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A New Genus for the New Caledonian Scincid Lizard *Lygosoma euryotis* Werner, 1909, and the Description of a New Species

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ABSTRACT. The generic allocation and alpha systematics of the New Caledonian scincid lizard *Lygosoma euryotis* Werner are reviewed. The species was known only from the type specimen for most of the last century, and was most recently placed in the genus *Marmorosphax* in 1986 (type species *Lygosoma tricolor* Bavay). The recent acquisition of additional specimens from the type locality on the Isle of Pines and from the far north of the Grande Terre has provided additional information on scalation, osteology, and mode of reproduction. These data in combination with mitochondrial and nuclear DNA sequence data indicate the current generic allocation for *Lygosoma euryotis* is inappropriate, and that it cannot be placed with confidence in any existing genus. A new genus is here proposed to accommodate the species. Further, *L. euryotis* is here recognized as comprising two widely allopatric species, *euryotis* from the Isle of Pines and a new species from the far north of the main island. Both species are regarded as threatened and categorized as Vulnerable, with the species from the north of the main island particularly at risk.

RÉSUMÉ. La position générique et la systématique alpha du lézard scincidé *Lygosoma euryotis* Werner de Nouvelle-Calédonie sont revus. L'espèce, qui n'était connue que par son spécimen-type durant la majeure partie du siècle passé, a été récemment placée dans le genre *Marmorosphax* en 1986 (espèce-type *Lygosoma tricolor* Bavay). L'acquisition récente de spécimens supplémentaires provenant de la localité-type sur l'Île des Pins et de l'extrême nord de la Grande Terre fourni des informations complémentaires sur l'écaillure, l'ostéologie et le mode de reproduction de ce lézard. Ces données, en combinaison avec les séquences d'ADN nucléaire et mitochondrial, montrent que l'attribution générique de *Lygosoma euryotis* n'est pas correcte et qu'il ne peut être placé avec fiabilité dans aucun des genres actuels. Nous proposons ici un nouveau genre pour cette espèce. De plus, nous montrons que *L. euryotis* comprend deux espèces nettement allopatriques, *euryotis* de l'Île des Pins et une nouvelle espèce de l'extrême nord de l'Île principale. Les deux espèces sont considérées comme menacées et classées dans la catégorie «vulnérable», l'espèce du nord de la Grande Terre étant particulièrement menacée.

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The scincid lizard *Lygosoma euryotis* was described by Werner in 1909 from a single specimen collected from the Isle of Pines, off the southern tip of New Caledonia. The species was only known from the type for over 75 years. The name has not appeared widely in literature, either in taxonomic accounts or regional inventories. Roux (1913) examined the type specimen and gave an account of the species as *Lygosoma (Leiolopisma) euryotis*. Greer (1974) listed it as one of 33 species in the genus *Leiolopisma*, which at the time included species from Australia (including Tasmania), New Zealand, New Caledonia, Vanuatu, Lord Howe Island, and Round Island (Mauritius).

A review of the New Caledonian scincid lizards by Sadlier (1986) assigned the majority of New Caledonian species previously included in *Leiolopisma* to a number of putatively monophyletic genera. Among the genera proposed was *Marmorosphax*, consisting of *Lygosoma tricolor* Bavay (type species) and *Lygosoma euryotis* Werner. At this time *M. euryotis* was only known from two specimens, Werner's type from the Isle of Pines, and a second skink from near Ouaième in northeastern New Caledonia, approximately 340 km distant.

The acquisition of a large series of specimens from the Isle of Pines (Bauer & Sadlier, 1994) provided data on aspects of osteology, reproduction, and variation in scalation for the type population of *euryotis* not previously available. Comparison of these skinks with the two older specimens discussed by Sadlier (1986), as well as an additional specimen from the mainland (AMNH 62685 from Tao on the northeast coast) revealed colouration differences between mainland (Grande Terre) and insular populations. Although Bauer & Sadlier (1994) tentatively considered all the material to be referrable to a single species, they noted that such differences, as well as the highly disjunct distribution of *M. euryotis* could be indicative of non-conspecificity.

The discovery of *Marmorosphax montana* from Mt Ouin in the Province Sud, in all aspects of appearance and behaviour the sister species to *Marmorosphax tricolor*, led Sadlier & Bauer (2000) to review the composition of the genus. In particular the generic allocation of *euryotis*, which lacks the viviparity and unfused atlantal arches characteristic of both *M. tricolor* and *M. montana*, within *Marmorosphax* was regarded as questionable. On this basis "*Lygosoma*" *euryotis* was regarded as incertae sedis within the *Pseudemoia* group of Greer (1989) pending further investigation (Sadlier & Bauer, 2000; Bauer & Sadlier, 2000).

The recent acquisition of additional specimens of "*euryotis*" from northern New Caledonia, and the availability of genetic techniques for assessing relationships now permit the re-evaluation of both the specific status of the disjunct populations currently assigned to *euryotis* and their generic allocation. The removal of *euryotis* from *Marmorosphax* also necessitates a re-diagnosis of that genus.

Materials and methods

Abbreviations. Institutional abbreviations are as follows: American Museum of Natural History, New York (AMNH); Australian Museum, Sydney (AMS); California Academy of Sciences, San Francisco (CAS); Institut Royal des Sciences Naturelles de Belgique, Brussels (IRSNB); Museum of Comparative Zoology, Harvard (MCZ); Muséum national d'Histoire naturelle, Paris (MNHN); and Queensland Museum, Brisbane (QM).

The full suite of morphological characters listed below was scored for each specimen where possible.

Measurements. Snout to vent length (SVL)—measured from tip of snout to caudal edge of anal scales; axilla to groin distance—measured from middle of base of forelimb to middle of base of hindlimb; forelimb to snout length—measured from tip of snout to middle of base of forelimb; hindlimb length—measured from middle of base of hindlimb to tip of fourth toe including nail; tail length—measured from caudal edge of anal scales to tip of tail, on complete original tails only as determined from X-rays. Body measurements (axilla to groin, forelimb to snout, hindlimb, and tail lengths) are for all specimens, Sexual maturity was determined by reproductive maturity (presence of enlarged yolked ovarian follicles or eggs in females, and presence of enlarged testes and distinctive colouration in males) and/or obvious size classes, and are expressed as percentages of snout to vent length in the taxon accounts.

