

# A new species of *Eremiascincus* (Squamata: Sauria: Scincidae) from the Pilbara region of Western Australia

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Accepted 12.xii.2017.

Published online at [www.senckenberg.de/vertebrate-zoology](http://www.senckenberg.de/vertebrate-zoology) on 5.iv.2018.

Editor in charge: Uwe Fritz

## Abstract

Lizards of the genus *Eremiascincus* GREER, 1979 include species from the Australian monsoonal tropics and the Lesser Sundas as well as a widespread radiation of banded forms from the Australian arid zone, some of which are ‘sand-swimmers.’ Here we describe a new, rusty red-coloured species of *Eremiascincus* from the Pilbara region of Western Australia. Unlike other *Eremiascincus*, *E. rubiginosus* **sp. nov.** is saxicolous and usually associated with deep gorges in the Hamersley Range. The new species differs morphologically from all other members of the genus by a combination of numerous mensural and scalation characters, including typically seven supralabials, three pairs of chin shields, a moderate-sized elliptical ear opening, smooth scales on dorsum and dorsal surface of tail lacking longitudinal ridges, scales on dorsal surface of fourth toe arranged in multiple rows with oblique sutures with only the terminal 1–4 single scales possessing transverse sutures, 24–31 subdigital lamellae under fourth toe that are grooved and bluntly callused, 10–13 plantar scales from heel to base of third toe and dark brownish-black calli on scales of palmar and plantar surfaces. Colouration and pattern are also unique in the genus, with a rich rusty red background colour on dorsum and tail, 17–24 narrow irregular bands on nape and dorsum that are at most a single scale wide and > 40 narrow bands on tail. The new species is the seventh *Eremiascincus* from Western Australia and also the sixth narrow-banded species in the genus.

## Kurzfassung

Die Gattung *Eremiascincus* GREER, 1979 beinhaltet Arten der australischen Monsunwälder und der Kleinen Sundainseln sowie eine weitverbreitete Gruppe von Formen mit dorsalen Bändern, die die australischen Trockengebiete bewohnt und von denen einige Arten aufgrund ihrer Lebensweise als ‘Australische Sandfische’ bezeichnet werden. Wir beschreiben hier eine neue, rostrot gefärbte Art der Gattung *Eremiascincus* aus der Pilbara-Region in West Australien. Im Gegensatz zu anderen Arten der Gattung ist *Eremiascincus rubiginosus* **sp. nov.** felsbewohnend und lebt überwiegend in tiefen Schluchten in der Hamersley Range. Die neue Art unterscheidet sich morphologisch von allen anderen Arten der Gattung durch eine Kombination zahlreicher metrischer und meristischer Merkmale, wie typischerweise sieben Supralabialia, drei paar Kinnschilden, einer mittelgroßen, elliptischen Ohröffnung, einer glatten dorsalen Rücken- und Schwanzbeschuppung, die keine längsorientierten Kiele aufweist, Schuppen auf der Dorsalseite der vierten Zehe bis auf die letzten 1–4 Schuppen in mehreren Reihen mit schrägverlaufenden Rändern, 24–31 gefurchte und mit Schwielen versehene Subdigitallamellen unter der vierten Zehe, 10–13 Plantarschuppen zwischen Ferse und Basis der dritten Zehe und dunkelgefärbten, braunschwarzen Schwielen auf den palmaren und plantaren Schuppen. Die Färbung und das Muster der neuen Art sind ebenfalls einzigartig innerhalb der Gattung und zeichnen sich durch eine satte rostrote dorsale Grundfarbe auf Rücken und Schwanz sowie 17–24 schmale, irreguläre Bänder auf dem Rücken, die höchstens so breit sind wie eine Schuppenreihe, und > 40 Bänder auf dem Schwanz, aus. *Eremiascincus rubiginosus* **sp. nov.** ist die siebte Art der Gattung aus West Australien und die sechste Art mit schmalen Bändern.

## Key words

Australia, arid zone, endemism, *Eremiascincus rubiginosus* **sp. nov.**, *Eremiascincus intermedius*, *Eremiascincus musivus*, *Eremiascincus pallidus*, morphology, skink, taxonomy.

## Introduction

The ancient Pilbara region of north-western Western Australia is a large area of rocky terrain, almost entirely surrounded by sandy deserts, well known for its species richness among reptiles, including a high number of saxicolous endemics (DOUGHTY *et al.* 2011a; PEPPER *et al.* 2013). The skink fauna of this region is no exception and includes > 60 species (see WILSON & SWAN 2013), some of which have been described only recently (HORNER 2007; SMITH & ADAMS 2007; DOUGHTY *et al.* 2011b; RABOSKY *et al.* 2017).

The genus *Eremiascincus* GREER, 1979 contains 14 small to medium-sized (SVL to 125 mm) secretive species, distributed throughout most parts of the Australian continent, with four species occurring in the Lesser Sunda Islands (MECKE *et al.* 2013, 2016). Six species occur in Western Australia: *Eremiascincus brongersmai* (STORR, 1972); *E. intermedius* (STERNFELD, 1919); *E. isolepis* (BOULENGER, 1887); *E. musivus* MECKE, DOUGHTY & DONNELLAN, 2009; *E. pallidus* (GÜNTHER, 1875), and *E. richardsonii* (GRAY, 1845). Typically crepuscular to nocturnal, *Eremiascincus* occupy a diverse array of habitats, ranging from tropical woodlands to sandy deserts (MECKE *et al.* 2013). *Eremiascincus* from the monsoonal tropics are typically brown to olive-brown with a slight reddish tinge and patterns comprising spots and dashes, often with a dark upper lateral zone. In contrast, species from the Australian arid zone are usually pale yellowish or pinkish brown, often with a series of highly contrasting dark cross-bands on the dorsum and tail (e.g., MECKE *et al.* 2013; COGGER 2014). Additionally, some arid zone species, especially *E. pallidus* and *E. phantasmus* MECKE, DOUGHTY & DONNELLAN, 2013, are known as ‘sand swimmers,’ owing to their preference for loose substrates and ability to rapidly burrow into sand (MECKE *et al.* 2013).

