

Advice to the Minister for the Environment and Heritage from the Threatened Species Scientific Committee (TSSC) on Amendments to the list of Threatened Species under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

1. Scientific name, common name

Engaeus granulatus (Central North Burrowing Crayfish)

2. Description

The Central North Burrowing Crayfish is a small crayfish with an average body length under 10cm. The species occupies seeps, wetlands and stream banks.

3. National Context

The Central North Burrowing Crayfish only occurs in central north Tasmania. The species is found in a triangular area running south west from Port Sorell to the Railton area and north to Quoiba, near Devonport (Nelson 2003). The range of the Central North Burrowing Crayfish was surveyed during 2002-2003 on behalf of the Burrowing Crayfish Recovery Team, which oversees implementation of the *Burrowing Crayfish Group Recovery Plan 2001-2005* (Doran 2000). The results indicated that this species was confined to seven geographically isolated areas, with a minimum of 5 km separating each area (Nelson 2003).

The Central North Burrowing Crayfish is listed as endangered under the Tasmanian *Threatened Species Protection Act 1995*.

4. How judged by TSSC in relation to the EPBC Act criteria.

TSSC judges the species to be **eligible** for listing as **endangered** under the EPBC Act. The justification against the criteria is as follows:

Criterion 1 – It has undergone, is suspected to have undergone or is likely to undergo in the immediate future a very severe, severe or substantial reduction in numbers.

The historical distribution of the Central North Burrowing Crayfish is difficult to determine. The species was only described relatively recently (Horwitz 1990) and little survey work was conducted prior to the studies described in Nelson (2003).

Within potential habitat around known colonies, nearly all land is disturbed. The Central North Burrowing Crayfish may be impacted on by activities that severely alter either water quality or quantity, or soil and food availability. Potential threats include the clearing of riparian and seepage way vegetation, ploughing, dam construction and unrestricted stock grazing (which churns and compacts the soil), burning, and conversion to plantation (which imposes significant mechanical disturbance on stream headwaters and seepage channels), frequent high intensity fires that have negative long term effects on soil and vegetation, the establishment of roads and associated drainage activities that impact on seep, wetland and stream bank habitat quality (*e.g.* through the promotion of siltation and erosion), and other activities that degrade river bank integrity and enhance erosion. The species' habitat may also be affected by poor waste management, waterway pollution, the inappropriate application of pesticides and fertilisers, and degradation through the establishment of weeds such as gorse and blackberries in waterways and seeps.

In addition, a recent survey recorded *Cherax destructor*, the Freshwater Yabby, from a dam where Central North Burrowing Crayfish burrows were present (Nelson 2003). *Cherax destructor* is not native to Tasmania and is regarded as an introduced pest. The species has been declared a controlled species under the Tasmanian *Inland Fisheries Act 1995* and as such it is illegal to import, keep or release them into Tasmanian waterways. *Cherax destructor* may pose a threat to the Central North Burrowing Crayfish through the spread of disease or parasites and may, in some situations, displace the Central North Burrowing Crayfish through competition for food and habitat.

There are no specific assessments of how such threats would impact on the seven known colonies of the Central North Burrowing Crayfish and it is currently difficult to determine how realistic these threats are to the survival of the species in the wild. While severe disturbance could eliminate the species, it can also persist, possibly for very long periods, in farm, suburban, and industrial forest surrounds. The species is apparently tolerant to some degree of clearing and agricultural development, occurring naturally in small and scattered colonies. Current evidence seems to suggest that the species occurs in modified habitats where the threats are difficult to quantify.

The degree the species may have once inhabited available habitat between current known colonies is uncertain as there is currently no estimate of potentially occupied habitat beyond known colonies, and it is difficult to determine those areas from which it may have been subsequently lost. How much of the species potential remaining habitat has actually been sampled is unclear and there may be potential for more sites to be found on some of the farms within the species' currently known extent of occurrence.

On the basis of habitat change alone, it is possible to argue that the species would have experienced a serious decline in the past 100 years with a potential decline greater than 80% over any ten year period or three generations.

There is limited historical survey work and the previous distribution of this species is difficult to determine. The known range of the Central North Burrowing Crayfish was surveyed during 2002-03 and the species was found to have a restricted, fragmented population and to be confined to seven geographically isolated areas with limited connectivity between them.

The available information makes it difficult to determine the level of impact that potential threats may be having, or are likely to have, and therefore to adequately understand to what degree the species has undergone, or is likely to undergo, at least a substantial reduction in numbers.

There is insufficient quantitative data available to assess the species against this criterion.