Scalation. Midbody scale rows—number of longitudinal scale rows around body counted midway between axilla and groin; paravertebral scale rows—number of scales in a paravertebral row from first scale posterior to parietal scale to last scale at level of vent opening; fourth finger and toe scales—number of dorsal scales on fourth digit of hand and foot, distal scale contains claw, basal scale broadly contacts adjacent basal scale of third finger or toe; fourth finger and toe lamellae—number of ventral scales on fourth digit of hand and foot, distal scale contains claw, basal scale is last largely undivided scale at, or proximal to, a point level with intersection of third and fourth digits. Bilateral scalation characters were scored on both sides and the mean value used. Sexual dimorphism in paravertebral scales (the scalation character most likely to exhibit this trait) was assessed using independent two-sample *t*-test in the largest single sample from a single location. Variation between populations was assessed using independent two-sample *t*-tests for all scalation characters.

Osteology. Specimens were radiographed using an Eresco AS2 X-ray machine to determine phalangeal formulae and the number of presacral vertebrae and postsacral vertebrae (complete original tails only) at exposures of 30 sec at 30 kV. Condition of the atlantal vertebrae was assessed from dried skeletal material.

Genetic studies. As part of a broad-scale phylogenetic study of the endemic reptiles of New Caledonia, we have obtained mitochondrial and nuclear DNA sequences (514bp of ND2 and 830bp of rag-1) from the majority of New Caledonian skink species (including all but one genus) and representatives of related lygosomine skink lineages from Africa, Australia and New Zealand. Our phylogenetic analysis includes two representatives of *euryotis* and three of the new species described from the northwest of the main island, and 18 specimens of *Marmorosphax tricolor* and *M. montana* from 10 localities, including regionally sympatric samples of *M.* cf. *tricolor* (n = 2) and the new species (n = 2) from Mt Taom in northwest New Caledonia.

Molecular data were analysed within maximum parsimony and Bayesian frameworks using PAUP* (b4v10 Swofford, 1999) and Mr Bayes v3 (Hulsenbeck & Ronquist, 2001) respectively. Support for nodes on the optimal topologies was assessed using bootstrap and Bayesian posterior probability values.

Systematics

From the available data we have attempted to identify monophyletic lineages for the taxa studied here. The assignment of *Lygosoma euryotis* Werner and *Lygosoma tricolor* Bavay to *Marmorosphax* was based on these species sharing a unique, but limited, suite of seven derived characters (Sadlier, 1986). At that time the state of two key characters, mode of reproduction and condition of the first cervical vertebrae, could not be determined for *Lygosoma euryotis* from the material available. A live-bearing mode of reproduction was reported for *Marmorosphax tricolor* at the time the genus was proposed, but was not listed among the apomorphies diagnosing it, as the mode of reproduction for *Lygosoma euryotis* was unknown. The first cervical vertebra of *M. tricolor* consists of three elements, the two lateral atlantal arches and the basal intercentrum—the pleisiomorphic condition among members of the *Eugongylus* group of skinks (Greer, 1989). The condition of the atlantal vertebrae cannot readily be determined without some damage, and given that only two specimens of *euryotis* were known to exist at that time (one of which was the type) such an examination was not attempted.

Specimens from recent field collections show *euryotis* and a sibling species from the north of the Grande Terre both have an egg-laying mode of reproduction and the atlantal arches of the first cervical vertebra fused to the intercentrum. Also, recently collected specimens of *Marmorosphax montana* show this species has a live-bearing mode of reproduction similar to its sister species *M. tricolor*.

In the light of this new information retention of *euryotis* within *Marmorosphax* would imply evolution of both viviparity (*tricolor* + *montana*) and fusion of the atlantal arches to the intercentrum (*euryotis*) within only certain members of the genus. This has not been observed in any New Caledonian genus of skinks.[1]

Phylogenetic studies in progress using mitochondrial and nuclear DNA sequences recognize *euryotis* + the sibling species described in this paper as a monophyletic lineage, and *M. tricolor* + *M. montana* + two undescribed species as an independent monophyletic lineage, with no support for the two being especially closely related with respect to each other.

The morphological and genetic data in combination indicate *Lygosoma euryotis* Werner cannot be placed with confidence in any existing monophyletic genus within the *Eugongylus* group of skinks, and that a new genus is warranted to accommodate the species *euryotis*, apparently restricted to the Isle of Pines, and a newly recognized sibling species from the north of the Grande Terre.

Celatiscincus Sadlier, Smith, & Bauer, n.gen.

Type species. *Lygosoma euryotis* Werner, 1909:271.

Diagnosis. The following suite of apomorphic characters in combination will distinguish *Celatiscincus* from all other genera in the *Eugongylus* group of Greer (1979): frontoparietal scales fused; naris positioned in a single large nasal scale, with no evidence of scale or postnasal suture; anterior loreal reduced, either contacting upper labials narrowly, or present as a semilunar scale failing to contact upper labials; contact between lower eyelid and adjacent upper labials interrupted by the presence of complete subocular scale row; parietal scales each bordered by a single enlarged upper temporal scale and 2 (rarely 3) equal sized nuchal scales no larger than the surrounding dorsal scales; lower eyelid with an obvious, centrally located semi-transparent disc; ear lobules barely distinguishable from blunt conical scales around upper, lower, and posterior edges of ear opening; premaxillary teeth 13; atlantal arches of first cervical vertebrae fused to intercentrum.

The genus sharing the greatest number of derived features with *Celatiscincus* is *Sigaloseps*. However, *Sigaloseps* lacks the elevated number of premaxillary teeth and has each parietal bordered by an enlarged upper secondary temporal and transversely enlarged nuchal scale, rather than an enlarged upper secondary temporal and two (or more) smaller equal sized scales seen in *Celatiscincus*. Further, *Sigaloseps* has smooth body scales, whereas *Celatiscincus* has keeled body scales. The polarity of this latter character has yet to be determined. Comparison to the two closest outgroups: New Zealand+Australian *Eugongylus* group species and *Eugongylus*+*Emoia*+*Leiolopisma* (based on genetic evidence—Smith, 2001) would indicate smooth scales are the pleisiomorphic state at the level of the New Caledonian radiation.

