



## C.D.A.A. Newsletter

No. 123 - MARCH 2013

### **INSIDE...**

**Stefan Eberhard:**

*Nullabor Cave  
Fauna & Diving*

### **PLUS...**

**Ian Lewis:**

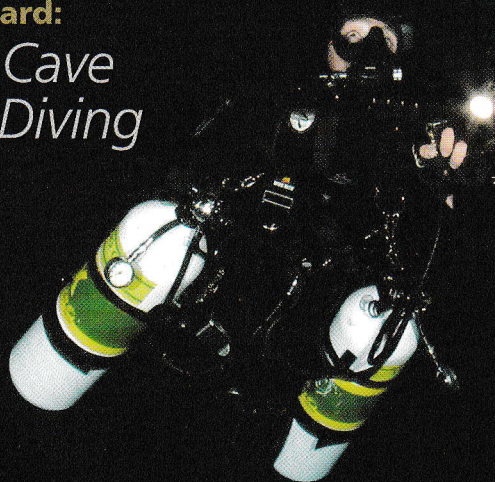
*Weebubbie with Catalyst*

***and lots more!***

# CAVE DIVERS ASSOCIATION OF AUSTRALIA

(Incorporated in South Australia)

Print Post No. PP 381691/00020



# SENTINEL DIVER





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# CONTENTS

Editorial - Rowan Stevens	5
National Committee Update	7
Notice Fundraising for the CDAA	9
Instructor List	32
Site Access	33
Portfolio - Toby Passauer	34 - 35

## Articles...

Piccs named as a RAMSAR site, Anelia Blakie	10
Water Plan to extend Wetlands, Anelia Blakie	12-13
Nullarbor Cave Fauna & Diving - Stefan Eberhard	14-21
Karst Geology, Ian Lewis (Weebubbie)	22-27
Florida Sinkhole Season just begun, Tamara Lush	30-31



## Cover:

Piccs.

Diver is  
Lucas Ford

Photo by:  
Toby Passauer

## CAVE DIVERS ASSOCIATION OF AUSTRALIA

ABN 65 062 259 956

P.O. BOX 544, Mt Gambier, SA 5291

GUIDELINES is a newsletter of the Cave Divers Association of Australia. All articles for the following issue are to be sent to the Publications Director, Email: publications@cavedivers.com.au

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## CONTACT LIST

Please contact the most relevant person or, if unsure write to:  
C.D.A.A. P.O. Box 544 Mt Gambier SA 5291 [www.cavedivers.com.au](http://www.cavedivers.com.au)

**NATIONAL DIRECTOR** - John Vanderleest  
Email: [national@cavedivers.com.au](mailto:national@cavedivers.com.au) Mobile: 0419 775 771

**STANDARDS DIRECTOR** - Linda Claridge Mobile: 0408 052 070  
Email: [standards@cavedivers.com.au](mailto:standards@cavedivers.com.au) AH: (03) 5565 8793

**Quality Control Officer** - Position Vacant  
Email: [quality@cavedivers.com.au](mailto:quality@cavedivers.com.au)

**Safety Officer** - Agnieszka Malkowska  
Email: [safety@cavedivers.com.au](mailto:safety@cavedivers.com.au) Mobile: 0401 416 330

**Search & Recovery Coordinator** - Richard Harris  
Email: [sar@cavedivers.com.au](mailto:sar@cavedivers.com.au) Mobile: 0417 177 830

**Instructor Records & Materials** - Deb Williams  
Ph: 0419 882 800 Fax: 03 5986 3179 Email: [instrecords@cavedivers.com.au](mailto:instrecords@cavedivers.com.au)

**BUSINESS DIRECTOR** - Helen Higgins  
Email: [business@cavedivers.com.au](mailto:business@cavedivers.com.au) Mobile: 0411 720 440

**Treasurer** - Tammy Beattie Email: [treasurer@cavedivers.com.au](mailto:treasurer@cavedivers.com.au)

**SITE DIRECTOR** - Grant Pearce  
Email: [site@cavedivers.com.au](mailto:site@cavedivers.com.au) Mobile: 0438 833 103

**Kilsby's Access** - Craig Larkin  
Email: [kilsby@cavedivers.com.au](mailto:kilsby@cavedivers.com.au) Mobile: 0418 821 191

