Rediscovery of the type species of *Euonyma* (Subulinidae) and observations on South African species of *Gulella* (Streptaxidae), with description of two new species (Gastropoda: Eupulmonata)

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**Abstract**
The rediscovery of the type species of the subulinid genus *Euonyma* Melvill and Ponsonby, 1896, *Euonyma laeocochlis* (Melvill and Ponsonby, 1896), is recorded and data regarding its distribution and habitat are provided. No specimens of this species had been collected in the more than 100 years since its original description. The streptaxid *Gulella fraudator* Connolly, 1939, a taxon previously considered to be of doubtful validity, is shown to be a distinct, narrow-range endemic and is compared with similar species. Type material and recently collected specimens of both species are illustrated. Two recently discovered species, *Gulella deviae* sp. n. and *G. lindae* sp. n., are described.

**Keywords:** Euonyma, Gulella, Mollusca, new species, South Africa, type species

**Introduction**
Ongoing field work continues to bring to light new information regarding the terrestrial molluscan fauna of southern Africa. In this paper I record the rediscovery of *Euonyma laeocochlis* (Melvill and Ponsonby, 1896), type species of the genus *Euonyma* Melvill and Ponsonby, 1896, and show that *Gulella fraudator* Connolly, 1939, a taxon previously considered to be of uncertain validity, is indeed a distinct species. In addition, I describe two new species of *Gulella* from South Africa, *G. deviae* and *G. lindae*.

The following abbreviations are used in the text: BMNH, Natural History Museum, London; ELM, East London Museum; NMSA, Natal Museum, Pietermaritzburg; NMW, National Museum of Wales, Cardiff; RMNH, Nationaal Natuurhistorisch Museum (Naturalis), Leiden.
Taxonomy

**Family SUBULINIDAE** Fischer and Crosse, 1877

_Euonyma laeocochlis_ (Melvill and Ponsonby, 1896)

(Figures 1–4)

_Subulina laeocochlis_ Melvill and Ponsonby 1896, p 316, Plate 16, Figure 3. Type locality: “Humansdorp, St Francis Bay”, E. Cape Province, South Africa.

_Euonyma laeocochlis_: Pilsbry 1906, p 39, Plate 10, Figure 68; Connolly 1912, p 214; 1939, p 337.

_Euonyma loeocochlis [sic]:_ Sturany 1898, p 62.

Material examined

*Type material.* Lectotype, “Humansdorp, St Francis Bay”, E. Cape, South Africa (BMNH 1902.7.30.19).

*Additional material.* All NMSA. South Africa, E. Cape: Baviaanskloof Wilderness Area, Kougaberg plateau above Geelhoutbos, 800–1000 m, grassland/fynbos, leg. D. Clark, 1999.
Distribution and habitat

Described from “Humansdorp”, but currently known only from the Kougaberg, Baviaanskloof Wilderness area, E. Cape, South Africa (Figure 4); under stones in grassy fynbos at altitudes from 500 to 1000 m.

Remarks

Melvill and Ponsonby’s description of this species was based upon two specimens collected in “Humansdorp, St Francis Bay”, E. Cape, one of which, the lectotype (designated Connolly 1939) (Figure 1), is in the Natural History Museum, London (BMNH 1902.7.30.19). [The location of the other specimen is unknown—it is not present in either the National Museum of Wales or the Manchester Museum (Rowson pers. comm., March 2005), both of which contain other Melvill types.] Although these two specimens

![Map of Kouga Mountain showing distribution of Euonyma laeocochlis](image.jpg)
were said to have been part of a larger sample, none of this additional material appears to have been deposited in South African museums.

In the more than 100 years since its description, no further specimens of this species have come to light. The absence of additional material, despite an interest in shell collecting at the Albany Museum, Grahamstown, in the first half of the 20th century, suggested that the species was a habitat specialist, which was either now extinct or perhaps confined to habitats of limited extent, the nature of which remained unknown. The type locality, “Humansdorp, St Francis Bay”, given by Melvill and Ponsonby (1896) almost certainly related to the general area of origin, rather than a precise locality, and is thus of limited value in locating a species of this kind.

Fortuitously, in 1999 some land snail specimens sent to me for identification by Mr Derek Clark, warden of the Baviaanskloof Wilderness Area, E. Cape, proved to be examples of *E. laeocochlis*. Pursuing this new evidence, I subsequently visited the Baviaanskloof area in 2000 and found the species to be moderately common there, living under stones in grassy fynbos on the summit regions (500–1000 m) of the Kougaberg, in the area between Geelhoutbos and Rooihoek, on the southern side of the valley (Figure 4).

