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Euastacus fetzneri sp. nov., a new highly range restricted dwarf spiny freshwater crayfish (Crustacea: Decapoda: Parastacidae) from the upper Nerang River, Southeast Queensland, Australia, with a conservation assessment and recommendations

Robert B. McCormack[1,2] and Shane T. Ahyong[3,4]

[1]Australian Crayfish Project, c/- Australian Aquatic Biological Pty Ltd, P.O. Box 3, Karuah, NSW, 2324, Australia, and Research Associate

[2]Carnegie Museum of Natural History, Section of Invertebrate Zoology, 4400 Forbes Avenue, Pittsburgh, PA 15213-4080 USA.

[3]Australian Museum Research Institute, 1 William Street Sydney, NSW, 2010, Australia

[4]School of Biological, Earth & Environmental Sciences, University of New South Wales, Kensington, NSW 2052, Australia.

Abstract. The Australian freshwater spiny crayfish genus *Euastacus* Clark, 1936 is the most speciose genus of the family Parastacidae, with 56 species currently described. A new species of dwarf spiny crayfish, *Euastacus fetzneri* sp. nov., is described from the uppermost headwaters of the Nerang River catchment in southeast Queensland, Australia. The species represents the most habitat-restricted freshwater crayfish known globally. This groundwater-dependent species inhabits a narrow seepage zone, with its known distribution largely restricted to stretches of less than 70 metres of stream channel below four permanent subterranean emergence points. Morphologically and genetically allied to the geographically proximate *E. binzayedi* and sympatric with the dwarf-group *E. maidae*, *E. fetzneri* is distinguished by the presence of four mesial carpal spines on the major cheliped (versus three in *E. binzayedi*) and a large, sharp ventral carpal spine (versus obsolete or absent in *E. maidae*), and unique genetic markers. Ecological observations, burrowing behaviour, and biological notes are provided. Given its extremely limited distribution, small population size, and the high vulnerability of its habitat to disturbance, *E. fetzneri* meets IUCN Red List criteria as Critically Endangered (CR B1ab(iii, iv)).

Keywords: Gondwana, spiny crayfish, climate change, conservation, Crustacea, critically endangered, freshwater crayfish, ectocommensal fauna, groundwater dependent species, habitat specialist, taxonomy
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ORCID iD: McCormack, 0000-0001-7599-8870; Ahyong, 0000-0002-2820-4158
Corresponding author: Shane T. Ahyong **Email**: shane.ahyong@austmus.gov.au
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Introduction

The Australian freshwater spiny crayfish genus *Euastacus* Clark, 1936 is the most speciose genus of the family Parastacidae, with 56 species currently described (Ahyong, 2014; McCormack & Ahyong, 2017; Van Der Wal *et al*., 2022; McCormack & Fetzner, 2024; McCormack, 2025) and over 30 additional species awaiting formal description (Austin *et al*., 2022; 2026; McCormack, 2025). McCormack (2012) divided the species of *Euastacus* into three informal eco-morphological groups (dwarf, intermediate, and giant) based on body size, spinosity, and the presence or absence of pale bands on abdominal somites 1 and 6 of juveniles. Dwarf group crayfish are generally small-bodied, lack the light-coloured abdominal bands in juveniles, possess a male cuticle partition on pereopod 5, are poorly spinose, and are strong, cryptic burrowers, often occupying headwater streams or marginal habitats where they are typically outcompeted by larger congeners.

Although *Euastacus* ranges from northern Queensland to Victoria into South Australia, with overall highest richness in the southeast (Ahyong, 2014), an important centre of species diversity of dwarf group species is in the Gondwana Rainforests of southeastern Queensland and northeastern New South Wales. The Australian Crayfish Project (ACP), a volunteer-based initiative, has been actively surveying the parastacid fauna of these rainforests over the past two decades, documenting species diversity, distribution, and ecological traits.

An unusual dwarf group species of *Euastacus* was brought to our attention in February 2021 by a resident of Springbrook, Queensland. Initial fieldwork in collaboration with the resident resulted in the collection of several specimens. In the field, the species bore a superficial resemblance to *E. mirangudjin* Coughran, 2002, from the Logan River drainage to the west (McCormack, 2025; unpubl.). However, given its proximity to the known distributions of two other dwarf group species, *E. binzayedi* Coughran & Furse *in* Furse, Dawkins & Coughran, 2013 and *E. maidae* (Riek, 1956), the specimens were initially thought to possibly represent a morphological variant of one of these species. Subsequent laboratory examination of specimens revealed diagnostic morphological differences that precluded assignment to any known species. The specimens were thus catalogued in the ACP Parastacidae Collection as *Euastacus* sp. nov. 13.

Subsequent molecular analyses (Austin *et al*., 2022), together with consistent morphological differences, indicate that *Euastacus* sp. nov. 13 represents a distinct species from the uppermost reaches of the Nerang River catchment. We herein formally describe this species as new to science. bringing the total number of described species of *Euastacus* to 57.

Materials and methods

In the field, the presence of crayfish was assessed through direct and indirect methods, including: (a) visual identification of burrow entrances, (b) manual inspection beneath in-stream structures such as rocks and logs, (c) hand excavation of burrows, and (d) manual capture of specimens. Where feasible, burrows were carefully excavated to document structural characteristics, including orientation, complexity, and the presence of branch tunnels or chambers. Individuals were examined to determine sex, injury status, and wet weight. Weights were recorded to the nearest 0.01 g using digital scales. Sexual maturity of female crayfish was inferred from the development of setae around the gonopores and the condition of the gonopore itself following Turvey and Merrick (1997). The female gonopores of subadults have sparse setation and closed gonopores, rather than the dense setation and open gonopores of adults. Mature males were recognised by having inflated genital papillae with a soft, membranous aperture (Morgan, 1997).

Specimens were deposited in the collections of the Australian Crayfish Collection, Karuah (ACP), Australian Museum, Sydney (AM) and Queensland Museum, Kurilpa (QM). Tissue samples from live individuals were preserved in cell lysis buffer for DNA analysis as part of the Australian Crayfish Project's ongoing genetic research collaboration with the Carnegie Museum of Natural History (Pittsburgh, USA). Additional tissue samples were preserved in 100% ethanol and submitted to Deakin University (Geelong, Victoria, Australia) for a separate phylogenetic study conducted between 2020 and 2024.

Morphological terminology and size descriptors generally follow Morgan (1986, 1988, 1997), McCormack and Ahyong (2017), McCormack and Fetzner (2024) and McCormack (2025). Qualitative size descriptors of spines and other ornamentation follow those illustrated by Morgan (1997: fig. 3–5). All linear measurements are provided in millimetres (mm), and all weights in grams (g). The primary metric for size, post-orbital (occipital) carapace length (POCL), is measured from the posterior margin of the orbit to the dorsal posterior margin of the carapace. Carapace length (CL) is measured along the dorsal midline from the tip of the rostrum to the posterior margin of the carapace.

Gastric mill characters were assessed in three specimens ranging from 21.46–31.06 mm POCL (AM P111628, AM P111631, ACP6903).

Comparative material. *Euastacus binzayedi* Coughran & Furse *in* Furse, Dawkins & Coughran, 2013: AM P111616, male (POCL 31.33 mm), Noringalala Creek, Green Mountains Section, Lamington National Park, Queensland, 28.25°S, 153.18°E, 1102 m asl, small clear flowing rainforest stream, coll. R.B. McCormack & P. Van der Werf, 14 July 2013; AM P111618, male (POCL 38.96 mm), Barrabareen Creek crossing Cave Circuit, Binna Burra, National Park, Queensland, 28.20°S, 153.18°E, 679 m asl, small clear flowing stream, bedrock, rainforest spinach, coll. R.B. McCormack *et al*., 05 February 2015.

Euastacus maidae (Riek, 1956): AM P111625, female (POCL 29.86 mm), unnamed tributary Nerang River, Springbrook National Park, below Lyrebird Ridge Road, QLD, 28.20°S, 153.25°E, 673 m asl, seeping water at start catchment, boulders/pools/iron bacteria/forested, coll. R. McCormack, 28 November 2022; AM P12888, male holotype (POCL 24.60 mm), upper reaches of Currumbin Creek, southeast Queensland, rainforest, coll. E.F. Riek, 1 October 1953.

Euastacus mirangudjin Coughran, 2002, Iron Pot Creek, Toonumbar National Park, New South Wales, 28°28'30"S 152°45'E, 560 m asl, rainforest stream, coll. J. Coughran & B. Black, 6 September 2000: H, AM P61073, female paratype (POCL 29.83 mm); I, AM P61072, male holotype (POCL 34.59 mm).

Taxonomy

Order Decapoda Latreille, 1802

Family Parastacidae Huxley, 1878

Genus *Euastacus* Clark, 1936

Euastacus fetzneri sp. nov.

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Figs. 1–7, 9

Euastacus sp. nov. 13. — McCormack, 2025: 28, 39, fig. 4B.
Euastacus cf. *binzayedi.* — Austin et al. 2022: 17, 29, fig. 3-1, 3-4, table 3-2, A-1.

Type material. HOLOTYPE: QM W55156 (exACP6960), male (CL 37.32 mm, POCL 32.20 mm, 21.68 g), unnamed tributary of Cave Creek, below Repeater Station Road, Springbrook, Queensland, 28.24°S, 153.27°E, 940 m above sea level (asl), coll. R.B. McCormack, 28 November 2022.