Currently there are four recognized species of *Eremiascincus* known from the Pilbara region: *E. isolepis* occurs in wooded habitats including creek lines and coastal environments, *E. musivus* in desert shrublands and coastal sands of the northern Pilbara with its distribution extending well into the Great Sandy Desert, *E. pallidus* in sandy areas surrounding the rocky, inner terrain of the Pilbara, and *E. richardsonii* from scattered locations with hard soils across the Pilbara, often found around buildings and wells. In 1986, an odd specimen of *Eremiascincus* was collected near Onslow, and 10 years later two further specimens were collected from the Hamersley Range. This form was mentioned by Storr *et al.* (1999) in their species account of *E. pallidus* (p. 161, known as *E. fasciolatus* at that time), and they suggested that the Hamersley Range population likely represented a new species. Further unusual specimens of *Eremiascincus* associated with gorges and caves were vouchered as part of surveys conducted by environmental consultants for resource projects in the 2000s, which provided sufficient material for taxonomic assessment. Although somewhat similar to *E. pallidus*, the new form differed from other *Eremiascincus* in possess-

ing a rich rusty red background colour with numerous thin dark bands on the dorsum and tail. Closer examination of specimens revealed other morphological differences such as the number and colour of plantar scales as well as the size and shape of the ear opening. Here we describe this reddish Pilbara form as a new species. Comparisons are made between the new taxon and other banded species from Western Australia, and we comment on its habitat preferences and distribution.

## Materials and methods

We examined 16 reddish *Eremiascincus* specimens (five males, seven females and four unsexed juveniles) from the Pilbara that are held in the collection of the Western Australian Museum (WAM). A detailed morphometric and meristic analysis was made with species with which the new taxon could be confused. Mensural and meristic characters follow the nomenclature, definitions, and protocols of MECKE *et al.* (2009, 2013). Head length corresponds to ‘head length 1’ in MECKE *et al.* (2013) and head width to ‘head width 1’ therein. Data were recorded from preserved material. Morphometric characters were measured with electronic digital callipers to the nearest 0.1 mm. We also calculated the following ratios: trunk length/SVL, head length/SVL, snout length/head length, arm length/SVL and leg length/SVL. Scale counts and observations of external morphology were made using a dissection microscope (Leica MZ6). Unless noted otherwise, bilaterally present characters were recorded from the left side. Status of tails as original or regrown was determined by assessment of caudal scalation and colouration. In our diagnosis and variation sections, ranges are followed by means and standard deviations. For descriptions of colouration we apply the terminology of BIESALSKI (1957). Numbers in parentheses behind the respective capitalized colour name refer to the coding therein. Sex was determined by a ventrolateral incision into the posterior quarter of the body, unless hemipenes of males were everted. Data of *Eremiascincus* species used for comparison are from STORR *et al.* (1999) and MECKE *et al.* (2009, 2013). For the taxonomic history and synonymy of the narrow-banded species of *Eremiascincus* we refer the reader to MECKE *et al.* (2013). As indicated therein, no other nomina are available for the new species described below. GPS coordinates were taken using the geodetic datum WGS84.

### *Eremiascincus rubiginosus* new species

E: Rusty skinks, G: Rost-Skink

Figs. 1A–D, Fig. 2A, Figs. 3A & D, Fig. 4

**Holotype.** WAM R174519 (Figs. 1A–D), adult female, Dale’s Gorge, Karijini National Park, Western Australia (22.48103°S, 118.56453°E; Fig. 1E), collected by R.J. ELLIS, P. DOUGHTY & A.M. BAUER on 16 August 2014.

**Paratypes.** WAM R129631, unsexed juvenile, gorge 120 km northwest of Newman (22.9166°S, 118.8833°E), collected 21 April 1997; WAM R157584, adult female, cave in a gorge near Robe River (21.6783°S, 114.8817°E), collected 18 May 2004; WAM R164205, adult male, rocky gully 48 km south-southwest of Panawonica (22.0475°S, 116.1872°E), collected 23 June 2007; WAM R172373, adult female, 10 km southwest of Rio Tinto Hope Downs, collected 14 April 2011; WAM R174598 and WAM R174599, adult females, Dale's Gorge, Karijini National Park (22.47698°S, 118.56302°E), collected 14 March 2015; WAM R174852, adult female, cave near Red Hill Creek, 30 km south-southeast of Panawonica (22.08139°S, 116.27583°E), collected 20 May 2015.

Morphological characters of the type series are presented in Table 1.

**Referred specimens.** WAM R95660, adult male, 17 km south Onslow (21.7947°S, 115.0867°E), collected 20 March 1986; WAM R125768, unsexed juvenile, Dale's Gorge (22.6433°S, 118.5631°E), collected 28 February 1996; WAM R157756, subadult male, dry riverbed in *Eucalyptus* woodland 10 km northwest Hamersley Gorge (22.1808°S, 117.9275°E), collected 21 February 2010; WAM 169963, subadult female, Packsaddle Range (22.9050°S, 119.1769°E), collected 26 March 2010; WAM R170738, adult male, 17 km east-southeast Mount Dempster (21.8947°S, 116.4086°E), collected 4 October 2005; WAM R174574, adult male, over wet overhang in Dale's Gorge, Karijini National Park (22.47545°S, 118.56226°E), collected 14 March 2015; WAM R174596, unsexed juvenile, Dale's Gorge, Karijini National Park (22.47698°S, 118.56302°E), collected 15 March 2015; WAM R174853, unsexed juvenile, cave floor within breakaway 30 km south-southeast Red Hill Creek (22.08139°S, 116.27583°E), collected 20 May 2015.

**Diagnosis.** A moderate-sized *Eremiascincus* (adult SVL 60–82 mm) with usually seven supralabials (rarely six or eight), three pairs of chin shields, a moderate-sized elliptical ear opening (Fig. 3A), smooth dorsal scales on dorsum and tail lacking longitudinal ridges (Fig. 1A & B, Fig. 2A), scales on dorsal surface of fourth toe arranged in multiple rows with oblique sutures with only the terminal 1–4 scales single, possessing transverse sutures, 24–31 subdigital lamellae under fourth toe that are grooved and bluntly callused, 10–13 plantar scales from heel to base of third toe and dark brownish-black calli on scales of palmar and plantar surfaces (Fig. 3D); background colour of dorsum and tail rich rusty red in live specimens, 17–24 narrow irregular dark bands on nape and dorsum that are at most a single scale wide and > 40 transverse narrow dark bands on original tail (Figs. 1A & B, Fig. 2A, Fig. 4).

**Description of holotype** (Figs. 1A–D). SVL 81.5 mm; tail length 109 mm (original portion – 40 mm, regenerated portion – 69 mm; Fig. 1A–B); trunk length 43.7 mm; head longer than wide, head length 15.0 mm, head width 12.1 mm, snout length 5.6 mm, eye length 3.9 mm, ear length 1.6 mm, ear height 2.2 mm; arm length 17.0 mm, length of fourth finger 4.3 mm; leg length 27.0 mm, foot length 11.9 mm, length of third toe 5.4 mm, length of fourth toe 7.9 mm; proportions: trunk length/SVL 0.54, head length/SVL 0.19, snout length/head length 0.40, arm length/SVL 0.21, and leg length/SVL 0.33.

