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Tails of two tips: first reports of tail furcations in a dozen Australian skink species, with the description of a highly unusual tail duplication morphology in *Carlia longipes* (Macleay, 1877)

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Abstract. Caudal autotomy and subsequent tail regeneration are well-known in lizards, but occasional abnormalities produce furcated (branched) tails. Here, we report 11 new records of tail furcations in Australian skinks, discovered through targeted searches of iNaturalist and Facebook supplemented by opportunistic observations. Among these, we document the first furcation records for the genera *Bellatorias*, *Concinnia*, *Hemiergis*, and *Saiphos*. To interpret the developmental origin of these anomalies, we propose a novel three-category framework distinguishing furcations arising from regeneration following autotomy (Category I), injury-induced blastema formation without complete autotomy (Category II), and those with no external signs of injury or regeneration, suggesting possible developmental duplication (Category III). Applying this scheme revealed multiple mechanisms operating across taxa. Most records conformed to Category II, but the symmetrical, externally normal tail duplication in *Carlia longipes* represents a compelling candidate for a true developmental anomaly (Category III). Our findings substantially expand the known taxonomic distribution of tail furcations in Australian skinks (to at least 33 species) and highlight the growing contribution of citizen science to documenting rare morphological anomalies. The lack of observed locomotor deficits or increased mortality in repeatedly sighted individuals suggests that furcated tails impose minor fitness costs, consistent with previous population-level studies. We encourage continued reporting of such observations together with radiographic examination of Category III cases to clarify the developmental mechanisms underlying supernumerary tail formation.

Keywords. Abnormal regeneration, autotomy, caudal furcation, citizen science, developmental anomaly, Scincidae.

Introduction

Skinks are a diverse family of lizards with the remarkable ability to shed tails along set fracture planes in a process called caudal autotomy (Etheridge, 1967; Bateman et al., 2009; Higham et al., 2013). Caudal autotomy is a mechanism found in 25 of the 43 known lizard families (Baum and Kaiser, 2024; Uetz et al., 2026), with skinks and geckos accounting for the majority of records. In Australia and elsewhere, skinks gain an advantage from dropping their tails to escape predation, especially considering the potential encounters with the country's many venomous snakes (Shine, 1980, 1981, 1987, 1988; Foufopoulos, 2009): caudal autonomy can isolate the venom from a bite to the dropped tail and preserve the lizard's life. Thus, the loss of a tail can mitigate an otherwise deadly encounter and sustain survivorship (Maginnis, 2006).

After a tail is lost, blood clotting seals the wound and re-epithelisation occurs, producing scar-free wound healing and the formation of a blastema at the wound site (Woodland, 1920; Werner, 1967; Bellairs and Bryant, 1985; McLean and Vickaryous, 2011; Delorme et al., 2012). Continued growth of the blastema leads to a regenerated tail, a familiar sight in many skinks. While a newly generated tail may bear some superficial resemblance to the original, it is composed of cartilage instead of bone and includes novel musculature and differences in tissue composition and nervous systems (Lozito et al, 2017).

Tail furcations that appear as split or branched tails may occur as part of a regeneration process, but they can also form by other means (Barr et al., 2020; Henle and Grimm-Seyfarth, 2020; Baum and Kaiser, 2024), such as an apparent result of injury (e.g., when a secondary tail sticks out at unusual angles from an

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otherwise normal main tail) or developmental error (when other than the supernumerary ends, the two tails look normal). When this process occurs external to the regeneration event, it is often a result of a disruption to the ependyma, a glial membrane that lines the spinal cord. When this membrane is disrupted during an event where partial autonomy has occurred, or when a sufficiently deep wound has occurred to the tail without autotomy, the formation of a blastema may result in the growth of additional tails while the original tail remains in place (Gilbert et al., 2015; Barr et al., 2020).

During searches on iNaturalist and Facebook as part of unrelated research, we found several images of tail furcations in Australian skink species that were not included in the comprehensive recent review by Baum and Kaiser (2024). We here present these observations to further expand on our knowledge of the tail furcation phenomenon.

Materials and Methods

After serendipitous finds of Australian skinks with forked tails on iNaturalist and Facebook, we searched all reptile records on the site by using a combination of the word "tail": and one of "bifurcation", "split", or "forked" in the filter option of the Explore section. We checked our discoveries against the list by Baum and Kaiser (2024) to determine which of the species found in our search these authors had not included. We then proceeded to obtain permission from the photographers to use their photographs.

The tail length percentage of the original tail segment vs. the post-bifurcation segment was calculated utilising ImageJ image processing software (Abramoff et al., 2004), which allows not only for straight-line measurements but also for multi-segment lengths or freehand lines to measure curved structures. We acknowledge that the differing angles and fields of view of the source photographs may have introduced minor measurement errors. Since images of animals in the field do not include scales to allow for accurate length determination, we used the lengths in units of pixels to produce ratios or comparisons. We first measured the distance from the estimated position of the cloaca to the centre of the area where the split occurred (cloaca to split, CS). We then measured the length of the branches. The length of the longer fork (F_L) added to CS provides the longest tail length (T_L), which then allowed us to calculate the relative length of the shorter fork (F_S). We use the definitions for duplications (the tail splits proximal to the mid-length of the longest tail or $CS \leq F_L$) and bifurcations (the tail divides distal to the mid-length of the longest tail, or $CS > F_L$) by Henle and Grimm-Seyfarth (2020).

Beyond the simple measurements, a brief survey of the literature regarding duplicate tails (Barr et al., 2020; Henle and Grimm-Seyfarth, 2020; Baum and Kaiser, 2024) revealed that there is no specialized terminology for supernumerary tails when autotomy had not occurred. Given the complexity of vertebrate tail development and regeneration (e.g., Lozito et al., 2021; Masselink and Murawala, 2024), this is perhaps an oversight. Thus, we differentiate between tails whose morphology shows that (1) regeneration played a role in the split (Category I), (2) an injury may have produced supernumerary tail growth at odd angles (such as lateral growth, as opposed to the expected posterior extension; Category II), or (3) no external symptoms are visible to explain the existence of a supernumerary tail (Category III). Species identifications were verified using Cogger (2018) or with the assistance of colleagues.

Results

In the following accounts, we document and detail our new findings. We also provide an updated table of Australian skinks with tail furcations (Table 1; modified from the information provided by Baum and Kaiser, 2024) for easy reference so that citizen scientists are quickly able to determine whether an observation of a skink with a tail furcation constitutes a new record.