PARATYPES: AM P111627 (exACP6609), female (POCL 28.38 mm, 14.82 g), tributary of Boy-Ull Creek, Springbrook, Queensland, 28.23°S, 153.27°E, 828 m asl, coll. R. McCormack & L. Adams, 3 February 2021. QM W55157 (exACP6610), female (POCL 24.32 mm, 9.37 g), tributary of Boy-Ull Creek, Springbrook, Queensland, 28.23°S, 153.27°E, 828 m asl, coll. R. McCormack & L. Adams, 3 February 2021. ACP6611, female (POCL 18.2 mm, 3.27 g), tributary Boy-Ull Creek, Queensland, 28.23°S, 153.27°E, 828 m asl, coll. R. McCormack & L. Adams, 3 February 2021. AM P111628 (exACP6612), female (POCL 31.06 mm, 16.95 g), tributary Boy-Ull Creek, Springbrook, Queensland, 28.23°S, 153.27°E, 819 m asl, coll. R. McCormack & L. Adams, 3 February 2021. ACP6613, female (POCL 31.22 mm, 15.41 g), tributary Boy-Ull Creek, Springbrook, Queensland, 28.23°S, 153.27°E, 828 m asl, coll. R. McCormack & L. Adams, 3 February 2021. ACP6900, male (POCL 16.41 mm, 2.38 g), tributary Boy-Ull Creek, Springbrook National Park, Queensland, 28.23°S, 153.28°E, 781 m asl, coll. R. McCormack, I. Wishart & P. Donatiu, 17 August 2022. ACP6901, male (POCL 23.32 mm, 7.25 g), tributary Boy-Ull Creek, Springbrook National Park, Queensland, 28.23°S, 153.28°E, 781 m asl, coll. R. McCormack, I. Wishart & P. Donatiu, 17 August 2022. AM P111629 (exACP6902), male (POCL 26.04 mm, 10.02 g), tributary Boy-Ull Creek, Springbrook, Queensland, 28.23°S, 153.28°E, 781 m asl, coll. R. McCormack & I. Wishart, P. Donatiu, 17 August 2022. ACP6903, male (POCL 27.14 mm, 10.07 g), tributary Boy-Ull Creek, Springbrook National Park, Queensland, 28.23°S, 153.28°E, 790 m asl, coll. R. McCormack, I. Wishart & P. Donatiu, 17 August 2022. AM P111630 (exACP6911), female (POCL 21.43 mm, 5.9 g), upper tributary Purling Brook below Lyrebird

Figure 1. Holotype male of Fetzner's Spiny Crayfish, *Euastacus fetzneri* sp. nov. (QM W55156), photographed in situ at Site 4, a groundwater-fed headwater tributary of the Nerang River in the Numinbah Valley, southeast Queensland.

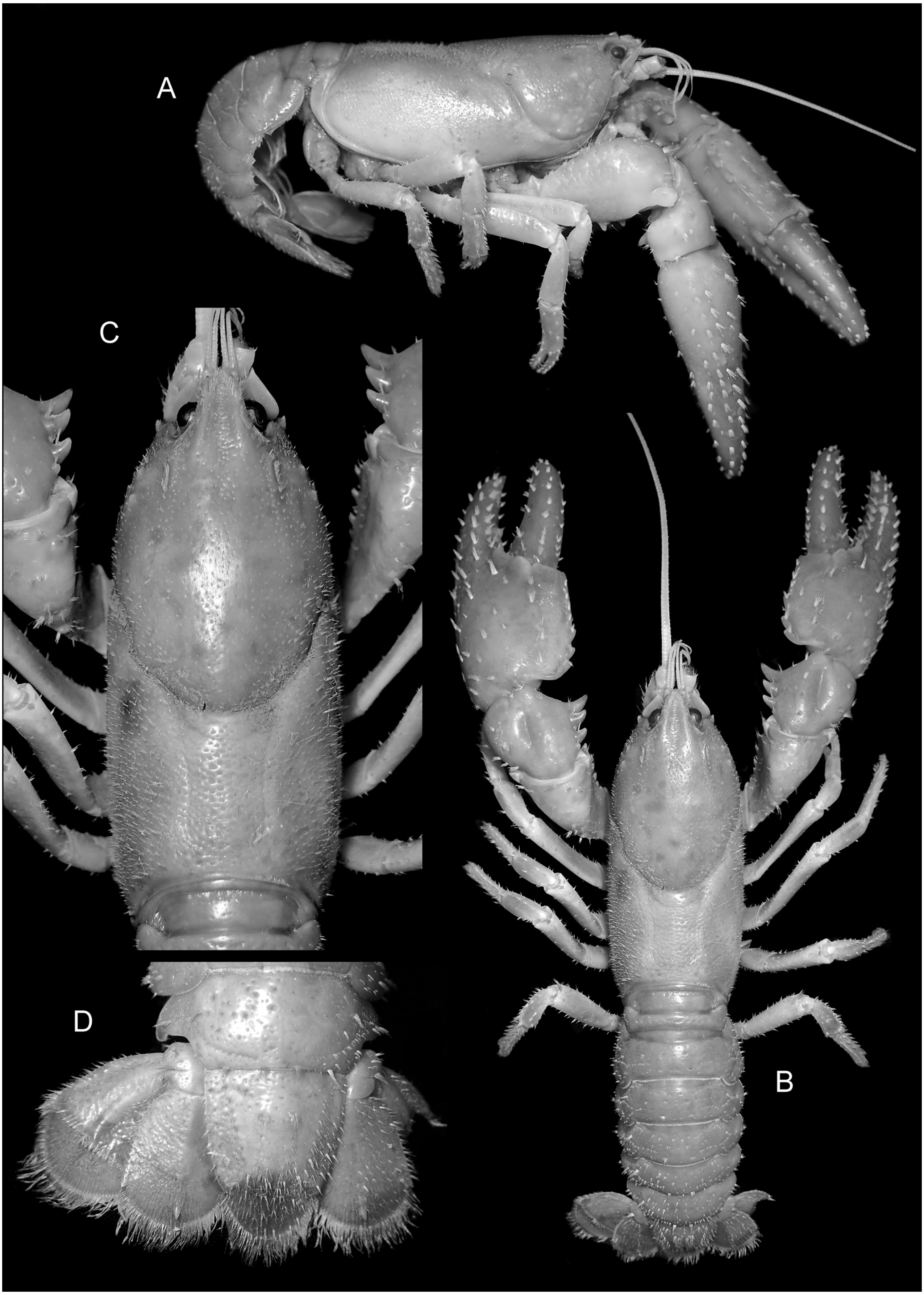

Figure 2. *Euastacus fetzneri* sp. nov., male holotype, POCL 32.20 mm, unnamed tributary of Cave Creek, Springbrook Queensland, QM W55156: A, right lateral habitus; B, dorsal habitus; C, cephalothorax, dorsal view; D, tailfan, dorsal view.

Ridge Road, Springbrook, Queensland, 28.21°S, 153.26°E, 650 m asl, coll. R. McCormack, I. Wishart & P. Donatiu, 17 August 2022. ACP6915, female (POCL 18.87 mm, 4.05 g), upper tributary Purling Brook below Lyrebird Ridge Road, Springbrook, Queensland, 28.21°S, 153.26°E, 659 m asl, coll. R. McCormack, I. Wishart & P. Donatiu, 17 August 2022. ACP6956, juvenile (POCL 10.68 mm, 0.61 g), unnamed tributary Cave Creek, below Repeater Station Road, Queensland, 28.24°S, 153.27°E, 933 m asl, coll. R.B. McCormack, 28 November 2022. ACP6958, juvenile (POCL 10.79 mm, 0.67 g), unnamed tributary Cave Creek, below Repeater Station Road, Springbrook, Queensland, 28.24°S, 153.27°E, 928 m asl, coll. R.B. McCormack, 28 November 2022. AM P111631 (exACP6961), male (POCL 21.46 mm, 5.74 g), unnamed tributary Cave Creek, below Repeater Station Road, Springbrook, Queensland, 28.24°S, 153.27°E, 941 m asl, coll. R.B. McCormack, 28 November 2022. AM P111632 (exACP6970), juvenile female (POCL 19.48 mm, 4.19 g), tributary Boy-Ull Creek below Springbrook Road, Springbrook Queensland, 28.23°S, 153.28°E, 782 m asl, coll. R.B. McCormack, 28 November 2022.

Other material examined. ACP6912, remnants of 1 individual, upper tributary Purling Brook below Lyrebird Ridge Road, Springbrook, Queensland, 28.21°S, 153.26°E, 650 m asl, coll. R. McCormack, I. Wishart, P. Donatiu, 17 August 2022.