Criterion 2 –Its geographic distribution is precarious for the survival of the species and is very restricted, restricted or limited.

Surveys undertaken during 2002-03, found the Central North Burrowing Crayfish to be confined to seven geographically isolated areas with an estimated extent of occurrence of 343 km². There is debate over the actual distribution of the species. One estimate suggests that the species has an area of occupancy of between 0.2-0.5 km². This figure is based on known locations, with a buffer applied to waterways and suitable wet areas within each colony to give an overall estimate of potentially occupied habitat. Prior conservation assessments for Tasmanian burrowing crayfish have used a 10 m buffer (providing the 0.2 km² estimate). A 10 m buffer may be appropriate and suitable for this species, however the upper level assessment (0.5 km²) uses a 20 m buffer. This broadens the predicted extent of colonies, but is still a conservative estimate. However, all potentially suitable habitat within the species' extent of occurrence may not have been taken into

account, there is currently no estimate of potentially occupied habitat beyond known colonies, and it is unclear how much of the species potential habitat has actually been sampled.

Despite this debate, the area of occupancy is still very restricted. Survey data indicates that the species is restricted to small areas within its overall range, with limited connectivity between these areas, and that it is highly probable that known populations will remain isolated due to the modified environments separating them and the continued threatening processes operating throughout the range of the species. Nearly all available habitat within the known range of the species is highly modified by agriculture, forestry and urban development (available habitat within the overall range is identified as all suitable waterways and wet areas using the same 20 m buffer). One estimate is that 70% of this available habitat has been subject to disturbance by agricultural development, urbanisation and associated land clearance from these uses; 11.5% occurs in State Forest which is subject to forestry activities; 16% occurs in either private land or unallocated Crown Land; and 2.5% is covered by Crown river reserves (*i.e.* not formally gazetted conservation or protected areas).

To date, the Central North Burrowing Crayfish has not been recorded in any secure reserves, despite intensive survey in these areas.

The Central North Burrowing Crayfish may be impacted on by activities that severely alter either water quality or quantity, or soil and food availability. Potential threats include the clearing of riparian and seepage way vegetation, ploughing, dam construction and unrestricted stock grazing (which churns and compacts the soil making it unsuitable for burrowing crayfish), burning, and conversion to plantation (which impose significant mechanical disturbance on stream headwaters and seepage channels), frequent high intensity fires that have negative long term effects on soil and vegetation, the establishment of roads and associated drainage activities that impact on seep, wetland and stream bank habitat quality (*e.g.* through the promotion of siltation and erosion), and other activities that degrade river bank integrity and enhance erosion. The species' habitat may also be affected by poor waste management, waterway pollution, the inappropriate application of pesticides and fertilisers, and degradation through the establishment of weeds such as gorse and blackberries in waterways and seeps.

There are no specific assessments of whether and how such threats would impact on the seven known colonies of the Central North Burrowing Crayfish and it is currently difficult to determine how realistic these threats are to the survival of the species in the wild (see Criterion 1).

Colonies in the least disturbed portions of the range are known to be small and scattered and this may also have been the situation at various spatial scales in pre-European times.

The geographic distribution of the Central North Burrowing Crayfish is currently very restricted with the species being confined to seven geographically isolated locations. This distribution is precarious for the survival of the species.

Therefore, the species is **eligible** for listing as **endangered** under this criterion.

Criterion 3 – The estimated total number of mature individuals is limited to a particular degree and: (a) evidence suggests that the number will continue to decline at a particular rate; or (b) the number is likely to continue to decline and its geographic distribution is precarious for its survival.

Population estimates for the Central North Burrowing Crayfish are based on detailed population density information available for the Scottsdale Burrowing Crayfish, *Engaeus spinicaudatus*. These population estimates identify a difference in burrowing crayfish density between disturbed and undisturbed land (Horwitz 1991). Maximum burrowing crayfish population sizes have previously been calculated using burrow density estimates of 0.78/m² in undisturbed habitat and

0.37/m² in disturbed habitat. Minimum population sizes have previously been calculated using burrow density estimates of 0.55/m² in undisturbed habitat and 0.05/m² in disturbed habitat, with both figures multiplied by 0.8 as a factor of actual burrow occupancy within each area.

These figures have also been used for the Central North Burrowing Crayfish as they are the best quantified figures available however they are likely to provide a major over-estimate of the total population due to the low population density of the Central North Burrowing Crayfish in comparison to other species, and the increased buffer size on colonies and potentially occupied habitat that has been used (*i.e.* 20 m). Previous estimates, including the ones used for burrowing crayfish under State legislation, have used the more restricted 10 m buffer.