Snout obtuse and rounded at tip (Figs. 1C & D); rostral wider than high, visible from above (Fig. 1D); frontonasal wider (2.9 mm) than long (2.0 mm), in contact with rostral, nasals, anterior loreals, prefrontals and

frontal (Fig. 1D); length of prefrontals 1.9 mm, prefrontals separated; length of frontal 5.1 mm, narrowing posteriorly, longer than the distance to tip of snout, in contact with frontonasal, prefrontals, first and second supraoculars and frontoparietals (Fig. 1D); frontoparietals in contact with each other for almost their entire length, bordered by frontal, three posterior supraoculars, parietals and interparietal (Fig. 1D); interparietal arrowhead-shaped with a small, rounded, greyish parietal eye in posterior angle (Fig. 1D), length of interparietal 2.8 mm; parietals in contact posteriorly, posterolateral border surrounded by three scales on each side; nuchals not significantly enlarged.

Nostril large, situated in centre of nasal; loreals two, posterior larger than anterior; supraciliaries nine, first largest; supraoculars four (Fig. 1D), second widest; primary temporals one, in contact with sixth and seventh supralabial; secondary temporals two, upper in contact with parietal, overlapping lower one; supralabials seven, fifth below the eye, row of smaller scales between fifth supralabial and lower eyelid absent; sixth and seventh supralabial largest; external ear opening elliptical, area of ear equals area of eye (Fig. 1C), two scales on the anterior margin of the ear opening slightly enlarged, not protruding significantly into ear opening.

Mental wider than long, rounded anteriorly, in contact with first infralabial and postmental; infralabials seven, first five infralabials largest, followed by two smaller scales in contact with last supralabial; postmental in contact with mental, first infralabial and anterior pair of chin shields; three pairs of chin shields, anterior pair in contact with each other anteriorly and separated by a single gular scale posteriorly, second pair separated from each other by two scales aligned longitudinally, third pair separated from each other by a transverse row of three gular scales.

Body two times as wide as high; neck wide with slight constriction near arms; right flank with a skin lesion located in the first quarter of the body (Fig. 1A & B); midbody scales in 34 rows; dorsal scales smooth; paravertebral scales 66, not enlarged; precloacals four, inner scales overlapping outer ones, medial two enlarged, left scale overlapping right scale.

Tail thick at base and maintaining ~ 75% of thickness to the point of regeneration (i.e. 40 mm from cloaca); regenerated portion gradually tapering to a fine point; scale rows on original portion regularly arranged, median subcaudal scales enlarged on both, original and regenerated, portion; scale rows on regenerated portion more irregular than on original portion.

Limbs relatively long (Fig. 1A), arms and legs meet when adpressed to the body; finger length: 3 > 4 > 2 > 5 > 1; toe length: 4 > 3 > 5 > 2 > 1; scales on dorsal surface of fourth toe in multiple rows with oblique sutures (17 scales along the digit), followed by four single terminal scales with transverse sutures; subdigital lamellae strongly callused with median groove or furrow, lamellae under fourth finger 14, under fourth toe 24; plantar scales 12 from heel to base of third finger, palmar and plantar scales capped with thickened dark calli.

**Table 1.** Measurements (in mm) and pholidosis of the type series of *Eremiascincus rubiginosus* **sp. nov.** in the herpetological collection of the WAM.

Character	Holotype	Paratypes						
	174519	129631	157584	164205	172373	174598	174599	174852
sex	female	juv.	female	male	female	female	female	female
SVL	81.5	46.3	77.6	71.2	73.6	80.0	62.3	73.0
trunk length	43.7	22.3	40.6	37.1	35.4	34.7	30.8	38.6
head length	15.0	9.8	15.1	14.5	14.2	13.8	12.7	13.9
head width	12.1	5.7	11.3	11.6	10.2	9.9	8.9	11.6
snout length	5.6	4.3	5.8	5.9	5.8	5.5	5.0	5.8
eye length	3.9	2.7	3.7	3.6	3.7	3.7	3.5	4.3
arm length	17.0	12.4	18.6	16.9	18.2	19.4	16.1	18.7
leg length	27.0	19.2	25.6	27.0	26.5	24.3	24.5	25.4
foot length	11.9	8.5	11.5	11.5	11.7	10.7	11.3	10.7
4 <sup>th</sup> toe length	7.9	5.9	7.6	8.0	8.2	6.6	7.2	6.9
trunk length/SVL	0.54	0.48	0.52	0.52	0.48	0.55	0.49	0.53
arm length/SVL	0.21	0.27	0.24	0.24	0.25	0.24	0.26	0.26
leg length/SVL	0.33	0.41	0.33	0.38	0.36	0.30	0.39	0.35
head length/SVL	0.18	0.21	0.19	0.20	0.19	0.17	0.20	0.19
frontonasal length	2.0	—	2.2	2.1	2.1	1.7	—	2.0
prefrontal length	1.9	1.1	1.4	1.5	1.9	—	1.3	1.3
frontal length	5.1	3.8	5.4	5.1	4.7	4.3	4.3	5.1
interparietal length	2.8	1.9	3.1	2.7	2.8	3.3	2.8	3.2
no. of supraciliaries	9	8	8	8	8	8	9	9
no. of supralabials	7	7	7	6	7	7	7	7
no. of infralabials	7	7	7	8	8	7	7	7
no. of midbody scales	34	—	34	34	34	32	34	34
no. of paravertebrals	66	66	59	64	64	62	66	66
no. of 4 <sup>th</sup> toe lamellae	24	28	28	27	29	27	27	29
no. of plantar scales	12	12	11	10	13	12	13	10
no. of bands on body	19	20	17	18	22	19	21	17

Colouration and pattern in life. Ground colour of head, dorsum and tail nasturtium red (6 D); approximately 19 dark cross bands from the nape to above the rear limbs, cross bands narrow (usually occupying less than one scale width with typically two scales separating bands), irregular across body, occasionally joining with or branching into adjacent bands; cross bands on original part of tail less defined but straighter than on body, absent on regenerated part; dorsal scales with dark edges, sutures of labials and head scales posterior to eyes with dark flecks; purplish-black of eye visible through supraoculars; loreals with diffuse dark line that continues posteriorly to anterior supraciliaries and dorsal edges of presuboculars and fifth supralabial; eyelids pale off-white; ground colour of lateral surfaces much brighter than that of dorsum (nasturtium red, 6 A), bands more diffuse and spaced more closely than on dorsum, intermixed with lighter scales, pale scales increasing towards ventrolateral edge, creating a marbled appearance; ground colour of limbs darker (nasturtium red, 6 Q), moderately stippled; dorsal surfaces of feet and digits more towards grey (nasturtium red, 6 H); regenerated portion of tail lighter than original (nasturtium red, 6 C).

