LAND SNAILS OF THE EUNGELLA PLATEAU AND ENVIRONS, CLARKE RANGE, MID-EASTERN QUEENSLAND

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This study documents the land snails recovered on the Eungella Biodiversity Survey. Thirty-three species belonging to 10 families are documented, representing the first attempt at analysing the altitudinal stratification of the Eungella land snail fauna. Three species were newly recorded and subsequently described from the survey, these being *Eungellaropa crediton* Holcroft 2018, *Burwellia staceythomsonae* Holcroft & Stanisic 2018, and *Pereduropa burwelli* Holcroft & Stanisic 2018. *Fastosarion comerfordae* Stanisic 2018 was also described from the survey material, having previously been confused with the Mt Dryander *Fastosarion superba* (Cox, 1871). Species are discussed in relation to their current taxonomy, their local and more widespread distributions, and their habitat and microhabitat preferences. Shortcomings of the land snail survey are also briefly discussed. A biogeographic overview of the Eungella rainforest land snails is presented.

Keywords: elevational gradient, land snails, taxonomy, distributions

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INTRODUCTION

The Eungella Biodiversity Survey (EBS) of 2014–2015 (Ashton *et al*., this volume) was the first concerted effort at surveying and documenting the land snails of the Eungella plateau and environs. Previous land snail collecting in the area by the Queensland Museum (QM) comprised only short-term visits that formed part of more wide-ranging expeditions. The expansive Australian Museum, Sydney (AMS)/QM rainforest biodiversity surveys of the mid-1970s included land snails as a target group. Sites at Finch Hatton and Crediton were visited, but the results for land snails were never documented. The Eungella region of the Clarke Range encompasses some of the highest peaks (Mt Henry, Mt William, Mt Dalrymple) encountered in the Clarke-Connors bioprovince of the Central Mackay Coast (CMC) bioregion. Rainforest on the Eungella plateau (altitude 800–1200 metres) consists of subtropical notophyll vine forest almost grading to more tropical mesophyll vine forest in some areas. At lower altitudes (200–600 metres), notophyll vine forest persists in sheltered gorges (Finch Hatton) and along drainage lines. Riparian habitats with uninterrupted connections with montane rainforest are important secondary habitats for land snails and provide corridors for dispersal. Hence, given the predilection of land snails for humid wet forests along the length of the continent's eastern seaboard, the Eungella region appears to offer a number of prime habitats for a robust community of land snails.

METHODS

Site locations and site descriptions are presented in Ashton *et al*. (this volume). Survey effort per site comprised one person-hour searching favoured snail microhabitat including both terrestrial and arboreal niches. Land snails were hand-collected as live specimens, dead shells, and from leaf litter sorting by microscope. The latter is an important source of micro-snails (Charopidae, Punctidae) whose shells are usually less than 4 mm in diameter. These micro-snails are usually collected as dead shells that nonetheless can be identified as species and, where necessary, formally described. Leaf litter collection involves taking the decaying leaves and top 1–2 cm of soil from places where dead shells accumulate.

Land snail collection during the day (as was the case with the EBS), and even at night, can be hit and miss because they are nocturnal creatures that are very sensitive to ambient conditions. Collecting after rain events when snails are most active and sheltering

in the top layer of forest debris gives the best results. The EBS snail survey was conducted in ideal rainy conditions. But even then, the patchy distribution of species in the litter zone does not guarantee finding a species at a site. Furthermore, a number of species that are catalogued in the QM collections as occurring at Eungella are absent from the final list. Personal experience has shown that follow-up collecting should result in more species being added to the inventory. A presence is a positive result, but an absence should not necessarily be considered an absolute absence, both from a site and the entire EBS.

In some sites leaf litter collection was not possible. Areas had been scoured by heavy rain, with little or no litter to be collected. This was particularly noticeable in the Diggings Road and Eungella Dam Road where palm fronds were all that formed the layers of forest debris. It is with these caveats that results of the EBS need to be scrutinised and analysed.