The Baviaanskloof lies within the broader Humansdorp District and it possible that this represents the area in which the original specimens were collected. Grassy fynbos is a plant community characteristic of the eastern region of the fynbos biome, occurring both in coastal lowlands and on mountains (Cowling and Richardson 1995). The absence of records from the much more accessible lowland localities suggests that *E. laeocochlis* is restricted to montane grassy fynbos habitats, which are largely remote and difficult to access. These will be somewhat cooler than coastal localities and benefit from more frequent mist and cloud (mean annual precipitation >800 mm; Schulze 1997). The species was not found at lower altitudes in the Baviaanskloof system where the vegetation changes variably to succulent thicket, Nama Karoo, and savanna, with isolated patches of forest in protected gorges.

The only figure of the species published to date is that of Melvill and Ponsonby (1896) (reproduced by Pilsbry 1906, Plate 10, Figure 68), which is poor and inadequate. I therefore take this opportunity to refigure the BMNH lectotype (Figure 1) and provide also an illustration of a fresh specimen in good condition (Figure 2). Connolly (1939) gave the length of the species as 30.4 mm, but the largest specimen in the newly acquired material measures 35.5 mm in length.

Connolly (1939) drew attention to the significance of *E. laeocochlis* as the type species of *Euonyma* Melvill and Ponsonby, 1896, pointing out that the referral of other large southern African subulinids to this genus may not be justified. Verdcourt (1968) reiterated this more strongly in relation to East African subulinids, stating “there is no evidence whatever that the larger species are really congeneric with the type of *Euonyma*…”. *Euonyma laeocochlis* has a distinctively acute apex (Figure 3), whereas most other supposed *Euonyma* species, including all those occurring in southern Africa, have a bluntly rounded apex. In this regard *E. laeocochlis* resembles members of the genus *Subuliniscus* Pilsbry, 1919, with which Connolly (1939) postulated it might be synonymous, and *Oreohomorus* Pilsbry, 1919. However, in these taxa the embryonic whorls are reported to have strong spiral sculpture, a feature that is entirely lacking in *E. laeocochlis*. The embryonic shell in the latter species, after an initially smooth first whorl, bears only axial riblets. Connolly (1939) speculated that the other local subulinids that he placed in *Euonyma* may need to be referred to a new or alternative genus (genera), but he wisely refrained from pursuing this on account of the lack of anatomical data, not only for *E. laeocochlis*, but for all local “*Euonyma*” species. The
rediscovery of the type species of Euonyma now provides material which can be studied in an attempt to resolve these uncertainties. A number of live-collected specimens were obtained and the soft parts preserved for anatomical examination. Samples were also preserved for molecular study.

Conservation

In the light of this new information, the threat status of the species has been assessed in terms of the current IUCN criteria (IUCN 2001). An application for red-listing as “Endangered B1” has been submitted. Fortunately, the Baviaanskloof has been identified as a priority area for conservation (Boshoff et al. 2000).

Family STREPTAXIDAE Gray, 1860

Gulella deviae sp. n.
(Figures 5–12)

Etymology

Named for Dr Devi Stuart-Fox, who has collected much valuable terrestrial molluscan material in South Africa, including specimens of this species.

Diagnosis

Shell very small to minute, cylindrical, smooth and glossy; apertural dentition three-fold: a parietal lamella, a protruding labral tooth, a very weak columella lamella; outer lip strongly concave above protruding labral tooth; whorls roundly rebated below suture; last whorl with an internal tubercle situated ca 0.5 whorl behind aperture; terminal part of body whorl lacking axial ribbing; umbilicus closed.

