Muir-Byenup wetlands acidification
case study

South West Kodjinup wetlands within the Muir-Byenup Ramsar wetland complex

The Muir-Byenup system is located in the south-west of Western Australia, approximately 50 km east of Manjimup, which is 300 km southeast of Perth.

It is the most outstanding peat swamp system in south-western Australia (Storey et al. 1998; Gibson and Keighery 2000ab).

The Muir-Byenup wetlands south-east of Manjimup are one of 12 wetland areas in WA that are internationally recognised for their conservation values under the Ramsar convention.

They were determined to be of international significance primarily on the basis of their large and varied waterbird populations (Farrell and Cook, 2009).

In particular, they are important for moulting Australian Shelduck, are a drought refuge for many waterbirds and some support the threatened Australasian bittern.

The wetlands also support rare and restricted plant species and diverse aquatic invertebrate (see Figure 1) and fish communities, including some species found nowhere else and/or are listed as threatened species.

In some shallow vegetated wetlands that are permanently inundated, the upper layers of sediment are composed entirely of decaying plant matter rather than mineral.

These organic sediments form under low oxygen conditions, where plant litter is deposited within the wetland faster than it breaks down.

In some wetlands these organic sediments form peat, which are deposits of highly compacted and fine-grained organic matter.

Within WA, such sediments are mainly found in the higher rainfall parts of the south-west, but also occur in some spring complexes elsewhere in the state where there is permanent groundwater discharge.

Naturally low oxygen conditions within these organic substrates can also lead to the accumulation of iron sulphides (and other metals derived from the groundwater) which, when exposed to the air, produce sulphuric acid.

This can happen, for instance, when previously saturated organic sediments dry.

SOUTH WEST SNAPSHOT

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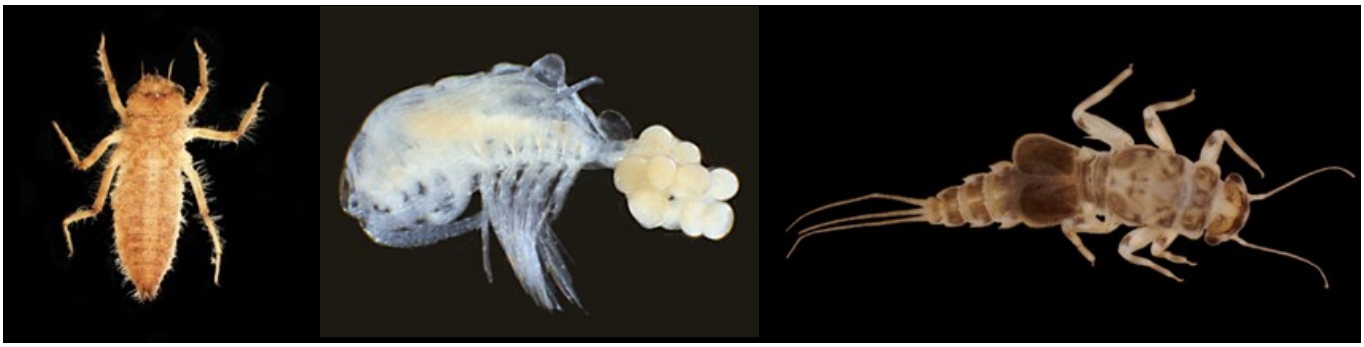

Figure 1: Aquatic invertebrates inhabiting Muir-Byenup wetlands. Left to right: *Archaeosynthemis occidentalis* (a dragonfly larva); female *Calamoecia clitellata* with eggs (a microscopic crustacean) and *Tasmanocoenis arcuata* (a mayfly nymph).

Threats

Many Muir-Byenup wetlands have potentially acid forming organic substrates.

In recent years, reduced rainfall in the south-west, and to some extent agroforestry, has resulted in declining groundwater tables in this area.

This has caused some Muir-Byenup wetlands that were once permanently inundated, or at least maintained saturated sediments during summer, to become drier (Lane et al. 2017), exposing the iron sulfides to the air.

Upon reflooding, the released acidity has caused pH in the wetlands to drop dramatically, with severe consequences for the plants and animals that live in these wetlands (e.g. Cale and Pinder, 2018).

Other potentially toxic elements previously bound within the peat, such as metals and plant nutrients, can become mobilised at the same time, and the reduced lake depths result in increased salinity.

Conservation activities

Research is underway to understand the hydrological and geochemical processes that influence the risk of Muir-Byenup wetlands further acidifying in a drying climate, and to determine the effects of the acidification on the wetlands' fauna.

This research could inform investigations into the feasibility and options for remediating acidified wetlands.

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Interesting facts

The **Muir-Byenup System Ramsar site is highly diverse** with at least 600 indigenous flora species recorded.

This site is considered a **centre of endemism** as it provides habitat for endemic freshwater fish fauna and supports a number of important endemic invertebrates.

Peat-based wetlands are rare in WA and the Muir-Byenup peat wetlands are recognised as amongst the most outstanding examples in the state.

New research by the Department of Biodiversity, Conservation and Attractions and the Global Peat Microbiome Project has shown that **Muir-Byenup peats are amongst the oldest in the world**, with some deposits up to 7000 years old.

Trends, condition & information reliability

Trend: Deteriorating. Three wetlands have become acidic since 2008. Predictions are for further decline in rainfall. As the wetlands are groundwater windows it is anticipated that further drying and acidification of organic Muir-Byenup wetlands is likely.

Condition: Good - 89% (three wetlands out of 28 have become significantly more acidic to date)

Information reliability:

Declining rainfall in south-western Australia is well documented (Charles et al. 2010).

Ten years of DBCA groundwater monitoring data have been modelled, confirming declines in aquifer groundwater levels are widespread in Muir-Byenup (PSM 2015),

Acidification of surface water has been documented as part of ongoing annual monitoring as part of the SWWMP program (Lane et al. 2017) and ongoing DBCA research.

DBCA research currently underway is assessing and identifying wetlands that are likely to be more resilient to changes in groundwater levels and acidification. It is also providing information on the effects of acidification on aquatic invertebrates (e.g. Cale et al. 2018).

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