Direct observations (Nelson 2003) have produced a population estimate across known sites of between 1 000 – 1 500 mature individuals. Extending this into potentially occupied habitat around the known colonies (using the burrow density figures (0.55/m² for undisturbed habitat and 0.05/m² for disturbed habitat), tenure/disturbance breakdown, and the area of occupancy, provides: a maximum population estimate of 188 000 mature individuals; and a minimum population estimate of 20 000 mature individuals. This minimum is still likely to be a substantial over-estimate because of the lower relative abundance of the Central North Burrowing Crayfish and the fact that a larger area buffer around colonies, or suitable habitat, is used in the calculations. In both cases, population numbers are extremely low for an invertebrate species, particularly considering the range over which it is found.

This population range may in fact be something in the order of 8 000 to 312 000. Given the lower relative abundance of this species, it is difficult to ascertain to what degree the actual population size may be limited below these estimated levels.

There is insufficient quantitative data available to assess the species against this criterion.

Criterion 4 – The estimated total number of mature individuals is extremely low, very low or low.

Population size estimates have previously been calculated for burrowing crayfish species using burrow density estimates of 0.55/m² for undisturbed habitat and 0.05/m² for disturbed habitat. These density estimates are based on earlier work for other burrowing crayfish species in Tasmania. Based on these calculations a maximum population estimate of approximately 188 000 mature individuals and a minimum estimate of 20 000 has been suggested. However, even the minimum population estimate is likely to be a substantial over-estimate of the actual population size because of the lower relative abundance of the Central North Burrowing Crayfish and the fact that a larger area buffer around colonies, or suitable habitat, is used in the calculations.

The population range may be between 8 000 to 312 000 individuals. Given the lower relative abundance of this species compared to other burrowing crayfish species, it is difficult to ascertain to what degree the actual population may be limited below these estimated levels. Precise population figures for an invertebrate species like the Central North Burrowing Crayfish are difficult to determine and estimates range considerably. There are no specific assessments of whether or how possible threats would impact on the seven known colonies of the Central North Burrowing Crayfish and it is currently difficult to determine how realistic these threats are to the survival of the species in the wild (see Criterion 1).

The currently known total population of the Central North Burrowing Crayfish is restricted with one estimate indicating a maximum area of occupancy of 0.5 km². Despite debate concerning the exact geographic distribution of the species, the species has a restricted distribution, is known from seven geographically isolated locations, and is likely to be prone to the impact of a number of ongoing threats.

Therefore, the species is **eligible** for listing as **vulnerable** under this criterion.

Criterion 5 - Probability of extinction in the wild

There are no quantitative data available to assess the species against this criterion.

5. CONCLUSION

Precise population figures for an invertebrate species like the Central North Burrowing Crayfish are difficult to determine and estimates range considerably. There is also debate concerning the species geographic distribution. Surveys undertaken in 2002-03, found the Central North Burrowing Crayfish to occur at only seven geographically isolated locations, with an estimated maximum area of occupancy of 0.5 km². The species has not, to date, been recorded from any secure conservation area and may be subject to a number of ongoing threats including activities that alter water quality or quantity, clearing of riparian and seepage way vegetation, ploughing, dam construction and unrestricted stock grazing. There are no specific assessments of whether or how potential threats impact on the seven known colonies of the Central North Burrowing Crayfish and it is currently difficult to determine how realistic these threats are to the survival of the species in the wild. The species is apparently tolerant to some degree of clearing and agricultural development, occurring naturally in small and scattered colonies.

The species is eligible for listing as **endangered** under criterion 2 and **vulnerable** under criterion 4.

6. Recommendation

TSSC recommends that the list referred to in section 178 of the EPBC Act be amended by **including** in the list in the **endangered** category:

***Engaeus granulatus* (Central North Burrowing Crayfish)**

Publications used to assess the nomination

Doran, N.E. (2000). Burrowing Crayfish (*Engaeus*) Recovery Plan 2001-2005. Department of Primary Industry, Water and the Environment, Hobart.

Horwitz, P. (1990). A taxonomic revision of species in the freshwater crayfish genus *Engaeus* Erichson (Decapoda: Parastacidae). *Invertebrate Taxonomy* **4**: 427-614.

Horwitz, P. (1991). The conservation biology of *Engaeus spinicaudatus*, a threatened crayfish from north-eastern Tasmania. Report to the Australian National Parks and Wildlife Service, Canberra.

Nelson, J. (2003). Report to the Burrowing Crayfish Recovery Team on *Engaeus granulatus* survey work as of July 2003. Unpublished report to the Threatened Species Unit, Department of Primary Industries, Water and Environment.