Etymology. The name *Celatiscincus* is derived from *celatus*, the Latin for concealed and *scincus*, a Latinized version of a Greek word for lizard, particularly applied to skinks or other "shiny-scaled" lizards, and alludes to the isolation of the ranges of the constituent species and the fact that the identity and affinities of these taxa remained "hidden" to systematists for so long. The name is masculine.

Recognized species. *Celatiscincus euryotis* (Werner, 1909); and *Celatiscincus similis* n.sp. Sadlier, Smith, & Bauer.

The two species of *Celatiscincus* are similar in overall appearance. They are small in size with long tails and relatively long limbs, and share the same basic configuration of head scalation that includes: prefrontals moderately large and moderately to widely separated; frontoparietals fused; interparietal distinct; parietals each bordered by a single large upper secondary temporal and two (rarely three) equal sized scales no larger than the surrounding dorsal scales; nasals well separated; loreals two, anterior narrowly contacting labials, occasionally present as a semilunar scale failing to contact the labials; supraciliaries usually 7; upper labials usually 7; a complete subocular row between preocular and pretemporal scales; primary temporal single; lower secondary temporal single; tertiary temporals two; postlabials two; lower eyelid with an obvious, centrally located semi-transparent disc. Both species are sexually dimorphic in adult colour (see Bauer & Sadlier, 2000, pl. 18C–F), and adult females of both species typically have a

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[1] Only in the Australian genus *Niveoscincus* as proposed by Hutchinson *et al*. (1990) are both conditions present. However, although the generic diagnoses provided for *Niveoscincus* and other genera proposed by Hutchinson *et al*. are based on morphological characters, the framework within which these diagnoses were formulated was determined by immunological data alone. As such the morphological data do not provide an independent test for the monophyly of groups identified by the immunological study.] The species *euryotis* and its sibling species from the north of the Grande Terre shares some apomorphic characters with *Sigaloseps* Sadlier, but none in particular, or even all in combination, are sufficiently compelling to infer a level relationship that would suggest they are congeneric.

Fig. 1. *Celatiscincus euryotis*, an adult male (above) and adult female (below) from Waa Mé Bay, Isle of Pines, New Caledonia.

narrow, white hip stripe (dark-edged above) that extends over the hindlimbs and along basal portion of tail that is not present in adult males.

Diagnoses and descriptive data for *Celatiscincus euryotis* have been published by: Werner (1909, as *Lygosoma euryotis*); Sadlier (1986, as *Marmorospha* × *euryotis*); and Bauer & Sadlier (1994, as *Marmorospha* × *euryotis*); and Bauer & Sadlier (2000, as *"Lygosoma" euryotis*). However, the species accounts of Sadlier (1986) and Bauer & Sadlier (2000) were composite, including information from specimens from both the Isle of Pines and from the north of the Grande Terre. We here redefine *C. euryotis* and diagnose and describe a second member of the genus to accommodate the mainland New Caledonian populations previously subsumed within *C. euryotis*.

Celatiscincus euryotis Werner, 1909

Figs. 1, 2

Material examined. AMS R138528–46, R138569–70, R138572–77, R138620, CAS 182089–108, 182118–27, 182140–45, 182181, 182186–88, 182199 New Caledonia, Province Sud, Isle of Pines, Gite Kodjeue on Waa Mé Bay, 22°34'S 167°25'E; AMNH 81783 New Caledonia, Province Sud, Isle of Pines, Vao; and CAS 80889 and IRSNB 2.025 Isle of Pines—no specific locality.

Diagnosis. *Celatiscincus euryotis* is distinguished in morphology from *Celatiscincus similis* n.sp. (the only other species in the genus) by differences in adult colouration and osteology. Adult male *Celatiscincus similis* n.sp. have a bright russet flush to the body around the area of the hindlimbs, and adult females a bright russet flush to the whole of the tail, whereas these colours are muted in *Celatiscincus euryotis* (see also Bauer & Sadlier [1994] for a discussion of colour in *C. euryotis*). *Celatiscincus euryotis* has fewer presacral vertebrae (mode 28) than *Celatiscincus similis* n.sp. (mode 29). These differences in colouration and osteology are supported by DNA sequence data (see section on relationships below).

Description. Based on 28 specimens (33.0–42.0 mm SVL) in the AMS collection, comprising 12 adult males, 14 adult females, and 2 subadults.

Measurements: maximum SVL of males 42.0 mm, females 40.0 mm; distance from axilla to groin 48.5–56.4% of SVL ($\bar{x}$ = 52.0%, n = 28); distance from forelimb to snout 37.5–45.5% of SVL ($\bar{x}$ = 41.2%, n = 28); hindlimb length 38.1–44.3% of SVL ($\bar{x}$ = 41.1%, n = 27); tail length 151.4% of SVL for adult individual with most complete tail.

Scalation: Midbody scale rows 30–36 ($\bar{x}$ = 33.1±1.26, n = 28); paravertebral scales 49–57 ($\bar{x}$ = 52.4±2.20, n = 28)—no sexual dimorphism between 12 males and 14 females ($\bar{x}$ 52.33 *vs* 52.57, t_{24} = -0.27, P<0.792); scales on top of fourth finger 8–10 ($\bar{x}$ = 8.9±0.38, n = 27); lamellae beneath fourth finger 15–18 ($\bar{x}$ = 16.2±0.68, n = 26); scales on top of fourth toe 11–13.5 ($\bar{x}$ = 12.75±0.57, n = 36); lamellae beneath fourth toe 30–40 ($\bar{x}$ = 35.3±1.87, n = 33).