**Tank Cave Access** - David Fielder  
Email: [tankcave@cavedivers.com.au](mailto:tankcave@cavedivers.com.au) Mobile: 0410 450 496

**Shaft Access** - Terri Allen  
Email: [shaft@cavedivers.com.au](mailto:shaft@cavedivers.com.au) Mobile: 0419 176 633

**PUBLICATIONS & RECORDS DIRECTOR** - Rowan Stevens  
Email: [publications@cavedivers.com.au](mailto:publications@cavedivers.com.au) - Mobile: 0417 550 509

**Records Officer (Membership matters)** - Rowan Stevens  
Email: [records@cavedivers.com.au](mailto:records@cavedivers.com.au) - Mobile: 0417 550 509

**Copy Editor** - Position Vacant

**Guidelines - Graphics & Advertising** - David Bryant  
Email: [guidelines@cavedivers.com.au](mailto:guidelines@cavedivers.com.au) - Mobile: 0417 125 710

**CDAA Products** - Graeme Roberts  
Email: [products@cavedivers.com.au](mailto:products@cavedivers.com.au) Mobile: 0425 719 419

**Webmaster** - Simon Roberts Email: [web@cavedivers.com.au](mailto:web@cavedivers.com.au) Mobile: 0433 069 751

## AREA REPRESENTATIVES

**ACT:** Heike Apps Email: [actrep@cavedivers.com.au](mailto:actrep@cavedivers.com.au) Ph: 0407 230 108

**NSW:** Peter Streit Email: [nswrep@cavedivers.com.au](mailto:nswrep@cavedivers.com.au) Ph: 0428 120 863

**N.T.:** Jeff Swann Email: [ntrep@cavedivers.com.au](mailto:ntrep@cavedivers.com.au) Mobile: 0408 819 782

**QLD:** Trent Lee Email: [qldrep@cavedivers.com.au](mailto:qldrep@cavedivers.com.au) Mobile: 0400 141 587

**SA:** Ken Smith Email: [sarep@cavedivers.com.au](mailto:sarep@cavedivers.com.au) Mobile: 0407 603 118

**South-East SA** - Grant Pearce Ph: 0438 833 103. Email: [sesarep@cavedivers.com.au](mailto:sesarep@cavedivers.com.au)

**WA:** Pippa Waterworth Email: [warep@cavedivers.com.au](mailto:warep@cavedivers.com.au) Mobile: 0410 304 894

**VIC:** Tim Muscat Email: [vicrep@cavedivers.com.au](mailto:vicrep@cavedivers.com.au) Mobile: 0422 127 802

**Public Officer** - Kevin Burrows Ph: 08 8351 0272 Email: [kburrows@esc.net.au](mailto:kburrows@esc.net.au)

## CDAA INSURANCE

Policy Type: Combined Liability Insurance Policy# SY-CAS-08-041140  
Insurer: Liberty International Underwriters ABN: 61 086 083 605  
Level 27, 1 Macquarie Place, Sydney NSW 2000  
Name Insured: Cave Divers Association of Australia  
Public Liability \$10,000,000 any one claim. Expiry: 30 September 2012



# 'The Basic Rules of Cave Diving'

*Through the study of past cave diving related accidents, researchers have found there are a number of common causes for these accidents. By becoming familiar with these causes, divers can learn to avoid similar accidents.*

*From the research, five main contributing factors have been found in over 90% of cave diving related fatalities.*

*These causes have led to the five basic rules:*

- **Be Correctly Trained.**

In the vast majority of fatalities world wide, the divers involved had no formal cavern/sinkhole (Deep Cavern) training. Of those who did have training, most were diving outside the recognised limits of that training. Many open water Instructors have died in caves.

- **Run a Continuous Guideline to the Open Water (Surface).**

In a large number of overhead fatalities, victims failed to run a continuous guideline from the open water. When silting took place or they became disorientated, exit was then not possible with gas remaining.