RESULTS

General identification and classification followed Stanisic *et al*. (2010). Additional identification is provided in Holcroft (2018b), Holcroft & Stanisic (2018) and Stanisic (2018). Thirty-three species of land snails belonging to ten families were catalogued from the 24 sites visited (Table 1). To put these numbers into perspective, the Queensland Museum collections hold more than 140 species from the entire CMC bioregion. The EBS collections form a small and circumscribed subset concentrated on the Eungella region. Twenty-six of the species collected on the EBS were already described and a further seven recognised as putative new species yet to be formally described. Four of the described species (*Eungellaropa crediton*, *Burwellia staceythomsonae*, *Pereduropa burwelli*, *Fastosarion comerfordae*) were found on, and subsequently described (Holcroft, 2018b; Holcroft & Stanisic, 2018; Stanisic, 2018) from, material collected on the EBS. For this report the species included in the undescribed cohort are identified by a descriptor comprising family name with an alpha-numeric suffix, e.g. Helicinidae MQ 2. This is a system used throughout the QM and AMS land snail collections to denote putative species.

SYSTEMATIC ANALYSIS

The land snails of the EBS fall into two morphologically distinct groups: the small minority are operculates which have an operculum (to seal the shell opening), separate sexes, an open pallial cavity and absorb oxygen directly from the air. The much more dominant pulmonates, which lack an operculum, are hermaphrodites and breathe by means of a lung. Operculates (neritopsinids and caenogastropods) are almost exclusively confined to wetter rainforests and vine thickets. In contrast, pulmonates, having a closed lung that can also act as a 'water bag', have the ability to inhabit a much more diverse array of environments ranging from very wet rainforest to arid desert.

The operculates are represented by five species in the EBS. These belong to the two families historically associated with MEQ.

Superorder Neritopsina, Family Helicinidae

The arboreal Mt Dryander Droplet Snail, *Pleuropoma queenslandica* Stanisic, 2010, was the most commonly encountered operculate land snail. This species lives on the leaves of trees, especially palms, and occurred from the lowlands in riparian habitat (200 m, Sites 1 & 2) to the 1200 m Site 2 on Mt Henry. This species also occurs in the Conway Range and at Mt Dryander of the Whitsunday bioprovince and displays the typical locally widespread distribution pattern associated with arboreal species that are open to wind-blown dispersal. A second, putative new species (Helicinidae MQ 2), endemic to the higher reaches of the Clarke Range, was recorded from the Dalrymple Road (1000 m, Site 1).