Osteology: presacral vertebrae 28 (n = 14)–29 (n = 3); postsacral vertebrae 41 (specimen with most complete tail showing no evidence of regeneration); phalangeal formula for manus and pes 2.3.4.5.3 and 2.3.4.5.4 respectively.

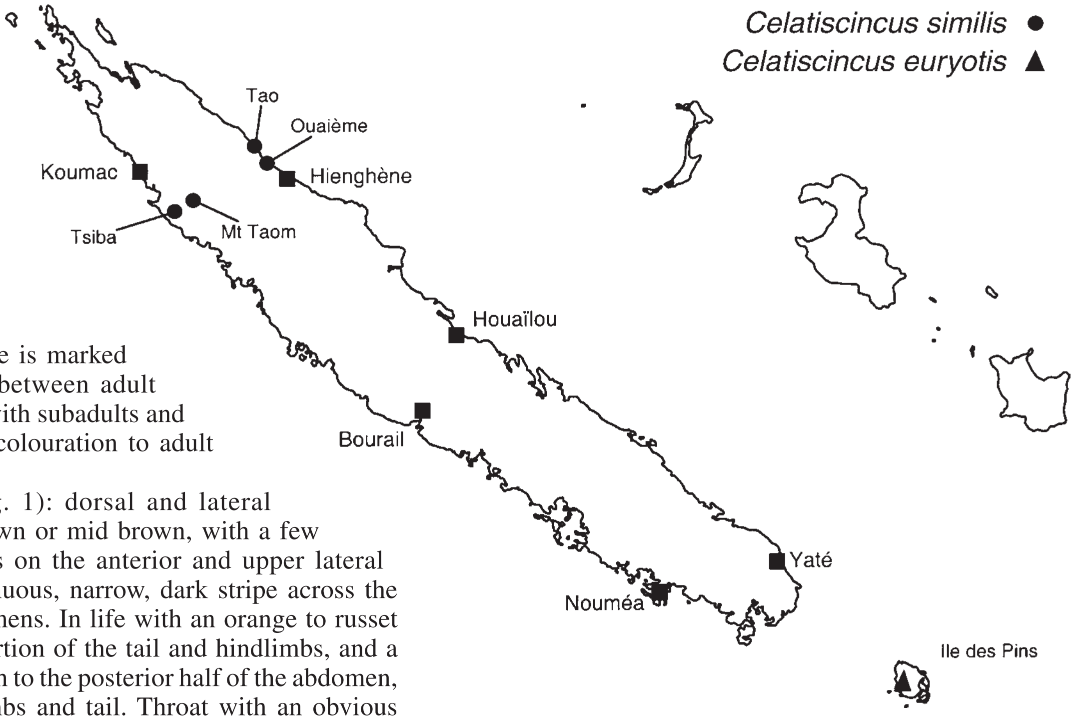

Fig. 2. Distribution of *Celatiscincus euryotis* and *Celatiscincus similis* n.sp. in New Caledonia.

Colouration: There is marked sexual dimorphism between adult males and females, with subadults and juveniles similar in colouration to adult females.

Adult males (Fig. 1): dorsal and lateral surface tan-light brown or mid brown, with a few scattered dark flecks on the anterior and upper lateral surface, and a continuous, narrow, dark stripe across the snout in some specimens. In life with an orange to russet flush to the basal portion of the tail and hindlimbs, and a moderate yellow flush to the posterior half of the abdomen, underside of hindlimbs and tail. Throat with an obvious pattern of dark transverse markings on the outer chinshields and throat scales, and a variably defined, narrow, dark, longitudinal streak on the throat and chest.

Adult females (Fig. 1): body usually two-toned, but the degree of differentiation between the dorsal and lateral surfaces varies. Dorsal surface of the body dull light-brown or mid-brown. Lateral surface light-mid grey with scattered dark flecking overall, boldly marked individuals with these darker markings covering most of the lateral surface and contrasting markedly with the paler dorsal colour. Dark markings on dorsal surface aligned as a concentration of longitudinal flecks along dorsolateral margin, tending to form a continuous, narrow, dark stripe along the temporal margin, and across the snout in some specimens. A narrow, white, hip stripe (dark-edged above) extends along basal portion of tail and over the hindlimbs, continuing as a pale, narrow upper edge (paler than hip stripe) to the dark dorsolateral markings, extending to near the temporal region in some specimens. In life with a dull orange flush to the lateral, dorsal, and ventral areas of the entire tail, remainder of underside of body and hindlimbs white.

Subadults—overall body colouration usually darker with dark lateral flecking extending over most of the lateral surface, otherwise subadult males have a colour pattern typical of adult females and juveniles including a weak to obvious pale hip stripe and a continuous concentration of dark flecks along the dorsolateral margin in the shoulder region—ventral colouration of pale.

Reproduction: The series collected during the wet season in early March 1992 contained a high proportion of gravid females which consistently showed an egg laying mode of reproduction with a clutch size of 2–3 shelled oviducal eggs.

Distribution and habitat. The species is known only from the Ile of Pines, approximately 50 km southeast of the southern coast of the Grande Terre (Fig. 2). Its distribution on the island and surrounding islets may be very localised. A recent survey of islets off the Ile of Pines did not reveal the presence of the species at any of those examined.

Celatiscincus similis Sadlier, Smith & Bauer, n.sp.

Figs. 2–5

Type material. HOLOTYPE: MNHN 2003.1006 (formerly AMS R153524); New Caledonia, Province Nord, Tsiba, c. 3 km north of Ouaco, 20°48'14"S 164°28'19"E; collected by R.A. Sadlier, M. Christy & M. Thurlow, 25.xi.1998. PARATYPES: AMS R153504–23, R153525, same location and date of collection as holotype; AMS R153559–66, CAS 226168–69, 226170–72, MCZ R183656, same location and collectors as holotype, 26.xi.1998; AMS R153585–86, CAS 226173, New Caledonia, Province Nord, Massif Ouazangou-Taom, Mt Taom, 20°45'35"S 164°32'51"E, collected by R.A. Sadlier, M. Christy & M. Thurlow, 26.xi.1998; AMS R164185, R164188, New Caledonia, Province Nord, Massif Ouazangou-Taom, Mt Taom summit, 20°46'52"S 164°34'46"E, collected by R.A. Sadlier & G.M. Shea, 7.xii.2004.