Description

Shell very small to minute, cylindrical, length 2.5–3.1 mm, width 1.20–1.28 mm; length: width 1.96–2.48 (N=13). Embryonic shell ca 0.78 mm in diameter, comprising just over two whorls, but junction with teleoconch indistinct; smooth and glossy (Figure 8). Teleoconch (Figures 5–7) comprising nearly 5.0 whorls; first whorl convex, but subsequent ones rather more flat-sided, as profile becomes cylindrical; suture narrowly indented, upper portion of abapical whorl roundly rebated (excavated); surface smooth and glossy, sculptured only with weak growth-lines. Peristome interrupted extensively in parietal region where base of preceding whorl is covered by a thin inductural layer; elsewhere margin of peristome slightly thickened and reflected to form a narrowly rounded marginal varix. Parietal lip almost horizontal and aperture thus D-shaped, the flat side situated apically. Apertural dentition three-fold (Figure 5): (1) an obliquely curving parietal lamella which is not fused to the outer lip at its insertion on the base of the penultimate whorl, instead extending well above this, leaving a distinct channel between the parietal lamella and the insertion of outer lip (Figure 9); (2) a strong, ridge-like, mid-labral tooth which projects strongly outward when viewed from the side (Figures 6, 9); (3) a very low columella lamella, often scarcely evident. In addition to the dentition associated with the aperture, there is a distinct tubercle situated inside the body whorl, just above and to the left of the insertion of the columella lip, ca 0.5
whorl behind aperture (Figures 7, 10). This is visible externally only in fresh (non-calcined) shells, appearing as an opaque white blotch in the otherwise translucent shell (Figure 7). It develops only at or near maturity, and is not a feature of juvenile shells. Outer lip strongly concave above labral tooth, but lacking an external pit underlying the tooth (Figure 9). Umbilicus completely closed (Figure 11) and with no evidence of crenulation or axial ribbing on base or terminal part of last whorl. Shell translucent, uniformly milky-white when fresh; orange-red dried remains of animal visible internally.

**Anatomy**

Unknown. Although some of the material discussed was live-collected, it was obtained from dried leaf-litter samples. No specimens preserved in ethanol are available.

**Material examined**

*Type material.* Holotype: South Africa, Limpopo, Soutpansberg, Hanglip Forest, 22.99966° S, 29.88986° E, afromontane forest, in leaf-litter, leg. J. Swaye, January 2002, length 2.64 mm, width 1.28 mm (NMSA T2032/W1966). Paratypes: all NMSA unless otherwise indicated. South Africa: Limpopo: Soutpansberg, Hanglip Forest, 22.99966° S, 29.88986° E, afromontane forest, in leaf-litter, leg. J. Swaye, January 2002 (T2033/W2808, two specimens; RMNH 101062, one specimen); Soutpansberg, Hanglip Forest, 23.0° S, 29.9° E, afromontane forest, in leaf-litter, leg. A. C. and W. H. van Bruggen, 8 February 1965 (T2112/W3649, three specimens); Soutpansberg, Entabeni, Goedehoop Forest, 23.0833° S, 30.1167° E, afromontane forest, in leaf-litter, leg. D. Herbert, 20 November 1997 (T2037/W5661, two specimens); Soutpansberg, Entabeni, Goedehoop Forest, 23.067° S, 30.121° E, afromontane forest, in leaf-litter, leg. C. Symes, 30 October 1999
(T2035/V7488, two specimens; BMNH 20050567, one specimen). Mpumalanga: Sabie area, Mount Sheba, 24.9391°S, 30.7118°E, afromontane forest, in leaf-litter, leg. A. Moussalli and D. Stuart-Fox, 25 February 2004 (T2034/W2051, one specimen); Lydenberg area, Buffelskloof Forest Reserve, 25.3134°S, 30.4724°E, afromontane forest, in leaf-litter, leg. A. Moussalli and D. Stuart-Fox, 17 February 2004 (T2038/W2053, one specimen; NMW.Z.2005.035.00001, one specimen); Waterval Boven area, Tulloch Mohr, Fairy Glen, 25.5596°S, 30.5833°E, afromontane forest, in gully with rocky slate substrate, in leaf-litter, leg. A. Moussalli and D. Stuart-Fox, 15 February 2004 (T2039/W2054, three specimens); 10 km south of Malelane, Sherlock Farm, 25°35.350'S, 31°31.250'E, 780 m a.s.l., indigenous forest, in leaf-litter, leg. J. Horn (L6), 21 November 2004 (T2118/
**W3651, one specimen); Nelspruit area, Kaapsehoop, 25.6199°S, 30.7634°E, afromontane forest, in leaf-litter, leg. A. Moussalli and D. Stuart-Fox, 12 February 2004 (T2048/ W2111, one specimen).**

**Other material.** Barberton Nature Reserve, 25.8594°S, 31.0366°E, afromontane forest in gully between pine plantations, in leaf-litter, leg. A. Moussalli and D. Stuart-Fox, 12 February 2004 (NMSA W2115, one juvenile).