***Bellatorias frerei* (Günther, 1897).** On 17 February 2025 Suzanne Muzic encountered an adult *B. frerei* on a rural property in Pawngilly, Queensland (17.4361°S, 145.8849°E, elevation 730 m). This individual displayed a bifurcated tail, with the fork close to the tail tip (Fig. 1A). While bifurcation percentage as a function of tail length cannot be determined from the photograph because the entire tail is not visible, we estimate it to be involving only the distalmost 5–10% of the tail. It appears that the longer tip is the original, because it terminates in the expected elongated conical shape congruent with the tail tips of normal *B. frerei*. The shorter tip is less than one-quarter the length of the longer one and is stubby, an unlikely original shape. The morphology indicates a Category II bifurcation, where an injury to the tail tip likely pushed the original tail to its present angle, resulting in blastema formation and secondary tail growth from the site of the injury.

Bellatorias frerei, previously recognized as a member of the genus *Egernia*, is a mid-sized skink with maximum snout–vent length (SVL) of 200 mm (Chapple, 2003).

Table 1. Documented occurrences of tail furcations (supernumerary tails) in Australian scincid lizards. The entries in the Type column encode bifurcations (B), duplications (D), trifurcations (T), or tetrafurcations (M4), with the preceding integer providing the known number of individuals. TS entries in the References column identify the record as originating from this study while the long numbers are iNaturalist observation identifiers. Species in boldface are those we newly report. An asterisk in the Type column indicates bifid tails for which we were unable to verify whether the listing was based on a bifurcation or duplication.

Scientific Name	Type	References
Bellatorias frerei (Günther, 1897)	**1B**	TS, 262021964
Carinascincus coventryi (Rawlinson, 1975)	1B*	Homan, 2015
Carlia longipes (Macleay, 1877)	**1D**	TS, 257770590
Carlia rhomboidalis (Peters, 1869)	**1B**	TS, 243282998
Carlia rostralis (De Vis, 1885)	**1D**	TS, 279365153
Concinnia tenuis (Gray, 1831)	**1B**	TS
Cryptoblepharus australis (Sternfeld, 1918)	**1D**	TS
Cryptoblepharus buchananii (Gray, 1839)	1B*	Homan, 2015
Cryptoblepharus pannosus Horner, 2007	1T	Jablonski and Reichstein, 2019
Cryptoblepharus pulcher (Sternfeld, 1918)	**2B**, **2D**	TS, 161929798, 314289612, 326941174, 329924475
Ctenotus grandis Storr, 1969	1B	Ellis, 2015
Ctenotus labillardieri (Duméril & Bibron, 1839)	1B*	Barr et al., 2020
Ctenotus leonhardii (Sternfeld, 1919)	1B*	Barr et al., 2020
Ctenotus quinkan Ingram, 1970	**1B**	TS
Ctenotus robustus Storr, 1970	1B*,1M4	Wilson, 2012; Homan, 2015
Ctenotus schomburgkii (Peters, 1863)	1B*	Barr et al., 2020
Ctenotus spaldingi (Macleay, 1877)	1B*	Barr et al., 2020
Ctenotus taeniolatus (White, 1790)	1B	Mo and Mo, 2023
Egernia cunninghami (Gray, 1832)	1B*, 1T	Barr et al., 2020
Egernia kingii (Gray, 1838)	1B*, 1T	Barr and Bateman, 2020
Emoia caeruleocauda (De Vis, 1892)	1B*	Barr et al., 2020
Eremiascincus richardsonii (Gray, 1845)	1B	Henle and Grimm-Seyfarth, 2020
Eulamprus heatwolei Wells & Wellington, 1983	1B*	Barr et al., 2020
Eulamprus quoyii (Duméril & Bibron, 1839)	1B*	Barr et al., 2020
Gnypetoscincus queenslandiae (De Vis, 1890)	1T	Barr et al., 2020
Hemiergis decresiensis continentis Copland, 1946	**1B**	TS, 245170213
Hemiergis quadrilineatus (Duméril & Bibron, 1839)	**1B**	TS, 245170213
Lamprolepis smaragdina (Lesson, 1829)	1B*	Barr et al., 2020
Lampropholis delicata (De Vis, 1888)	1B*	Barr et al., 2020
Lampropholis guichenoti (Duméril & Bibron, 1839)	2D	Barr et al., 2020, TS
Lampropholis mirabilis Ingram & Rawlinson, 1981	1B*	Barr et al., 2020
Lerista bougainvillii (Gray, 1839)	1B*	Homan, 2015
Lerista labialis Storr, 1971	1B*	Wilson, 2012
Lerista punctatovittata (Günther, 1867)	2B	Henle and Grimm-Seyfarth, 2020
Liopholis modesta (Storr, 1968)	1B*	Barr et al., 2020
Liopholis whitii (La Cépède, 1804)	1B, **1D**	Hickman, 1960; TS, 107736956
Morethia boulengeri (Ogilby, 1890)	3B	Henle and Grimm-Seyfarth, 2020
Oligosoma lichenigerum (O'Shaughnessy, 1874)	1B*	Barr et al., 2020
Pseudemoia entrecastauxii (Duméril & Bibron, 1839)	1B*	Barr et al., 2020
Pseudemoia pagenstecheri (Lindholm, 1901)	1B*	Barr et al., 2020
Saiphos equalis (Gray, 1825)	**1B**	TS, 58568797
Saproscincus challenger (Boulenger, 1887)	1B*	Barr et al., 2020
Saproscincus mustelinus (O'Shaughnesst, 1874)	1B*	Barr et al., 2020
Tiliqua scincoides (White, 1790)	1D	Willis, 1932; Mo, 2020

Figure 1. Four Australian skinks with furcated tails. (A) *Bellatorias frerei* from Pawngilly, Queensland, with a tail-tip bifurcation. Photo by Suzanne Muzic, used under CC BY 4.0 license. (B) *Carlia longipes* from Wonga Beach, Queensland, with an unusual tail duplication. In this case, there is no obvious evidence of autotomy, and both tails have a normal external appearance. Photo by David White, used under CC BY-NC 4.0 license. (C) *Carlia rhomboidalis* from west of Mackay, Queensland, with a bifurcated tail tip. Photo by Rosemary Braithwaite, used by permission. (D) *Carlia rostralis* from Balgal Beach, Queensland, with a tail duplication. The presumed primary tail is bent to the side and regrowth is occurring, while a complete, regrown tail is already present. Photo by iNaturalist user "kcro", used under CC BY-NC 4.0 license.