Diagnosis. Male cuticle partition present. Rostrum short, reaching base to midlength of antennal article 3, lateral margins with 2–4 spines, extending beyond midlength of rostrum. Scaphocerite length twice width or less, widest near midlength. Carapace suborbital spine small and pointed; 3–6 cervical spines, barely discernible; thoracic spines absent. Abdomen with 0–2 very small blunt Li spines on somite 2, absent on other somites; Lii, D-L & D spines and abdominal boss absent. Telsonic and uropodal marginal spines absent. Cheliped 1 with 1 or 2 (usually 1) dorsal apical propodal spines and 0–1 apical spines above dorsal cutting edge, spines absent on ventral cutting edge; dactylar articulation spines present; dactylus with 1 or 2 (usually 1) apical spine above cutting edge (occasionally 1 extra spine above dorsal cutting edge on regenerating chelae), 1 apical mesial spine, basal spines absent; ventrolateral propodal spine row absent; carpus with 4 (rarely 3) mesial spines, proximal most distinctly smaller than others, blunt; large, sharp ventral spine; 1 (occasionally 2) ventromesial spines, reduced to low, rounded protrusion; lateral spines absent. TAP count 3.5–4.5.

Description. ***Rostrum***. Rostrum short reaching base to midlength of antennular peduncle article 3; lateral margins convergent, with 2–4 (usually 2 or 3) marginal spines, extending beyond midlength of rostrum; apical spine similar size to subapical spines, margins between spines setose; POCL/CL 0.84–0.87. Rostrum length 0.19–0.25 POCL, width 0.10–0.13 POCL. POCL 0.38–0.40 total body length.

Cephalothorax. Anterior cephalothorax poorly spinose; 1–2 small spines and numerous smaller blunt spines and protrusions ventral to post orbital ridges, spines coloured yellow. First post-orbital ridge spine small-medium and pointed. Second post-orbital ridge absent. Suborbital spine small and sharp. Dorsal thoracic spines absent; general tubercles small, densely distributed; 0–6 barely discernible cervical spines, setation moderate to heavy. Areola length 0.36–0.38 POCL. Areola width 0.16–0.19 POCL. Carapace width 0.49–0.56 POCL. Carapace depth 0.46–0.53 POCL. Epistome sparsely setose, anteriorly produced to form interantennal spine; interantennal spine sharply triangular, as long as wide in juveniles to 1.30× longer than wide in adults, margins straight to irregularly tuberculate.

Antennae. Scaphocerite unarmed laterally, lateral margin straight, widest at or slightly proximal to midlength, length 0.13–0.17 POCL, length 1.75–2.00 × width (narrowest in smaller specimens); interantennal spine sharply triangular, margins straight to irregular basipodite spine absent; coxopodite spine obtusely angular, bifid on one side in holotype.

Abdomen. Somite 2 with 0–1 small blunt Li spines (one specimen with 2 on one side). Lii, D-L & D spines absent. Dorsal boss absent. Female abdomen width/OCL 0.49–0.57. Male abdomen width/OCL 0.47–0.51 total length.

Tailfan. Telson and uropodal marginal spines absent; standard spines present. Telson length 0.32–0.35 POCL.

Pereopod 1 (first cheliped). Chelae moderately stout to elongate in shape, with 1 large prominent propodal tooth. *Dactylus*: with rows of large, long tuffs of setae; occlusal margin (cutting edge) with 1 or 2 apical spines above (occasionally 1 extra spine above occlusal margin (cutting edge) on regenerate chelae); 1 apical mesial dactylar spine; basal mesial marginal and marginal mesial basal spines absent; dactylar groove absent-weak; dactyl length / propodus length 0.50–0.57. *Propodus*: with rows of large, long tuffs of setae; ventrolateral spine row absent; dorsolateral spines starting just before midlength and continuing to apex of pollex, with 6–8 spines; 4 or 5 mesial spines (one specimen with 6 on one side); 1 dorsal apical spine; 0–1 apical spines above occlusal margin; occlusal margin with 1 large prominent tooth proximal to midlength; ventral spines absent along occlusal margin, dactylar articulation spines present; propodus length / POCL 0.86–0.99 (female), 0.82–1.07 (male); propodus width / propodus length 0.43–0.47 (female), 0.41–0.46 (male); propodus depth / propodus length 0.29–0.39 (female), 0.35–0.43 (male). *Carpus*: dorsal groove deep; usually 4 graded, mesial spines >20 mm POCL (rarely 3 in normal chelae, increasing in size proximal to distal; occasionally 3 in regenerate chelae and <25 mm POCL), distalmost spine offset ventrally and distinctly larger and sharper, proximal spine being poorly developed, much smaller than others, rounded, blunt; lateral spines absent or evident as pointed ridge at articulation; ventral spine large sharp, 1 or 2 small–medium ventromesial spines, reduced to low rounded lobe. *Merus*: with 4–8 small dorsal spines, first distal spines medium-sized, remainder very small to small and blunt; outer spine small to absent.

Maxilliped 3. Ischium distolateral corner produced to a distinct point; shaft of exopod reaching proximal to midlength of ischium, flagellum just overreaching ischium.

Thoracic sternal keel. Pr1 close and parallel; Pr2 slightly apart and slightly closed; Pr3, narrow, scoops absent; Pr4, very broad, anterior margin rounded, posterior margin convex.

Gastric mill. TAP count 3.5–4.5; TAA count 1.5; spread 2–3. Urocardiac ridges 5–6.

Male pereopod 5 coxa: cuticle partition present.

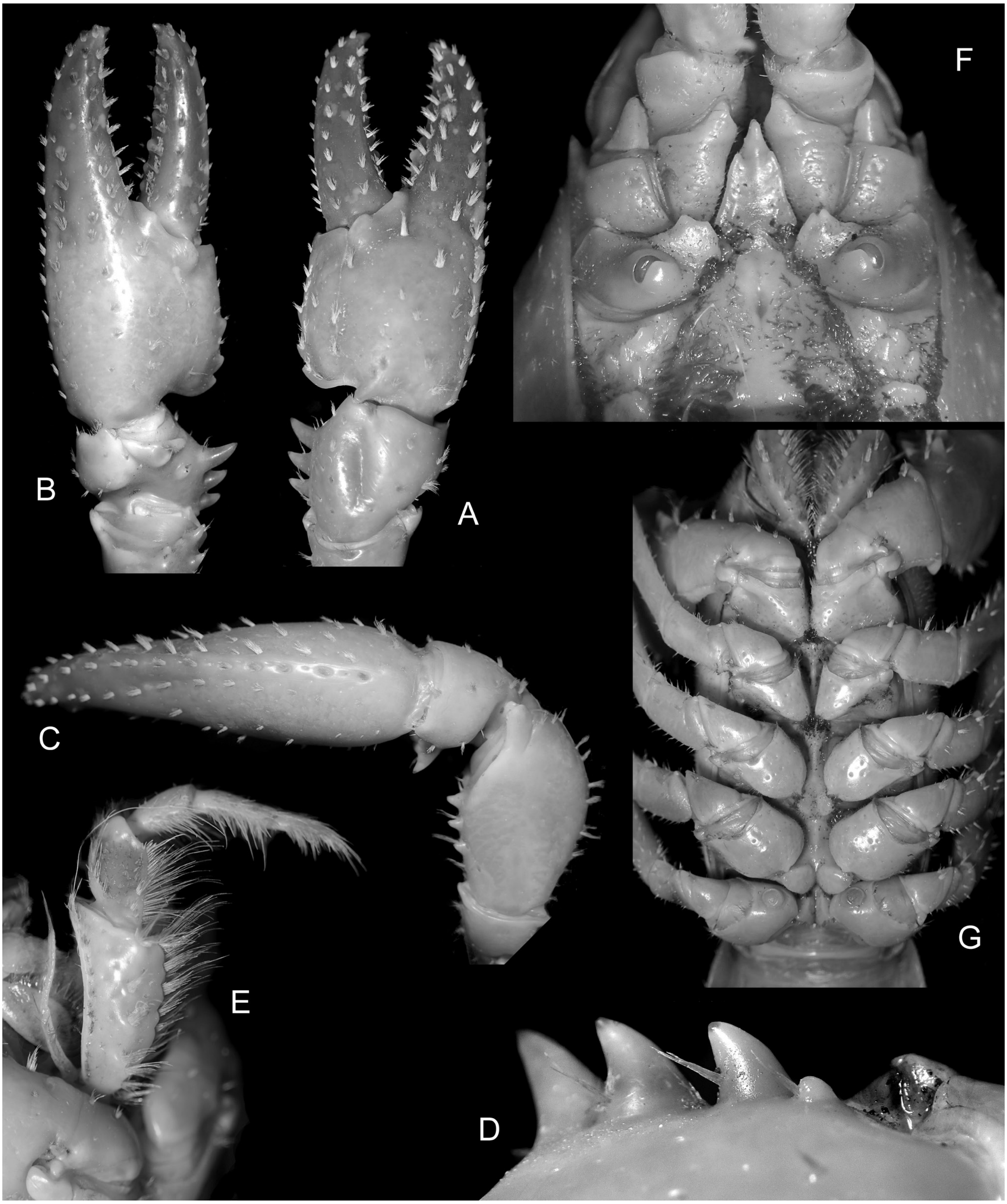

Figure 3. *Euastacus fetzneri* sp. nov., male holotype, POCL 32.20 mm, unnamed tributary of Cave Creek, Springbrook Queensland, QM W55156: A, right cheliped, dorsal view; B, right cheliped, ventral view; C, left cheliped, ventral view; D, left cheliped, mesial carpal spines, dorsal view; E, right maxilliped 3, lateral view; F, anterior cephalothorax, ventral view; G, thorax, ventral view.