**Distribution and habitat**

Northeastern South Africa, from the Soutpansberg (Limpopo) to the environs of Barberton (Mpumalanga) (Figure 12); in leaf-litter of afromontane forests along the edge of the northern Drakensberg, at altitudes from 750 to 2000 m.

**Remarks**

The first specimens of this species collected were provisionally identified as *Gulella perspiciuefornis* (Sturany, 1898), to which it is undoubtedly superficially similar.
That species, however, has a strictly coastal distribution, occurring primarily in dune and coastal lowland forest in southern Mozambique and northern Zululand (Maputaland), at the southern end of the East African coastal plain (Herbert and Kilburn 2004). It has not been found further than 35 km from the coast or at altitudes greater than 250 m. The collection of specimens, perhaps representing *G. perspicuaeformis*, in afromontane forests far from the coast and at altitudes in excess of 750 m, was thus unexpected. Subsequent study, however, revealed that this afromontane material in fact differs consistently from *G. perspicuaeformis* in a number of features and represents a distinct, undescribed species, here described as *G. deviae*. The most obvious feature distinguishing *G. deviae* from *G. perspicuaeformis* is the presence of the internal tubercle in the former. This feature had not initially been observed since the first shells collected were calcined and thus no longer translucent. Only when fresh live-collected material became available did this feature become evident. Additional differences include: (1) the greater degree to which the labral tooth projects beyond the outer lip in *G. deviae*, such that the portion of this lip apical to the tooth is rendered strongly concave; (2) the consistent presence of axial ribbing, albeit weak, on the terminal part of the last whorl, behind the outer lip in *G. perspicuaeformis* (absent in *G. deviae*) (compare Figures 9 and 14).

In terms of the *Gulella* subdivisions proposed by Herbert and Kilburn (2004), *G. deviae* lies with *G. perspicuaeformis* in Group 2CB (Group 6(ii) of Connolly 1939). Of other species within this group, *G. elliptica* (Melvill and Ponsonby, 1898) has superficial denticles on the columella lip, *G. inhluzaniensis* (Burnup, 1914) has subsutural riblets and *G. pentheri* (Sturany, 1898) has a more obvious columella lamella and is considerably more elongate. None of these species are known to range north of KwaZulu-Natal. *Gulella perspicuaeformis* (Sturany, 1898), Greater St Lucia Wetland Park, Cape Vidal, Bhangazi Hill, 28°07.7’S, 32°33’E, coastal dune forest, NMSA V9240. (13) Whole shell, length 2.82 mm. (14) Side view of aperture. Scale bar: 250 μm.

Figures 13, 14. *Gulella perspicuaeformis* (Sturany, 1898), Greater St Lucia Wetland Park, Cape Vidal, Bhangazi Hill, 28°07.7’S, 32°33’E, coastal dune forest, NMSA V9240. (13) Whole shell, length 2.82 mm. (14) Side view of aperture. Scale bar: 250 μm.
(Melvill and Ponsonby, 1893), with apertural dentition resembling that of *G. deviae*, occurs like *G. deviae* in Mpumalanga and Limpopo, and shares with it the unusual, roundly rebated suture, but lacks an internal tubercle. It is also considerably larger (length up to 5 mm), often proportionately broader, sometimes has a basal denticle in the aperture and its outer lip scarcely protrudes in the area of the labral tooth.

The true affinities of *G. deviae* within the genus *Gulella* s. l. remain to be established. Although superficially similar to *G. perspicuaeformis*, the two may not in reality be closely related, having arisen in different faunal assemblages, namely afromontane and tropical/subtropical coastal belt, respectively. The presence of the internal tubercle inside the last whorl is a feature I have not seen described in other *Gulella* species, suggesting that *G. deviae* is rather unusual. Some *Gulella* species are known to possess internal teeth in juveniles (Herbert and Kilburn 2004), but these are generally situated close to the growing aperture lip and are laid down and resorbed progressively with growth, and ultimately lost once the adult apertural dentition is formed. The species concerned usually have strong axial ribs and often also a spirally lirate embryonic shell. The internal tubercle found in *G. deviae* is clearly unrelated.

