



Euastacus neodiversus South Gippsland Spiny Crayfish

Taxonomy

Euastacus neodiversus Riek, 1969

Current conservation status

Listed as threatened under the *Flora and Fauna Guarantee Act 1988* (SAC 2001).

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 South Gippsland Spiny Crayfish is a small species of spiny crayfish with a maximum recorded occipital carapace length (OCL) of 45 mm (McCormack 2012). Most species of *Euastacus* are moderate burrowers, seeking refuge under rock ledges and amongst submerged, in-stream tree roots (Zeidler 1982). The South Gippsland Spiny Crayfish is a burrowing species which can build burrows under rocks in clear, flowing shallow streams (McCormack, 2012). The diet of spiny freshwater crayfish consists primarily of aquatic to semi-aquatic vegetation and benthic invertebrates (Goddard 1988). Fungi and bacteria found in rotting detrital matter is also consumed (DCE 1992).

Mating activity between mature individuals occurs from May to July, following which females carry their brood of 30 - 90 large crimson eggs under their tail, with the final release of independent juveniles in December (McCormack, 2012). After hatching from eggs, the dependent juvenile crayfish are carried beneath the tail until their release. The yolk of the egg is retained by the young hatchlings as a yolk sac supplying food during early growth. Once the yolk sac has been completely absorbed, the juveniles disperse to fend for themselves.

Generation Length

The generation length of the South Gippsland Spiny Crayfish is inferred to be 5 to 15 years. A number of reproductive studies show *Euastacus* spp. mature late with females only becoming reproductive at >5-8 years in most species (Honan and Mitchell 1995, Turvey and Merrick 1997, Furse and Wild 2004). The minimum generation is therefore set at 5 years. Studies on large species of *Euastacus* show ages of up to 30 years and above (e.g. Turvey and Merrick 1997). As a small species, (maximum of 45mm OCL) the generation length for *E. neodiversus* is nominally set at 15 years. There has been no research into age in this species. Dr James Furse notes that most if not all *Eustacus* species are very long-lived, with some species living 40-50 years (Furse pers. comm. to M. O'Brien, September 2018).

Distribution

The South Gippsland Spiny Crayfish has a restricted distribution and has been found to occur in relatively low abundance. The species occurs at Wilsons Promontory and on the southern slopes of the Strzelecki Ranges within the South Gippsland river basin, Victoria. The species is found at elevations of 50 m to 650 m above sea level



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(McCormack 2012) but has been found below elevations of 30 m asl in Growler Creek at Wilson Promontory (Bryant et al 2012). The taxon's range is divided in two by the lowland of the Yanakie Isthmus (Morgan 1986). In South Gippsland the species appears to be restricted to the southern side of the Strzelecki Ranges and the Merriman Creek system represents the most eastern extent of the species range (Morgan 1986). Outside of Wilsons Promontory, the species occurs in streams in sclerophyll forest where the streamside vegetation is dominated by Mountain Ash (*Eucalyptus regnans*), tree ferns (*Cyathea* species) and Lilly Pilly (*Acmena smithii*) (Morgan 1986). At Wilsons Promontory inhabited streams are typically coastal heath with ferns along stream banks (McCormack 2012). A study by Koster et al (1999) shows the species occurs in generally rocky streams with low aquatic vegetation and low silt cover.

Habitat

Streams where the South Gippsland Spiny Crayfish have been recorded are typically narrow and shallow with stream temperatures ranging between 7 and 15 °C (Koster et al. 1999). Dissolved oxygen is generally high. The taxon is more common in streams with pool habitat and with little or no aquatic vegetation cover (Koster et al. 1999). Other *Euastacus* species occur in coastal and inland streams of south-east South Australia, and in both lowland and mountainous regions of Victoria.

Threats

The major threat to taxa of spiny crayfish in Victoria is the decline in quality and quantity of habitat, both underground and at the surface. This can be caused by a range of factors, many of which are predicted to be exacerbated by climate change. These include decline in quantity and quality of streamflows and/or groundwater; decline or loss of vegetation due to removal or disturbance; soil disturbance; sedimentation or smothering from overland debris flow during high rainfall events following soil disturbance; the impact of chemicals and loss of areas of suitable soil profile in which to construct burrows.