Sexes. Of the 17 specimens examined, all apart from 2 indeterminate juveniles (ACP6956, 6958) were clearly differentiated as male or female; no intersex specimens were detected. Males appearing mature by about 25 mm POCL. Females mature >28 mm POCL. No ovigerous females documented to date.

Colouration. (Fig. 1, 6, 7A, 9D). Body dorsally brown. Anterior cephalothorax very dark brown dorsally, lightening to light brown-yellow laterally; dorsum posterior to cervical groove brown, lightening laterally; cervical and cephalic spines yellow-orange.

Abdomen dark-brown, telson lighter brown-orange.

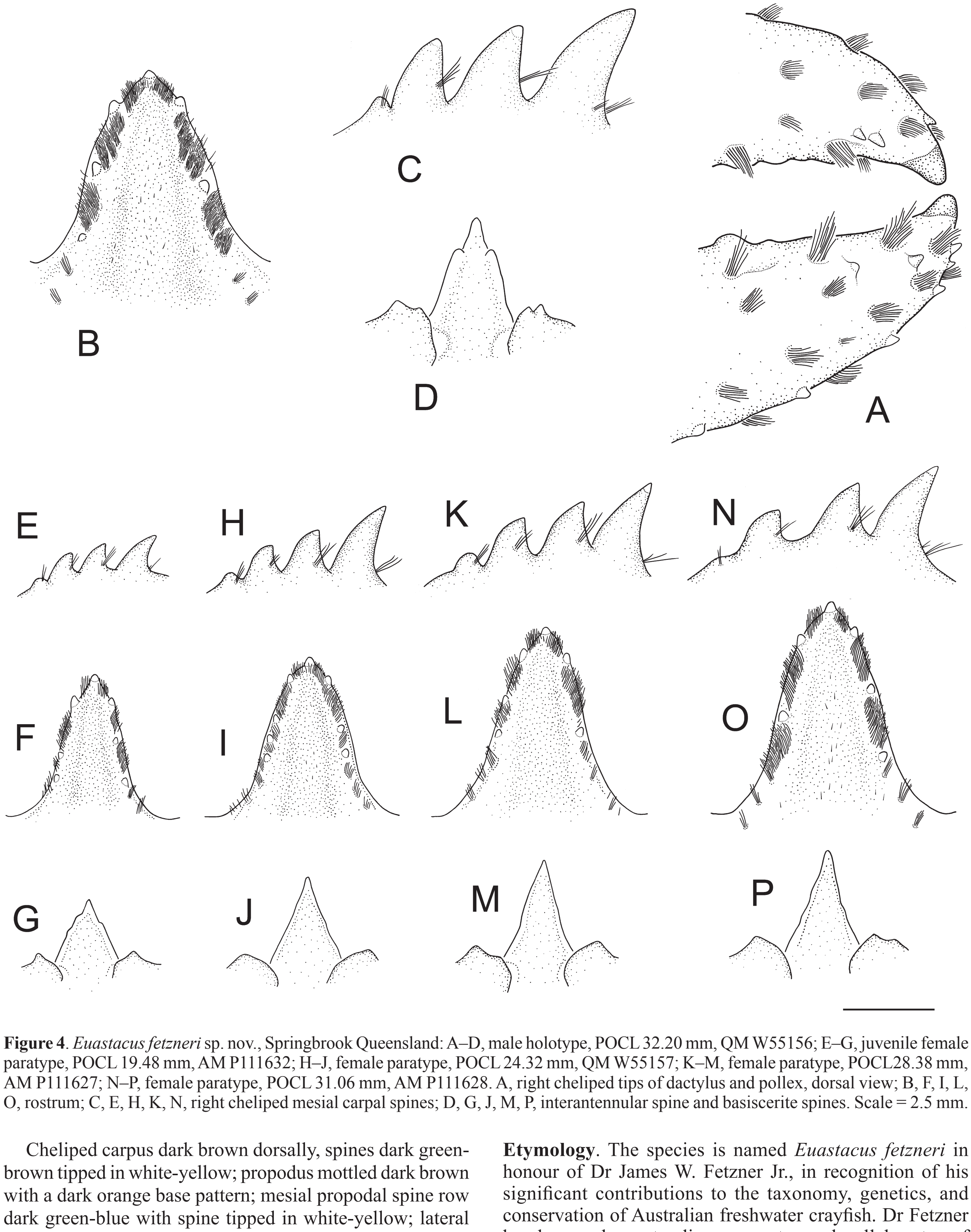

Figure 4. *Euastacus fetzneri* sp. nov., Springbrook Queensland: A–D, male holotype, POCL 32.20 mm, QM W55156; E–G, juvenile female paratype, POCL 19.48 mm, AM P111632; H–J, female paratype, POCL 24.32 mm, QM W55157; K–M, female paratype, POCL28.38 mm, AM P111627; N–P, female paratype, POCL 31.06 mm, AM P111628. A, right cheliped tips of dactylus and pollex, dorsal view; B, F, I, L, O, rostrum; C, E, H, K, N, right cheliped mesial carpal spines; D, G, J, M, P, interantennular spine and basiscerite spines. Scale = 2.5 mm.

Cheliped carpus dark brown dorsally, spines dark green-brown tipped in white-yellow; propodus mottled dark brown with a dark orange base pattern; mesial propodal spine row dark green-blue with spine tipped in white-yellow; lateral propodal spine ridge green-blue with spines tipped in yellow.

Ventral surface of body and chelipeds red-orange. (Note: this bright red-orange ventral colouration of *E. fetzneri* (Fig. 7A) is the signature colour that immediately distinguishes it from *E. maidae* (cream coloured; Fig. 7B) that can be found in sympatry or below its distribution.

Etymology. The species is named *Euastacus fetzneri* in honour of Dr James W. Fetzner Jr., in recognition of his significant contributions to the taxonomy, genetics, and conservation of Australian freshwater crayfish. Dr Fetzner has been a long-standing supporter and collaborator of the Australian Crayfish Project, and his work continues to advance our understanding of the Parastacidae. Common name: Fetzner's Spiny Crayfish.

Size. The largest specimen recorded is the male holotype (QM W55156, POCL 32.20 mm, 21.68 g), from an unnamed

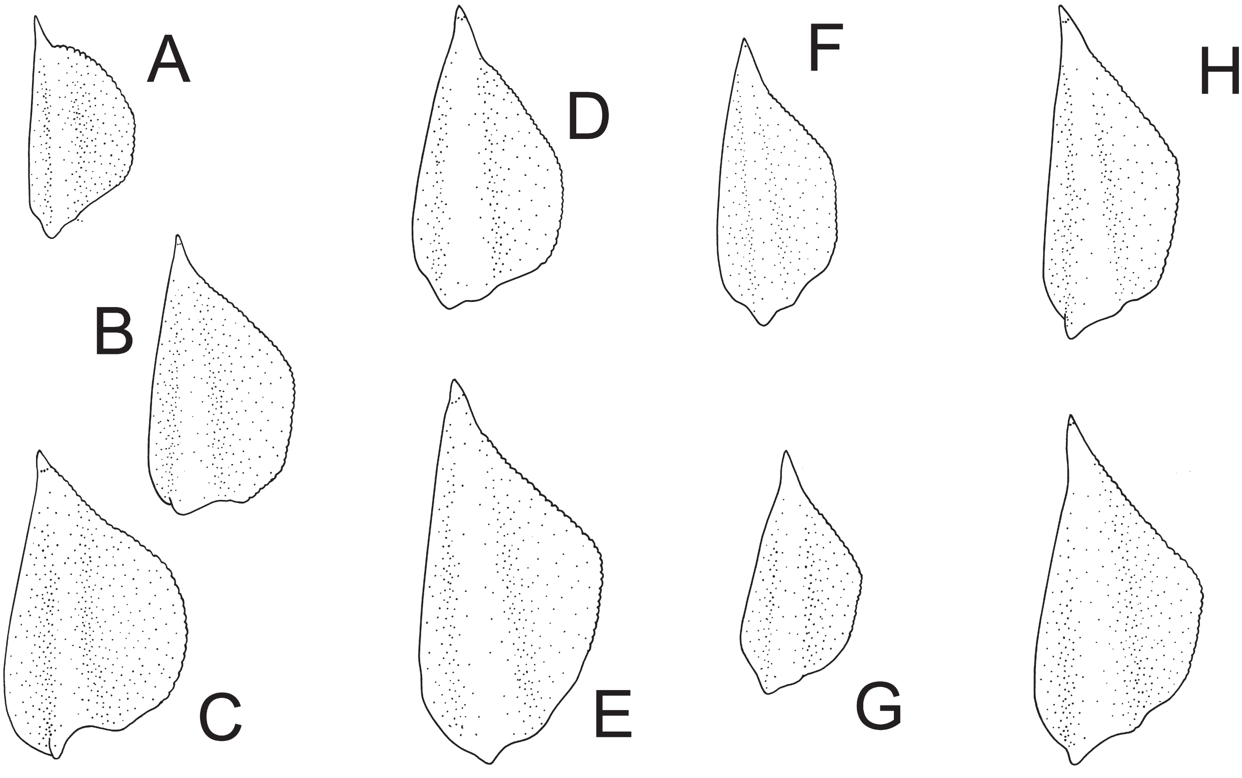

Figure 5. Right scaphocerite, ventral view. *Euastacus fetzneri* sp. nov.: A, juvenile female paratype, POCL 19.48 mm, AM P111632 (ACP6970); B, female paratype, POCL 28.38 mm, AM P111627; C, male holotype, POCL 32.20 mm, QM W55156. *Euastacus binzayedi* Coughran & Furse *in* Furse, Dawkins & Coughran, 2013: D, male, POCL 31.33 mm, AM P111616; E, male, POCL 38.96 mm, AM P111618. *Euastacus maidae* (Riek, 1956): F, female, POCL 29.86 mm, AM P111625; G, male holotype, POCL 24.60 mm, AM P12888. *Euastacus mirangudjin* Coughran, 2002: H, female paratype, POCL 29.83 mm, AM P61073; I, male holotype, POCL 34.59 mm, AM P61072. Scale = 2.5 mm.

tributary of Cave Creek, Springbrook. The largest recorded female (ACP6613, 31.22 mm POCL, 15.41 g) was collected from a tributary of Boy-Ull Creek, below Repeater Station Road, Springbrook.