Additional material. In addition to the type material the following specimens referable to *Celatiscincus similis* were examined but do not form part of the type series or description: AMS R161164–65, R161184, Massif Ouazangou-Taom, Gomen Mine Mt Taom, 20°46'36"S 164° 33'44"E; QM J37441 Ouaième via Hienghène, 20°37'S 164°51'E; AMNH 62685 Tao 20°33'S 164°48'E—note the specimens from Ouaième (Sadlier,1986) and Tao (Bauer & Sadlier, 1994) were originally reported as *C. euryotis*.

Diagnosis. See diagnosis for *Celatiscincus euryotis* above.

Etymology. The epithet *similis* is Latin for similar or resembling, and refers to the great overall similarity of the new species to *C. euryotis*.

Description. Based on the type series of 41 specimens (32.0–45.5 mm SVL), comprising 16 adult males, 19 adult females, and 6 subadults.

Measurements. Maximum SVL of males 43.0 mm, females 45.5 mm; distance from axilla to groin 48.8–58.8% of SVL (x̄ = 53.9%, n = 41); distance from forelimb to snout 37.4–43.4% of SVL (x̄ = 40.6%, n = 41); hindlimb length 40.0–48.7% of SVL (x̄ = 4.0%, n = 35); tail length 167.6% of SVL for adult individual with most complete tail.

Scalation (Fig. 3): prefrontals moderately large and moderately to widely separated; frontoparietals fused; interparietal distinct; parietals each bordered by a single large upper secondary temporal and two (rarely three) equal sized scales no larger than the surrounding dorsal scales; nasals well separated; loreals two, anterior narrowly contacting labials, occasionally present as a semilunar scale failing to contact the labials; supraciliaries usually 7 (95%), rarely 6 (3.8%) or 8; upper labials usually 7; a complete subocular row between preocular and pretemporal scales; primary temporal single; lower secondary temporal single; tertiary temporals two; postlabials two; lower eyelid with an obvious, centrally located semi-transparent disc.

Midbody scale rows 30–32 (x̄ = 31.0±1.00, n = 41); paravertebral scales 49–56 (x̄ = 52.4±1.75, n = 41)—no sexual dimorphism between 13 males and 15 females (x̄ 52.38 *vs* 52.25, $t_{34} = 0.202$, $P<0.99$); scales on top of fourth finger 8–11 (x̄ = 9.5±0.61, n = 39); lamellae beneath fourth finger 15–20 (x̄ = 17.2±1.02, n = 39); scales on top of fourth toe 12–15 (x̄ = 13.3±0.63, n = 35); lamellae beneath fourth toe 30–40 (x̄ = 35.4±1.87, n = 35).

Osteology: presacral vertebrae 29 (n = 37)–30 (n = 2); postsacral vertebrae 40 (specimen with most complete tail showing no evidence of regeneration); phalangeal formula for manus and pes 2.3.4.5.3 and 2.3.4.5.4 respectively.

Colouration: There is marked sexual dimorphism between adult males and females, with subadults and juveniles similar in colouration to adult females.

Adult males (Fig. 4): dorsal and lateral surface tan-light brown or mid brown, with a few scattered dark flecks on the anterior and upper lateral surface, and a continuous, narrow, dark stripe across the snout in some specimens. In life with a bold russet flush to the lateral, dorsal, and ventral areas at the base of the tail and hindlimbs, and a dull to moderate orange to yellow flush to the posterior half of the abdomen. Throat and chest pale and without an obvious pattern of dark transverse markings on the outer chinshields and throat scales, and a variably defined, narrow, dark, longitudinal streak on the throat and chest.

Adult females (Fig. 4): body usually two-toned. Dorsal surface of the body a dull light-brown or mid-brown. Lateral surface light-mid grey with scattered dark flecking overall, boldly marked individuals with these darker markings covering most of the lateral surface and contrasting markedly with the paler dorsal colour. Dark markings on dorsal surface occasionally aligned in longitudinal rows in the paravertebral region, and as a concentration of longitudinal flecks along dorsolateral margin, tending to form a more continuous, narrow, dark stripe along the temporal margin and across the snout in some specimens. A narrow, white, hip stripe (dark-edged above) extends along basal portion of tail and over the hindlimbs, continuing as a pale, narrow upper edge (paler than hip stripe) to the dark dorsolateral markings, variably extending forward to near the temporal region. In life with a bold orange to russet flush to the lateral, dorsal, and ventral areas of the entire tail, remainder of underside of body and hindlimbs white.

