

Engaeus phyllocercus Narracan Burrowing Crayfish

Taxonomy

Engaeus phyllocercus Smith & Schuster, 1913

Current conservation status

Listed as threatened under the *Flora and Fauna Guarantee Act 1988*.

Categorised as Endangered in the 2009 Advisory list of threatened invertebrate fauna in Victoria (DSE 2009).

Proposed conservation status

Endangered in Australia

Criteria B1ab(i,ii,iii,v)+2ab(i,ii,iii,v)

Species Information

Description and Life History

The Narracan Burrowing Crayfish is a small terrestrial burrowing crayfish belonging to the southern hemisphere crayfish family Parastacidae. The maximum reported carapace length of the Narracan Burrowing Crayfish is 26 mm. The taxon is characterised by the presence of leaf-like uropods and a prominent terminal spine on the inner ramus of the uropod (Horwitz 1990a).

Poor dispersal, slow maturation and confinement to discontinuous habitats are common to short-range endemics (Harvey 2002) including the Narracan Burrowing Crayfish. Burrowing crayfish spend most of their time underground and freshly excavated soil at burrow entrances is the most obvious sign of their presence. Surface activity is suspected to be nocturnal (Richardson and Swain 1980) and is linked to dispersal and foraging (Shaw 1996) and breeding (Van Praagh and Hinkley 1999). The diet of burrowing crayfish is predominantly plant-based and consists of roots, decomposing leaves and occasionally, small invertebrates (Lake and Newcombe 1975, Suter and Richardson 1977, Gowns and Richardson 1988). The diet of the Lilly Pilly Burrowing Crayfish is not specifically known but is suspected to be similar. Activity is commonly related to seasonal rainfall (Morey and Hollis 1997, Van Praagh and Hinkley 1999).

As *Engaeus* spend most of their life underground the life history for this species remains poorly known. Individuals are almost always intersexed and females with eggs have been found in late September with both male and females in the same burrow system suggesting the species breeds in mid to late spring, carries larva in summer and releases juveniles in late summer (Horwitz 1990a).

Generation Length

The generation length of the Narracan Burrowing Crayfish is inferred to be 3 to 4 years. Life history and larval development studies on two Tasmanian species (*E. cisternarius* and *E. fossor*) suggest the life span may be 3 - 4 years for these species (Suter 1977b). A similar generation length has been used for *E. phyllocercus*.

Distribution

The 35 known species of the genus *Engaeus* are endemic to south-east Australia, with most occurring in Victoria and Tasmania (Horwitz 1994). The majority of *Engaeus* species have small natural distributions so are also known as short-range endemics (Horwitz 1994, Harvey 2002). The Narracan Burrowing Crayfish is a short-range endemic



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due to its restricted distribution. It is found in the hills, generally above 120 m in altitude, to the north and west of the eastern Strzelecki Ranges in Gippsland Victoria (Horwitz 1990a, Van Praagh 2018). The species is sympatric with a common and more widespread species, *E. hemircirratulus*, but microhabitat separation is typically evident between the species, with the former occupying blue grey clay soils in the flood bed regions of ferny gullies, and the latter occupying yellow-orange clay soils on hilltops (Horwitz 1990a, Van Praagh and Hinkley 1999).

Burrows of *E. phyllocercus*, which are found in the flood bed regions of ferny gullies in wet sclerophyll forest, are connected to the water table, often contain multiple openings with conical pelleted chimneys which are connected by lateral tunnels underneath often under tree fern root mats (Horwitz 1990a, Horwitz 1990b). The range includes as far west as Mt Worth and Strzelecki - Ferndale to the Little Morwell River at Darlimurla in the south east. It is also found in the Sunny Creek catchment just south of Trafalgar (Van Praagh 2018). To the west of their range, they have been found in sparsely vegetated stream banks, surrounded by pasture and in more disturbed areas such as roadside table drains adjacent to remnant vegetation (Van Praagh op. cit.). Van Praagh (2018) provides a detailed distribution map for the species.

Habitat

The Narracan Burrowing Crayfish is predominantly a burrower, spending most of its life underground. It has burrows, consisting of two or more openings which are typically found in the flood bed region of fern tree gullies in wet sclerophyll forest. Each opening carries a conical chimney of pelleted soil of varying height or a wider rim shaped chimney of 1 - 2 cm height. Burrows are sometimes found in groups in which chimney height decreases the further distance they are away from the creek bed (Van Praagh and Hinkley 1999). The burrows descend to lateral ramifications (10-30cm below the surface) below which there may be one or two further descending tunnels (Horwitz 1990a). The lateral ramifications may be situated directly below the root mats of Tree-ferns *Dicksonia antarctica* and *Cyathea* spp. (Horwitz 1990). Soils in the flood beds are often high in organic matter, dark and have a high silt component.

The taxon may sometimes be found in the banks of flowing creeks where the burrows have several openings ultimately descending to the deepest level of the water table. These are described as 'type 2' burrows by Horwitz and Richardson (1986) which refers to burrows that are connected to the water table and the water is derived from ground water and surface runoff. The crayfish appears to be confined primarily to blue-grey clay soils, however, a site at Darlimurla State Forest had a brown to light grey soil with relatively high coarse sand component (Van Praagh and Hinkley 1999).