Remarks. *Euastacus fetzneri* sp. nov. clearly belongs to the dwarf group, being of small size, having minimal body ornamentation, and lacking white abdominal bands in juveniles. The upper Nerang River and adjacent drainages form part of a known hotspot for dwarf *Euastacus*, with ten other dwarf species occurring in the immediate region: the Narrow Crayfish *Euastacus angustus* Coughran & Dawkins *in* Furse, Dawkins & Coughran, 2013, Embezee's Crayfish *Euastacus binzayedi* Coughran & Furse *in* Furse, Dawkins & Coughran, 2013, the Mud Gully Crayfish *Euastacus dalagarbe* Coughran, 2005, the Smooth Crayfish *Euastacus girurmulayn* Coughran, 2005, the Swollen Crayfish *Euastacus guruhgi* Coughran, 2005, the Blue-black Crayfish *Euastacus jagabar* Coughran, 2005, the Jagara Hairy Crayfish *Euastacus jagara* Morgan, 1988, the Hinterland Crayfish *Euastacus maidae* (Riek, 1956), the Orange-bellied Crayfish *Euastacus mirangudjin* Coughran, 2002, and Van der Werf's Crayfish *Euastacus vanderwerfi* McCormack, 2025. Morphological and genetic comparisons indicate that *E. fetzneri* is closely allied to a cluster of members of the dwarf group, *E. binzayedi* in particular.

Euastacus fetzneri is morphologically and genetically most similar to *E. binzayedi*, differing in spination of the major cheliped carpus and in the slenderness of the antennal scaphocerite. Four (rarely three) mesial carpal spines are present in *E. fetzneri*, compared with always three in *E. binzayedi*. In *E. fetzneri*, the proximal most (fourth) mesial carpal spine is markedly smaller than the other spines, being small and rounded. Whereas the distal three mesial carpal spines are always prominent and distinct, the fourth spine is usually undeveloped in specimens smaller than 20 mm POCL. In larger specimens, the proximal spine is occasionally absent or present only as an incipient swelling, usually only on one side, and often but not always associated with a regenerating cheliped.

The proportions of the antennal scaphocerite vary allometrically in *Euastacus*, becoming proportionally wider with increasing body size. In *E. fetzneri* and *E. binzayedi*, the scaphocerite length:width proportions are similar up to about 30 mm POCL, but above this size, those of *E. fetzneri* are distinctly less than twice as long as wide (~1.8), versus distinctly more than twice as long as wide (~2.2). The two species occur in relatively close proximity but are not known to be sympatric, with *E. fetzneri* and *E. binzayedi* occurring to the east and west of the Nerang River, respectively. Although most similar to *E. binzayedi* and to a lesser extent, *E. mirangudjin*, *E. fetzneri* can be readily distinguished from these and other morphologically similar species by a unique combination of characters, particularly in the spination of the cheliped carpus, propodus, and dactylus. These diagnostic differences are summarised in Table 1.

Euastacus maidae and *E. fetzneri* can be sympatric and are similar in overall size, shape, and dorsal coloration.

Figure 6. *Euastacus fetzneri* sp. nov., male paratype, POCL 26.04 mm, tributary Boy-Ull Creek, Springbrook, Queensland, AM **P111629** (ACP 6902). A, dorsal view; B, ventral view.

However, they are easily distinguished in the field by their ventral colouration. In *E. maidae*, the ventral surface of the body is cream-coloured, with the cheliped fingers varying from pale to bright blue and pereopods 2–5 often exhibiting a light blue hue (Fig. 7B). In contrast, *E. fetzneri* displays a distinctly red to orange ventral colouration across the cephalothorax and abdomen, with reddish-orange extending onto the chelipeds and pereopods 2–5 (Fig. 6, 7A). This red/orange versus cream/blue ventral colouration serves as the most immediate means of distinguishing these two dwarf-group species in the field. Morphologically, *E. fetzneri* differs from *E. maidae* in the presence of a sharp, well-developed

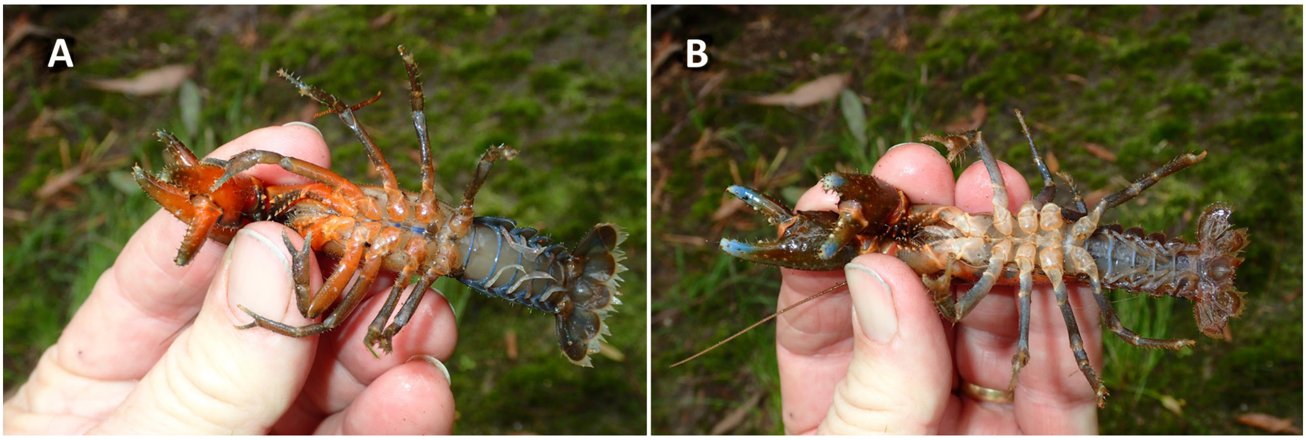

Figure 7. Ventral colouration: A, *Euastacus fetzneri* sp. nov., male paratype, POCL 27.14 mm, Little Nerang Creek, Springbrook (ACP6903); B, *Euastacus maidae* (Riek, 1956), male POCL 29.7 mm, Little Nerang Creek, Springbrook (ACP6905).

ventral carpal spine (versus at most low, blunt in *E. maidae*), the mesial ventral carpal spine is reduced to a low blunt lobe (versus sharp, prominent in *E. maidae*), and a proportionally wider antennal scaphocerite, with length less than twice width in adults (versus distinctly exceeding twice width in *E. maidae*).

Phylogenetic relationships. Comprehensive multigene molecular phylogenetic assessment of *Euastacus* (Austin *et al*., 2022) encompassed all described species up to that point, as well as several undescribed or putative taxa. Crucially, the study provided the first molecular coverage for all dwarf-group species of *Euastacus* occurring within the Gondwana Rainforests of south-eastern Queensland and north-eastern New South Wales, addressing major historical gaps in the genetic database of the genus. Prior to this work, no COI sequence data were available for several morphologically similar and taxonomically challenging taxa, including *E. guruhgi*, *E. girurmulayn*, *E. jagabar*, *E. maidae* (from New South Wales), and *E. mirangudjin* (from Queensland), all of which are morphologically very similar and difficult to identify in the field.

Two type specimens of *Euastacus fetzneri* (QM W55157 and ACP6611; Repeater Station Road, Springbrook, Queensland) were analysed by Austin *et al*. (2022) as *E.* cf. *binzayedi* (CA147 and CA148). These specimens formed a well-supported and genetically distinct lineage as sister to *E. binzayedi* (Fig. 8), with a mean uncorrected pairwise divergence of 3.7% in COI (range: 3.6–3.8%). This level of divergence is consistent with interspecific differentiation among dwarf-group *Euastacus* and exceeds typical intraspecific values reported for the genus (Austin *et al*., 2022).

In addition to their molecular distinctiveness, *E. fetzneri* is geographically separate from all known populations of *E. binzayedi*, occurring east of the latter within the South Coast Basin of south-eastern Queensland. This spatial separation, when considered alongside consistent genetic divergence, supports long-term isolation and an independent evolutionary history.

Based on combined molecular, geographic, and morphological evidence, *E. fetzneri* is most closely allied to *E. binzayedi*, which occurs in neighbouring western drainages. However, consistent genetic divergence, geographic isolation, and the presence of diagnostic morphological characters collectively support its recognition as a distinct species, sister to but clearly separable from *E. binzayedi*.