These threats may be driven by a range of land and water management activities, including urban and agriculture development, road construction and maintenance, bushfire prevention and suppression, water extraction and forestry operations. These threats may also be triggered or exacerbated by natural events such as droughts, floods and bushfires.

Bushfires have the potential to degrade water quality and alter the dynamics of stream ecosystems. Most critical effects occur if there is heavy rain soon after fire, as loss of vegetation and altered soil structure can make fire-affected soils more erodible. Runoff can carry sediments and pollutants that affect aquatic environments and consequently aquatic species.

Loss of food resources due to soil disturbance or loss of riparian vegetation can lead to various ecological changes, particularly sedimentation affecting instream processes, increased water temperature from greater incidence of light, and reduction in the type and amount of debris accumulation in streams, changes which generally reduce the suitability of streams as habitat for *Euastacus* species. The coarse woody debris provides important crayfish habitat and the finer debris would provide an important food source for the species.

The introduction of exotic biota could also be a threat due to predation, competition, or the spread of disease (Horwitz 1990b). Introduced fish, including Brown Trout *Salmo trutta*, occur throughout many of the river systems within the taxon's range, and predation may have a detrimental impact on populations of the crayfish.

The overall level of threat and the relative contribution of each of the land management activities and natural events varies according to the circumstances of each species. In the case of the South Gippsland Spiny Crayfish, the taxon occurs in streams within Wet Forest at Tarra Bulga National Park in the Strzelecki Ranges. This habitat occurs extensively in the Strzelecki Ranges and it is most likely the taxon occurs in suitable habitat within this area. A substantial amount of land within the potential range of the species distribution is used for plantations. Spatial analysis of catchments occupied by this taxon on all land tenures indicates that 29% occurs within the Comprehensive, Adequate and Representative (CAR) reserve system, including parks, reserves and special protection zones within State forest. Further areas are excluded from harvesting by prescription under the Victorian Code of Practice for Timber Production 2014 (the Code). Species-specific prescriptions for the South Gippsland Spiny Crayfish are included in the Code. General forestry prescriptions such as protection and buffering of waterways also provide protection from forestry operations. The Code also applies to plantation management, including hardwood and softwood, on public and private land. The Flora and Fauna Guarantee action statement provides further details of potential threats to this taxon (DSE 2003).

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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 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

The past population reduction does not meet the threshold for eligibility under criterion A2, and the future population reduction does not meet the threshold for eligibility under criterion A3.

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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 3,363 km², based on accepted, post-1970 records from the Victorian Biodiversity Atlas (VBA).

The taxon is estimated to be severely fragmented, based on all available survey data (e.g. Bryant et al. 2012, Raadik 2001, Koster et al 1999).

It has a continuing decline in (i), (ii), (iii) and (v) above. Impairment and modification to instream and riparian habitat and extreme events have occurred and continue to occur within the known range of the taxon, therefore future population trends are inferred as declining. Predation by introduced species such as trout (Furse and Coughran 2011), , removal of vegetation and siltation and the long term impacts of climate change are likely drivers of further decline (Furse and Coughran 2011, Johnston et al 2014).

Eligible under Criterion B2 as Endangered

The Area of Occupancy (AoO) across the taxon's range is estimated to be 132 km², based on 2 x 2 km grids derived from accepted, post-1970 records in the VBA. As above, it is severely fragmented, and has a continuing decline in (i), (ii), (iii) and (v).

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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

The taxon has a restricted distribution in small streams in southern Victoria. Collections of the taxon reveal it is generally found in relatively low numbers (Koster et al. 1999, Bryant et al. 2012) at the sites it inhabits. No population data exists for the taxon so it is not possible to estimate 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:

Ineligible under Criterion D

There is insufficient evidence to determine the number of mature individuals.

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

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