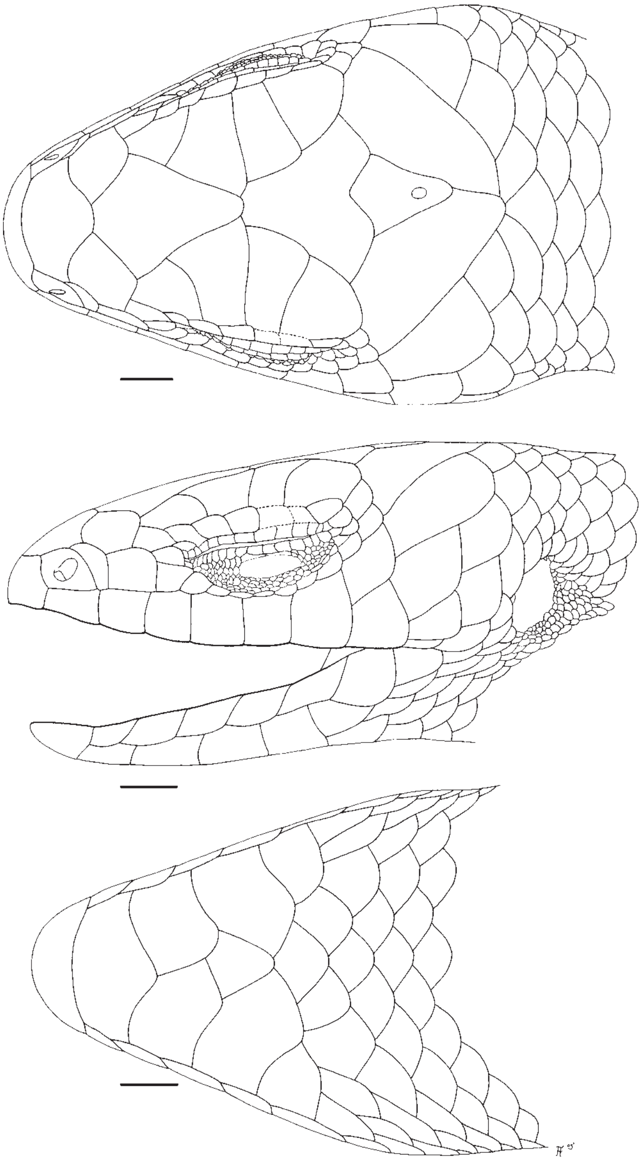

Fig. 3. Dorsal (upper), lateral (middle), and ventral (lower) views of the headshields of the holotype of *Celatiscincus similis* n.sp. (MNHN 2003.1006).

Subadults—overall body colouration usually darker with dark lateral flecking extending over most of the lateral surface, otherwise subadult males have a colour pattern typical of adult females and juveniles including a weak to obvious pale hip stripe and a continuous concentration of dark flecks along the dorsolateral margin in the shoulder region.

Note—The features of colouration along the dorsolateral margin mentioned by Sadlier (1986) for the specimen from Ouaième on the northeast coast are similar to those seen in some of the more boldly marked female specimens from the northwest coast.

Reproduction: The series of specimens collected at the very end of the dry season in late November 1998 contained four gravid females which consistently showed an egg laying mode of reproduction with a clutch size of 2 shelled oviducal eggs, one in each oviduct. Three other adult females collected at this time had 2 enlarged yolked ovarian follicles (one in each oviduct), and one individual 3 (one in the left oviduct and 2 in the right).

Distribution and habitat. The species is known from two locations on the far northwest coast and two on the far northeast coast (Fig. 2).

The two sites in the northwest of the main island, the Ouazangou-Taom Massif and Tsiba just north of Ouaco, are approximately 15 km apart. In this region the species was collected at both low (Tsiba 220 m; Mt Toam 275 m) and moderately high (Mt Toam 850 & 1000 m) elevation. At low elevations it was collected in remnant patches of low closed vegetation, usually located in steep gullies, on ultramafic ranges. They were observed active amongst leaf litter in sunlit patches. These patches were surrounded by extensive area of maquis shrubland, the heath-like vegetation endemic to this soil type. At higher elevations it was collected in maquis/forest at 850 m, and near the summit of Mt Toam in low moderately dense maquis (1000 m). It is worth noting that individuals collected at low elevation sites appeared to have low levels of heat tolerance in comparison to locally sympatric skink species (*Caledoniscincus austrocaledonicus* and *Caledoniscincus haplorhinus*) of similar size. The species occurrence in the more open maquis habitat at higher elevations is most likely due to the more moderate conditions present at higher elevations in temperature and humidity.

There is no precise information regarding the site of collection or habitat for the two specimens from Ouaième and Tao on the northeast coast of the main island. Opportunistic field research by the authors in this region over a number of years has not located further specimens from either area or any surrounding areas searched. However, the habitat searched in this region has nearly always been closed humid forest, and it is possible the species is restricted to a different habitat type which has not yet been sampled, perhaps similar to that occupied on the northwest coast.

The species occurrence on both the northwest and northeast coast could suggest a wider distribution in the north of the island. However, extensive field research in recent times covering a wide range of habitats in the northwest from Sommet Poum south to Massif du Boulinda (Whitaker Consultants, in prep.) has failed to locate it at any site other than Mt Taom and nearby Tsiba.

Conservation status

Celatiscincus similis satisfies the criteria for inclusion into one of the threatened species categories under a modified IUCN classification system (see Sadlier & Bauer, 2003). It is currently known from only four locations, and from what is known of the two populations on the northwest coast the species is at risk from a range of threats.

The preferred habitat of *C. similis* on the northwest coast is severely fragmented, and the size of the patches of remnant closed vegetation on the ultramafic massifs is very small, particularly at lower elevations—the extent of suitable habitat at Tsiba (Fig. 5) is estimated at about 1 hectare. These isolated sub-populations are undergoing a decline in extent of occurrence as a result of the impact of burning of adjacent maquis shrubland, and from activities associated with mining (Fig. 6). The extent of the species' overall distribution on the western side of the island may ultimately prove to be much broader (i.e. extend further south and north in suitable habitat on ultramafic soils), but its area of occupancy (by virtue of the patchy and relictual nature of its preferred habitat) will most likely remain small.

Due to the fragmented and relictual nature of its distribution, the threats posed by the presence or potential for mining (some sites), and the impact of frequent firing, *C. similis* could be conservatively ranked as Vulnerable under the modified IUCN classification system (Sadlier & Bauer, 2003) used for the New Caledonian lizard fauna (area of occupancy <500 km^2, severely fragmented i.e. isolated sub-populations with a reduced probability of colonization, if once extinct; number of locations <5; continuing decline in area and extent of occurrence as indicated by a continuing decline in quality of habitat at some sites). It could be placed at a higher level of threat if continued declines in the area, extent and/or quality of habitat in the species very narrow range persist. Targeted field research is required, particularly in the northeast coast of the main island to fully assess the species' distribution and habitat preferences in the region. Assessing the species status on the northeast coast of the main island is problematic due to a lack of precise information on the species preferred habitat in this region. It is probably similarly restricted in its habitat preferences, even though ultramafic soils do not occur in this region (Paris, 1981; Sautter, 1981).

