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Will our drying climate lead to the extinction of Perth's wetland fauna?

In Mediterranean climate regions like Perth, wetlands are often seasonal, and the fauna is adapted to annual wetland drying. However, with a drying climate, wetlands are drying out more frequently and/or for longer, yet so far they have retained their high biodiversity.

Perth's wetlands have a diverse range of habitats. For example, fringing trees provide shade and leaf litter, altering the wetland sediment beneath them. Some wetlands also have naturally occurring cracks in the sediment that remain moist and cool when sediments dry out.

Invertebrates, such as dragonflies, water beetles, crustaceans and molluscs, are the most species-rich wetland animals. They use a variety of ways to survive wetland drying, and some species depend on the presence of special habitats, termed refuges (see Box 1). This project aimed to identify potential refuges from warmer, drier conditions for wetland invertebrates.

Methods and results

We sampled sediment microhabitats (cracks and deeper fissures, Figure 2) that retain moisture during dry periods. These cracks and fissures were found to be up to 20°C cooler than the surrounding sediment surface, and contained both dormant and active invertebrates (Strachan *et al.* 2014). These findings demonstrated, for the first time, how animals that have no desiccation resistant life stage, can persist in

Box 1.

What are refuges and microhabitats and why are they important?

Refuges are natural places where animals are protected from environmental disturbances and from which animals can disperse out into the landscape once the disturbance (e.g. drought) is over.

Figure 1 shows some potential refuges that invertebrates may use in wetlands to survive hot, dry summers. Microhabitats are small parts of habitats that have different environmental conditions to surrounding areas, for example, pools that remain when the rest of the wetland is dry.

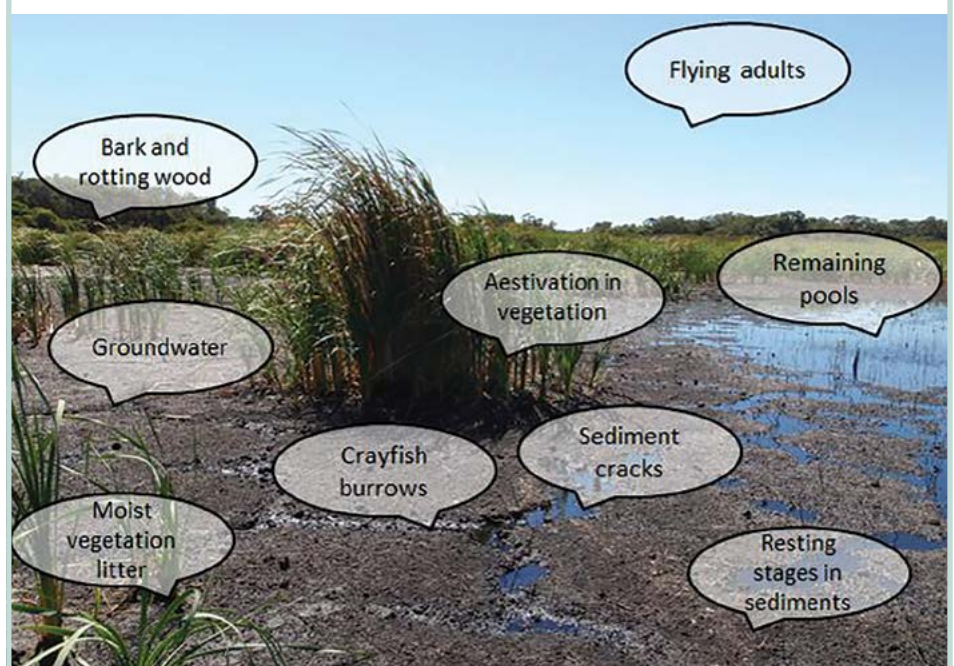


FIGURE 1 Potential microrefuges from drought for wetland fauna
 Adapted from Boulton and Brock (1999)



FIGURE 2 The three stages of South Lake, (right to left) flooded, drying out and dry: these cracks and fissures in the drying sediment enable many freshwater invertebrates to survive hot dry summer conditions

seasonally-dry wetlands. They also showed that some aquatic insects survive drying as larvae, preying on stranded invertebrates or consuming organic matter, and then emerge as flying adults after the wetland has dried out.

Dry sediment was also sampled from two habitats (the middle of the wetland, where open water had been during spring, and from beneath the fringing trees) in eight wetlands. Sediment properties were measured, and sediment was reflooded in the laboratory to count and identify the freshwater invertebrates surviving in the sediment. Fringing tree sediment remained cooler, had higher organic matter content (leaves and sticks), water saturation potential (the ability for the soil to retain moisture) and different diversity of invertebrates to open water sediment. Amphibious invertebrates were more likely to be found in fringing tree sediment than open water sediment.

We found three common strategies by which invertebrates survived drying in Perth wetlands. Some animals lack adaptations to survive desiccation, so are either restricted to perennial waters, or

use fissures in wetland sediment to persist in drying wetlands. Many insect larvae emerge as flying adults either before wetlands dry out, or following retreat into sediment fissures. Other invertebrates have a desiccation resistant life-stage: either eggs or the capacity for adults to enter a dormant life stage.

Conclusions and recommendations

- Shallow seasonal wetlands may contain both habitat and microhabitat-scale refuges from higher temperatures and prolonged drying, explaining the resistance of their fauna to drought.
- To sustain wetland biodiversity, native fringing vegetation should be protected and replanted (where necessary), to sustain this cool, moist habitat.
- Drying wetland sediments can provide cracks and fissures that form cooler, moister microhabitats for invertebrates, some of which cannot survive drying anywhere else. Wetlands need to be protected from degrading processes such as sedimentation and eutrophication, because they alter sediment composition and structure, potentially limiting the

availability of sediment microhabitat refuges for fauna. ■

More information

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