These skinks are primarily known from the east coast of Australia, with a range that spans from Coffs Harbour, New South Wales, north into central Papua New Guinea, where they occupy an array of habitats spanning from rainforests to coastal dunes (Cogger, 2014). They can be distinguished from the rest of the members of their genus by a rich brown dorsum and by fewer than 38 midbody scale rows. This is the first account of a bifid tail in the genus *Bellatorias*, but furcated tails are known from the closely related genus *Egernia* (*E. cunninghami*, *E. kingii*; Baum and Kaiser, 2024).

***Carlia longipes* (Macleay, 1877).** On 8 January 2025 David White observed an adult *C. longipes* basking on leaf litter at an urban property in Wonga Beach, Queensland (21.0752°S, 148.6387°E, elevation 418 m). This lizard presented with a tail that split at a length of ca. 22% of the total length of the longer tail. The difference in length of these complete tails is only 5%, and this type of furcation is a duplication (Fig. 1B). Both forks appear to possess regular dorsal scalation, and neither looks like the expected discoloured secondary tail commonly produced during regeneration. However, the origin of the longer tail is slightly lateral to the lizard's midline but based on the near-equal length of these tails we would not consider one primary or secondary. This is a Category III duplication, where no external factors can explain the existence of two tails.

The morphology of this tail duplication is noteworthy because both branches appear externally identical, lacking the obvious differences in shape and scalation typically associated with regenerated tails. Such a pattern may indicate one of three developmental defects (Wouter Masselink, in litt., 2026): (1) a partial axis duplication due to an abnormality in the Spemann-Mangold organizer (Niehrs, 2004); (2) a duplication of the notochord (Alelyani et al., 2022); or (3) a

splitting/duplication of the tail bud (Row et al., 2016). Duplications of the Spemann-Mangold organizer are well studied but mostly result in prominent duplication of anterior structures (Martinez Arias and Steventon, 2018), likely because it is developmentally difficult to sustain complete duplication of the entire axis. To wit, axial duplication is known in both snakes and lizards (Di Marzio et al., 2023; Wallach, 2018), but in snakes these reports are about dicephalic individuals and in lizards about twins cojoined mainly in the cephalic region. To the best of our knowledge, a duplication of tail only regions (secondary neurulation) has never been reported. The differences in the position of the tail relative to the midline of the body might be due to a resource allocation issue, with one of the tails receiving more notochord or tail bud (Bénazéraf, 2018). All of this points to a split of the distal vertebral axis rather than conventional accessory regeneration (contrary to the process described by Gilbert et al., 2015), a hypothesis that could be tested through radiographic examination. As indicated by Schwaner et al. (2021), more research is needed to determine how tail development occurs in different vertebrate groups. In a recent review of spinal deformities in reptiles, Horváth (2025) did not include caudal furcations.

Carlia longipes is a relatively small skink with maximum SVL of 69 mm (Donnellan et al., 2009). It is primarily known from the northern Queensland coastal areas (Donnellan et al., 2009). The species is distinguished from most other species of *Carlia* by the presence of a free interparietal scale. In the field, it may be reliably separated from sympatric *C. munda* and *C. storri* (usually in drier habitats; Stephen Zozaya, pers. comm.) by its ear aperture completely ringed with sharply pointed lobules (vs. small and rounded in *C. munda* and variable in *C. storri*). Colour pattern further distinguishes it from these species in breeding males: *C. longipes* displays a pale throat and red flanks lacking a black upper border, whereas *C. storri* has a black throat and *C. munda* a blue throat. Breeding male *C. longipes* are also readily separated from the sympatric *C. rostralis* by their brown back with a black upper lateral stripe restricted to the forelimb and red sides, compared with the black throat, black-speckled back, and red lower lateral stripe of *C. rostralis*. Females are similarly distinguishable: *C. rostralis* females exhibit a white dorsolateral stripe, whereas *C. longipes* females display the same colour pattern as the males (Ingram and Covacevich, 1989). This is the first published account of bifurcations in the genus *Carlia*, but bifurcations have been recorded in broader *Pseudemoia* group lygosomine skinks (Chapple et al., 2023), with Baum and Kaiser (2024) listing bifid tails in both the genera *Saproscincus* and *Lampropholis*, two closely allied groups.

***Carlia rhomboidalis* (Peters, 1869).** On 22 September 2024, Rosemary Braithwaite observed an adult *C. rhomboidalis* basking on leaf litter next to a fence at a rural property ca. 55 km west of Mackay, Queensland (21.0752°S, 148.6387°E, elevation 171 m). This lizard had with a bifurcation (Fig. 1C) with the split at ca. 60% of the longest tail length. The shorter tail is about 17% shorter than the longer tail. The tail's morphology does not appear to indicate a history of autotomy. Both tail tips taper to a fine point and appear to present with normal colour and scalation (Category III bifurcation). This lizard was observed multiple times at the same location, and it did not appear as if the bifurcation impeded the lizard's the ability to avoid predation (R. Braithwaite, pers. comm.).

Carlia rhomboidalis is a relatively small skink, reaching a maximum SVL of 50 mm (Cogger, 2014). It can be distinguished from all other Australian species of *Carlia*, except *C. rubrigularis*, *C. crypta*, and *C. wundalthini*, by a fused frontoparietal-interparietal shield and a free interparietal scale. It is separated from the three species that also display this fusion by the breeding colouration. Breeding males are distinguished by a vivid blue chin and lips with an orange neck. This is the first published account of a tail duplication in *C. rhomboidalis*.

***Carlia rostralis* (De Vis, 1885).** On 8 May 2025, iNaturalist user "kcro" photographed an adult *C. rostralis* with a duplicated tail (Fig. 1D) on sandy substrate at Balgal Beach, Queensland (19.0303°S, 146.4172°E, elevation ca. 60 m). The tail splits close to the tail base, approximately 15% of the tail length posterior to the cloaca. The longer branch comprises roughly 85% of the total tail length and tapers gradually to a fine point. The shorter branch is noticeably stouter and terminates after approximately one-quarter of the total tail length. A short tapering extension is present at the tip of the shorter branch and may represent regenerating tissue. This branch may be the original tail based on its dimensions vis-à-vis the longer, straight tail. The marked asymmetry between the two branches is consistent with a history of injury, incomplete autotomy, and subsequent regeneration (Category II), although the precise sequence of events cannot be determined from the photograph alone.