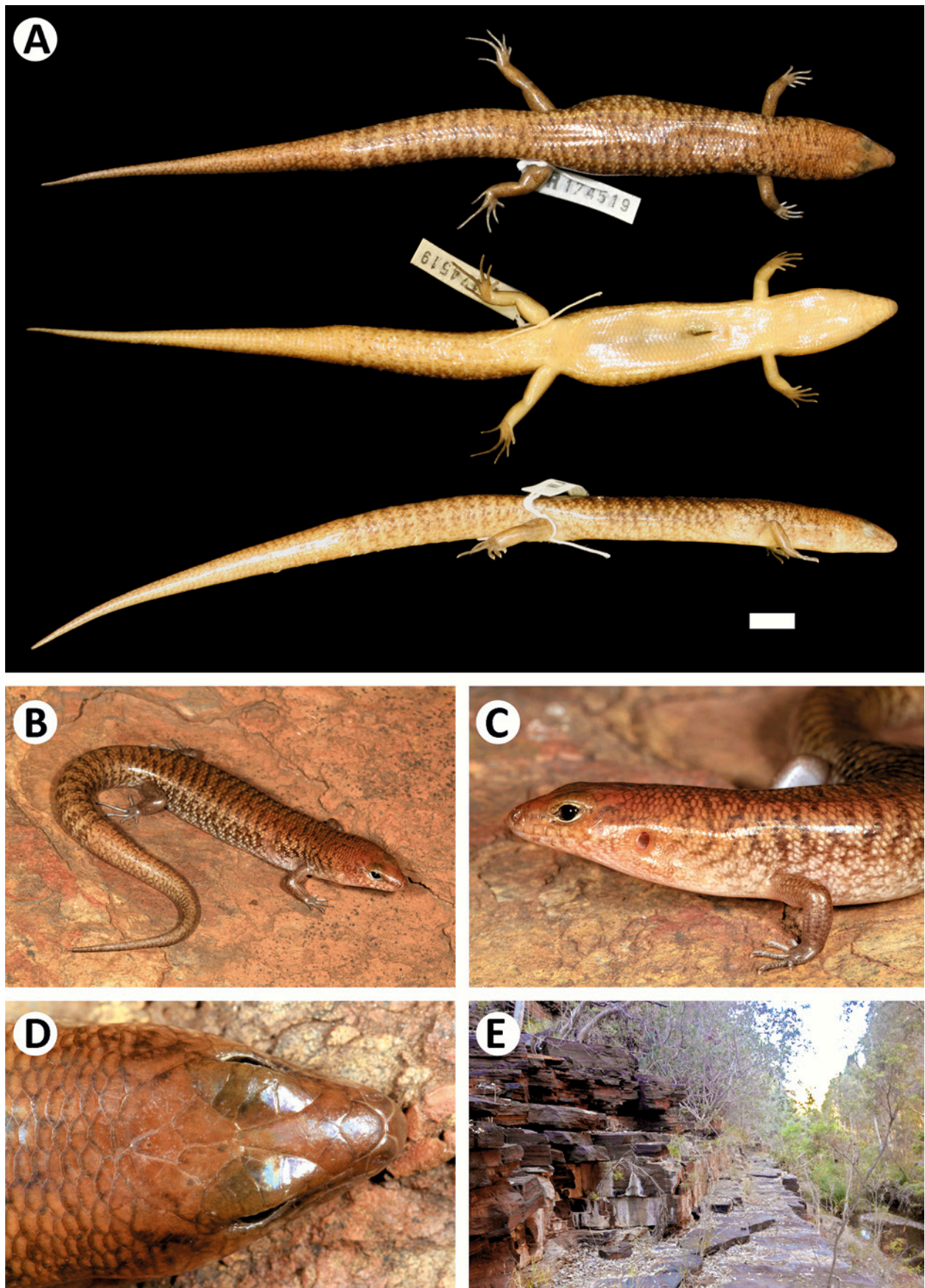
Colouration and pattern in preservative. As for colour and pattern in life, with the following differences or new observations (especially undersurface). Background or-

angefruit colour (4 D); venter pale dutch crocus-yellow (3 C), chin shields and anterior gulars with dark stippling on edges, precloacal region lightly stippled, ventral surface of tail moderately stippled with hiatus of pigment along midline; palmar and plantar surfaces and subdigital lamellae dark orangefruit colour (4 H) with even darker calli (4 P).

**Variation.** Our assessment of variation is based on the holotype and 15 additional specimens from the Pilbara, Western Australia, unless stated otherwise. Most sample sizes are smaller, because of the exclusion of juveniles from mensural data or because specimens were unsuitable for the examinations performed. Measurements are listed as range followed by mean  $\pm$  S.D. and sample size (provided in parentheses).

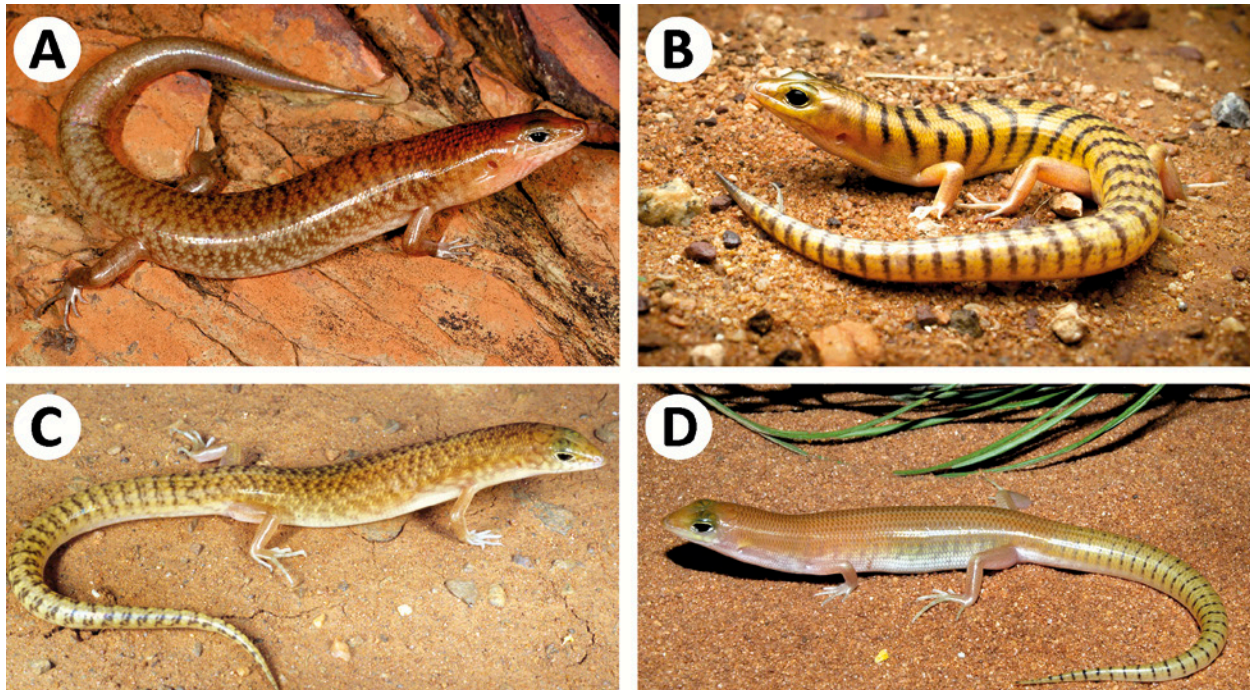
SVL 59.7–81.5 mm ( $71.4 \pm 6.9$ ,  $n=12$ ); original tail length 131.1 mm ( $n=1$ ); trunk length 28.7–43.7 mm ( $35.7 \pm 4.3$ ,  $n=12$ ); head length 12.4–15.1 mm ( $14.0 \pm 0.9$ ,  $n=12$ ), head width 8.6–12.1 mm ( $10.4 \pm 1.2$ ,  $n=12$ ), snout length 5.0–5.9 mm ( $5.6 \pm 0.3$ ,  $n=12$ ), eye length 3.1–4.3 mm ( $3.7 \pm 0.3$ ,  $n=12$ ), ear length 1.5–2.0 mm ( $1.7 \pm 0.1$ ,  $n=12$ ), ear height 1.5–2.2 mm ( $1.8 \pm 0.2$ ,  $n=12$ ); arm length 15.6–19.4 mm ( $17.7 \pm 1.2$ ,  $n=12$ ), length of fourth finger 3.0–4.3 mm ( $3.6 \pm 0.5$ ,  $n=12$ ); leg length 24.3–27.8 mm ( $25.9 \pm 1.1$ ,  $n=12$ ), foot length