**Conservation**

Although described for the first time herein, this is probably a result of the small size of the shell, rather than the narrow range of the species. Indeed its distribution is not particularly restricted, spanning more than 300 km of the northern Drakensberg escarpment. However, it is surprising that the species has not been found, despite relatively good sampling, in the forests of the Wolkberg near Tzaneen, suggesting that it occurs only patchily within its total range. Based on the available evidence *G. deviae* would probably qualify in the “vulnerable” category, in terms of the IUCN red-listing criteria (IUCN 2001).

*Gulella lindae* sp. n.

(Figures 15–23)

**Etymology**

Named for Mrs Linda Davis, collections manager and scientific artist, Department of Mollusca, Natal Museum.

**Diagnosis**

Shell minute, cylindrical, with short but distinct axial riblets below suture; apertural dentition five-fold: a parietal lamella, two labral teeth, a small basal tooth to left of centre and a strong columella lamella, umbilicus open, its margin crenulate.

**Description**

Shell minute cylindrical, length 1.77–2.28 mm, width 0.82–0.96 mm, length: width 1.967–2.478 (*N*=50). Embryonic shell domed in specimens from coastal localities (Figures 15–17), flatter in those from localities further inland (Figure 18); diameter ca 0.58 mm, smooth, comprising approximately two whorls, but its terminal limit frequently not easy to discern (Figure 21). Teleoconch (Figures 15–18) comprising 4.0–4.5 whorls; first whorl
strongly convex, subsequent ones less so; as whorls cease to expand outward, shell profile becomes cylindrical; suture shallowly indented; surface mostly smooth and glossy, but with short, distinct subsutural riblets, giving suture a milled appearance. Peristome interrupted extensively in parietal region where base of preceding whorl is covered by a thin inductural layer; elsewhere margin of peristome thickened and reflected to form a relatively strong marginal varix (Figures 17, 20). Apertural dentition five-fold (Figure 19): (1) a parietal lamella, the outer part of which curves obliquely to merge smoothly with outer lip at its insertion on base of penultimate whorl; (2–3) two mid-labral teeth, the lower one stronger and ridge-like; (4) a small basal tooth to left of centre, peg-like in some samples, obliquely trigonal in others; (5) a columella lamella with a strong tooth (shape somewhat variable), which extends outward for a short distance as a low ridge, but does not reach aperture edge. There may in addition be a more deeply set, low collabral thickening between the lower labral and basal teeth (Figure 19). Labral tooth marked externally by shallow pit behind thickened outer lip; terminal part of last whorl with distinct axial riblets. Umbilicus relatively widely patent (Figure 20), ovoid, with margin crenulated by short axial riblets. Juvenile shells frequently with a small low tubercle inside basal lip, near its junction with columella lip (Figure 22); this laid down and resorbed with growth, and its position relative to aperture edge thus variable; a series of up to three such tubercles may be present at any one time, progressing inward from aperture edge and separated by 0.25–0.5 whorl. Shell almost transparent when fresh; orange-red dried remains of animal visible internally.

**Anatomy**

Unknown. On account of its minute size, this species has only been obtained from dried leaf-litter samples. Although a number of specimens were evidently alive when collected, none were preserved in ethanol.
Distribution and habitat

Known only from northeastern KwaZulu-Natal, South Africa (Figure 23), primarily in the coastal strip from just south of the St Lucia system to Kosi Bay near the border between South Africa and Mozambique, but ranging inland to Hluhluwe-Imfolosi Park in the south; in leaf-litter of coastal and scarp forests, from sea-level to 460 m. Evidently moderately common in dune forests.

