

INVERTEBRATE COMMUNITIES OF CAVES

on the South West coastal plain

T h r e a t e n e d E c o l o g i c a l C o m m u n i t i e s o f W e s t e r n A u s t r a l i a

There are several areas of caves in the south west of Western Australia. Most dark caves are inhospitable places for animals to reside permanently mainly due to the lack of a reliable source of nutrients. In some caves, however, roots from living trees above the ground branch out forming root mats within cave streams or pools. These root mats provide a constant and abundant food source for a rich aquatic fauna, especially invertebrates. Aquatic root mat communities are known in caves from two areas at Yanchep, and Augusta-Margaret River.

The root mat fauna of the Augusta-Margaret River and Yanchep caves are remarkable in their high species richness and abundance. They may contain 30-40 species of invertebrates, while three to six species is more usual for aquatic caves elsewhere in the world. Some species only occur in these cave streams and some, including the Crystal Cave Crangonyctoid, are Gondwanan relicts—with ancestors traceable back to when Australia was part of the super-continent, Gondwana, at least 100 million years ago. The aquatic root mat communities have been listed as threatened ecological communities. As the invertebrate communities are highly restricted, and facing high levels of threat, they have been ranked Critically Endangered.

The caves that contain root mat communities in the Augusta-Margaret River area occur on a geological formation known as the Leeuwin-Naturaliste Ridge. The cave streams are either of groundwater origin or, especially in the case of temporary streams, are a continuation of surface creeks that flow into the caves. Several caves known to contain root mat communities occur within 10km of the coastline on a Tamala (coastal) limestone ridge between 0.5 and 25km apart. The invertebrate species present vary greatly in composition and abundance from cave to cave. This, plus differences in the water (pH, temperature, electrical conductivity) between the caves, has resulted in these caves being considered to contain distinct communities. Several tree species, including karri (*Eucalyptus diversicolor*), marri (*Eucalyptus callophylla*) and peppermint (*Agonis flexuosa*) extend roots into these caves.

Root mat communities in Yanchep caves occur at the junction of the Bassendean sands and Tamala Limestone (Spearwood Dunes). On the western side of the Gnangara mound (a shallow aquifer that extends from Moore River to the Swan River) waters



The Crystal Cave crangonyctoid within Yanchep National Park is critically endangered.
Photo – Edyta Jasinska

flow towards the coast and seep through the sand forming pools and streams in caves around Yanchep. The Australian Speleological Federation has recorded 315 caves in Yanchep National Park but only 10–15 contain permanent water. Six of these contain root mats and support 30–40 species of animals. All the roots that grow into the caves belong to Tuart trees (*Eucalyptus gomphocephala*). More than half of the species of each cave at Yanchep occur in the root mats, with the remainder in open water, root detritus, and sand in the stream bed.

The persistence of the root mat communities of the Leeuwin and Yanchep caves depends on the presence of permanent water in caves. Continuing decline in the level of groundwater will cause the streams to completely dry out and the communities to be lost. Many of the species have no drought-resistant stages and therefore are unable to survive drying. Water levels in caves in both areas have been declining, and this presents the most serious threat to the communities. At Yanchep this is due to a combination of a drying climate and increased use of the waters of the Gnangara mound. The reasons are less clear in the Leeuwin caves, but also appear to include the dry climate. The loss of the trees whose roots provide habitat and food for the communities is also a threat, as is pollution of the groundwater.

For further information please contact the Department's Swan Region office on (08) 9368 4399 or the Blackwood District office on (08) 9752 1677.

Recovery of threatened ecological communities

The Department of Conservation and Land Management (the Department) is committed to ensuring that Critically Endangered Ecological Communities are not totally destroyed. This is done through the preparation of an Interim Recovery Plan (IRP), which outlines the recovery actions that are required to urgently address those threatening processes most affecting the ongoing survival of threatened ecological communities in the wild and begin the recovery process.

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The Department has established a Recovery Team to coordinate the implementation of recovery actions that address the greatest threats to the survival of the Yanchep caves community. A team for the Leeuwin caves is currently being established. Recovery Teams consist of representatives from the Department, community groups, private landowners, local shires and various government agencies. Recovery actions that have been, and will be, progressively implemented to protect the threatened ecological communities include:

Protection from current threats:

Monitoring of water levels and quality, investigating and mapping caves streams, monitoring trees above caves, conducting further surveys for the community, establishing a semi-permanent system for remote monitoring and artificial watering of caves at Yanchep caves, and regular monitoring of the health of each community.

Protection from future threats:

The development of strategies to manage fire, regenerate trees above caves if required, monitor invertebrate communities, minimise impacts of current and future management practices, ensuring that all relevant people are aware of the communities' presence and the need to protect them, and that all are familiar with the threats identified in the Interim Recovery Plans.