Superorder Caenogastropoda, Family Pupinidae

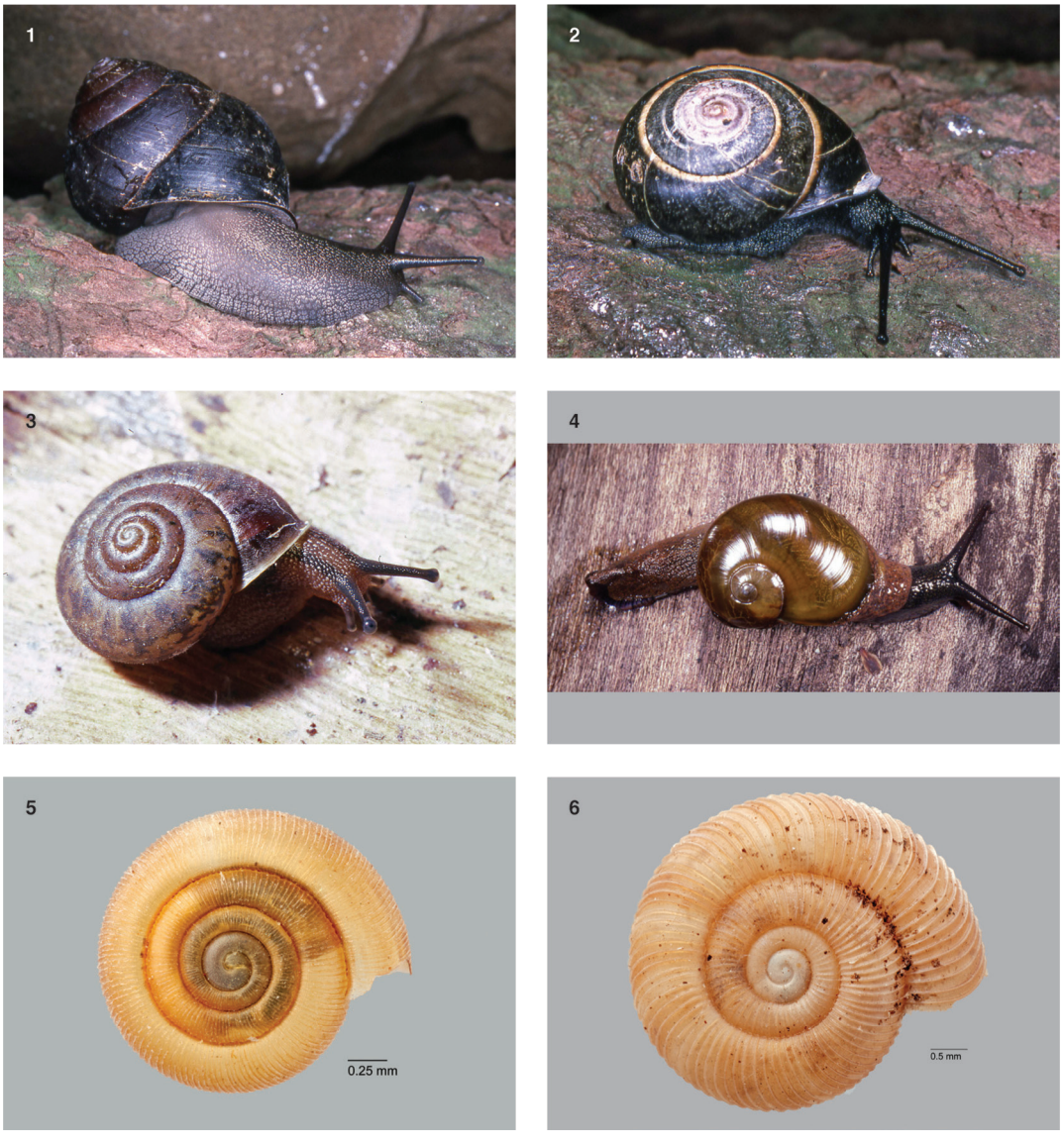
The ground-dwelling Golden Chrysalis Snail, *Signepupina meridionalis* (Pfeiffer, 1864), was the second most commonly encountered operculate land snail. Pupinids are somewhat specialised in their range of microhabitat preferences in that they can be found inside very wet, rotten logs. Land snails in general like moist but not overly moist microhabitats. Too much moisture will cause the snail to hyper-secrete mucus, resulting in considerable stress and death. A second species, the Glossy Eungella Chrysalis Snail, *Signepupina masoni* Stanisic, 2010, was recorded at the 200 m, 400 m and 600 m elevations. Records of the QM indicate that this species is also common in the Crediton and Eungella areas at elevations of 800–1000 m. A third putative species (Pupinidae MQ 6) was represented by a single record from a site along Owens Creek (200 m, Site 1) This species is more common in the lowland rainforest around Sarina.

The pulmonates are represented by 28 species belonging to 10 families in two orders.