Carlia rostralis is a relatively large skink, reaching a maximum SVL of 70 mm (Cogger, 2014). It can be distinguished from other sympatric species of *Carlia* primarily through ear morphology and male breeding colouration. Its ear aperture lacks posterior lobules, possessing only two enlarged, bluntly tipped lobules on the anterior edge, whereas *C. longipes* possesses sharp lobules on all ear margins. Breeding males are highly distinctive, displaying a black throat, bright red flanks, and a broad black upper lateral stripe extending to the hindlimb, a pattern not observed in the parapatric *C. longipes* or *C. rhomboidalis*. This is the first published account of a tail duplication in *C. rostralis*.

***Concinnia tenuis* (Gray, 1831).** In March 2026, Paul Riddett posted an image of an adult *C. tenuis* (Fig. 2A) to the Gympie & District Field Naturalists Group on Facebook. The split involves the distalmost 25% of the original tail, which juts off on the lizard's right at an odd angle. The length of the secondary tail is 20% of the total longest tail length. The origin of this bifurcation appears to be an injury during which the tail tip was bent sufficiently to cause blastema formation, resulting in the secondary tail (Category II).

Concinnia tenuis is a sleek, diurnal skink reaching about 70 mm in body length (Cogger, 2014). In the field, the species can be identified by its pale grey-brown dorsum with a ragged-edged, dark brown dorsolateral stripe running from behind the eye to the base of the tail. This stripe breaks into large black blotches on the rear body. It has smooth, shiny scales, a creamy-yellow belly, and a notably long tail. It is distinguished from other members of the genus by its smooth, glossy scales, a postmental scale contacting two infralabials on each side, and 26–34 midbody scale rows. This is the first published account of tail bifurcation for the genus *Concinnia*.

***Cryptoblepharus australis* (Sternfeld, 1918).** On 21 August 2025 Christabel Moschetti documented an adult *C. australis* (Fig. 2B) taking shelter inside the Alice Springs Reptile Centre in Alice Springs, Northern Territory (23.7031°S, 133.8780°E, elevation 545 m). This individual presented with a tail duplication from a clearly identifiable point of autotomy. The autotomy occurred at 24% of current total longest tail length. The second tail measures just over 53% of longest tail length in the distalmost half of the tail, with the scale detail changing from the standard checkerboard pattern characteristic to this species, to a plain pattern characteristic of an autonomised and regrown tail approximately eight scales anterior to the bifurcation (Category I).

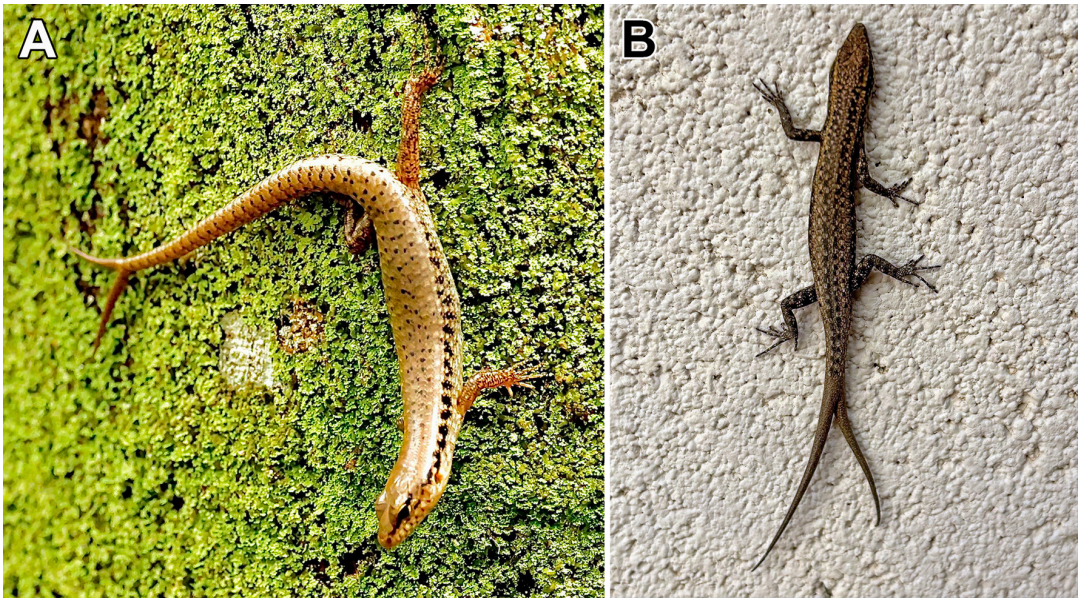

Figure 2. (A) *Concinnia tenuis* from the Sunshine Coast hinterland, Queensland, with a bifurcated tail tip. Photo by Paul Riddett. (B) *Cryptoblepharus australis* from Alice Springs, Northern Territory, with a tail duplication. Photo by Christabel Moschetti, used by permission.

Cryptoblepharus australis is a small skink with maximum SVL 50 mm (Horner, 2007) known exclusively from inland Australia, where its natural arboreal habit has developed into the effective use of urban environments, where they generally bask on the walls of buildings, fenceposts, and tree trunks, as well as other similar surfaces (Horner, 2007). It is distinguished from other members of the genus by a combination of longitudinally aligned dorsal patterning, the presence of postnasal scales, and smooth plantar scales with dark brown calli. It is distinguished from the similar and frequently sympatric *C. pannosus* by having smooth subdigital lamellae (versus strongly keeled in *C. pannosus*) and typically six supraciliary scales (versus five in *C. pannosus*). In the field, it can be identified by its grey to grey-brown dorsum with a ragged-edged, silvery-grey dorsolateral stripe from above the eye to the base of the tail, bordered above by a black stripe, and a dark upper lateral zone with scattered pale flecks (Horner, 2007).

***Cryptoblepharus pulcher pulcher* (Sternfeld, 1918).** None of the localities reported here are from Western Australia or the Nullarbor Coast in South Australia, where the subspecies *C. p. clarus* (Storr, 1961) occurs, so the four following observations are all of the nominate subspecies. This is a frequently observed skink with over 4700 observations on iNaturalist as of 31 May 2026.