Threats

Van Praagh (2018) identified the following potential threats to the taxon: dam construction, which floods suitable habitat and removes existing habitat; channelization of streams, which alters drainage patterns, disturbs creek bank integrity and water flow, and dries suitable habitat; removal of native vegetation, which dries out soil, leads to erosion and sedimentation of waterways, exposes burrows and alters soil microclimate; pollution of water systems (pesticides and fertilizers poison crayfish and reduce water quality); trampling by stock and machinery, which causes stream bank erosion, vegetation loss, soil compaction, and crushing of burrows; cultivation and intensive farming, which removes habitat, destroys burrows and alters soil condition; and construction of infrastructure such as roads and tracks, affecting water quality and quantity, changing catchments and removing habitat.

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IUCN Criteria

Criterion A. Population size reduction. Population reduction (measured over the longer of 10 years or 3 generations) based on any of A1 to A4			
	Critically Endangered	Endangered	Vulnerable
A1	≥ 90%	≥ 70%	≥ 50%
A2, A3, A4	≥ 80%	≥ 50%	≥ 30%

<p>A1 Population reduction observed, estimated, inferred or suspected in the past and the causes of the reduction are clearly reversible AND understood AND ceased.</p> <p>A2 Population reduction observed, estimated, inferred or suspected in the past where the causes of the reduction may not have ceased OR may not be understood OR may not be reversible.</p> <p>A3 Population reduction, projected or suspected to be met in the future (up to a maximum of 100 years) [(a) cannot be used for A3]</p> <p>A4 An observed, estimated, inferred, projected or suspected population reduction where the time period must include both the past and the future (up to a max. of 100 years in future), and where the causes of reduction may not have ceased OR may not be understood OR may not be reversible.</p>	<p>based on any of the following:</p>	<p>(a) direct observation [except A3]</p> <p>(b) an index of abundance appropriate to the taxon</p> <p>(c) a decline in area of occupancy, extent of occurrence and/or quality of habitat</p> <p>(d) actual or potential levels of exploitation</p> <p>(e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites</p>
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Evidence:

Ineligible under Criterion A

The thresholds for past and future decline have not been met.

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Criterion B. Geographic range in the form of either B1 (extent of occurrence) and/or B2 (area of occupancy)			
	Critically Endangered Very restricted	Endangered Restricted	Vulnerable Limited
B1. Extent of occurrence (EOO)	< 100 km ²	< 5,000 km ²	< 20,000 km ²
B2. Area of occupancy (AOO)	< 10 km ²	< 500 km ²	< 2,000 km ²
AND at least 2 of the following 3 conditions:			
(a) Severely fragmented OR Number of locations	= 1	≤ 5	≤ 10
(b) Continuing decline observed, estimated, inferred or projected in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) area, extent and/or quality of habitat; (iv) number of locations or subpopulations; (v) number of mature individuals			
(c) Extreme fluctuations in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) number of locations or subpopulations; (iv) number of mature individuals			

Evidence:

Eligible under Criterion B1 as Endangered

The Extent of Occurrence (EoO) across the taxon's range is estimated to be 236 km², based on accepted, post-1970 records from the Victorian Biodiversity Atlas (VBA).

The taxon is estimated to be severely fragmented, as determined by Doran & Horwitz (2010), and is inferred to have 1 location. It has a continuing decline in (i), (ii), (iii) and (v) above.

Much of the habitat where the taxon is found has been extensively modified via clearing for farming and can be subject to trampling by livestock and impacts of pesticides (Horwitz 1990b). This situation is expected to continue in the future. Low flows experienced through droughts, soil and vegetation impacts of fire, and ongoing impacts of climate change in the landscape considered to have impacts in the future.

Eligible under Criterion B2 as Endangered

The Area of Occupancy (AoO) across the taxon's range is estimated to be 56 km², based on 2 x 2 km grids derived from accepted, post-1970 records in the VBA. As above the taxon is estimated to be severely fragmented, is inferred to have 1 location and has a continuing decline in (i), (ii), (iii) and (v) above.

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Criterion C. Small Population size and decline				
		Critically Endangered	Endangered	Vulnerable
Number of mature individuals		< 250	< 2,500	< 10,000
AND at least one of C1 or C2				
C1	An observed, estimated or projected continuing decline of at least (up to a max. of 100 years in future):	25% in 3 years or 1 generation (whichever is longer)	20% in 5 years or 2 generations (whichever is longer)	10% in 10 years or 3 generations (whichever is longer)
C2	An observed, estimated, projected or inferred continuing decline AND least 1 of the following 3 conditions:			
(a)	(i) Number of mature individuals in each subpopulation	≤ 50	≤ 250	≤ 1,000
	(ii) % of mature individuals in one subpopulation =	90 – 100%	95 – 100%	100%
(b)	Extreme fluctuations in the number of mature individuals			

Evidence:

Ineligible under Criterion C as Data Deficient

There is insufficient evidence to determine the number of mature individuals. As the species lives in underground systems and rarely surfaces, there is insufficient evidence to support an estimate of total population size.

Criterion D. Very small or restricted populations				
		Critically Endangered	Endangered	Vulnerable
Number of mature individuals (observed or estimated)		< 50	< 250	< 1,000
D2. Only applies to the VU category Restricted area of occupancy or number of locations with a plausible future threat that could drive the species to critically endangered or Extinct in a very short time.		-	-	D2. Typically: AoO < 20 km ² or number of locations ≤ 5

Evidence:

Eligible under criterion D2 as Vulnerable

The taxon is projected to be very restricted.

Criterion E (Quantitative Analysis) was not addressed as the taxon does not have a detailed Population Viability Analysis.

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