Celatiscincus euryotis is known only from two sites on the Isle of Pines, one a remnant of closed forest near Waa Mé Bay on the west side of the island, and the second at Vao. The main island of the Ile des Pins has a total area of 152 km^2, and the likely area of suitable habitat (excluding maquis shrubland and introduced plantations) is considerably less than this. It had previously been regarded as Secure by Bauer & Sadlier (2000) but given its extremely limited distribution it has been reassessed and conservatively ranked as Vulnerable (Sadlier & Bauer, 2003). The species distribution on the island and the threats likely to impact on the species need to be established to fully evaluate its conservation status.

Relationships

Our interpretations as to the generic distinctiveness of *Celatiscincus* and the specific distinction between *C. euryotis* and *C. similis* are based on a combination of evidence from the morphological information and DNA sequence data.

Intergeneric Relationships: Both ND2 and Rag-1 support the monophyly of the two species of *Celatiscincus*. Mitochondrial ND2 haplotypes of *C. euryotis* from two individuals from the Isle of Pines and five individuals (from two localities) of *C. similis* show a high level of sequence divergence between populations (12.5%), and no or very low levels of divergence within each population (southern: 0, northern: 0.16%). This level of genetic differentiation suggests the two widely allopatric populations represent two distinct evolutionary lineages, and is comparable with between-species divergence in other genera (e.g., *Marmorosphax* 12.1%, *Caledoniscincus* 12.9%). No single scalation character will allow unequivocal assignment to one species or the other. However, significant differences were detected between the two species which showed a trend towards *C. similis* having: fewer midbody scale rows ($\bar{x}$ 30.9 *vs* 33.1, $t_{67} = 7.92$, P<0.01); more scales on top of fourth finger ($\bar{x}$ 9.5 *vs* 8.9, $t_{64} = -4.58$, P<0.01); more lamellae beneath fourth finger ($\bar{x}$ 17.2 *vs* 16.2, $t_{63} = -4.60$, P<0.01); more scales on top of fourth toe ($\bar{x}$ 13.3 *vs* 12.75, $t_{59} = -3.60$, P<0.01); and

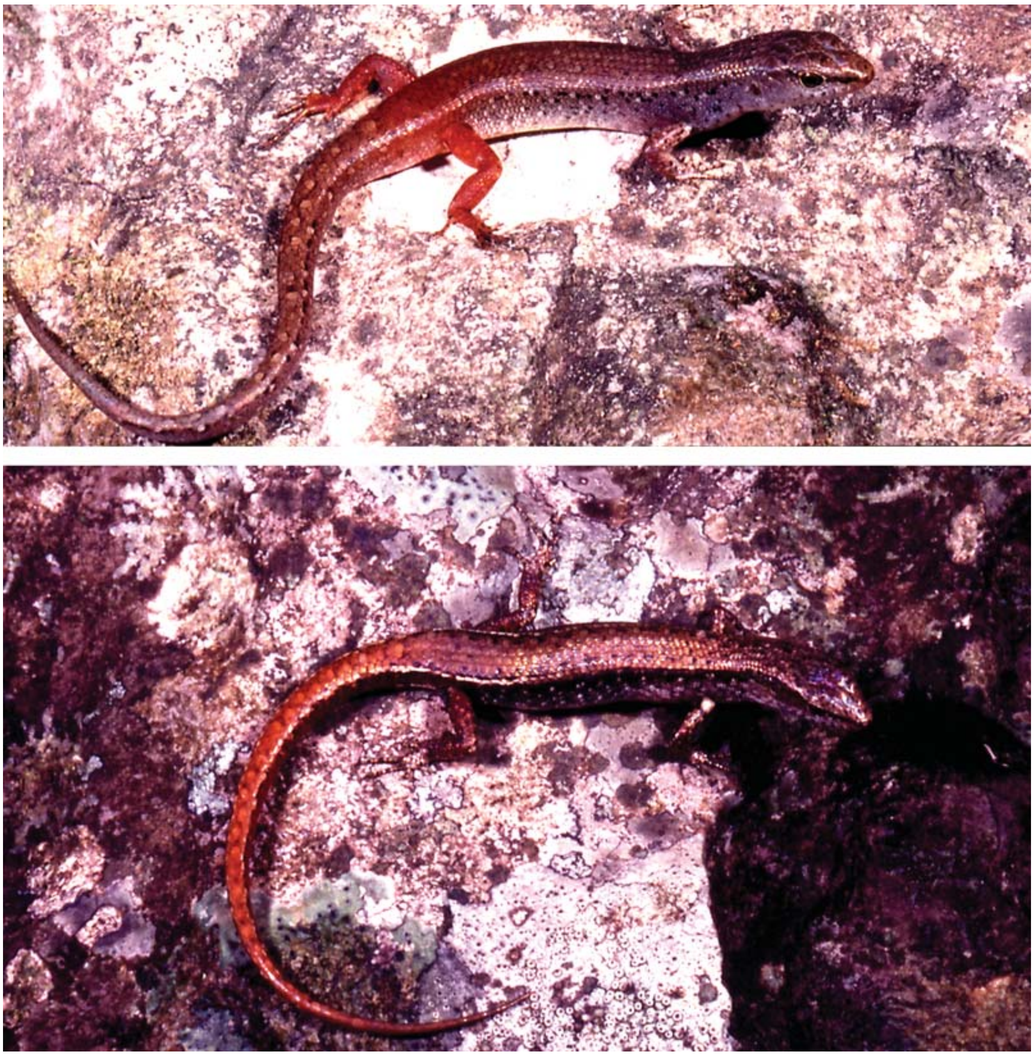

Fig. 4. *Celatiscincus similis* n.sp., an adult male (upper—AMS R153524) and adult female (lower—AMS R153525) from Tsiba, northwest New Caledonia.

more lamellae beneath fourth toe ($\bar{x}$ 35.4 *vs* 32.2, $t_{58} = -7.10$, $P<0.01$)—see Table 1. Further, there were significant differences in the modal number of presacral vertebrae between the two species, but again these were not unequivocal.