On 16 September 2025 Darcy. E. Wilson encountered an adult *C. pulcher* (Fig. 3A) basking on a sheet of roofing tin in Newcastle, New South Wales (32.9095°S, 151.7035°E, elevation ca. 70 m). This individual's regenerated tail had two tips of unequal length, with a split at approximately a third of the length of the longest tail. This is a tail duplication. Both forks have very similar morphology, but the longer fork is nearly twice as long as the shorter fork. While this lizard's tail is clearly regenerated, it appears as if further injury to the regenerated tail resulted in generation of a shorter, secondary tail (Category I).

On 24 October 2025, iNaturalist user "FunkyNature" photographed an adult *C. pulcher* in the Greater Sydney area (33.8877°S, 151.0747°E, elevation 18 m), which also presented with a regenerated, duplicated tail (Fig. 3B). The split occurred about 23% along the longer tail, with both tail tips of roughly equal length and morphology (Category I).

Similarly, on 8 December 2025 Kaylah Paul observed and recorded an adult *C. pulcher* with a bifurcated tail in Sarina Beach, Queensland (21.3898, 149.3127, elevation 10 m). This bifurcation only involved the distalmost 20% of the tail, with one of the forks appearing decidedly thinner and shorter than the other (Category II).

Lastly, in May 2023, Owen Konopka photographed an adult *C. pulcher* with a bifurcated tail in the Greater Sydney area (33.7817°S, 150.9526°E, elevation 30 m), which was basking on the back fence of his backyard, directly above a garden. The split in the tail occurred about two-thirds along the length of the longer tail. There was almost a 30% difference in length between the two tail tips, with the longer one growing at an angle from the lizard's midline and appearing to be the extra tail (Category II).

Cryptoblepharus pulcher is a small skink, with maximum SVL of 37 mm (Pike et al., 2020), with a disjunct range that includes parts of eastern Australia (New South Wales, Queensland) and dry regions of southern Australia (South Australia, Western Australia), where it is seen on tree trunks, palms, and sandstone outcrops in the wild or on fenceposts, bricks, and other basking surfaces in urban areas (Horner, 2007; Pike et al., 2020). This species thrives in and around cities, where upwards of three individuals basking on a single urban brick wall is not uncommon. It can be distinguished from other members of the genus by its longitudinally aligned dorsal pattern, the absence of postnasal scales, and smooth plantar scales. In the field, the nominate subspecies is identified by a brownish or greyish dorsum with a narrow, pale dorso-lateral stripe bordered above by a sharp-edged black stripe, and dark pigmentation on the lower surfaces of the hands and feet. The species thrives in urban environments, where it is frequently observed basking on fenceposts, brick walls, and tree trunks, often in high densities (Horner, 2007). Whilst bifurcations already known for the genus *Cryptoblepharus*, (*C. nigropunctatus*, *C. pannosus*, *C. buchananii*; Baum and Kaiser, 2024) this is the first record for a bifurcation in the frequently seen *C. pulcher* (based on iNaturalist records, *C. pulcher* was observed on 3926 occasions vs. 17:778:1450 for *C. nigropunctatus*, *pannosus*, and *buchananii* respectively, as of 12 September 2025).

***Ctenotus quinkan* Ingram, 1979.** On 14 June 2025, Rob Valentic photographed an adult *C. quinkan* (Fig. 4B) in a habitat along Old Coach Road, ca. 63 km by air west of Lakeland, Queensland (15.7770°S, 144.2739°E, elevation 227 m). The animal was active in the mid-afternoon around the edge of a sandstone escarpment in the dry season. Its long tail had a bifurcation beginning near the tail end (87% of tail length). The two tail tips appear to be the result of an injury to the tail, resulting in a short branch (29% of the longer, original branch). This appears to be a Category II bifurcation.

