

Threatened Species Assessment

Engaeus karnanga South Gippsland Burrowing Crayfish

Taxonomy

Engaeus karnanga Horwitz, 1990

Current conservation status

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

Proposed conservation status

Endangered in Australia

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

Species Information

Description and Life History

The South Gippsland Burrowing Crayfish is a small terrestrial burrowing crayfish belonging to the southern hemisphere crayfish family Parastacidae. The species is separated from all other taxa in the genus by the combination of: sternum with pores on LP 3rd P, exopodite of third maxilliped multiarticulate and as long as or longer than ischium, ischium of third maxilliped without setae, sternum without pores on LP 1st and 2nd P, propodus without patch of plumose setae, propodal palm with subcarinate row of tubercles (Horwitz 1990). Maximum recorded length (occipital carapace length) is about 29 mm. All specimens are intersexed, burrows are constructed on the flood-plain of creeks and the species occupies horizontal tunnels during winter (Horwitz 1990).

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). Activity is commonly related to seasonal rainfall (Morey and Hollis 1997, Van Praagh and Hinkley 1999). The cryptic behaviour of burrowing crayfish means little is known about their life history and ecology, including the South Gippsland Burrowing Crayfish. Poor dispersal, slow maturation and confinement to discontinuous habitats are common to short-range endemics (Harvey 2002) such as the South Gippsland Burrowing Crayfish. 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). Males surface during late spring and early summer to search for mates and then enter the burrows of females (Van Praagh and Hinkley 1999). Females collected in December had eggs, which they incubate under the abdomen and the juveniles hatch in late summer (Van Praagh and Hinkley 1999).

Generation Length

The generation length of the South Gippsland 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 1977). The Tasmanian species share some similarities with *E. karnanga* (Horwitz, 1990) so the generation length has been suggested as the same.

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 South Gippsland Burrowing Crayfish is restricted to an area of South Gippsland

Engaeus karnanga

South Gippsland Burrowing Crayfish

on the south-west and north-west side of the Strzelecki Range, south to Wilsons Promontory (predominantly in the Powlett River system), Tarwin River system, very upper Morwell River system near Boolarra and smaller tributaries along the coast and throughout Wilsons Promontory National Park (Horwitz 1990).

Habitat

This taxon is found along the flood-plain of creeks and larger streams, predominantly in low-lying areas (Horwitz 1990).

Threats

The major threat to this taxon is the decline in quality and quantity of habitat, both underground and at the surface. This can be caused by a range of threats, many of which are predicted to be exacerbated by climate change. These include decline in quantity and quality of groundwater, or surface run-off from drought, water extraction, or alteration to stream flows; decline or loss of vegetation due to removal or disturbance (e.g. urban or agricultural development, fire); soil disturbance (e.g. mechanical disturbance from agriculture and erosion during floods); sedimentation/smothering from overland debris flow during high rainfall events following soil disturbance; impact of chemicals from agriculture or during fire suppression activities; loss of areas of suitable soil profile in which to construct burrows; loss of food resources due to soil disturbance or loss of vegetation leading to various ecological changes; and trout predation. Changes to river discharge patterns can reduce the preferred adult macrohabitats, and siltation from catchment erosion can smother the preferred spawning habitat (rocks).

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 style="text-align: center;"><i>based on any of the following:</i></p> <ul style="list-style-type: none"> (a) direct observation [except A3] (b) an index of abundance appropriate to the taxon (c) a decline in area of occupancy, extent of occurrence and/or quality of habitat (d) actual or potential levels of exploitation (e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites 			

Evidence:

Ineligible under Criterion A

Engaeus karnanga

South Gippsland Burrowing Crayfish

There is insufficient evidence to determine whether there has been a reduction in population (criterion A2). The future population reduction does not meet the threshold for eligibility under criterion A3.

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 2,641 km², based on accepted, post-1970 records from the Victorian Biodiversity Atlas (VBA), and also on the available records from field work.