TABLE 1. List of snails encountered in the Eungella Biodiversity Survey ordered by elevation and study site

EBS snail data 1914–1915	200 m				400 m				600 m				800 m				1000 m				1200 m			
	1	2	3	4	1	4	6	7	1	4	6	7	2	4	6	7	1	2	3	4	1	2	3	4
Pleuropoma queenslandica	x	x					x	x										x				x		
Helicinid MQ 2																	x							
Signepupina macgillivrayi		x						x			x													
Signepupina masoni				x				x																
Pupindae MQ 6	x																							
Atopos australis					x		x	x						x	x									
Pupisoma porti														x										
Coelocion australis							x																	
Briansmithia clarkensis	x							x							x	x		x						
Pandofella whitei		x																						
Punctidae MQ 2					x			x							x	x				x		x		
Biomphalopa recava																				x		x		
Burwellia staceythomsonae																							x	
Charopid MQ 28												x												
Charopid MQ 13																								x
Eungellaropa crediton					x								x											x
Isolderopa deliqua																						x		
Isolderopa iangallowayi	x				x															x				
Isolderopa minuta	x			x										x	x			x	x	x	x	x	x	
Pereduropa burwelli				x						x			x				x	x						
Setomedea janae																						x		
Stanisicaropa chambersae				x						x			x			x	x	x						
Triboniophorus graeffei																	x							
Coneuplecta calculosa		x	x																					
Eddiella proserpiniana																		x						
Eddiella nana			x				x				x						x	x		x				
Eungarion mcdonaldi																x	x					x		
Fastosarion comerfordae								x	x	x	x	x		x	x		x	x	x		x	x	x	x
Helicarionid MQ 13	x	x	x		x	x	x	x			x	x			x									
Helicarionid MQ 16																	x							
Trachygenia praecursoris							x				x	x			x	x								
Sphaerospira informis	x	x	x		x			x			x			x	x	x	x		x					
Sphaerospira oconnellensis		x					x							x										

EUNGELLA LAND SNAILS. 1, *Sphaerospira informis* (Mousson, 1869); 2, *Sphaerospira oconnellensis* (Cox, 1871); 3, *Trachygenia praecursoris* (Hedley, 1912); 4, *Fastosarion comerfordae* Stanisic, 2018; 5, *Pereduropa delicata* Stanisic, 2010; 6, *Stanisicaropa chambersae* Stanisic, 2010.



Order Systellomatophora, Family Rathouisiidae

The Australian Prism Slug, *Atopos australis* (Heynemann, 1876), is one of only a handful of Australian native slugs. Inhabiting wet rainforests from the Torres Strait islands to Wauchope in mid-eastern New South Wales, *A. australis* is the only Australian representative of the family. Additional species are found in Papua New Guinea and Southeast Asia. The slug was recorded from 400 m and 800 m sites and is probably present at the 600 m sites. The species appears to prefer mid-altitude habitats throughout its extensive range.

Order Eupulmonata

This order included the largest grouping of EBS snails, comprising 27 species belonging to ten families. Three

families (Charopidae, Helicarionidae, Camaenidae) dominate the east coast land snail fauna, and all are well represented in the EBS.

Family Pupillidae. A single species of this family, the Tall Toothless Pupasnail, *Pupisoma porti* (Brazier, 1876), was recorded as a dead shell at the 800 m elevation off Eungella Dam Road (Site 4). The species is uncommon in wetter rainforests, preferring drier rainforest and vine thickets. *P. porti* lives on the branches of shrubs and under bark of standing trees.

Family Megaspiridae. The Australian Megaspire Snail, *Coelocion australis* (Forbes, 1851), was recorded at only one site along Owens Creek (400 m, Site 6), although QM records show the species to be common at other sites in the Eungella section of the Clarke Range. The species prefers drier araucarian rainforests and lives among rocky rubble. This microhabitat was scarcely encountered during the EBS and probably explains its absence in most sites.

Family Rhytididae. This family of carnivorous snails comprises both large and very small species. A single large species, the Clarke Range Carnivorous Snail, *Briansmithia clarkensis* Stanisic, 2010, was recorded from five sites at elevations ranging from 200–1000 m. Carnivorous snails are typically low in numbers in snail communities when compared with other species.

