The Minister's delegate approved this Conservation Advice on 16/12/2016.

Conservation Advice

Engaeus yabbimunna

Burnie burrowing crayfish

Conservation Status

Engaeus yabbimunna (Burnie burrowing crayfish) is listed as Vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth) (EPBC Act) effective from the 6 August 2001.

Species can also be listed as threatened under state and territory legislation. For information on the current listing status of this species under relevant state or territory legislation, see http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl

The main factors that are the cause of the species being eligible for listing in the Vulnerable category are that its extent of occurrence and area of occupancy are limited, it is known from only ten locations and potential declines in the area, extent and/or quality of habitat can be inferred from the impacts of water removal and diversion, and habitat loss.

Description

Species of *Engaeus* are small freshwater crayfish, with a general body length of under ten centimetres (Doran 2000). Colouration among *Engaeus* species can vary from orange to reddish brown, to grey-blue or purple (Doran 2000). The Burnie burrowing crayfish grows to a length of approximately six centimetres (TSS 2016).

Distribution

The Burnie burrowing crayfish is known from a range covering the city of Burnie, and the area immediately to the west, in north-west Tasmania (Doran 2000; TSS 2016). The species has been recorded in a number of locations, including: Burnie Park, Shorewell Creek, Romaine Creek and the eastern arm of Cooee Creek within urban Burnie; Seabrook Creek; and along Camp Creek, Distillery Creek, two small intervening catchments and one small tributary of the Cam River (Doran 2000).

Relevant Biology/Ecology

The Burnie burrowing crayfish can be found in a variety of habitats, including fern-dominated stream-side vegetation, open and grassy sheep pasture, farm dams, roadside seeps and culverts, and sedgy marsh (Doran 2000; TSS 2016). However, the species appears to prefer well-covered, slowly draining strips of fern-dominated native riparian vegetation (Doran 2000).

Most species of *Engaeus* are characterised by their ability to burrow, often to considerable depths, and specimens are only rarely seen above ground or in standing water (Horwitz 1990a). Burrows often have chimneys of pelleted soil where they meet the surface, and in sheltered areas these may be quite high (up to 40 cm). Burrows can be simple and shallow or complex, deep and extensive, and each species constructs a slightly different burrow type (Doran 2000). The Burnie burrowing crayfish often connects its burrow to the water table rather than directly to a stream or lake (Doran 2000). Burrow systems are often the product of several generations of crayfish activity (Doran 2000).

Relatively little is known about the life history of species within the *Engaeus* genus in general (Doran 2000). Based on the life history of *E. spinicaudatus* (Scottsdale burrowing crayfish), the Burnie burrowing crayfish may be found with varying size classes of young within their burrows,

and individuals may show some degree of variation in morphological features and sexual characteristics between and within sites (Horwitz 1990a; Doran & Richards 1996). Burnie burrowing crayfish may breed in spring, as a large male and female have been observed together in early September in proximity suggestive of courtship and mating (Doran 2000). Large numbers of berried females (i.e. females carrying eggs) have been recorded in early December (Horwitz 1994).

Threats

All listed species within the *Engaeus* genus are of conservation concern due to their acutely restricted ranges and areas of occupancy, and the presence of actively threatening processes within these areas (Horwitz 1990b; Doran & Richards 1996). Threatening processes particularly include those that affect water quality and quantity, and soil and food (i.e. wood and plant) availability (Doran 2000).

The principal threats to the Burnie burrowing crayfish are water pollution (including contamination of waterways by herbicides and pesticides), water diversion and habitat removal within the urban environment (Doran 2000). Other key threats include activities which degrade streamside habitat, such as agricultural and forestry activities, road work, mining and high-intensity burning of streamside habitat (TSS 2016). While all threatening processes have the potential to affect burrowing crayfish habitat quality over the long term, crayfish are at most risk when they are moulting, visiting the surface, mating or nurturing young (Horwitz 1991).

Table 1 – Threats impacting the Burnie burrowing crayfish in approximate order of severity of risk, based on available evidence.

Threat factor	**Threat type and status**	**Evidence base**
Water quality and quantity		
Road work and drainage activities	known current and likely future	General road work and drainage activities (urban and non-urban) are known to impact seepage, wetland and stream bank habitat quality, as are any associated activities that degrade river bank integrity and enhance erosion (Doran 2000). These activities can all lead to increased sediment loads and chemical pollutants, such as fertilisers, herbicides and pesticides, entering waterways (TSS 2016). The use of heavy machinery within burrowing crayfish habitat can crush burrows and crayfish, and lead to severe degradation of habitat by damaging vegetation and compacting soil (TSS 2016).
Agriculture and forestry	known current and likely future	Both agriculture and forestry may have significant effects on the species habitat due to the alteration of drainage characteristics, the application of fertilisers and pesticides, and the use of hazard reduction burning (Doran 2000). The removal of vegetation from a site can lead to drying out of soil, erosion, sediment input into waterways, and changes in water table levels and drainage (TSS 2016). Activities which can result in changes in drainage patterns or water flow, or major deterioration of water quality, can all damage burrowing crayfish habitat (TSS 2016).