Distribution and habitat. Southeastern Queensland represents a biodiversity hotspot for dwarf-group *Euastacus*. To the west, *E. binzayedi* occurs across three drainage basins: the Nerang, Coomera, and Albert Rivers (McCormack, Van der Werf & Ahyong, unpubl.). Further west, *E. vanderwerfi* McCormack, 2025 inhabits the Logan River basin, followed by *E. dalagarbe* Coughran, 2005, and then *E. mirangudjin*, which also occurs in the Logan River drainage (McCormack, unpubl.).

In the extreme upper catchments of its range, *Euastacus fetzneri* is confined to groundwater-fed headwater streams and occurs only within the first ~70 m downstream of groundwater emergence points where subsurface flow reaches the surface and forms a permanent stream (Fig. 9). Within this narrow zone, *E. fetzneri* may occur in sympatry with the dwarf-group species *Euastacus maidae* and the larger *Euastacus sulcatus*. Beyond this short groundwater-influenced reach, *E. fetzneri* is absent, and only *E. maidae* and *E. sulcatus* persist in downstream sections of the stream.

Euastacus fetzneri is known from only four adjacent localities in the Springbrook region of southeastern Queensland, at elevations ranging from 650 to 941 m asl (Fig. 10). This extraordinarily narrow distribution makes it the most range-restricted freshwater crayfish documented globally. Despite extensive surveys at over 100 nearby sites, *E. fetzneri* has not been detected outside these four headwater locations.

The entire known distribution is confined to the uppermost reaches of groundwater-fed first-order streams, with individuals recorded no more than 70 m downstream of the primary groundwater emergence points. These streams are typically very small (0.2–1.0 m wide) and shallow (<20 mm deep). The species exhibits a highly localized and consistent occupancy pattern, strongly indicating an obligate dependence on cool, thermally stable, and permanently saturated microhabitats. Its persistence appears contingent upon uninterrupted subterranean hydrological input, highlighting its extreme ecological specialization and acute vulnerability to hydrological disturbance.

Although *E. fetzneri* occurs across a range of vegetation types (Fig. 9), vegetation composition and canopy cover

Table 1. Selected morphological differences between *Euastacus fetzneri* and close relatives.

Morphological characters	*E. fetzneri*	*E. maidae*	*E. binzayedi*	*E. mirangudjin*
Cheliped mesial carpal spines	3 or 4 (usually 4)	3 or 4 (usually 4)	3	3 or 4
Cheliped ventral carpal spine	1 large, prominent, sharp	1 small-tiny, blunt, rounded	1 large, prominent, sharp	1 large, prominent, sharp
Cheliped ventromesial carpal spine	1 or 2 small, blunt, rounded	2–4 large, sharp	1 small, blunt, rounded	1 large, sharp
Cheliped spines above propodal cutting edge	0 or 1	0	1	4–7
Cheliped dorsal apical propodal spines	1	1 or 2	1	3 or 4
Cheliped apical mesial dactylar spines	1 or 2	1 or 2	1	1
Cheliped spine above dactylar cutting edge	1 or 2 apical	1 apical	1	Row of 3 or 4
Cheliped dactylar basal spines	0	0	0 or 1	0
Scaphocerite length/width	1.79–2.02	2.29–2.41	2.05–2.18	2.26–2.57

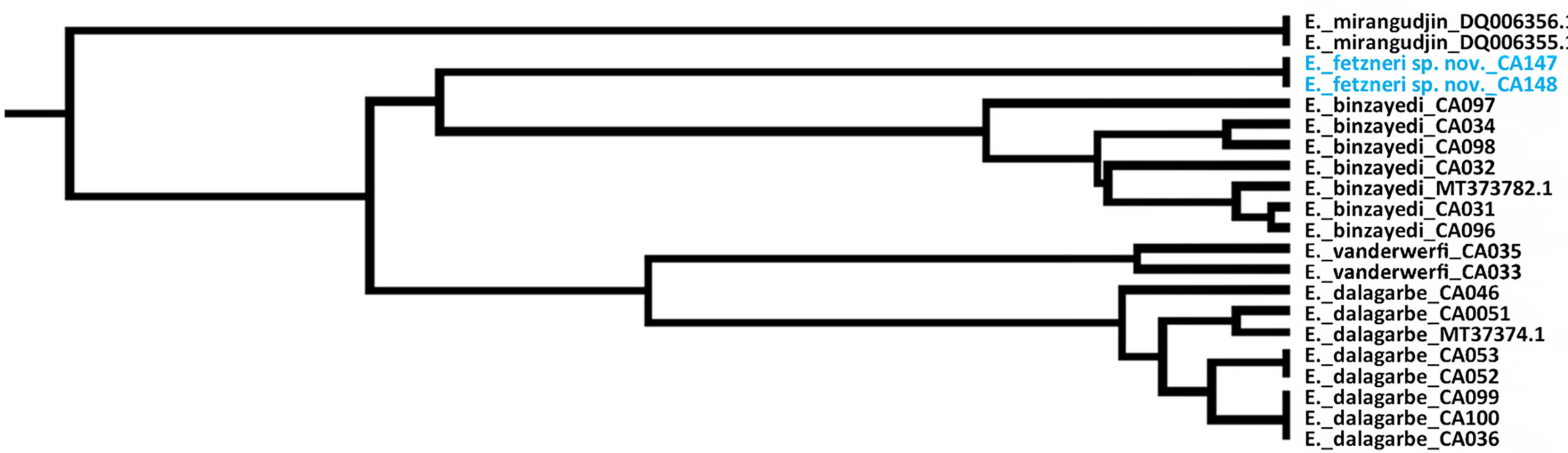

Figure 8. Phylogenetic placement of *E. fetzneri* sp. nov. relative to *E. binzayedi* Coughran & Furse *in* Furse, Dawkins & Coughran, 2013, *E. vanderwerfi* McCormack, 2025, *E. dalagarbe* Coughran, 2005 and *E. mirangudjin* Coughran, 2002, based on COI dataset (modified after Austin *et al*., 2022: fig. 3-4).

Figure 9. Habitat vegetation types of *Euastacus fetzneri* sp. nov.: A, Bangalow palm forest (*Archontophoenix cunninghamiana* (H. Wendland)), Site 2; B, cunjevoi grove (*Alocasia brisbanensis* (F.M. Bailey)), Site 3; C, stream lily (*Helmholtzia glaberrima* (Hooker)) habitat, Site 4; D, male paratype of *Euastacus fetzneri* sp. nov., male paratype (POCL 26.04 mm), AM P111629 in situ Site 2. All sites are located in the upper Nerang River catchment, southeast Queensland.

do not appear to influence its distribution. Instead, habitat suitability is primarily governed by the presence of shallow, slow-flowing groundwater over bedrock substrates, typically overlain by cobble, gravel, or fine sediments.

Below the distributional range of *E. fetzneri* between approximately 300 and 650 m elevation, stream communities are dominated by *Euastacus maidae* and *Euastacus sulcatus*. At elevations below 300 m, additional crayfish taxa occupy these lower reaches, including *E. valentulus* and an undescribed species of *Cherax,* which occur in sympatry with *E. maidae* and *E. sulcatus*.

Burrows. *Euastacus fetzneri* constructs Type 1b burrows (Horwitz & Richardson, 1986), which are directly connected to shallow surface water or shallow subsurface flows. Specimens of *E. fetzneri* were collected by turning over rocks and excavating burrows located both within the stream bed and in swampy areas adjacent to the stream margins. Burrow structure varied depending on the crayfish's position along the stream, underlying geology, and the size or maturity of the individual constructing the burrow.

Burrows typically had one or two entrances and were built in relatively shallow substrates, where groundwater percolated over bedrock and through a thin overlying layer (<1 m) composed of gravel, sand, silt, cobbles, or organic detritus. All burrows contained actively flowing water and were saturated year-round due to their position in groundwater seepage zones at the stream headwaters.

Site descriptions

Site 1 (823 m asl) — Located on private property in the upper reaches of the Little Nerang Creek (West Branch), this steep headwater forested site features minimal surface water, with groundwater trickling beneath rocks and through leaf litter. Specimens of *E. fetzneri* were collected over a 6 m section downstream of the seepage point. No other crayfish species were present.

Site 2 (781–790 m asl) — A shaded, narrow, clear-flowing rainforest stream located within Springbrook National Park. Groundwater emerges from a spring on the mountainside, with *E. fetzneri* collected over a 70 m section downstream from the origin. This is one of two sites where *E. fetzneri, E. maidae* and *E. sulcatus* were found in sympatry (Fig. 9A, D). Beyond the 70 m section only *E. maidae* and *E. sulcatus* were found.

Site 3 (650–659 m asl) — Situated on private land in semi-rainforest, this site is characterised by vegetation including cunjevoi (*Alocasia brisbanensis*) and stinging tree (*Dendrocnide excelsa*) (Fig. 9B). *E. fetzneri* occurred along a 50 m groundwater-fed stream segment and was found in sympatry with both *E. sulcatus* and *E. maidae*.

