740, R11742, Wotjulium, west Kimberley, 16°14'S 123°38'E; WAM R166899, Wilson Point, south of Kuri Bay, 15°33'S 124°25'39"E.

Ctenotus tantillus

Western Australia: WAM R45567 (holotype), Kununurra, 15°42'S 128°42'E. PARATYPES: WAM R23127 (Paratype), Cockatoo Spring, 37 km SE of Kununurra, 15°56'S 120°55'E; WAM R26790 (Paratype), Grotto Creek, 35 km SSE of Wyndham, 15°42'S 128°16'E; WAM R32070 (Paratype), Manning Creek, 16°42'S 125°56'E; NTM R6797, R6799, 5km W Ivanhoe Crossing Ord River, 15°45'S 128°42'E; NTM R34679, Ord River, 15°18'50"S 129°03'55"E; WAM R60177, Saw Ranges, 16°01'S 128°23'E; WAM R101382, R101405, 8km SE Kununurra, 15°50'S 128°49'E; WAM R101389, 3km SE Kununurra, 15°48'S 128°46'E; WAM R103007, Bungle Bungle National Park, 17°19'S 128°27'E; WAM R119714, Emma Gorge, Cockburn Range, 15°50'S 128°02'E; WAM R120002, Cockburn Range, 15°50'S 128°02'E; WAM R125991, R126022, ca 2km SW Point Springs Yard, 15°25'09"S 128°51'50"E; WAM R126039, R126040, R126046, ca 4km SW Point Spring Yard, 15°25'09"S 128°51'50"E;

WAM R126044, ca 30km ENE Point Spring Yard, 15°21'40"S 129°07'48"E; WAM R151014–015, R151017, 30km NNE Kununurra, 15°32'46"S 128°48'12"E.

Northern Territory: NTM R9168, R10062, Keep River National Park, 15°45'S 129°05'E; NTM R18624, Spirit Hills Station, 15°32'11"S 129°07'33"E; NTM R18638, Bradshaw Station, 15°21'S 130°17'E; NTM R23193, Spirit Hills, 15°27'15"S 129°18'35"E; NTM R24108, North Kollendong Swamp, Bradshaw

Station, 15°00'16"S 130°03'07"E; NTM R24198–200, Mussel Waterhole Two, Bradshaw Station, 15°08'05"S 130°08'13"E; NTM R24220, Little Fitzmaurice River, Bradshaw Station, 15°06'22"S 130°19'22"E; NTM R24428–429, R24432, Bradshaw Creek, Dorisvale, 14°30'14"S 131°19'22"E; NTM R24988, Upper Daly Aboriginal Land Trust, Daly River Region, 14°18'29"S 131°12'07"E; NTM R28922, Keep River National Park, Keep River, 15°49'S 129°02'E.