Family Caryodidae. Previously only known from the upland rainforests of the Clarke Range (Eungella, Mt Dalrymple, Mt Macartney), the Slug-like Panda Snail, *Pandofella whitei* (Hedley, 1912), was recorded from a 200 m site (Site 2) along Owens Creek. Being unable to retract into its reduced half-shell, the species is extremely prone to desiccation and typically prefers very wet rainforest habitats. The presence of *P. whitei* in lowland riparian rainforest was unexpected.

Family Punctidae. A single putative species, tentatively identified as the Miniscule Pinhead Snail, *Iotula microcosmos* (Cox, 1868), was recorded across several elevations ranging from 400–1200 m. This is a widespread species occurring in wet rainforests and vine thickets from south-eastern New South Wales to mid-eastern Queensland. It is one of Australia's smallest land snails, with a shell diameter of 1.2 mm.

Family Charopidae. The Charopidae is the dominant family of east coast land snails, with an estimated 750 species but comprising many that still have to be described. The family also dominates the EBS fauna with eleven species recorded. Until recently the charopid fauna of MEQ consisted of 12 species. Following the studies of Holcroft (2018a, 2018b) and Holcroft & Stanisic (2018), this number has increased to 37 with many putative species yet to be described and possibly many more to be discovered. The majority of these species are endemic to the CMC bioregion, specifically the Clarke Range. QM records show that ten of the species collected in the EBS are Clarke Range endemics. Several of these are exclusively endemic to the higher elevations of the Clarke Range. These comprise the Caramel-flamed Pinwheel Snail, *Biomphalopa recava* (Hedley, 1912), Ranger Stacey's Pinwheel Snail, *Burwellia staceythomsonae* Holcroft & Stanisic, 2018, and the putative Charopid MQ 13. The high local endemicity of the charopid fauna is typical of large rainforest tracts in eastern Australia. These snails are usually recovered as dead shells through leaf litter sorting, and their live counterparts are very difficult to find because of their small size and associated ability to fit into the narrowest of crevices.

Family Athoracophoridae. The Red-triangle Slug, *Triboniophorus graeffei* Humbert, 1863, was recorded in the EBS from a single specimen. The species is widely distributed in eastern Australia, ranging from south-eastern New South Wales to north of the Wet Tropics, north-eastern Queensland. Records show that the species is uncommon in MEQ. The slug displays a wide range of colour forms throughout its range, varying from golden-yellow to orange to red. *T. graeffei* is currently under revision and early indications are that the taxon is an umbrella for a number of undescribed cryptic species of which the MEQ may be one.

Family Euconulidae. The widespread Tropical Beehive Snail, *Coneuplecta calculosa* (Gould, 1852), was collected from several sites during the EBS. *C. calculosa* is an arboreal species widely distributed in subtropical and tropical rainforests in eastern and northern Australia. The species also has a wide presence on land masses in the south-west Pacific region. Wind dispersal is probably responsible for the extensive range of the species.

Family Helicarionidae. This family includes both glass snails with a full shell and semi-slugs with a reduced ear-shaped shell. Semi-slugs of the family Helicarionidae have a reduced ear-shaped shell into which the snail can no longer withdraw to escape a snail's two worst enemies: predators and desiccation. They are therefore mainly active in the most humid parts of the day (early morning and early evening) or during and after rain. The moist Eungella rainforests are inhabited by several semi-slug species, but none more spectacular than the large, black Comerford's Semi-slug (*Fastosarion comerfordae* Stanisic, 2018)