Site 4 (928–941 m asl) — Located in the Numinbah Valley within a tributary of the Nerang River, this high-elevation rainforest creek consists of

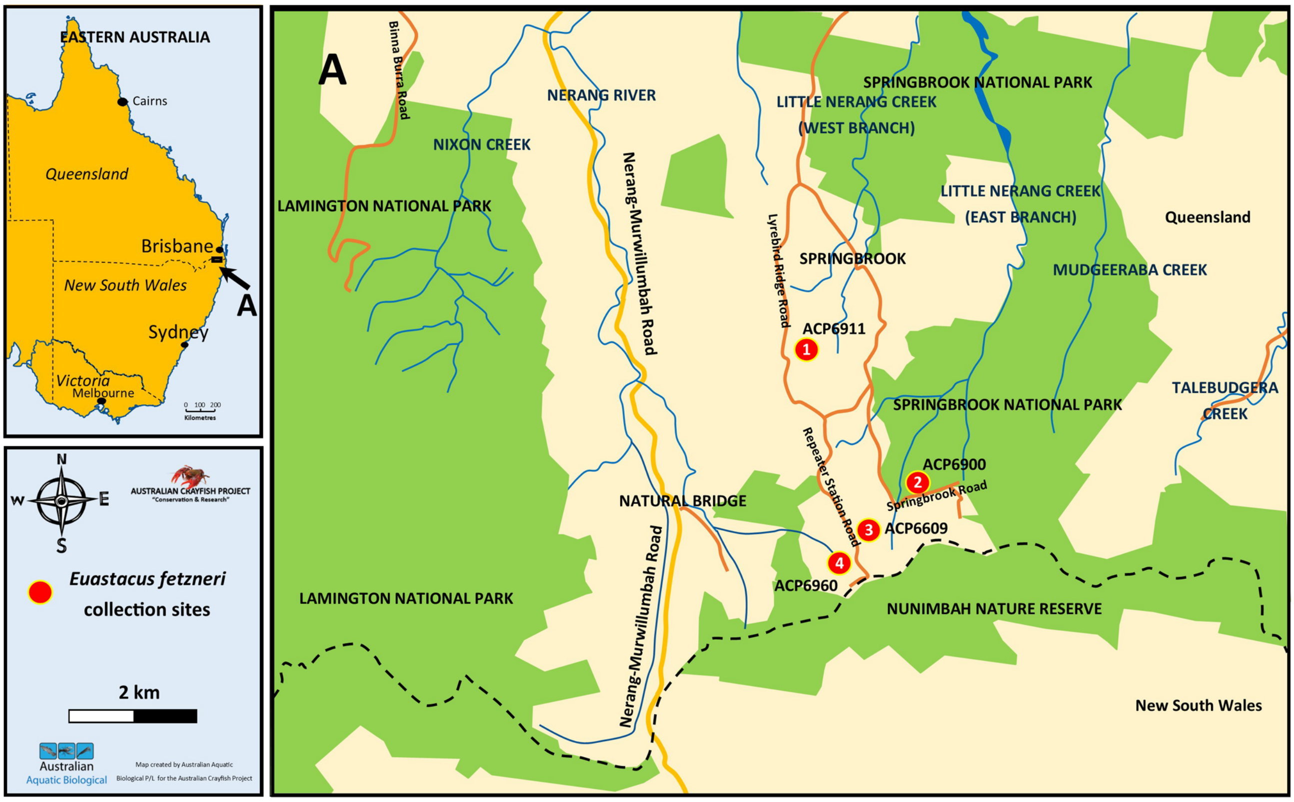

Figure 10. Known distribution of *Euastacus fetzneri* sp. nov. in 2026. Site 1 is an uppermost tributary Little Nerang Creek (West branch). Sites 2 & 3 are uppermost tributaries of Little Nerang Creek (East branch). Site 4 is a tributary of the Nerang River.

large boulders, shallow gravel pools, and flowing water beneath rocks. The stream is lined with *Helmholtzia glaberrima* (stream lily) and hosts both *E. fetzneri* and *E. sulcatus* over a 50 m section (Fig. 9C).

To date, *E. fetzneri* remains known from only these four isolated, microhabitat-specific locations, making it the most range-restricted freshwater crayfish species globally. Further research may identify additional sites, but the current data indicate an extremely narrow distribution highly susceptible to localised threats.

Ectosymbiotic fauna. *Euastacus fetzneri* hosts temnocephalan flatworms (Platyhelminthes: Turbellaria), which are commonly associated with freshwater decapods, particularly parastacid crayfish (Sewell *et al*., 2006; Sewell, 2013; Hoyal-Cuthill *et al*., 2016; Sibraa *et al*., 2021). Two temnocephalan genera were recorded: *Temnosewellia* (small white forms with five anterior tentacles and present in small numbers) and *Temnohaswellia* (even smaller white forms with six anterior tentacles and observed in much higher numbers). Interestingly, some crayfish exhibited very clean exoskeletons and did not display any commensals, possibly as a result of recent moulting. The species of temnocephalans on *E. fetzneri* have not yet been identified but Hoyal Cuthill *et al.* (2016) recorded *Temnosewellia bacrioniculus* from *E. maidae*.

In addition to temnocephalans, colonies of ectocommensal phreodrilid oligochaetes, are typically found living on the external surfaces of *Euastacus* (McCormack & Van der Werf, 2013; McCormack, 2015; McCormack & Ahyong, 2017; Pinder & Brinkhurst, 1997; McCormack & Whiterod, 2024a, 2024b; McCormack, 2025), often residing within grooves and recesses. The sympatric *E. maidae* is known to host phreodrilid (McCormack & Ahyong, unpubl.), but none were recorded on any specimens of *E. fetzneri* in this study.

Population estimates. Population estimates for *E. fetzneri* remain speculative and should be regarded as informed approximations based on intensive field observations. Key factors influencing these estimates include the extent of available habitat, ease of specimen capture, the number of observed active burrows, and the relative abundance of sympatric species. Estimates are provided as the number of larger individuals (>16 mm POCL) per linear metre (lm) of stream channel. Juveniles and sub-adults have been excluded due to seasonal variability in abundance.

Across all four known sites, population density was consistently estimated at 2–4 individuals per linear metre. Assuming an average density of 3 individuals per metre and a maximum occupied habitat length of 70 metres per site, this equates to approximately 210 mature individuals per site. With only four confirmed sites, the total known population of *E. fetzneri* is estimated at fewer than 1,000 individuals. This exceptionally small population size reinforces its status as the most range- and population-restricted freshwater crayfish currently known globally.

Threats and conservation status. *Euastacus fetzneri* is an extremely range-restricted, groundwater-dependent freshwater crayfish currently known from only four discrete seepage-fed headwater sites within the Springbrook region of southeast Queensland. Three of these sites occur entirely on private land with no formal conservation protection, while only a single site lies within the boundary of Springbrook National Park. Critically, the entire contributing catchments and groundwater recharge zones for all known populations lie predominantly outside protected areas and remain subject to anthropogenic land-use pressures.

Within the Nerang River drainage, surveys at 198 sites across the 319 km² catchment failed to detect *E. fetzneri*. Despite additional survey effort in the adjacent Mudgeeraba Creek drainage (108 sites), Tallebudgera Creek (54 sites), Currumbin Creek (89 sites), and the nearby Tweed River drainage (510 survey sites across a 950 km² catchment), *E. fetzneri* was detected only at four closely spaced headwater sites in the upper Nerang River catchment, giving an estimated Extent of Occurrence (EOO) of only 12 km². *Euastacus fetzneri* exhibits exceptional microhabitat fidelity, occupying permanently saturated groundwater emergence zones and occurring no more than 70 m downstream from seepage points. Despite these intensive catchment-wide surveys, *E. fetzneri* has not been detected elsewhere. This extreme ecological specialisation of *E. fetzneri*, combined with its minute distribution and reliance on shallow groundwater systems, renders the species highly vulnerable to a small number of interacting threats that affect groundwater temperature, quantity, and hydrological stability.

Climate change – increasing temperature. *Euastacus fetzneri* displays a strict dependence on cool, thermally stable groundwater seepage environments. Recorded water temperatures at known sites range from 11.8–14.6°C, with minimal seasonal variability. These habitats are characterised by shallow groundwater emergence (approximately 0–15 m depth), where thermal buffering is limited and water temperatures closely track ambient air temperatures.

Climate change therefore represents a severe and ongoing threat. Global climate models indicate a near 100% probability that most years between 2019 and 2028 will rank among the ten warmest years on record (Arguez *et al.*, 2020). Regional climate projections for southeast Queensland consistently forecast increasing mean and maximum temperatures, reduced annual rainfall, and increased frequency of heatwaves and extreme fire weather (Pearce *et al*., 2007; Williams *et al*., 2009; Steffen *et al*., 2014; IPCC 2021).

Observed climate trends confirm that warming is already occurring within the species' range. At Springbrook, mean temperatures increased by approximately 1.0°C and maximum temperatures by 1.5°C between 1950 and 2003 (ANU, 2009; Williams *et al*., 2009). This demonstrates that climate-driven thermal stress is not a future risk but an active, ongoing process.

Given its obligate reliance on shallow groundwater discharge and absence of access to deeper, cooler refugia, *E. fetzneri* is unable to buffer or escape rising temperatures through behavioural or spatial shifts. Comparable cold-adapted species of *Euastacus* have exhibited strong negative responses to warming, including range contraction and population loss (Richman *et al*., 2015; McCormack & Whiterod, 2024a). Even modest increases in groundwater temperature may therefore exceed physiological tolerance limits, leading to reduced survivorship, localised extirpation, or complete loss of suitable habitat.