- **Always keep a Minimum of 2/3rds of the Starting Gas Supply for Exit when Entering an Overhead Environment.**

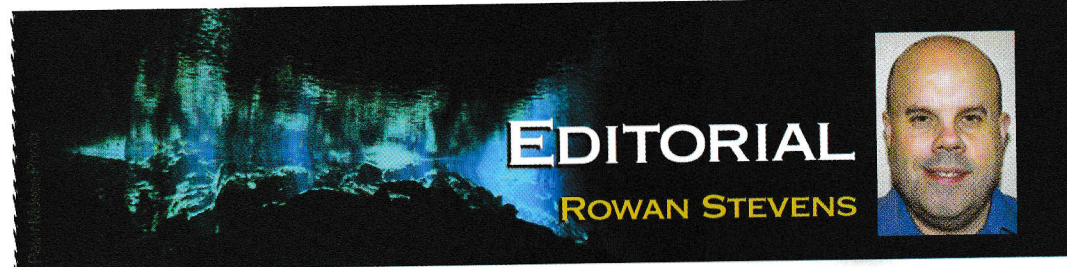
The rule is seen as the minimum in overhead environments and may not offer enough gas if trouble is encountered at the maximum penetration.

- **Always use a Minimum of 3 Light Sources.**

In cave diving this would be a primary and a minimum of two backups, all with the ability of lasting the duration of the dive.

- **Don't Dive Below 40m on Compressed Air.**

The CDAA's maximum depth limit is 40m. Of the trained, well equipped cave divers who have died, almost all were diving beyond 40m on air.



## Dear Members,

As we enter the Year of the Snake we are reminded by ancient Chinese wisdom that says "a snake in the house is a good omen because it means your family will not starve". This year the CDAA will not starve and will continue to grow as it has over the past 40 years. Welcome to 2013.

We start with an important notice to members on an innovative fundraising drive in which you can help the CDAA raise money while saving yourself money at the same time on your phone, gas and electricity bills – see page 9 for more details.

## In this issue ...

We are proud to be the first to showcase Dr. Stefan Eberhard's work on Nullarbor Cave Fauna. Ian continues his series on Karst Geology with focus on Weebubbe, the Nullarbor's deepest cave. There is an interesting article from the USA about 'Sinkhole Season' in Florida and we are showcasing some of Toby Passaeur's underwater photography work. There are also articles on Piccaninnie Ponds' receiving Ramsar Status (<http://www.ramsar.org>) as well as an article on the site works underway at Pic's.

## Also in this issue ...

We are sad to report that Alexander Kewal (#72) passed away on 15th December 2012. The CDAA expresses our sympathies to Alex's family and in particular to his wife Helen (#73) who is still an active diver and CDAA member. Both have been regularly diving the sinkholes of Mt. Gambier since 1969.

## And finally ...

This year's AGM coincides with the CDAA 40th Celebrations and both will be held over the weekend of November 9th and 10th, 2013 in Mt. Gambier. Write these important dates in your dairies now.

Until the June edition, happy diving ...

Rowan Stevens #3177 | Publications and Records Director  
M: 0417 550 509 | E: [publications@cavedivers.com.au](mailto:publications@cavedivers.com.au)

## Articles for Guidelines June 2013 - Deadline is May 15th.

- Send articles by email to [guidelines@cavedivers.com.au](mailto:guidelines@cavedivers.com.au)
- Text files should be saved as Word files or Simple Text
- Pictures saved from digital cameras or scanned from photos must be at least 200-300 dpi at 15cm wide, RGB files, and saved as Maximum Quality JPEG's.



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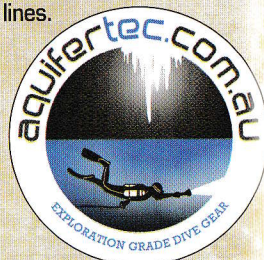
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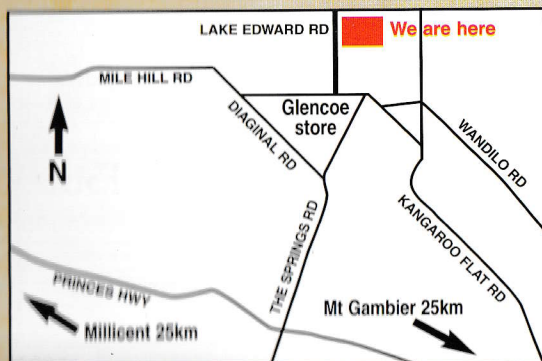
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Mobile: 0438 833 103

Email: [stay@ptdivelodge.on.net](mailto:stay@ptdivelodge.on.net)

Email: [admin@aquifertec.com.au](mailto:admin@aquifertec.com.au)

Web: [aquifertec.com.au](http://aquifertec.com.au)



# NATIONAL COMMITTEE UPDATE

**MARCH 2013**

We trust you all had a good Christmas and have been enjoying the sun. Things on the CDAA front have also been progressing in a structured and even pace.

