



LAKE CAVE ECO-HYDROLOGY RECOVERY PROJECT UPDATE

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– Sarah Davies*

In June 2010, the Augusta Margaret River Tourism Association (AMRTA) received State NRM funding to implement its Lake and Jewel Cave Eco-Hydrology Recovery Project. This research program has three aims:

- 1) Control the water level decline in Lake Cave, by harvesting rainfall and using this to supplement recharge of the lake;
- 2) Assess the ecological condition of the aquatic root mat community and other stygofauna in Lake Cave;
- 3) Initiate studies of the hydrology of the cave and catchment, to develop a hydrological model with a view to managing water resources and dependent ecosystems in the face of a drying climate future.

To date, two reports have been produced and distributed to key stakeholders, community and grant bodies for review and comment. These reports include:

Report 1: Threatened Ecological Community Condition & Assessment Report – Aquatic Root Mat Communities of the Leeuwin Naturaliste Ridge Caves, Community 1: Jewel and Easter

Report 2: Lake Cave Eco-hydrology Recovery Project – Threatened Ecological Community & Hydrology Baseline Monitoring Report No.1

To provide a context for the recovery project taking place at Lake Cave, one must first understand the problem. Lake Cave is a stunning tourist attraction, which since its discovery in the late 1800's has been renowned for its stunning reflections and mesmerising subterranean stream, so slow moving one could be forgiven for calling it a 'lake'.

Unfortunately, 2005 marked the beginning of a progressive decline in the water level within the cave – an alarming average of 1mm per week. At that rate, without management intervention, Lake Cave would be completely dry within 2 to 3 years.

Stygofauna are often the forgotten life in the underworld, being invisible to the naked eye. Because of this, they are at risk of disappearing—whether through extinction due to loss of suitable habitat, or by disappearing from our lack awareness by being forgotten. Being a popular tourist attraction with more than 44000 visitors annually, Lake Cave is the ideal platform for public education on issues such as the cause and effect of

groundwater decline in karst areas, as well as the impacts on cave ecosystems

So exactly what is taking place at Lake Cave?

A team has been established comprised of Environmental Biologist Dr Stefan Eberhard, Hydrogeologists Dr Steve Appleyard, Margaret Smith and Dr Ryan Vogwill from DEC, as well as AMRTA staff and management, including our on ground research officer, graduate environmental scientist Sarah Davies.

Short term management actions aimed to conserve the known available habitat of the groundwater dependent ecosystem while longer term research focuses on identifying the cause of groundwater decline.

Current Actions Being Undertaken – Rainwater harvesting and recharge supplementation trial

Rainfall harvesting involves the collection and storage of rainwater. At Lake Cave, two environmental rainwater tanks have been installed and rainfall is collected from existing roof areas.

The collected water is directed to the back of Lake Cave where a drip irrigation system allows the gradual infiltration of water to the Lake via a natural sand bank (at approx.110L/hour).The aim of recharge supplementation is to halt water level decline and maintain the current water level.

Although every precaution possible is being taken to ensure that the water is as close as possible to the composition of natural seepage water, it is still a foreign source and so carries risks. These risks include the modification of water quality parameters such as pH, temperature and calcite saturation which may impact upon hydrogeological and ecological processes.

These risks will be minimised and managed by regular monitoring and adopting a precautionary approach. If any potential adverse changes are detected then the recharge trial will be halted or modified until conditions are restored to within acceptable limits.

The recharge supplementation trial was implemented in October 2010, following the completion of a baseline stygofauna survey and baseline water quality monitoring over the preceding year. Since its commencement, there have been no major changes in water quality with pH, electrical conductivity, temperature and alkalinity being monitored on a weekly basis. Thus far, it appears to be sustaining the water level.

Ecological condition of groundwater dependent community

Groundwater dependent ecosystems in Lake Cave include stygofauna and the aquatic root mat community which were last surveyed in 2000, when 23 species were recorded. This is the highest diversity recorded from a cave in the Leeuwin-

Naturaliste Ridge (Eberhard 2004). The objective of the survey in July 2010 was to assess the ecological condition of the aquatic root mat community and stygofauna prior to commencement of the recharge trial. A baseline can then be established to ensure that the community is not adversely impacted by the recharge trial, although water decline is the major threatening process.

The aquatic root mat community in Lake Cave is located in a miner's tunnel. In 2010, water levels had declined below the bottom of the miner's tunnel and this root mat community probably no longer exists. Fourteen species with root mat associations were not recorded in 2010. The declining water levels and drying out of the root mat habitat in Lake Cave has resulted in a 74% decline in species richness over the past 10 years. Maintenance of the current water level is imperative for the conservation of the remaining stygofauna community.

Hydrology Investigation

In order to be able to effectively manage Lake Cave in the face of a drying climate, AMRTA has initiated studies of the hydrology of the cave and catchment. Ultimately, a hydrological model of the system will be developed to be used as a tool for managing water resources and groundwater dependent ecosystems.

The first stages of the investigation include aging of water from within the cave and Nindup Plain (likely catchment area) using chlorofluorocarbon (CFC) and sulfurhexafluoride (SF6) analysis. A stable isotope signature will be developed for groundwater in the cave and Nindup Plain as well as drip water to better define the origin of the cave water and assist in delineating the catchment boundary and subsurface flow paths. Other work will focus on analysing rainfall, fire history, land use and vegetation changes within the catchment in order to develop the hydrological model.

Unfortunately the rise in water levels observed in some of the other caves in the LNR as reported in the last ACKMA journal was not recorded in Lake Cave. Indeed we cross our fingers and hope that we see the same response in coming years, but in the mean time, it is AMRTA's approach to tackle an issue head on allowing us to undertake the core research to understand the karst drainage system. The hydrology of the Leeuwin Naturaliste Ridge remains a mystery, and we are in the planning stages of a regional hydrology and stygofauna research program to address this knowledge gap.

Results of the Lake Cave Eco-Hydrology Recovery Project and any other research that may take place in the future will be used not only to aid the management of Lake Cave and its water resources, but by land managers in and around karst areas to better understand the impacts of land use decisions on karst systems.

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