which can usually be found inside rolled-up, fallen palm fronds on the forest floor. This species has close relatives living in the Conway Range, Mt Dryander and in the northern Wet Tropics, and is one of the few MEQ land snails that still show past connections with the rainforests of the north. In contrast, the somewhat smaller, endemic and restricted McDonald's Semi-slug (*Eungarion mcdonaldi* Stanisic, 1993) can be found inhabiting the leaves and branches of low rainforest shrubs in the higher-rainfall areas of Eungella. This species has a shell which is almost plate-like and very membranous. Two unnamed species of semi-slug were also recorded (Helicarionid MQ 13, Helicarionid MQ 16) during the survey. Helicarionid MQ 13 was found at many sites at elevations ranging from 200–800 m. A single specimen of Helicarionid MQ 16 was located at the 1000 m elevation, Site 1. Two species of glass snail were also recorded. This group of helicarionids is currently under revision and identifications are tentative and broad, pending the outcome of that study. *Eddiella proserpiniana* Stanisic, 2010, has a very wide distribution in the MEQ region that includes the Eungella plateau. The much smaller *Eddiella nana* Stanisic, 2010 has a more restricted distribution encompassing the Eungella plateau. Records of the QM have this species also occurring on the off-shore islands and in the drier scrubs west of Eungella, suggesting that more than one species is involved.

Family Camaenidae. Mid-eastern Queensland has a great variety of large snails belonging to the family Camaenidae, and several of these occur in the Eungella area. Most notable is the very large Giant Mid-eastern Snail, *Sphaerospira informis* (Mousson, 1869), which lives under logs and rocks. This species has a distribution encompassing the Clarke Range but also extending to the Proserpine-Sarina lowlands. An outlier population has been recorded from Connors Hump, east of St Lawrence. A sister species, the O'Connell River Dark Snail, *Sphaerospira oconnellensis* (Cox, 1871), co-occurs with the former, but is micro-allopatric. Rather than living under logs and rocks, this species is usually found under bark of standing trees and fallen logs. This species has also been recorded farther south in the Connors Range. Another camaenid, the Eungella Bristle Snail, *Trachygenia praecursoris* (Hedley, 1912), which is distinguished by having tiny hairs on the shell surface, is also a common inhabitant of these rainforests. The species occurs in the higher reaches of the Clarke Range and Connors Range from Mt Macartney to the Blue Mountains, south-west of Sarina.

DISCUSSION

The land snail fauna of MEQ is diverse in its make-up and derivation. This pattern is strongly reflected in the results of the EBS. The Eungella region and its rainforests have had relatively few mentions in past discussions of east coast rainforest biogeography (Webb & Tracey, 1981; Adam, 1992) which have focussed chiefly on the Wet Tropics of North Queensland or on the central eastern rainforests of southern Queensland and northern New South Wales. The lack of significant numbers of vertebrate and plant endemics in the region seems to have been the major driver of this lack hiatus. However, the scarcity of detailed studies of the invertebrates of the CMC region, as well as in areas to the north and south, is the primary reason for their absence in these discussions. Yet these animals, especially those with low vagility such as land snails, may potentially have significant input into future biogeographic analyses involving CMC mesic communities. The recent study of Rix & Harvey (2012) on assassin spiders is the exception and a case in point.

Land snails present an ideal opportunity to contribute to the biogeographic dialogue. Although the study of land snails in the CMC is still in its infancy, there is a mounting volume of morphological data and preliminary molecular data which, when combined with robust distribution data, is fuel for informed speculation and hypotheses (Stanisic, 1990; Stanisic, 1993; Stanisic *et al*., 2010; Hugall & Stanisic, 2011; Holcroft, 2018a; Holcroft, 2018b; Holcroft & Stanisic, 2018; Stanisic, 2018). The absence of comprehensive molecular data on land snails, similar to that provided by Rix & Harvey (2012) for assassin spiders, should not be an impediment to progressing these discussions.

The EBS land snail results provide a platform for initiating these conversations. The following discussion is presented in the wider context of the entire CMC bioregion.