Material examined

Type material. Holotype: South Africa, KwaZulu-Natal, Cape Vidal, Bhangazi Hill, 28°07.4’S, 32°33.3’E, 60–80 m a.s.l., dune forest, in leaf-litter, leg. Herbert, Seddon and
Tattersfield, Site 1, 27 November 1998, length 1.97 mm, width 0.86 mm (NMSA T2116/V7966). Paratypes: all NMSA unless otherwise indicated. South Africa, Kwazulu-Natal: Black Rock, 27°07.5’S, 32°49.5’E, coastal forest, in leaf-litter/soil, leg. J. P. Marais, July 2001 (T2059/V9295, two specimens); Lake Sibaya area, Lala Nek, 27°13’S, 32°47’E, coastal dune forest, in leaf-litter/soil, leg. J. P. Marais, July 2001 (T2113/V9320, one specimen); Lake Sibaya, 27°44’S, 32°23’E, coastal bush on dune ridge between lake and sea, in leaf-litter/soil, leg. J. P. Marais, July 2001 (T2114/V9285, two specimens); Cape Vidal, Bhangazi Hill, 28°07.8’S, 32°32.8’E, 60–80 m a.s.l., dune forest, in leaf-litter, leg. Herbert, Seddon and Tattersfield, Site 2, 27 November 1998 (T2115/V7930, 18 specimens); Cape Vidal, Bhangazi Hill, 28°07.4’S, 32°33.3’E, 60–80 m a.s.l., dune forest, in leaf-litter, leg. Herbert, Seddon and Tattersfield, Site 1, 27 November 1998 (T2117/W3650, 14 specimens); Cape Vidal, 28°07.7’S, 32°33’E, 10–100 m a.s.l., dune forest, in leaf-litter, leg. D. Herbert, 18 October 1997 (T2036/V5364, 41 specimens; BMNH 20050568, two specimens; NMW.Z.2005.035.00002, two specimens; RMNH 101063, two specimens); Greater St Lucia Wetland Park, False Bay Park, 27.96460°S, 32.37869’E, closed woodland/forest on fossiliferous sediments beside lake, in leaf-litter and under logs, leg. Earthwatch Team 8, 5 November 2004 (T2049/W2609, three specimens); Hluhluwe Game Reserve, 28°04.62’S, 32°02.7’E, 460 m a.s.l., scarp forest, in leaf-litter, leg. Herbert, Seddon and Tattersfield, 29 November 1998 (T2060/V7681, two specimens).
Other material. Kosi Bay area, near mouth, 26°52.153’S, 32°52.955’E, dune forest, in leaf-litter, leg. S. Lovell et al., 21 October 2003 (W1874); Lake Sibaya, 27°44’S, 32°23’E, dune ridge between sea and lake shore, coastal dune forest, in leaf-litter/soil, leg. J. P. Marais, July 2001 (V9273); “St Lucia Bay”, leg. H. J. Puzey, July 1944 (W1570); Mapelane, coastal forest, in leaf-litter, leg. D. Plisko, 14 May 1997 (V5037, V5036); Hluhluwe Game Reserve, 28°04.5’S, 32°03.3’E, 400 m a.s.l., scarp forest, in leaf-litter, leg. Herbert, Seddon and Tattersfield, 30 November 1998 (V7660).

Remarks

Specimens of this species have previously been recorded as *G. bushmanensis* Burnup, 1926 (Bruggen and Appleton 1977). The material concerned was collected by H. J. Puzey in the St Lucia area, in 1944, and Prof. C. Appleton in the Lake Sibaya area in 1973. Examination of Puzey’s specimens, after return to the Natal Museum from long-term loan, and Appleton’s material housed in the RMNH, showed these to be referable to the present species. This eliminates the record of *G. bushmanensis*, an otherwise inland mid-altitude species, from coastal localities, a distribution noted as unusual, though not without precedent, by Bruggen and Appleton (1977).

In terms of its apertural dentition and sculpture, *G. lindae* falls within Group 3B of Herbert and Kilburn (2004). It is, however, very much smaller than any of the other species within this group. Its apertural dentition also resembles that of *G. bushmanensis*, but that species is much more elongate and almost completely smooth, and its labral tooth is in the form of one bicuspid tooth rather than two separate teeth on a shared base (although the distinctness of these is admittedly somewhat variable in *G. lindae*). *Gulella maritzburgensis* (Melvill and Ponsonby, 1893), from the KwaZulu-Natal Midlands, is likewise aperturally similar and also has subsutural sculpture, but it is larger (length up to 4.5 mm), has a much more weakly indented suture and its subsutural riblets are extremely fine. Perhaps the most unusual feature of *G. lindae* is the brevity and relative strength of the subsutural ribbing which gives the suture a milled appearance. This, together with its minute size and five-fold apertural dentition, render the species distinctive.

The distribution of *G. lindae* resembles that of *G. appletoni* Bruggen, 1975, *G. browni* Bruggen, 1969, and *G. daedalea* (Melvill and Ponsonby, 1903), and it is clearly a tropical element of the fauna. Although currently not recorded from Mozambique, it will undoubtedly prove to occur at least in the southern parts of that country. The northern-most record available (Kosi Bay) lies immediately to the south of the Mozambique border. Whether *G. lindae* represents an element endemic to the southern extremity of the Indian Ocean coastal belt or is more widespread remains to be established. It was not found in samples collected recently in the Ponta da Barra Falsa area, between Inhambane and Vilanculos, but in general the molluscan fauna of the coastal forests of Mozambique remains almost unknown.