**Fig. 1.** Holotype of *Eremiascincus rubiginosus* **sp. nov.** (WAM R174519). **(A)** Preserved holotype in dorsal, ventral and lateral view. Scale bar = 10 mm. **(B)** Dorso-lateral view of the holotype in life. **(C)** Lateral view of the front part of the holotype in life. **(D)** Detail of dorsal aspect of head. **(E)** Collection location of the holotype showing the habitat of *E. rubiginosus* **sp. nov.** in Dale's Gorge, Karijini National Park, Western Australia (22.48103°S, 118.56453°E). **(A)** – LUKE KEALLEY, **(B–E)** – RYAN J. ELLIS.





**Fig. 2.** Comparison of body habitus and colouration pattern in narrow-banded *Eremiascincus* occurring in Western Australia. (A) *E. rubiginosus* sp. nov. from Duck Creek, Western Australia. (B) *E. intermedius* from West MacDonnell National Park, Alice Springs, Northern Territory. (C) *E. musivus* from Dampier, Western Australia. (D) *E. pallidus* from Exmouth, Western Australia. (A & C) – BRAD MARYAN, (B) – PETER SOLTYS, (D) – BRIAN BUSH.

9.6–11.9 mm ( $11.2 \pm 0.6$ ,  $n=12$ ), length of third toe 5.1–6.4 mm ( $5.4 \pm 0.3$ ,  $n=12$ ), length of fourth toe 6.6–8.2 mm ( $7.5 \pm 0.5$ ,  $n=12$ ); proportions: trunk length/SVL 0.43–0.54 ( $0.50 \pm 0.03$ ,  $n=15$ ), head length/SVL 0.17–0.25 ( $0.20 \pm 0.02$ ,  $n=15$ ), snout length/head length 0.37–0.44 ( $0.40 \pm 0.02$ ,  $n=15$ ), arm length/SVL 0.21–0.32 ( $0.26 \pm 0.02$ ,  $n=15$ ), and leg length/SVL 0.30–0.43 ( $0.37 \pm 0.04$ ,  $n=15$ ); everted hemipenis of male (WAM R164205) with bifid tips, extending one-quarter of hemipenis length.

Frontonasal wider (2.3–2.9 mm,  $n=12$ ) than long (1.7–2.4 mm,  $n=12$ ), in contact with ( $n=7$ ) or separated from frontal ( $n=8$ ) by prefrontals, prefrontals fused with frontal in a single specimen (WAM R174598); length of prefrontals 1.3–1.9 mm ( $1.5 \pm 0.2$ ,  $n=12$ ); length of frontal 4.3–5.4 mm ( $4.8 \pm 0.4$ ,  $n=12$ ); length of interparietal 2.5–3.3 ( $2.9 \pm 0.3$ ,  $n=11$ ), nuchals 0–3 ( $n=14$ ), usually only a single nuchal in a paravertebral series present; supraciliaries eight or nine ( $n=15$ ), usually eight ( $n=10$ ); supralabials 6–8 ( $n=15$ ), usually seven ( $n=13$ ), 1–6 scales on the anterior margin of the ear opening slightly enlarged, not protruding significantly into ear opening; infralabials 6–8 ( $n=13$ ), usually seven ( $n=9$ ); midbody scales in 30–34 rows ( $n=12$ ), usually in 34 rows ( $n=8$ ); paravertebral scales 59–67 ( $n=15$ ); scales on dorsal surface of fourth toe in multiple rows with oblique sutures (17–22 scales along the digit,  $n=10$ ), followed by 1–4 (usually two) single terminal scales with transverse sutures; subdigital lamellae strongly callused with median groove or furrow, lamellae under fourth finger 13–17 ( $n=15$ ), under fourth toe 24–31 ( $n=15$ ); plantar scales 10–13 ( $n=15$ ).

Colouration and pattern in life (Fig. 1B–D, Fig. 2A). Background colour of head, dorsum and tail rusty marigold red (5 K), nasturtium red (6 D) or corn poppy-red (7 K & L); 17–24 (usually 19 or more), dark, diffuse cross bands from nape to above the rear limbs; cross bands on original tail 42–57 (based on preserved specimens and photographic vouchers,  $n=6$ ), banding much more intense in juveniles; ground colour of lateral surfaces much brighter than background colour of dorsum (nasturtium red, 6 A or B), bands more diffuse and spaced more closely than on dorsum; ground colour of limbs often darker than of body (marigold red, 5 R; nasturtium red, 6 Q).

Colouration in preservative (Fig. 4). Background colour of dorsal surface sunflower-yellow (2 Q), Dutch crocus-yellow (3 J), orange-fruit colour (4 D or J) or dark marigold red (5 H or P); venter pale Dutch crocus-yellow (3 B or C) or orange-fruit colour (4 H to K); pattern as for specimens in life.

**Distribution.** *Eremiascincus rubiginosus* sp. nov. is known only from the Pilbara region in Western Australia, with all but one museum voucher (WAM R95660) collected from the Hamersley Range. The species occurs on rocky substrates from as far west as Onslow (21.7947°S, 115.0867°E) through the Hamersley Range east to Hope Downs mine (23.0169°S, 119.0429°E), with several specimens collected from Karijini National Park (Fig. 5).