Climate change – drought. Drought is a recurrent feature of eastern Australia and represents one of the most significant threats to freshwater-dependent fauna. *Euastacus fetzneri* is an obligate groundwater-dependent species, restricted to four permanently saturated seepage zones sustained by continuous shallow subsurface flow. The persistence of these microhabitats is contingent on effective groundwater recharge driven primarily by rainfall infiltration.

Prolonged drought substantially reduces groundwater recharge by limiting rainfall inputs, lowering water tables, and diminishing discharge at groundwater emergence points. Long-term climate records indicate a decline in total annual rainfall of approximately 75.8 mm between 1950 and 2003 across the Gondwana Rainforests World Heritage Area (Pearce *et al*., 2007; ANU, 2009). Climate projections for southeast Queensland further indicate increasing frequency and severity of drought, declining cool-season rainfall, and higher evaporative demand associated with rising temperatures (Pearce *et al*., 2007; Steffen *et al*., 2014; IPCC, 2021).

For *E. fetzneri*, even minor reductions in groundwater discharge may result in contraction or complete loss of suitable habitat, given the species' extreme spatial confinement and lack of dispersal opportunity. Similar groundwater-dependent dwarf-group *Euastacus* species have experienced upstream extirpations during prolonged droughts, most notably *E. spinichelatus*, which disappeared from its headwater habitats during the 2017–2019 drought (McCormack & Whiterod, 2024b).

Drought impacts may be further compounded by interactions with bushfire. Post-fire hydrological responses frequently include increased surface runoff, soil hydrophobicity, erosion, and reduced infiltration, thereby limiting groundwater recharge even during subsequent rainfall events (Shakesby & Doerr, 2006; Certini, 2005). These interactions may prolong drought effects on groundwater-dependent ecosystems well beyond the duration of the meteorological drought itself.

Although no direct evidence of past drought-driven population decline has been recorded at sites at which *Euastacus fetzneri* occurs, the species' obligate reliance on continuous groundwater input, extremely restricted distribution and small population size, together with projected increases in drought frequency and severity, indicate a high level of future vulnerability.

Bushfire. Bushfire is a natural component of eastern Australian landscapes; however, it is fire intensity rather than frequency that poses the primary threat to freshwater crayfish. Low- to moderate-intensity fires typically have minimal direct impacts on crayfish populations, particularly where riparian vegetation, soil structure, and subsurface refugia remain intact. In contrast, high-intensity fires have caused severe population declines and local extirpations in several high-altitude, cool-water species of *Euastacus* (McCormack, 2015; McCormack & Whiterod, 2024a,b).

During the 2019–2020 megafire event, only a small proportion of Gondwana Rainforest within Springbrook National Park was impacted, and post-fire surveys detected no observable impacts on *E. fetzneri* habitat or presence (Hines *et al*., 2020; DAWE, 2020). However, only one of the four known sites occurs within the national park estate, with the remaining sites located on adjacent private land that may be more vulnerable to future high-intensity fire.

Climate change is projected to substantially increase bushfire risk through rising temperatures, prolonged drought, and more extreme fire weather (Williams *et al*., 2009; Legge *et al*., 2022; Ensbey *et al*., 2023). High-intensity fire poses a significant future threat primarily through indirect mechanisms, including post-fire hydrological disruption. Increased runoff, soil hydrophobicity, sedimentation, and reduced infiltration can substantially diminish groundwater recharge, potentially eliminating seepage-fed habitats critical to *E. fetzneri*. Given the species' confinement to shallow Type 1b burrow systems (Horwitz & Richardson, 1986), such hydrological changes could rapidly precipitate local extirpation.

Anthropogenic hydrological change. Approximately 75% of the known distribution of *Euastacus fetzneri* occurs outside the protected area estate, and the entire contributing catchments and groundwater recharge zones for all known sites lie predominantly on private land. Consequently, the species is exposed to anthropogenic land-use changes that have the potential to alter local hydrology.

Activities such as vegetation clearance, soil compaction, construction of farm dams, diversion of surface runoff, drainage installation, road construction, and infrastructure development can reduce infiltration and redirect rainfall away from groundwater recharge pathways (Allan, 2004; Boulton *et al*., 2014). Given the extremely small size of the contributing catchments, even minor hydrological modifications may significantly reduce groundwater discharge at seepage points, degrading or eliminating permanently saturated microhabitats.

Due to its extreme range restriction, lack of dispersal capacity, and obligate dependence on shallow groundwater flow, anthropogenic hydrological alteration represents a significant current and ongoing threat, particularly where it acts synergistically with climate change-driven drought and warming.

Water extraction and groundwater mining. Groundwater extraction for agricultural, domestic, or commercial purposes represents a high-severity threat to *Euastacus fetzneri*. The species is confined to headwater seepage systems sustained by small, finite groundwater flows that are highly sensitive to drawdown and reduced recharge.

Euastacus fetzneri is an obligate groundwater-dependent species, relying on permanently saturated Type 1b burrow systems directly connected to shallow subsurface flows (Horwitz & Richardson, 1986). Any reduction in groundwater discharge is likely to rapidly degrade or eliminate suitable habitat and result in local extirpation, as the species lacks access to alternative refugia or dispersal pathways.

Concerns regarding groundwater extraction on the Springbrook Plateau have been raised for more than a decade (Australian Rainforest Conservation Society, 2018; City of Gold Coast, 2021; Environmental Defenders Office, 2024). In 2023, approval was granted for extraction of up to 8 million litres of groundwater per annum near Springbrook National Park (ABC News, 2023). The cumulative and long-term impacts of such extraction on groundwater-dependent ecosystems remain unknown. Given the extremely restricted distribution of *E. fetzneri* and its complete reliance on shallow groundwater discharge, even relatively modest groundwater extraction within recharge zones is likely to result in irreversible habitat loss and population collapse.

Summary. In combination, climate driven warming, increasing drought frequency, high-intensity bushfire, anthropogenic hydrological modification, and groundwater extraction pose severe and interacting threats to *E. fetzneri*. The species' extreme habitat specialisation, minute distribution, and lack of dispersal capacity leave it with virtually no resilience to disturbance. These factors collectively indicate a very high risk of extinction in the absence of immediate and effective protection of groundwater recharge zones and hydrological processes across its entire known range.

Conservation assessment

The Area of Occupancy (AOO) for *Euastacus fetzneri* is estimated at 2.297 km², and the Extent of Occurrence (EOO) at 12 km², based on 2 × 2 km grid cells as recommended by the IUCN Red List. These values were calculated using GeoCAT (Geospatial Conservation Assessment Tool; Bachman *et al*., 2011), which provides a transparent, repeatable, and efficient platform for data-driven conservation assessments. Automated IUCN assessments based on Australian Crayfish Project (ACP) collection data support listing the species as Critically Endangered. *Euastacus fetzneri* sp. nov. meets the IUCN Red List criteria for Critically Endangered under B1ab(iii,iv), based on the following:

B1: Extent of Occurrence < 100 km².

a: Known from fewer than five locations (here treated as a single location due to a shared overarching threat).

b(iii,iv): Continuing decline inferred in the extent and quality of habitat, and in the number of locations or subpopulations.

Although *E. fetzneri* sp. nov. is currently known from four discrete sites, one in Little Nerang Creek (west branch), two in Little Nerang Creek (east branch), and one in the Nerang River, these sites are separated only by a narrow ridgeline and are exposed to common landscape-scale threats. Consistent with IUCN guidelines, the species is therefore considered to occur at a single "location", as a single threatening event (e.g. climate change-induced drought, elevated temperatures, high-intensity bushfire or water mining) could rapidly and simultaneously impact all known populations and their groundwater-dependent habitats.

Projected climate change impacts in south-eastern Queensland, including reduced rainfall, increased drought frequency, rising temperatures, and more severe bushfires, are expected to result in a continuing decline in habitat quality, extent, and connectivity. These threats are particularly acute in high-altitude catchments with limited groundwater recharge potential. Given the dependence of *E. fetzneri* sp. nov. on cool, stable groundwater flows and its apparent inability to persist outside a narrow environmental envelope, the species is considered to be at very high risk of extinction in the near future.

Accordingly, *Euastacus fetzneri* sp. nov. also qualifies for listing as Critically Endangered under the Queensland *Nature Conservation Act 1992*, based on the same criteria of extremely limited distribution, severe habitat specificity, and high vulnerability to environmental change.

Conservation recommendations

To support the conservation of *Euastacus fetzneri*, the following actions are recommended:

Targeted field surveys across a broader geographic area to better define the species' full distribution, identify potential additional populations, and prioritise areas for protection. (Noting that most of the distribution area occurs on private property).

Determination of the species' thermal tolerance through controlled laboratory studies or in situ monitoring, to clarify its ecological limits and vulnerability to rising water temperatures.

Protect groundwater quantity and quality by establishing baseline data on temperature and flow rates at all known locations. Long-term hydrological monitoring should be initiated to detect changes over time.

Prioritise integrated groundwater management and catchment planning to ensure the ecological integrity of the species' critical habitat. This should include restrictions on aquifer extraction, consideration of environmental water needs, and protection of recharge zones.

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