Conservation

*Gulella lindae* is evidently not rare. Although its currently known area of occupancy is relatively restricted, it is has been found in some numbers in coastal dune forest. Much of this habitat in Zululand falls within the Greater St Lucia Wetland Park World Heritage Site and is thus afforded a high level of protection. Records from inland localities also fall within a conservation area, namely the Hluhluwe-Imfolosi Park.
**Gulella fraudator** Connolly, 1939

(Figures 24–30)

*Gulella fraudator* Connolly 1939, p 57, Plate 2, Figure 3; Aiken 1995, p 10. Type locality: “Mbotyi Beach bush”, E. Cape Province, South Africa.

**Material examined**

*Type material.* Holotype and two paratypes (BMNH 1937.12.30.862-5), three paratypes (NMSA T560/W1574), “Mbotyi Beach bush”, E. Cape Province, South Africa, leg. W. Falcon, 1934.

*Additional material.* South Africa, E. Cape: Mkambati Nature Reserve “Super Bowl” forest at junction of Msikaba and Kwadlambu rivers, 31°17.728’S, 29°55.752’E, indigenous forest, in leaf-litter, leg. D. Herbert, 5 March 2001 (NMSA V8965); Manteku area, 31°31.422’S, 29°40.3572’E, coastal scarp forest, in leaf-litter, leg. D. Herbert and M. Bursey, 30 April 2004 (NMSA W1919); Mntafufu, south side of river, 31°33.0126’S, 29°37.0662’E, coastal scarp forest, amongst talus and leaf-litter at base of road cutting, leg. D. Herbert and M. Bursey, 29 April 2004 (NMSA W1818); Hluleka Nature Reserve, 31°49.216’S, 29°18.182’E, coastal forest, sorted from leaf-litter leg. D. Herbert, L. Davis and M. Bursey, 20 April 2005 (NMSA W3457); Xora River mouth area, Kumqolo Forest, 32°09.553’S, 28°59.121’E, coastal forest, in leaf-litter, leg. M. Bursey, 12 August 2003 (ELM 14265).

**Distribution and habitat**

Known only from the coastal hinterland of the Transkei region, E. Cape, South Africa; from Mkambati Nature Reserve in the north, to the vicinity of Xora River mouth in the south (Figure 30); in leaf-litter of coastal forests.

**Remarks**

Connolly’s (1939) description of *G. fraudator* was based on a sample collected at Mbotyi by W. Falcon in March, 1934. The holotype and two paratypes are in the BMNH (1937.12.30.862-5), and three further paratypes are present in the NMSA (W1574/T560), the latter recently returned from long-term loan. Although a second locality, “Hole in the Wall” (Transkei region, E. Cape), was recorded by Aiken (1995), for which there is no voucher specimen, no further material of the species has been collected and it has remained poorly known. In the absence of reference material, Herbert and Kilburn (2004) were unable to adequately discuss the taxon and tentatively postulated that it might represent a synonym of *G. mariae* (Melvill and Ponsonby, 1892).

Recently, regular field visits to the Transkei region of E. Cape have brought to light much new streptaxid material (Bursey and Herbert 2004), including specimens which are clearly referable to *G. fraudator*. This has been confirmed by comparison with the holotype and the recently returned paratypes. Connolly’s figure of the species, though accurate, is typically small and I take this opportunity to refigure the holotype (Figure 24) and illustrate additional features using the recently collected material (Figures 25–29). The original description of the species is adequate and redescription is unwarranted, although it is puzzling that Connolly treated the species in his Group 4iiia, comprising species with...
five-fold dentition, when, as he himself indicated, the species has six-fold dentition (Figure 27). He also did not comment on the weak but distinct subsutural riblets, noting only “growth wrinkles”. He did, however, observe that the latter become more regular and stronger behind the outer lip (Figure 28) and on the base, around the umbilical margin (Figure 29). In side view the base itself shows a distinct concavity and basal heel behind the reflected basal lip (Figure 28). Using the *Gulella* subdivisions proposed by Herbert and Kilburn (2004), *G. fraudator* belongs within Group 8B, but it should be noted that there is some variability in the shape of the labral and columella teeth. Connolly gave the dimensions of the species as length 2.75 mm, width 1.5 mm, but measurements of the additional material range as follows: length 2.53–3.05 mm, width 1.24–1.5 mm, length: width 1.86–2.17 (N=12).