**Habitat.** Specimens of *E. rubiginosus* sp. nov. throughout the species' range have been collected in gorges,

**Table 2.** Comparison of morphological characters of adult banded *Eremiascincus* occurring in the Pilbara region, Western Australia.

species	SVL (mm)	snout	ear opening	paravertebral scales	4 <sup>th</sup> toe lamellae	plantar scales	vertebral line	bands dorsum
<i>musivus</i>	43.9–59.2	depressed pointed	small	52–62	18–26	10–15 no calli	present	absent
<i>pallidus</i>	47.9–77.0	depressed pointed	small	58–72	20–31	14–18 no calli	absent	absent
<i>richardsonii</i>	79.0–125.0	rounded	moderate elliptical	61–70	21–30	11–17 callused	absent	present (7–14)
<i>rubiginosus</i> sp. nov.	59.7–81.5	rounded	moderate elliptical	59–67	24–31	10–13 callused	absent	present (17–24)

rocky gullies, riverbeds or caves surrounded by woodland. The species appears to be largely restricted to rocky habitats and may be encountered in leaf litter covering rock formations or under rock ledges (see Fig. 1E).

**Etymology.** The specific name is based on the Latin adjective *rubiginosus* (rusty red). As common names we suggest ‘Rusty skinks’ (English) and ‘Rost-Skink’ (German).

**Comparisons with other species.** Based on specimen examination and data from the literature (STORR *et al.* 1999; MECKE *et al.* 2009, 2013), we compare *E. rubiginosus* with other banded taxa from Western Australia, with which the new taxon could be confused.

*Eremiascincus rubiginosus* can be distinguished from *E. intermedius* by scales covering fourth toe in multiple rows with oblique sutures, followed by 1–4 single terminal scales with transverse sutures (vs scales on top of fourth toe in multiple rows with oblique sutures followed by usually > 7 single scales with transverse sutures, single scales cover approximately a third of the length of the fourth toe); smooth dorsal surface of tail (vs dorsal surface of tail ridged); numerous (17–24) diffuse bands on nape and dorsum covering a single scale row at most, bands little contrasting with rusty red ground colour, separated by an interspace of one or two scales only (vs 6–16 bands on dorsum, sharply defined, much more prominent, dark, and in strong contrast with the lighter, yellow to orange ground colour, separated by an interspace of three or four scales; cf Fig. 2A & B). *Eremiascincus intermedius* in Western Australia is confined to the Tanami Desert, and more widely distributed in the Northern Territory.

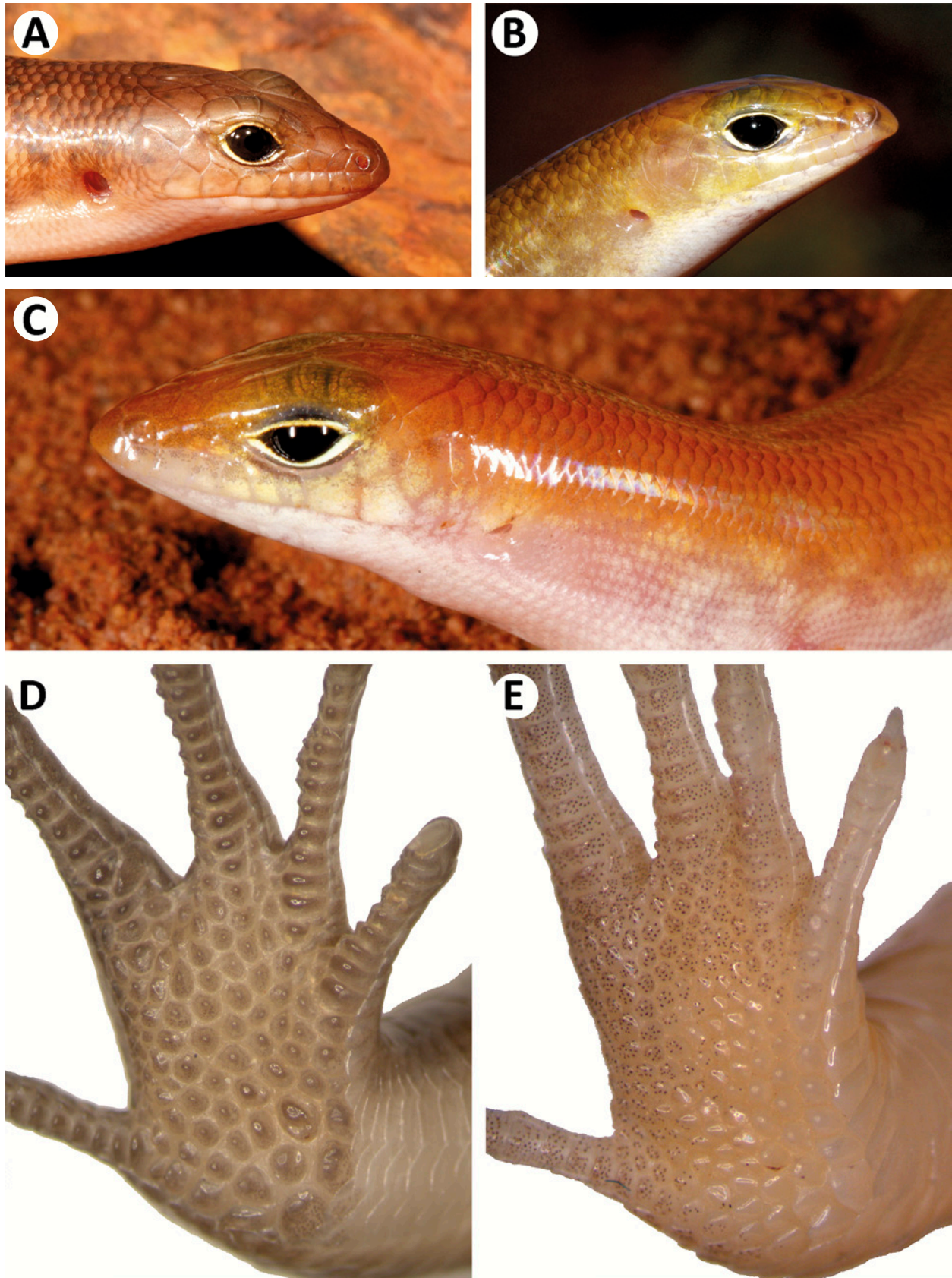
*Eremiascincus rubiginosus* can be distinguished from *E. musivus* by larger size in adults (59.7–81.5 mm vs 43.9–59.2 mm); snout rounded (vs depressed and pointed; cf Fig. 3A & B); ear opening moderate and elliptical, with area of ear equalling area of eye (vs anterior margin of ear oblique towards top, with ear opening much smaller than eye; cf Fig. 3A & B); paravertebral scales in 59–67 rows (vs paravertebral scales in 52–62 rows); lamellae under fourth toe in 24–31 rows, scales bluntly callused (vs lamellae under fourth toe in 18–26 rows, scales feebly keeled); pale vertebral line absent (vs pale vertebral line present); bands present on the dorsum (vs bands on the dorsum absent, dorsal pattern comprising

pale and dark spots; cf Fig. 2A & B). *Eremiascincus musivus* is restricted to sandy habitats along the Pilbara coast, and more widely distributed in sandy regions outside the Pilbara (Fig. 5).

