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

Conservation Advice

Engaeus spinicaudatus

Scottsdale burrowing crayfish

Conservation Status

Engaeus spinicaudatus (Scottsdale burrowing crayfish) is listed as Endangered under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth) (EPBC Act) effective 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 Endangered category are that its extent of occurrence and area of occupancy are restricted, it is known from only five locations and potential declines in the area, extent and/or quality of habitat can be inferred from the impacts of forestry and agricultural activities.

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 Scottsdale burrowing crayfish grows to a length of approximately 25 mm and is usually brown or purplish in colour (TSS 2016).

Distribution

The Scottsdale burrowing crayfish is found north of Scottsdale in north-eastern Tasmania (Doran 2000; TSS 2016). The species has considerable overlap with other crayfish from the *Engaeus* species including *E. tayatea*, *E. mairener*, *E. leptorhynchus*, *E. orramakunna* and *E. cunicularius* (Doran & Richards 1996).

Relevant Biology/Ecology

The Scottsdale burrowing crayfish can be found in a variety of habitats, including *Gymnoschoenus sphaerocephalus* (wet buttongrass) and heathy plains (particularly with peaty and saturated soils), surface seepages, the floodplains of creeks (often with scrubby or taller tea-tree vegetation), wet areas converted to pasture from any of the preceding habitat types, and some creek banks in open dry eucalypt forest (Horwitz 1991, Richards 1997). However, the species' preferred habitat appears to be wet buttongrass and heathy plains (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 Scottsdale 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).

The Scottsdale 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). Females become reproductively mature once they reach an occipital carapace length of 16.4 mm, and may undergo a pre-copulatory moult (which possibly releases mating pheromones and reduces aggression) (Doran 2000). Mating occurs between mid November and late December, and may represent the only time that male crayfish will be found openly wandering on the surface (in search of females' burrows) (Doran 2000). Females carry eggs and larvae through December and January, with light orange undifferentiated eggs developing early limbs and eyespots, followed by clear development of the limbs, abdomen, telson and carapace (Doran 2000). Females have been found with free young in their burrow in March (Horwitz 1990a). While a strong linear relationship exists between body size and fecundity, no information exists regarding the rate of growth, survivorship and recruitment, age, or number and frequency of breeding events (e.g. biennial or singular) for this species (Doran 2000).

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 Scottsdale burrowing crayfish are forestry and agricultural activities, the downstream effects of road construction, quarrying and the impacts of inappropriate fire management (Doran 2000). 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 Scottsdale burrowing crayfish in approximate order of severity of risk, based on available evidence.

Threat factor	Threat type and status	Evidence base
Habitat loss and degradation		
Forestry	known current and likely 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).
Agriculture	known current and likely future	Agricultural processes including stock grazing, dam construction, clearance of riparian vegetation and ploughing may all degrade the habitat of the Scottsdale 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).

Water quality and quantity		
Road work and drainage activities	known current and likely future	General road work and drainage, and associated activities, are known to impact seepage, wetland and stream bank habitat quality, including by degrading river bank integrity and enhancing erosion (Doran 2000). These activities can increase sediment loads and chemical pollutants, such as fertilisers, herbicides and pesticides, entering waterways (TSS 2016). The use of heavy machinery 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).
Fire		
Inappropriate fire management	potential current and likely future	Peat fires pose a direct threat to the soils in which the Scottsdale burrowing crayfish is found, while conversely the absence of fire may promote tree establishment and lead to the eventual drying of the buttongrass communities found on the soils (Doran 2000).
Climate change		
Habitat alteration	potential 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 Scottsdale 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 Scottsdale burrowing crayfish has a limited distribution, avoiding activities that are likely to cause further loss or degradation of its habitat, or impact upon water quality and quantity, will be critical to the species' survival.

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.

- Restrict the use of heavy machinery through and within areas of known 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 habitat quality, such as quarrying, within the known distribution of the Scottsdale burrowing crayfish.
- Consider the development of an agricultural 'code of practice' that takes the ecological needs of the species into consideration.

Water quality and quantity

- Ensure that the species ecological requirements are considered in the development of water management plans.
- Avoid activities, including drainage and groundwater extraction, which may 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.

Fire

- Avoid hot fires in areas of habitat for the Scottsdale burrowing crayfish, and seek advice from the Threatened Species Section of the Department of Primary Industries, Parks, Water and Environment (Tasmania) on appropriate fire management in areas of known or likely crayfish habitat.

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 Scottsdale burrowing crayfish.
- 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.
- Investigate the effects of various fire types and intensities on the species survival and fecundity.

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