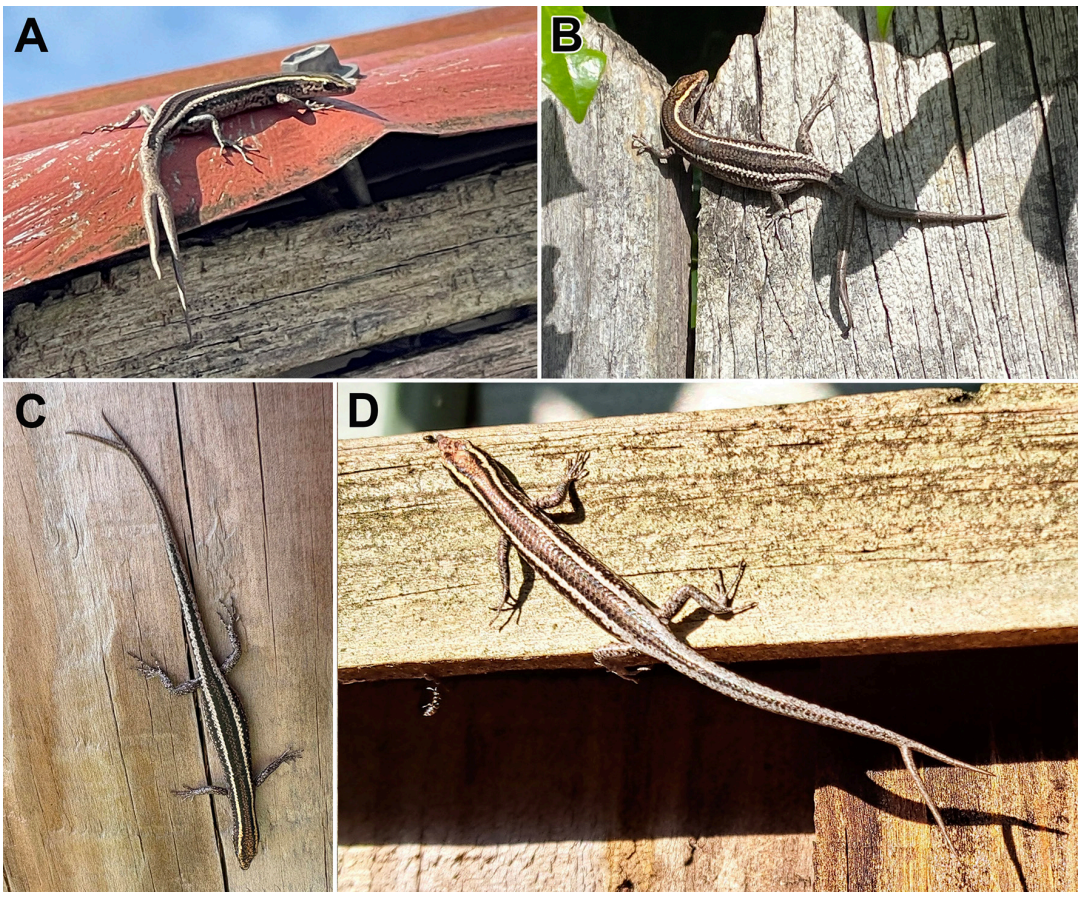

Figure 3. Several examples of furcated tails in *Cryptoblepharus pulcher*. (A) An individual with a tail duplication from Newcastle, New South Wales, Photo by Darcy Wilson, used under CC BY-NC 4.0 license. (B) An individual with a tail duplication from the Greater Sydney area, New South Wales. Photo by iNaturalist user "FunkyNature", used under CC BY-NC 4.0 license. (C) An individual with a bifurcated tail tip from Sarina Beach, Queensland. Photo by Kaylah Paul. (D) An individual with a tail-tip bifurcation from the Greater Sydney area, New South Wales. Photo by Owen Konopka, used under CC BY-NC 4.0 license.

Ctenotus quinkan is a ground-dwelling skink reaching about 81 mm in SVL (Zozaya et al., 2024) with characteristic extremely long tails (ca. 2–2.5 times SVL). It is identified by its plain olive-brown back, which lacks a dark stripe down the middle. Its most distinctive feature is a broad, blackish lateral band. It has a pale stripe from the ear to the back leg, and its lips are mottled with dark brown. These characteristics, along with a high lamella count (32 under the fourth toe), distinguish it from other members of the genus *Ctenotus*, including the similar *C. rungulla* and *C. terrareginae* (Ingram, 1979; Zozaya et al., 2024). This is the first published account of tail bifurcation in *C. quinkan*. Baum and Kaiser (2024) listed several other species of the genus with tail furcations (*C. grandis*, *C. labillardieri*, *C. leonhardii*, *C. robustus*, *C. schomburgkii*, *C. spaldingi*, *C. taeniolatus*).

***Hemiergis decresiensis continentis* Copland, 1946.** On 2 October 2024, Graham Armstrong found a Southern Three-toed Earless Skink (Fig. 4C) near Horsnell Gully, South Australia, in the Adelaide Hills (34.9303°S, 138.7149°E, elevation 360 m). As befits a largely fossorial animal, the individual was found in moist debris. This is the first report of a tail bifurcation in *H. decresiensis*. The split occurs at a point 72% along the longest tail length. The shorter tail tip is about three-quarters the length of the longer tail tip. Both tail tips are robust, but only the shorter one has the same pattern that continues the pattern on the body. The longer tail only has the ventrolateral pattern of the body, not the dorsal colouration.

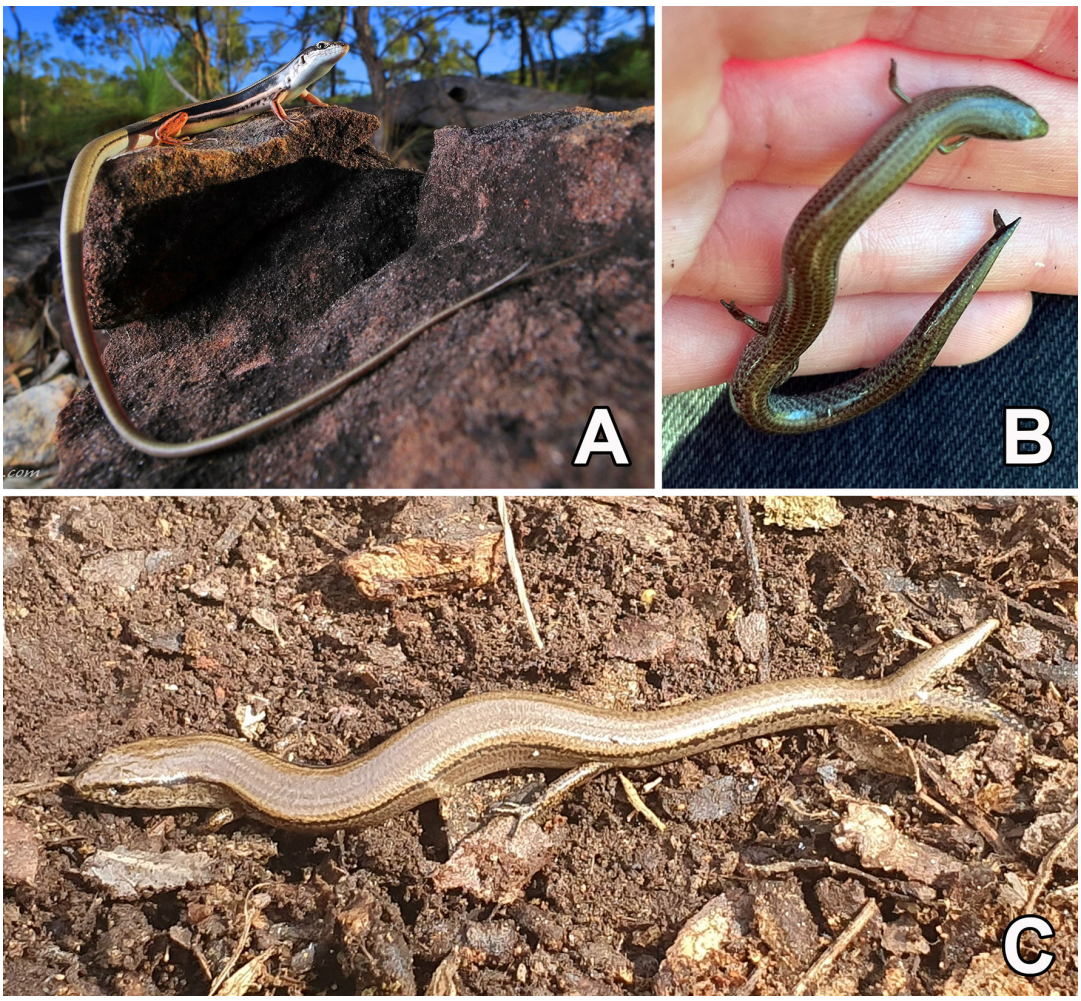

Figure 4. (A) *Ctenotus quinkan* with a bifurcated tail tip from west of Lakeland, Queensland. Photo by Rob Valentic, used by permission. (B) *Hemiergis quadrilineatus* with a bifurcated tail tip from the Trigg Reserve, Western Australia. Photo by Eva Ladyman, used under CC BY-NC 4.0 license. (C) *H. decresiensis continentis* with a bifurcated tail from near Horsnell Gully in the Adelaide Hills, South Australia. Photo by Graham Armstrong, used under CC BY-NC 4.0 license.