Biogeographic analysis

The MEQ rainforests are isolated by two major dry corridors: the large and highly influential Burdekin Gap in the north and the somewhat smaller St Lawrence Gap in the south (Bryant & Krosch, 2016). Vicariance, driven by the onset of climate-induced continental aridity in the early Miocene, gradually isolated the MEQ rainforest communities and their land snails from those in the north and south as these corridors became established. Joseph *et al*. (1993) suggested that connections with the south would

have been maintained for longer than those with the north through an archipelago of drier vine thickets and that their separation would have been relatively more recent. The associated drying during the many glacial periods of the Plio-Pleistocene would have had significant consequences for the MEQ mesic communities, especially moisture-sensitive taxa such as land snails. This led Galloway & Kemp (1981) to conclude that these changes would have placed considerable stress particularly on montane environments, leading to many episodes of extinction, and that modern communities in these situations are recent phenomena consisting of biota that have survived in isolated refuges. Winter (1988) suggested that MEQ rainforests contracted to such small areas during this period that rainforest specialist mammals would not have survived. However, land snails do not need large-acreage landscapes to exist and persist.

Throughout the period of MEQ mesic habitat reduction (but not complete elimination) during the Quaternary, land snails would have been able to survive in arrow-head gullies, riparian habitats and scattered lithorefugia where remnant rainforest would presumably have persisted, albeit in very small patches. The MEQ land snails, particularly those of the uplands and environs, are modern-day survivors of these past episodes of climatically induced environmental sifting.

The following discussion is limited to the pulmonates, with brief mention of the operculate families.

Biogeographically, the pulmonate land snails of the EBS fall into two main groups. These are the southern or Gondwanan families (Athoracophoridae, Charopidae, Rhytididae, Caryodidae, Megaspiridae) and the northern post-Miocene immigrant families (Camaenidae, Helicarionidae, Rathouisiidae). Families that are part of wider world distributions include the Pupillidae and Punctidae. While the lack of robust phylogenies hinders rigorous biogeographic analyses, several generalisations about the former two groups are possible.

Both the Caryodidae and the Megaspiridae reach their northern limit in the CMC bioregion and do not appear to have been able to colonise north of the Burdekin Gap. The nearest relatives of the caryodid, *Pandofella whitei*, are in south-eastern Queensland, south of Gympie in the form of the Giant Panda Snails, *Hedleyella falconeri* (Gray, 1834) and *H. maconelli* (Reeve, 1854). Both are wet rainforest species, and the evolution of drier forests in the intervening areas between Gympie and the CMC leads to the conclusion that there have been extinctions of related forms in these areas. The megaspirids, on the other hand, have been able to radiate in the drier araucarian forests of southern and central Queensland. Apart from *Coelocion australis* in the CMC, congeners occur in both the Bobby Range (*C. circumumbilicata* Stanisic, 2010) and Lockyer Valley (*C. craigeddiei* Stanisic, 2010) in the southern Queensland brigalow belt (Stanisic *et al*., 2010). The Athoracophoridae and Rhytididae span both the St Lawrence and Burdekin Gaps, with the Rhytididae ranging from Tasmania (*Tasmaphena* spp.) through to the Torres Strait (*Torresiropa* spp.). The Athoracophoridae range from the south coast of New South Wales to north of the Daintree, north-eastern Queensland. Both groups appear to have established their broad presence before the advent of the dry corridors along the eastern seaboard and have managed to maintain that foothold through the subsequent period of climatic attrition. Their survival in the Eungella rainforests is a measure of their resilience.