*Eremiascincus rubiginosus* can be distinguished from *E. pallidus* by snout rounded (vs depressed and pointed; cf Fig. 3A & C); ear opening moderate and elliptical, with area of ear equalling area of eye (vs anterodorsal edge of ear opening with skin covering the opening extensively, with ear opening much smaller than eye; cf Fig. 3A & C); smooth dorsal surface of tail (vs dorsal surface of tail ridged); scales covering fourth toe in multiple rows with oblique sutures, followed by 1–4 single terminal scales with transverse sutures (vs scales on top of fourth toe covered by single scales with transverse sutures for entire length of digit); subdigital lamellae grooved and bluntly callused (vs subdigital lamellae not grooved and only feebly keeled or callused); plantar scales 10–13, ovate and capped with dark calli (vs plantar scales 14–18, acute, without calli; cf Fig. 3D & E); bands present on the dorsum (vs bands on the dorsum almost always absent in adults, at most faint bands on side of body, pale; cf Fig. 2A & D, Fig. 4). Juveniles of *E. pallidus* may exhibit bands on the dorsum, which fade with growth (Fig. 4B). *Eremiascincus pallidus*, throughout its entire range, is found in sandy habitats only and is absent from the rocky, more elevated parts of the Pilbara (Fig. 5).

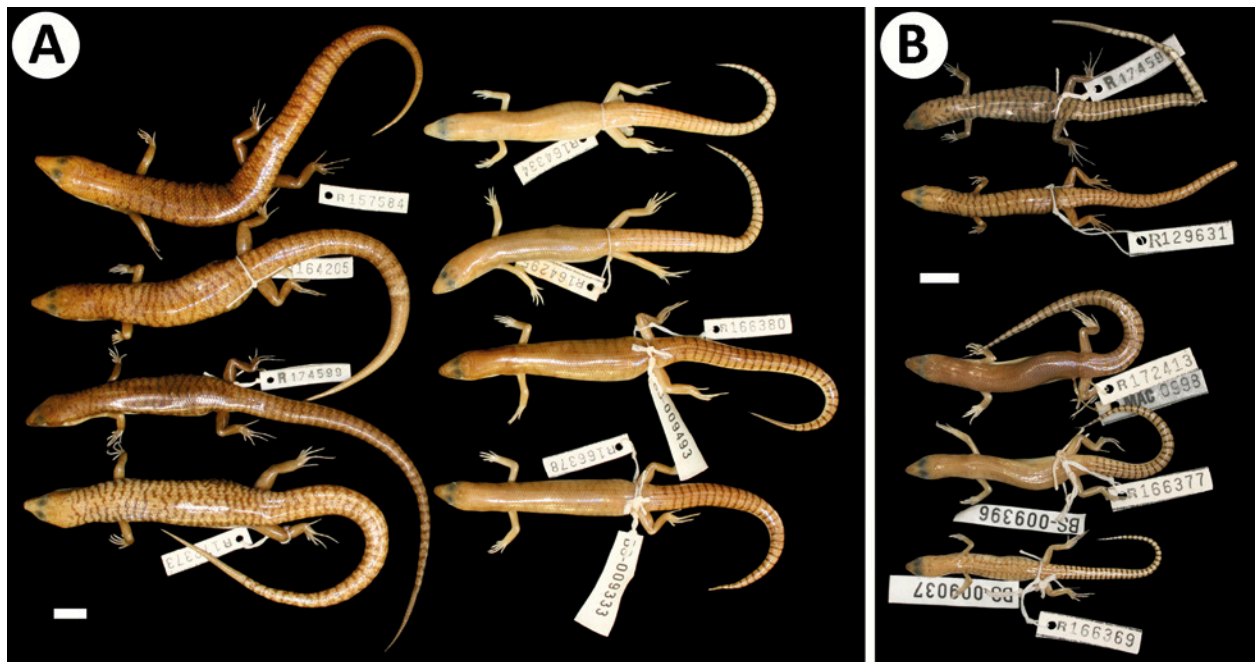
*Eremiascincus rubiginosus* can be distinguished from *E. richardsonii* by typically seven supralabials (vs usually eight supralabials); three chin shields (vs usually four chin shields); smooth dorsal surface of tail (vs dorsal surface of tail ridged); numerous (17–24) diffuse bands on nape and dorsum covering a single scale row at most, bands little contrasting with rusty red ground colour, separated by an interspace of one or two scales only (vs 7–14 bands on dorsum sharply defined, much more prominent, dark, and in strong contrast with the lighter, yellow to orange ground colour, separated by an interspace of three or four scales); > 40 narrow bands on tail (vs 19–32 usually broad bands on tail). *Eremiascincus richardsonii* in Western Australia favours heavy and stony soils and may be encountered in sympatry with *E. rubiginosus*. Characters distinguishing the banded species of *Eremiascincus* occurring in the Pilbara region are summarized in Table 2.