It therefore appears that the shorter tail is the original tail, which was bent and injured, resulting in the secondary tail growth (Category II).

Hemiergis d. continentis is the mainland South Australian subspecies of *H. decresiensis*. These slender fossorial skinks reach a SVL of ca. 50 mm (Cogger, 2014). In South Australia, this species is distinguished from all other species of *Hemiergis* by having three digits on each limb, with the second toe slightly longer than third. This is the first recorded bifurcation in the genus *Hemiergis*, but bifurcation has been recorded in the closely allied *Eremiascincus* (Baum and Kaiser, 2024).

***Hemiergis quadrilineatus* (Duméril & Bibron, 1839).** On 1 August 2025, Eva Ladyman found an adult *Hemiergis quadrilineatus* (Fig. 4B) in Trigg Reserve, Western Australia (31.8808°S, 115.7603°E, elevation 12 m). This individual presented with a bifurcation in the distalmost 5% of the tail, with both tail tips of approximately the same length. It looks as if there was a tail injury in which the tail on the lizard's right, which is slightly more robust, became bent and broke, resulting in a secondary tail (Category II).

Hemiergis quadrilineatus is a relatively small fossorial skink reaching an SVL of 55 mm (Cogger,

2014) that is known from southwestern coastal Western Australia (Storr et al., 1975). It is distinguished from other members of the genus by having two digits on each limb, with the second toe much longer than the first. These skinks thrive in urban sandy environments, with over 400 individuals recorded on iNaturalist alone from Dawesville to Yanchep (ca. 130 km along the coast). *Hemiergis quadrilineatus* is a limb-reduced fossorial skink, often utilising limbs for self-propulsion on the surface and transitioning to an undulating form of locomotion below (Choquent and Greer, 1989). This is the second recorded bifurcation in the genus *Hemiergis*.

***Liopholis whitii* (La Cépède, 1804).** On 2 March 2022, David Gobbett photographed an adult *L. whitii* (Fig. 5A) near Mt. Direction, Tasmania (41.2407°S, 147.0251°E, elevation 218 m) seen on a sun-exposed slope covered with scattered trees and patches of rocks. The individual had a regenerated, duplicated tail (Category I). The split occurred at 32% of the length of the longer tail measurement, giving the longer tail tip 68% of total tail length. The left, shorter tail only had a length of 54% of total tail length. Baum and Kaiser (2024) already included a bifurcation of *L. whitii* in their list, but this is the first tail duplication for this species and the genus *Liopholis*.

A recent reassessment of the taxonomy and nomenclature of the *Liopholis whitii* complex by Parkin et al. (2026) showed that *L. whitii* is the correct name for a southern group that includes Tasmania. It is a moderately sized, robust skink with maximum SVL of 93 mm (Parkin et al., 2026). The species exhibits three distinct colour-pattern morphs: a patterned morph (most frequent), a plain-back morph, and a patternless morph (rare). Patterned individuals have complex dorsal patterns of brown to black dorsolateral stripes and spots, with longitudinally aligned series of dark or pale cream to yellow stripes, dashes and spots, while plain-back and patternless individuals lack this complexity. In Tasmania, the species is absent from the southwestern region. It occupies predominantly rocky and sandy habitats, including open eucalypt forest, dry woodland, coastal heathland and open tussock grasslands. It is distinguished from other members of the genus by its smooth dorsal scales (versus keeled in *L. pulchra*), subdigital lamellae lacking a conspicuous black callus (versus present in *L. margaretae*), and an interparietal scale that is much narrower than the frontal in adults (versus as wide as or wider than the frontal in *L. inornata*, *L. kintorei*, and *L. striata*) (Parkin et al., 2026).

***Saiphos equalis* (Gray, 1825).** On 5 September 2020 Charles Williams spotted an adult *Saiphos equalis* (Fig. 5B) in Ebor, New South Wales (30.3973°S, 152.3479°E, elevation ca. 1300 m). Given that members of this monotypic genus have a tail length roughly equal to their body length, we estimate that this individual autotomized roughly 75% of its tail, likely resulting not only in a significant weight loss but also changed mobility. The current state of the regrowing bifid tail qualifies it as a Category I bifurcation when measured against the existing tail, but complete elongation of the

Figure 5. (A) *Liopholis whitii* with a tail duplication from Mt. Direction, Tasmania. Photo by David Gobbett, used under CC BY-NC 4.0 license. (B) *Saiphos equalis* from Ebor, New South Wales, with a tail bifurcation. Photo by Charles Williams, used with permission.

two tails to the expected total tail length will eventually result in a duplication.

Saiphos equalis is a mid-sized semi-fossorial skink with an average SVL of 75 mm (Wilson and Swan, 2010) known from coastal southeastern Australia (Smith et al., 2001). These skinks can be common in damp, high-humidity areas under debris in urbanised parks, where their reduced limbs are essential for burrowing through soil (pers. obs.). Furthermore, *Saiphos* are one of three species known to vary in reproductive mode, switching between viviparity and oviparity at elevations > 1000 m, respectively, and even when viviparous, some southern populations can exhibit short incubation periods of approximately five days (Smith and Shine, 1997). It is the sole member of its genus and is readily identified by its reduced, tridactyl limbs (forelimbs and hindlimbs each with three digits) and its distinctive colour pattern. This is the first bifurcation recorded in the genus *Saiphos*.

Discussion

Our findings substantially expand the known taxonomic and geographic distribution of caudal furcations in Australian skinks, while also revealing novel morphological patterns that challenge conventional interpretations of how such anomalies arise. We documented new records across nine species and six genera, including first reports for the genera *Bellatorias*, *Concinnia*, *Hemiergis*, and *Saiphos*, as well as first species records for *Carlia longipes*, *C. rhomboidalis*, *C. rostralis*, *Ctenotus quinkan*, *Cryptoblepharus pulcher*, *Hemiergis decresiensis continentis*, and *H. quadrilineatus*, as well as the first duplication for *Liopholis whitii*. These discoveries bring the total number of Australian skink species with recorded tail furcations to at least 33, underscoring that such anomalies, while individually rare, are taxonomically widespread across the Scincidae.

