



## SUBTERRANEAN WETLANDS

Subterranean wetlands include all underground areas containing water (including ice caves). The most striking subterranean wetlands occur in cave and karst areas.

Karst is a three-dimensional, dynamic and integrated system of animals and plants, water, soils, landforms, bedrock, energy, water and gases. The drainage patterns and landforms are shaped by bedrock being dissolved by naturally acidic waters. Karst has underground drainage systems including caves, and distinctive surface features including blind valleys, closed depressions, sinking streams and springs.

### Distribution within Australia

The distribution of karst regions within Australia is very patchy, and most of these regions are less than a few thousand hectares in size. Highly significant subterranean wetlands occur in:

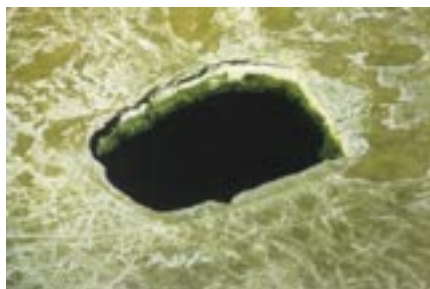
- **Cape Range/Barrow Island, WA:** blind cave fish and many critically endangered species occur here including species whose closest relatives occur on the other side of the North Atlantic.
- Numerous **calcrete aquifers of the inland and central arid zone of WA and NT:** where over 50 species of blind beetles have been found.
- **Limestone Coast, SA; Wellington and Wombeyan, NSW; Ida Bay, Junee-Florentine and Mole Creek, TAS:** these karst regions contain a high diversity of snails and crustaceans that are relict species with very localised distributions.

### Special features of subterranean wetlands

At the Sixth Conference of the Contracting Parties to the Convention on Wetlands (Ramsar, Iran, 1971), the Parties agreed to include subterranean karst wetlands as a wetland type under the Ramsar Wetland Classification System. This agreement recognised that some subterranean cave and karst systems provide natural underground wetlands and constitute a resource of ecological, cultural, scientific, aesthetic and recreational value, providing an environment for specialist vertebrate and invertebrate species. It also recognised the importance of such areas as groundwater sources for some arid areas.

Subterranean karst wetlands can include underground streams, deep lakes and groundwater reservoirs, seepage points and springs.

Subterranean wetlands provide habitat for a range of animals that are highly adapted to living underground. These animals are called stygobites and they are generally blind, lack pigment and may have long antennae and legs.



*The Black Hole, SA, is a karst wetland type known as a cenote. Cenotes are a window into the groundwater ecosystems and caves below the surface.* Photograph courtesy of Peter Horne.

Stygobites cannot survive in surface environments. Many stygobites are endemic species that are restricted to a single cave or karst area. Many are also rare or endangered species.

Stygobitic crustaceans (including isopods, syncarids and amphipods) are found in subterranean wetlands across Australia. Many of these are considered 'living fossils' because they closely resemble fossils dating back to hundreds of millions of years ago. These crustaceans have survived major climatic changes by finding refuge in subterranean wetlands. By studying stygobites we can learn much about the past history of the Australian continent and the evolution of subterranean species.



*Halosbaena tulki, the only member of the crustacean order Thermobaenacea known from the Southern Hemisphere.*

Photographer: Douglas Elford, Western Australia Museum.



*New species of blind syncarid found recently at Jenolan Caves, NSW.*

Photographer: A. Mostead.



*Blind Cave Gudgeon (Milyeringa veritas)*. Photographer: Douglas Elford, Western Australian Museum.

There are two species of cave fish found in Australia – the Blind Cave Gudgeon (*Milyeringa veritas*) and the Blind Cave Eel (*Ophisternon candidum*) – found only in WA. Both are critically endangered and are considered vulnerable nationally (see below). Virtually nothing is known of the biology of these two species.

Some springs and caves were once a focal point for human settlement or activity because they provide a source of water. Today many



*Aerial view of Ewens Ponds, a large karst spring system in the south east of SA.*

Photograph courtesy of Ian Lewis.

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subterranean wetlands are important for groundwater supplies, as well as for tourism and recreational activities, including cave diving.

**Threats to subterranean wetlands**

Subterranean wetlands are very susceptible to groundwater pollution, and the nature and extent of the underlying hydrological system plays a major role in the distribution of pollutants.

In some regions, groundwater can move quickly through the karst via large interconnected cave systems, travelling many kilometres within a few days. Pollutants entering these types of systems can spread rapidly as there is no natural filtration of the groundwater, so disease and toxins can spread unchecked.

In comparison, there are other karst systems where cave development is not so extensive, and the groundwater flows are extremely slow, taking hundreds of years for the water to move a short distance. This means that although pollutants may not disperse very far, they remain in the groundwater for a very long time.

Groundwater pollution can lead to the local extinction of fauna in subterranean wetlands, or may cause a change in the composition of dominant species. Other threats to subterranean wetlands include altered hydrological regimes from clearing, drainage and groundwater extraction.

**Protection under the EPBC Act**

The *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides protection to matters of national environmental significance. Some important subterranean wetlands are being protected through this mechanism. For example, the internationally important karst systems of The Dales, Christmas Island are protected as a Ramsar Wetland; the Blind Cave Gudgeon and Blind Cave Eel are protected as Threatened Species; and the aquatic root mat communities 1, 2, 3 and 4 in caves of the Leeuwin Naturaliste Ridge, WA, are protected as a Threatened Ecological Community under the Act.



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