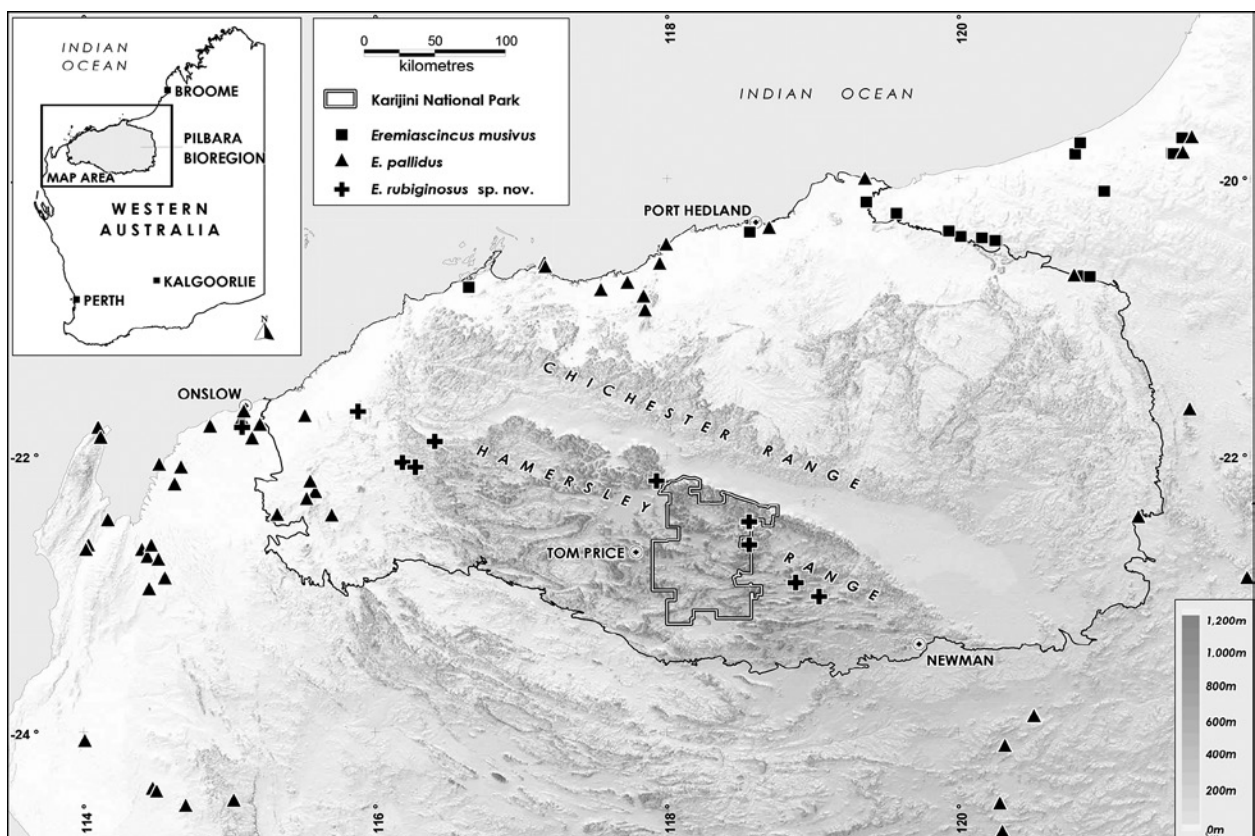


**Fig. 3.** Comparison of head and plantar morphology in narrow-banded *Eremiascincus* occurring in the Pilbara, Western Australia. (A) *E. rubiginosus* **sp. nov.** from Karijini National Park, Western Australia. (B) *E. musivus* from Shay Gap, Marble Bar, Western Australia. (C) *E. pallidus* from 7 km south-southwest Onslow, Western Australia. (D) Ventral surface of the pes in *E. rubiginosus* **sp. nov.** (WAM R174852; paratype), in which the ovate plantar scales (10 from heel to base of third toe) possess dark brownish-black calli. (E) Ventral surface of the pes in *E. pallidus* (WAM R164259), in which the plantar scales (17 from heel to base of third toe) are acute, pale and lack calli. (A) – CHRIS NELSON, (B) – BRIAN BUSH, (C) – BRAD MARYAN, (D & E) – LUKE KEALLEY.





**Fig. 4.** Colouration and pattern in *Eremiascincus rubiginosus* **sp. nov.** and *E. pallidus*. (A) Adults of *E. rubiginosus* **sp. nov.** (left) and *E. pallidus* (right). (B) Juveniles of *E. rubiginosus* **sp. nov.** (upper two specimens) and *E. pallidus* (lower three specimens); small juveniles of *E. pallidus* may exhibit a pattern of bands on the dorsum. Scale bars = 10 mm. (A & B) – LUKE KEALLEY.



**Fig. 5.** Distribution of the narrow-banded *Eremiascincus rubiginosus* **sp. nov.**, *E. musivus*, and *E. pallidus* in the Pilbara region of Western Australia. – Map by PAUL SAWERS.

## Discussion

The description of *Eremiascincus rubiginosus* brings the number of described *Eremiascincus* species to 15. Most of these show a strong fidelity to certain habitat types and substrates (MECKE *et al.* 2013; pers. obs.). *Eremiascincus rubiginosus* is a typical species from the rocky country of the Pilbara, in that it is associated with gorges, rocky gullies, riverbeds and caves in the Hamersley Range, and exhibits a rich reddish colouration as is common for many species of animals from this region. In contrast, *E. musivus* and *E. pallidus* are sand-swimmers that readily will burrow into loose sand, with both only occurring along the sandy coastline of the Pilbara and the adjacent sandy deserts. While *E. rubiginosus* and *E. musivus* do not occur together, *E. rubiginosus* and *E. pallidus* may be encountered in sympatry in the Onslow area (Fig. 5).

Morphologically, *E. rubiginosus* shares many characters with other narrow-banded *Eremiascincus* from the Australian arid zone, all of which are sand-swimmers. The saxicoline habitat preferences of *E. rubiginosus* are intriguing, because it is the first narrow-banded species of *Eremiascincus* to have a strong association with rocky habitats and possesses characters (bluntly callused palmar and plantar scales, callused lamellae) that may be an adaption for rock climbing, similar to the saxicoline species *Cryptoblepharus ustulatus* HORNER, 2007 from the same general area in the Hamersley Range. It is likely that *E. rubiginosus* has evolved from an *E. pallidus*-like ancestor, such that the microhabitat of sand in gorges was a bridging habitat for the evolution of a more derived habitat preference of a gorge-dwelling lizard. Morphology in the genus *Eremiascincus*, however, may be of limited value to elucidate phylogenetic relationships, and former phenetic groupings (e.g., GREER 1979, 1989) have not been supported by molecular phylogenetic approaches (REEDER 2003; RABOSKY *et al.* 2007; SKINNER 2007; MECKE *et al.* 2009; S.C. DONNELLAN & P. DOUGHTY, unpublished data). Studies on the phylogenetic position and ecology of *E. rubiginosus* would be of interest.

## Acknowledgements

For support throughout the project the authors thank Roy Teale and others from Biota Environmental Sciences (Leederville, Australia). We thank Britta Döring for contributing to scale counts and Steve Donnellan (South Australian Museum, Adelaide, Australia) for discussion and preliminary genetic analyses. Photographs of live specimens were kindly provided by Ryan J. Ellis, Brad Maryan, Brian Bush (Snakes Harmful and Harmless, Stoneville, Australia), Chris Nelson (SECA Reptiles, Pakenham, Australia) and Peter Soltys (OZ Minerals, Adelaide, Australia). Luke Kealley photographed the preserved specimens. Photos were edited and digitally mounted on photo plates by Luke Kealley and Max Kieckbusch (DB Engineering and Consulting, Munich, Germany). Paul Saw-

ers (Biota Environmental Sciences) created the distribution map. We thank Max Kieckbusch for comments on an earlier draft of the manuscript. We also thank the two anonymous reviewers that contributed to improving the manuscript. Financial support by Pilbara Iron, Rio Tinto and the Department of Parks & Wildlife (Western Australia, Australia) is acknowledged with thanks.

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