Root-mat close up showing new growth (white shoots).
Photo – Micheal James

IRPs will be deemed a success if they result in a better understanding of the communities and the factors affecting them, no drying out of known occurrences of the root mats occur, all the Gondwanan species in the aquatic root mat assemblages are maintained, the trees that are currently supplying or are likely in future to supply roots to the caves are maintained, and overall reduction of threatening processes occurs.



Cabaret Cave area in Yanchep National Park showing tuart forest surrounding limestone caves. Photo – Michael James



Calgardup Cave in the Leeuwin-Naturaliste Ridge. Photo – Michael James

ORGANIC MOUND SPRINGS OF THE SWAN COASTAL PLAIN

T h r e a t e n e d E c o l o g i c a l C o m m u n i t i e s o f W e s t e r n A u s t r a l i a

Organic mound springs occur where the heavy clay soils of the Guildford Formation on the eastern side of the Swan Coastal Plain and the Bassendean Dune sands meet. The Bassendean sands contain the Gnangara Mound, a shallow aquifer that extends from the Moore River to the Swan River. This groundwater is forced to the surface at a series of discharge points on the eastern boundary of the aquifer where waters encounter the impermeable Guildford clays. A permanent supply of fresh water allows the continuous growth of vegetation. The build up of decayed plant material from this dense vegetation forms peat around the permanent water supply. Water is continually forced, under pressure, to the surface, carrying sand and silt, which enhances the formation of the peat mounds.

These mounds provide a year-round wet area for a number of unique animals that cannot survive drying out. They are a refuge for seed shrimp, roundworms, mites, side swimmers, water fleas, copepods, worms and insects, that used to occur over a much greater area millions of years ago when Australia was much wetter. Underground species that naturally occur in the groundwater may also emerge and be found at these springs.

Historically, the mound springs were common within their narrow range, forming a north-south line parallel to the Darling Scarp. They have typically been excavated to create farm dams or cleared and sealed with limestone to provide pasture for horses and cattle. The mound springs have been listed as a threatened ecological community because they are now extremely restricted in distribution. With only three vegetated springs remaining which face a number of significant threats, the mound springs have been classified as Critically Endangered.

The conservation of the Mound Springs' plants and animals depends on maintaining the quality and quantity of the water supplied from the Gnangara Mound and the pressure head caused by the presence of dunes adjacent to each of the springs. Management practices on land adjacent to the mounds have the potential to change the water quality and quantity to the



Kings Mound Springs in Bullsbrook showing flooded gum, rushes and bracken fern. Photo – Val English

springs. Some of the invertebrate species that live in the peat mounds do not have dormant stages and would not survive if the peat mounds dried out. A combination of a drying climate and increased use of the waters of the Gnangara mound pose the biggest threat to the mound spring community, with one area of mounds springs drying up at the surface recently.

Other threats to the mounds include increased weed invasion and too frequent fire. Too many hot fires are likely to impact the wetland-adapted flora and fauna. In the extreme the peat itself can be completely burned out by hot fires under dry conditions. Although the mound spring vegetation is generally not susceptible to dieback disease caused by the pathogen *Phytophthora*, the vegetated dunes adjacent to the mounds contains *Banksia* woodland, which is highly susceptible to the disease. Loss of this dune vegetation may alter the local hydrology.

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ORGANIC MOUND SPRINGS OF THE SWAN COASTAL PLAIN

The Department has set up a Threatened Flora and Communities Recovery Team for the Swan Region to coordinate the implementation of recovery actions that address the greatest threats to the survival of the mound springs community. Recovery Teams consist of representatives from the Department, community groups, private landowners, local shires and various government agencies. Recovery actions that have been, and will be, progressively implemented to protect threatened ecological communities include the following:

Protection from current threats:

Weed control, fencing, conducting surveys for new occurrences, and regular monitoring of the health of and flora and fauna each area of the community.

Protection from future threats:

Developing strategies to manage fire and dieback, acquiring areas as conservation reserves, rehabilitating degraded areas, and ensuring that all relevant people are aware of the community and the need to protect all occurrences from threats identified in the Interim Recovery Plan.



Vegetated mound springs in Ellenbrook. Photo – Val English



Fire and grazing were a threat to this Mound Spring in Muchea. Photo – Val English

IRPs will be deemed a success if there is an increase in the area and/or number of occurrences of the community under conservation management, hydrological and biological processes and the diversity and composition of native species are maintained, and there is an improvement in the condition of the habitat, through the re-establishment of fringing buffer vegetation and a reduction in the numbers of weeds and threatening processes.



Staff from the Department of Conservation and Land Management surveying mound springs in Ellenbrook. Photo – Val English