Similarly, the highly speciose Charopidae has numerous species ranging from Tasmania through to the Wet Tropics in north-eastern Queensland. Historically considered a temperate group, this family has been shown to be a significant faunal unit in the subtropics and tropics (Stanisic, 1990; Stanisic *et al*., 2010). Of the EBS taxa, *Setomedea janae* has congeners in both southern [*S. seticostata* (Hedley, 1924)] and north-eastern Queensland (*S. monteithi* Stanisic, 1990): *Biomphalopa recava* has links with the Wet Tropics [*B. concinna* (Hedley, 1924)] but no relatives in the south. These are ancient distributions that once again show the survival ability of these tiny species in CMC refugia in the wake of mesic forest contraction since the early Miocene. However, there is also evidence of CMC extinctions in this family. The arboreal *Hedleyoconcha* Pilsbry 1893 has congeners in the south [*H. delta* (Pfeiffer, 1857)] and in the north (*H. ailaketoae* Stanisic, 1990) but none in the central Queensland rainforests (Stanisic, 1990). Arboreal existence is more prone to the vagaries of climatic change, and the absence of this tree-dwelling genus in the CMC bioregion has analogues in the Camaenidae. This family has tree snails in both southern and northern Queensland rainforests but none in the CMC coast. The Charopidae also show a high degree of endemism in the Eungella rainforests, exemplified by the relictual *Burwellia staceythomsonae* (see Holcroft & Stanisic, 2018) attesting to the significance of the tiny Plio-Pleistocene refugia of the higher reaches of the Eungella plateau.

The Rathouisiidae, a family of northern origin, is represented in the EBS by a single species, *Atopos australis*. Considered a single species that ranges from Cape York to central New South Wales, *A. australis* shows a similar distribution range to both the operculate families, Helicinidae and Pupinidae. Together they display a wave of colonisation that preceded the creation of the St Lawrence and Burdekin Gaps. *A. australis* is an obligate wet rainforest dweller, while the operculate families have been able to radiate into drier rainforest scrub throughout their vast ranges.

Both the Helicarionidae and Camaenidae have a dominant presence in eastern Australian rainforests. The two families are present down much of the eastern seaboard from Cape York to Tasmania (Helicarionidae) and southern Victoria (Camaenidae). Both have managed to disperse prior to the formation of the many dry corridors (Byrant & Krosch, 2016) that have affected other families of land snails. The semi-slugs of the Helicarionidae have dispersed as far south as Tasmania, whereas the helicarionid glass snails have not managed to cross the Southern Transition Zone. This is counter-intuitive since the glass snails as a group show a much wider tolerance to environmental conditions than do the semi-slugs. This is shown in the EBS by the local endemism of *Fastosarion comerfordae*, *Eungarion macdonaldi* and Helicarionid MQ 16 in contrast to *Eddiella nana* and *Eddiella proserpiniana*. Three genera of large MEQ camaenid land snails belonging to the hadroid lineage (*Bentosites* spp., *Marilynessa* spp., *Sphaerospira* spp.) occur in the CMC bioregion. *Sphaerospira informis* and *S. oconnellensis* are the only two species found during the EBS, and both have wider distributions within the CMC and along the southern Connors Range but not south of the St Lawrence Gap dry corridor. Congeneric relatives occur in the rainforest of the Byfield area [*S. mortenseni* (Iredale, 1929)], the drier vine thickets and rainforest refugia of the Rockhampton-Gympie region [*S. rockhamptonensis* (Cox, 1873), *S. blomfieldi* (Cox, 1864), *S. bencarlessi* Stanisic, 2010, *S. sidneyi* (Iredale, 1933)] and in the Border Ranges [*S. fraseri* (Griffith & Pidgeon, 1833)]. This genus appears to have been isolated south of the Burdekin Gap, with two species isolated in the CMC by the two dry corridors to the north and south. Interestingly, no camaenid tree snails occur in the MERQ. This group of Australian land snails, once thought to form a singular taxonomic group (Papuinidae), was shown by Hugall & Stanisic, 2011) to comprise independently derived species from local terrestrial forms. Their absence in MEQ is considered to be a reflection of the severe climatic attrition of mesic communities, especially arboreal species.

CONCLUDING REMARKS

The above discussion, while somewhat tentative, shows that land snails can be useful in outlining the chronological sequence of events that have moulded east coast mesic communities. Their responsiveness to both local and broad landscape changes caused by climatic fluctuation suggests that they could be, given further study, the exemplar invertebrate group for interpreting east coast biogeography.

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