Beyond simple documentation, we applied a categorical framework to interpret the probable developmental origin of each observed furcation. A brief survey of the literature regarding duplicate tails (e.g., Barr et al., 2020; Henle and Grimm-Seyfarth, 2020; Baum and Kaiser, 2024) revealed that there is no specialized terminology for supernumerary tails when autotomy has not occurred. Applying a scheme to our new records, we found examples spanning all three categories, indicating that multiple mechanisms – ranging from post-autotomy regeneration to possible developmental anomalies – likely contribute to caudal furcations in Australian skinks.

Our observations also refine the frequency estimates previously available in the literature. Henle & Grimm-Seyfarth (2020) reported population frequencies of supernumerary tails ranging from 0.1–16.7%, with a mean of 2.75%, based largely on systematic sampling in Australian arid-zone lizard communities. While our study was not designed to estimate population frequencies, the relatively rapid accumulation of citizen science observations over a short period (2020–2026) suggests that the true incidence of tail furcations in natural populations may be higher than previously appreciated, supporting the contention of Baum and Kaiser (2024) that such phenomena are likely underreported. The increasing contribution of non-specialist observers, also noted by Henle and Grimm-Seyfarth (2020), is clearly accelerating the documentation of these events.

A particularly noteworthy finding is the tail duplication in *Carlia longipes* (Fig. 1B), which appears externally symmetrical, with both branches displaying normal scalation and pigmentation, lacking the typical signs of regeneration (e.g., altered colour, irregular scales, or cartilage rod replacement). This morphology is inconsistent with the hyperregeneration model proposed by Barr et al. (2020) and Henle and Grimm-Seyfarth (2020), where supernumerary tails arise from incomplete autotomy or injury to the wound epidermis and ependyma. Instead, we suggest that this case may represent a true developmental duplication of the distal vertebral axis (our Category III), possibly arising from a split of the tail bud during embryonic or early post-hatching development. While axial duplications are well known in snakes (often manifesting as dicephaly) and have been reported in lizard twins (Wallach, 2007; Di Marzio et al., 2023), duplication confined to the tail with otherwise normal external morphology appears to be extremely rare, if not previously undocumented, in lepidosaurs. Radiographic examination of this specimen would be required to determine whether the duplicated tails contain separate vertebral columns or share a common cartilaginous rod, a distinction that would clarify the developmental mechanism.

The remaining records conform more closely to the categories of abnormal regeneration outlined by Barr et al. (2020). Most of our observations (e.g., *Bellatorias frerei*, *Cryptoblepharus pulcher* [Fig. 3A, B], *Ctenotus quinkan*, *Hemiergis decresiensis continentis*, *H. quadrilineatus*) fit Category II, where injury to an original or previously regenerated tail resulted in blastema formation and secondary tail growth..The duplications in *Cryptoblepharus australis* and *Liopholis*

whitii clearly involved regeneration following autotomy (Category I), with the bifurcation occurring at the point of tail breakage. Notably, the duplicated tail in *Saiphos equalis* represents an early-stage bifid regenerate, which, if the lizard survives to full regrowth, would likely become a duplication.

Our findings also highlight a striking taxonomic pattern: the genus *Cryptoblepharus* (Tribe Eugongylini) now accounts for four species with recorded furcations (*C. buchananii*, *C. nigropunctatus*, *C. pannosus*, and now *C. pulcher*), making it the genus with the second-highest number of documented furcation events among Australian skinks behind the species-rich genus *Ctenotus* (Tribe Sphenomorphini) with eight species. Three species each have now been recorded in the genera *Carlia* (Eugongylini), *Lampropholis* (Eugongylini), and *Lerista* (Sphenomorphini). While these numbers likely reflect a combination of true biological variation and sampling effort, the dominance by species of the Eugongylini (which includes many arboreal and terrestrial taxa) and Sphenomorphini (which includes the highly diverse *Ctenotus* and fossorial *Lerista*) suggests that furcations are not restricted to particular ecological or phylogenetic lineages.

The frequency of records, however, is almost certainly influenced by detectability. Baum and Kaiser (2024) noted that frequently observed, synanthropic species may be overrepresented in furcation records due to observer availability bias. *Cryptoblepharus pulcher*, with over 4700 iNaturalist observations as of mid-2026, exemplifies this phenomenon: its abundance in urban environments increases the probability of detecting rare anomalies. Conversely, the fossorial genera *Hemiergis* and *Saiphos*, which can both be locally common, including in urban settings, are far less frequently observed due to their cryptic, ground- or soil-dwelling ecologies. Despite this, we recorded multiple furcations in these genera, suggesting that furcation events are not rare in fossorial skinks but are simply under-detected. More broadly, comparing ecological categories from our records reveals that furcations have been documented across arboreal (*Cryptoblepharus*, *Lampropholis*), terrestrial (*Carlia*, *Ctenotus*, *Liopholis*, *Bellatorias*, *Concinnia*), and fossorial (*Hemiergis*, *Lerista*, *Saiphos*) skinks in Australia, indicating that no single lifestyle precludes furcation. The uneven distribution of records therefore more likely reflects observation effort, with arboreal and synanthropic species overrepresented, than any fundamental ecological constraint on the occurrence of tail furcations.

Finally, our observations add to the growing body of evidence that abnormal caudal regeneration rarely impedes survival or behaviour in the wild. The *Carlia rhomboidalis* individual was observed repeatedly over time with no apparent locomotor deficit, and all other individuals were encountered active and apparently healthy. We also observed an active adult *Lampropholis guichenoti* with a tail duplication on multiple occasions in the spring of 2025 (Fig. 6). While this type of furcation was already included by Baum and Kaiser (2024), the observations are another example for how such tail malformations may not appear to impact an affected individual's locomotion or fitness. This aligns with the conclusions of Henle and Grimm-Seyfarth (2020) and Barr et al. (2020), who found little evidence that supernumerary tails negatively affect body condition, survival, or reproductive success in natural populations. While experimental studies are lacking, the continued occurrence of furcated individuals in wild populations suggests that any fitness costs are likely minor or effectively mitigated by behavioural compensation.

Figure 6. An adult *Lampropholis guichenoti* from the Bondi Beach area of Greater Sydney, New South Wales with a tail duplication. Photo by River Kedzier-Hurst.

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