The taxon is clearly distinct and not a synonym of *G. mariae* (cf. Herbert and Kilburn 2004). That species lacks subsutural riblets and has a much weaker labral tooth complex, a less oblique parietal lamella, and a less elongate columella tooth. This broad, flat-topped tooth in the middle of the columella lip is one of the more distinctive characters of *G. fraudator*. Few southern African *Gulella* species share this feature and those that do differ in other respects. Perhaps the most similar species are *G. himerothales* (Melvill and Ponsonby, 1903), *G. rumpiana* Connolly, 1932, and *G. contraria* Connolly, 1932, but all are noticeably larger than *G. fraudator*. *Gulella himerothales* (length up to 4.2 mm), from southern KwaZulu-Natal and E. Cape, has a labral complex in the form of two clearly distinct teeth, a more ridge-like basal tooth which is situated nearer to the columella, and a mamillate columella lamella. *Gulella rumpiana* (length up to 5.5 mm), from the E. Cape/KwaZulu-Natal border, has an even broader columella tooth, and lacks subsutural riblets. *Gulella contraria* (length up to 4.8 mm), from afro montane forests in northern KwaZulu-Natal,
Mpumalanga, and Swaziland, likewise lacks subsutural riblets and has a labral tooth complex of very different form.

**Conservation**

*Gulella fraudator* is an element of the endemic subtropical/warm-temperate subtraction zone fauna characteristic of the Transkei region, E. Cape. Such species typically have narrow distribution ranges and frequently meet the IUCN criteria for red-listing. Issues relevant to the conservation of these species have been discussed by Bursey and Herbert (2004). The distribution of *G. fraudator* is similar to that of *G. latimerae* Bursey and Herbert, 2004, although it ranges slightly further northward than that species.
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References

Aiken D. 1995. The Streptaxidae of South Africa. Conchological Society of Southern Africa. (Conchological Society of Southern Africa special publication: Pretoria; 6).
Boshoff A, Cowling R, Kerley G. 2000. The Baviaanskloof Conservation Area: a conservation and tourism development priority. Port Elizabeth: University of Port Elizabeth, Terrestrial Ecology Research Unit. Report nr 27. http://zoo.uep.ac.za/teru/BCA/.
Bruggen AC van, Appleton CC. 1977. Studies on the ecology and systematics of the terrestrial molluscs of the Lake Sibaya area of Zululand, South Africa. Zoologische Verhandelingen 154:1–44.
Bursey M, Herbert DG. 2004. Four new narrow-range endemic species of Gulella from Eastern Cape, South Africa (Mollusca: Pulmonata: Streptaxidae). African Invertebrates 45:249–262.
Connolly M. 1912. A revised reference list of South African non-marine Mollusca; with descriptions of new species in the South African Museum. Annals of the South African Museum 11:59–306.
Connolly M. 1939. A monographic survey of South African non-marine Mollusca. Annals of the South African Museum 33:1–660.
Cowling R, Richardson D. 1995. Fynbos, South Africa’s unique floral kingdom. Vlaeberg: Fernwood Press.
Herbert DG, Kilburn RN. 2004. Field guide to the land snails and slugs of eastern South Africa. Pietermaritzburg: Natal Museum.
IUCN, 2001. IUCN red list categories and criteria: version 3.1. Prepared by the IUCN Species Survival Commission, Gland (Switzerland): IUCN.
Melvill JC, Ponsonby J. 1896. Descriptions of new terrestrial Mollusca from South Africa. Annals and Magazine of Natural History 18:314–318.
Pilsbry HA. 1906. Achatinidae. Manual of Conchology (Series 2) 18(69):1–64.
Schulze RE. 1997. South African atlas of agrohydrology and -climatology. Pretoria: Water Research Commission. Report nr TT82/96.
Sturany R. 1898. Catalog der bisher bekannt gewordenen Südafrikanischen Land- und Süßwasser-Mollusken mit besonderer Berücksichtigung des von Dr Penther gesammelten Materiales. Denkschriften der Kaiserlichen Akademie der Wissenschaften, Mathematisch-Naturwissenschaftlichen Classe 67:537–642.
Verdcourt B. 1968. Notes on Euonyma Melvill & Ponsonby in East Africa (Subulinidae). Arkiv für Molluskenkunde 98:95–101.