Habitat loss and degradation		
Urban activities/ developments	known current and likely future	Due to its proximity to urban environments, the Burnie burrowing crayfish may also be impacted by inappropriate waste management policies, urban run-off and other contaminants leading to waterway pollution and habitat removal resulting from urban development (Doran 2000).
Agriculture	known current and future	Agricultural processes including stock grazing, dam construction, clearance of riparian vegetation and ploughing may all degrade the habitat of the Burnie burrowing crayfish (Doran 2000). Burrowing crayfish habitat can be severely degraded by the trampling of vegetation and compaction of soil resulting from grazing activities, which can also damage burrows and crush crayfish (TSS 2016). There are no 'codes of conduct' or guidelines in place to manage agricultural activity within the species habitat (Doran 2000).
Forestry	known current and future	Forestry activities such as clearing, burning and conversion to plantation impose significant mechanical disturbance on stream headwaters and seepage channels and may affect crayfish and their habitat to varying degrees (Doran 2000). However, the provisions of the Forest Practices Code may reduce direct impacts to the species (FPB 2000).
Mining	future	Alluvial mining can degrade burrowing crayfish habitat by impacting upon water quality, drainage and siltation characteristics, both within and upstream of known habitat (TSS 2016).
Fire		
Too frequent burning	future	High intensity fires, and the consequent effects on vegetation and habitat quality, may impact upon the Burnie burrowing crayfish (TSS 2016). Exposure to higher levels of predation in the post-fire conditions may reduce population sizes of the crayfish.
Climate change		
Habitat alteration	future	Within Australia climate-mediated threats, including impacts on water temperature and availability, are putting the conservation status of two-thirds of all freshwater crayfish species at risk (Richman et al., 2015). Climate change may affect the Burnie burrowing crayfish in the future if changes in weather, water and drainage patterns result in broad scale habitat changes. However, the likely impacts to this species from climate change are not well understood as predictions suggest both more weather extremes and increased temperatures, but also increased rainfall.

Conservation Actions

Conservation and Management priorities

As the Burnie burrowing crayfish has a limited distribution avoiding activities that are likely to impact upon water quality and quantity, or cause further loss or degradation of its habitat, will be critical to the species' survival.

Water quality and quantity

- Ensure that the species ecological requirements are considered in the development of water management plans.
- Avoid activities which have an impact on water table levels in areas of burrowing crayfish habitat.
- Ensure weed control operations, and the application of fertiliser, do not lead to entry of chemicals into burrowing crayfish habitat.
- Avoid activities which alter the hydrology in areas of habitat, including removal of native vegetation, earthworks, construction and changes to drainage.
- Do not inundate known localities of burrowing crayfish through dam construction.

Habitat loss and degradation

- Avoid the clearance and conversion of habitat for forestry activities (e.g. establishment of plantations) and agricultural activities (e.g. conversion to pasture or cropping land).
- Avoid clearing trees and other vegetation in areas of burrowing crayfish habitat, including in urban environments within the known range of the species.
- Take measures to reduce the impacts of potential urban-expansion into known crayfish habitat.
- Restrict the use of heavy machinery through and within areas of habitat.
- Maintain and improve native riparian vegetation and soil integrity within known habitat.
- Avoid changes to the status of unallocated Crown land that may open habitat up to forestry or agricultural activities, and consider increasing the area under reservation.
- Increase protection of the species on private land, by increasing the number of conservation covenants or developing other mechanisms to conserve the species.
- Avoid activities that degrade river bank integrity and enhance erosion (e.g. alluvial mining).
- Consider the development of an agricultural 'code of practice' that takes the ecological needs of the species into consideration.

Domestic species

- Fence-off known habitat to protect crayfish localities from trampling by stock.

Fire

- Avoid deliberate burning in areas of habitat for the Burnie burrowing crayfish.

Stakeholder Engagement

- Develop information brochures on the species, its habitat requirements (including a guide to habitat identification) and its relevance to environmental health, and distribute these to landholders, industry, schools, community groups and individuals.
- Conduct community field days to showcase best practice management for improving habitat and waterway quality, and highlight the successes that have been achieved.
- Seek opportunities to actively promote community participation in the conservation of the species, including encouraging the reporting of sightings to the Department of Primary Industries, Parks, Water and Environment's Natural Values Atlas.

Survey and Monitoring priorities

- Regularly conduct surveys (minimum five-yearly) at long-term monitoring sites for the Burnie burrowing crayfish.
- Undertake predictive modelling to identify additional areas where the species may occur based upon known habitat requirements.
- Assess survey results to identify any changes to the population trajectory and evaluate the effectiveness of recovery actions.

Information and research priorities

- Improve knowledge on the ecology of the species, with a focus on improving understanding of population structures, including survival, recruitment and dispersal rates.
- More precisely assess the relative impact of threatening processes on the species' survival.
- Resolve the relationship between land-use, changes in water quality and habitat suitability for the species.

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