We recognize that an arbitrary degree of genetic differentiation alone is an inappropriate measure of specific distinctness (Ferguson, 2002; Sites & Marshall, 2003), however, we here use such measures in support of diagnostic features of colour and osteology outlined in the diagnoses. While colour may be regarded by some as too highly labile to serve alone as an adequate diagnostic feature, the relatively large samples of *C. euryotis* and *C. similis* demonstrate the consistency of this feature. Minor differences in colour, scalation, and proportion are also diagnostic of some other New Caledonian skinks that show similar levels of genetic differentiation between species (i.e. certain *Caledoniscincus* and *Marmorosphax*), including instances of broad sympatry between sister or "sibling" species (Bauer & Sadlier, 2000).

Based on both intensive and extensive sampling by the authors over a period of more than 20 years, the large geographic gap separating the two species of *Celatiscincus* from one another appears to be real. This disjunction is certainly great enough to completely isolate the populations from one another. As such, the two species, diagnostic differences aside, are certainly evolving as separate lineages on independent trajectories and would in any case meet the criteria for phylogenetic species (Frost *et al*., 1992; Grismer, 1999; McKitrick & Zink, 1988). This disjunction remains enigmatic. No other sister taxa pair of New Caledonian reptiles exhibits this particular distribution pattern, or such a degree of geographic separation. It is difficult to surmise what historical factors may have contributed to such a pattern. The geological and ecological dissimilarity of the areas where the two species occur argues against their ever having shared a common continuous range, and their apparent intolerance of heat and exposure suggest that they are not likely to have achieved their current distribution through dispersal. It is perhaps most likely that *Celatiscincus* was once a more speciose and widely distributed genus and that differential extinction of geographically intervening species may have resulted in the pattern observed today.

Intrageneric Relationships: A phylogenetic analysis of all New Caledonian skink taxa using the mitochondrial gene ND2 (514 bp) and the nuclear gene Rag-1 (830 bp) suggests that most described New Caledonian endemic lygosomine genera are strongly supported monophyletic lineages, but reveals little regarding intergeneric relationships (Smith *et al*., in prep.). *Celatiscincus* is one of many generic level lineages with long

Fig. 5. Tsiba near Ouaco, the small population of *Celatiscincus similis* n.sp. at this site was located in low closed vegetation in the centre of the photo.

Fig. 6. Ultramafic ranges south of Pouembout in northwestern New Caledonia, showing impact of strip mining on the environment.

independent histories that form a basal polytomy within Australo-Pacific *Eugongylus* group skinks. There is no evidence to suggest that *Celatiscincus* is more closely related to *Marmorosphax* or *Sigaloseps* than to other New Caledonian skink genera. As such, we regard the genetic data as supporting our morphological interpretation of the distinctiveness of *Celatiscincus*. Although we remain ignorant of the position of *Celatiscincus* within the New Caledonian *Eugongylus* group, we believe that the erection of a new genus serves an important purpose: to highlight *Celatiscincus* as a distinctive, monophyletic lineage that must be considered separately from all others in future phylogenetic analyses.

A revised diagnosis for *Marmorosphax* Sadlier

The transfer of *Lygosoma euryotis* Werner to the newly erected genus *Celatiscincus* Sadlier, Smith and Bauer necessitates a redefinition of *Marmorosphax* Sadlier. Also the recent acquisition of a gravid specimen of *Marmorosphax montana* that contains developing embryos allows a live bearing mode of reproduction to tentatively be added to the suite of apomorphic characters diagnosing the genus.

The revised diagnosis below for *Marmorosphax* provides a suite of apomorphic character states to diagnose this genus from all other genera in the *Eugongylus* group of skinks.

Marmorosphax Sadlier, 1986

Type species. *Lygosoma tricolor* Bavay, 1868: 17.

Diagnosis. The following combination of characters will distinguish *Marmorosphax* from all other genera in the *Eugongylus* group of skinks as defined by Greer (1979): frontoparietals fused; supranasal scale or postnasal suture absent; anterior loreal present as a semilunar scale failing to contact upper labials; subocular scale row complete; lower eyelid with an obvious, centrally located semi-transparent disc; ear lobules barely distinguishable from blunt conical scales around upper, lower, and posterior edges of ear opening; enlarged pairs of chinshields two, third pair of chinshields divided obliquely such that they are separated by five scales; premaxillary teeth 13; live-bearing mode of reproduction confirmed in *M. tricolor* and *M. montana*.

Recognized species. *Marmorosphax tricolor* Sadlier, 1986, and *Marmorosphax montana* Sadlier & Bauer, 2000.

Table 1. Comparison of key scalation characters between *Celatiscincus euryotis* and *C. similis*.

	C. euryotis	*C. similis*
midbody scale rows range	30–36	30–32
mean±sd (N)	33.1±1.26 (28)	31.0±1.00 (41)
$t_{67} = 7.92$, $P<0.01$		
paravertebral scale rows range	48–57	49–56
mean±sd (N)	52.4±2.20 (28)	52.4±1.75 (41)
$t_{66} = 0.089$, $P=0.93$		
fourth finger scales range	8–10	8–11
mean±sd (N)	8.9±0.38 (27)	9.5±0.61 (39)
$t_{64} = -4.58$, $P<0.01$		
fourth finger lamellae range	15–18	15–20
mean±sd (N)	16.2±0.68 (26)	17.2±1.02 (39)
$t_{63} = -4.60$, $P<0.01$		
fourth toe scales range	11–14	12–15
mean±sd (N)	12.75±0.57 (26)	13.3±0.63 (35)
$t_{59} = -3.60$, $P<0.01$		
fourth toe lamellae range	29–36	30–40
mean±sd (N)	32.2±1.49 (25)	34.5±1.87 (35)
$t_{58} = -7.10$, $P<0.01$		

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Appendix 1. List of specimens of *Celatiscincus* examined for genetic study (bracketed numbers are tissue collection numbers).

Celatiscincus euryotis: AMS R138573 (NR810); AMS R138574 (NR811)—see listing of comparative material examined for location details.

Celatiscincus similis: AMS R153504 (NR7360); AMS R153505 (NR7361)—see listing of paratypes for location details. AMS R161164 (EBU15288); AMS R161165 (EBU15289); AMS R161184 (EBU15308)—see additional material referable to *C. similis* for location details.