The taxon is estimated to have 1 location. It has a continuing decline in (iii) and (v) above. The South Gippsland Burrowing Crayfish is restricted to low lying areas of distinct areas in South Gippsland. Agricultural development, climate change and agricultural development and impacts are suspected to be causing the decline of this taxon now and into the near future.

Eligible under Criterion B2 as Endangered

The Area of Occupancy (AoO) across the taxon's range is estimated to be 72 km², based on 2 x 2 km grids derived from accepted, post-1970 records in the VBA. As above, it is estimated to have 1 location and a continuing decline in (iii) and (v) above.

Engaeus karnanga

South Gippsland Burrowing Crayfish

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.

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 inferred to be very restricted.

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

References

DSE (2009). *Advisory list of threatened invertebrate fauna in Victoria - 2009*. Department of Sustainability and Environment, Melbourne. Retrieved from: https://www.environment.vic.gov.au/__data/assets/pdf_file/0016/50452/Advisory_List_of_Threatened_Invertebrate_Fauna_2009_FINAL_Sept_2009.pdf



Engaeus karnanga South Gippsland Burrowing Crayfish

- Growns, I.O. and Richardson, A.M.M. (1988). Diet and burrowing habits of the freshwater crayfish. *Parastacoides tasmanicus tasmanicus* Clark (Decapoda: Parastacidae). *Australian Journal of Marine and Freshwater Research* 39: 525-534.
- Harvey, M.S., (2002). Short-range endemism among the Australian fauna: some examples from non-marine environments. *Invertebrate Systematics* 16, 555-570.
- Horwitz, P. (1990). A taxonomic revision of species in the freshwater crayfish genus *Engaeus* Erichson (Decapoda: Parastacidae). *Invertebrate Taxonomy* 4: 427-614.
- Horwitz (1994). A new species of the freshwater crayfish genus *Engaeus* Erichson (Decapoda: Parastacidae) from north-western Tasmania. *Memoirs of the Museum of Victoria* 54 (2), 439-445.
- Lake, P.S. and Newcombe, P.S. (1975). Observations on the ecology of *Parastacoides tasmanicus* (Decapoda: Parastacidae) from south western Tasmania. *Australian Journal of Zoology* 18: 197-214
- Morey, J. and Hollis, G. (1997). Australia's most diverse crayfish habitat? *Memoirs of the Museum of Victoria* 56, 667-669.
- Richardson, A.M.M. and Swain, R. (1980). Habitat requirements and distribution of *Engaeus cisternarius* and three subspecies of *Parastacoides tasmanicus* (Decapoda: Parastacidae), burrowing crayfish from an area of south western Tasmania. *Australian Journal of Marine and Freshwater Research* 31: 475-484.
- Shaw, J. (1996). Australia's rarest crayfish? - A survey of the Labertouche Creek and tributaries in West Gippsland to extend the known range of the Warragul burrowing crayfish (*Engaeus sternalis*). Department of Natural Resources and Environment, Victoria, Australia.
- Suter, P.J. (1977). The biology of two species of *Engaeus* (Decapoda: Parastacidae) in Tasmania II. Life history and larval development, with particular reference to *E. cisternarius*. *Australian Journal of Marine and Freshwater Research* 28: 85-93.
- Suter, P.J. and Richardson, A.M.M. (1977). The Biology of Two Species of *Engaeus* (Decapoda: Parastacidae) in Tasmania. 111 Habitat, Food, Associated Fauna and Distribution. *Australian Journal of Marine and Freshwater Research* 28: 95-103.
- Van Praagh, B. and Hinkley, S. (1999). Distribution of four species of burrowing crayfish, the Warragul burrowing crayfish *Engaeus sternalis* (Clark); the Narracan burrowing crayfish *E. phyllocercus* (Smith and Schuster); the Strzelecki burrowing crayfish *E. rostrogaleatus* (Horwitz); and the Lilly Pilly burrowing crayfish *E. australis* (Riek); in the Gippsland Regional Forest Agreement area. Museum Victoria, Report prepared for the Department of Natural Resources and Environment.

*