There has been a considerable amount of work that has gone into establishing sustainable access plans for the Roe Plains. To this end, conservation has been the key focus, with an information video having been produced for divers wishing to visit the site. This video highlights areas of sensitivity and how CDAA members are expected to behave in these areas. If, by the time Guidelines is printed, you have not already been notified by email on the access protocol for the Roe Plains, you can expect to very shortly.

On other development fronts, the National Committee summary of the State Meetings and On-line Survey is now available in the members' document downloads area. This summary provides the basis of our business plan and focus for our on-going work.

As discussed at the State Meetings, one of the biggest challenges of any organisation is its operational cost. With the purchase of Tank Cave, we have lost the income derived from the interest earned on our cash reserves. Add to this not having any fee increases for several years, we are now back to funding only the basics. We did think that we would run in the red this year and may need to apply a levy to all members, but with good financial controls now in place, we have been able to avoid this. Next year is a different story. Without a fee increase, we will not be able to continue to develop the Association. At the time of writing, the budget and subsequently, the fees for 2013-14 are still being reviewed.

Also discussed at the State meetings was the desire to better support exploration. One such move was to support the beta trialling of a new side mount rebreather. Not only will this provide Australian feedback to its development, but also place us in the forefront in regard to training of new divers using this technology. With side mount rebreathers, we can see many of the boundaries that now exist with open circuit side mount diving being lifted and new cave diving territory being opened up.

Hand in hand with exploration is scientific discovery. In February, ABC Catalyst aired an extremely good story on cave divers, science and the Nullarbor. This story showed the positive and often forgotten side of what cave divers con-

tribute to the community. Having positive, good news stories about what we do goes a long way to rebuilding credibility with Government land owners and the public alike. Our thanks go out to Peter Buzzacott and Ian Lewis for their coordination and helping bring this story to life.

While on the topic of presenting a positive story, the CDAA once again has a stand at the OzTek event. The stand allows us to continue to show our strength in the Australian technical diving community. Our thanks goes out to David Strike, the OzTek coordinator, for his continued support for the CDAA, by providing a free booth for us to hold our display. We will provide photos and a short story in the next issue of Guidelines.

The AGM, symposium and 40th anniversary celebrations have been booked at the Main Corner in Mt Gambier for the weekend of the 9th and 10th November. Put this date in your diaries now. More information will follow in the next issue of Guidelines.

Until next time, may the outside of your drysuit remain wet and the inside dry.

## The National Committee



John Vanderleest,  
National Director



Helen Higgins,  
Business Director



Linda Claridge,  
Standards Director



Grant Pearce,  
Site Director

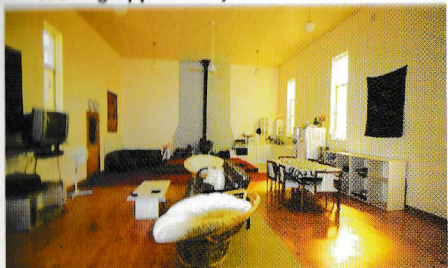


Rowan Stevens,  
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## In Memory of Alexander Francis Kewal 1947 - 2012

We are sad to report that long time CDAA member Alexander Kewal (CDAA 72) passed away on 15th December 2012.

Alex was certified as a FAUI diver in 1965 and he and his wife Helen first dived the Mount Gambier sink-holes in 1969, well before the CDAA was formed. They maintained their CDAA membership from the early days, right through to the present time. Their favourite dive was Piccaninnie Ponds where they dived at dawn, at night, and all times in between. Helen remembers how the clarity of water in the slot took their breath away when they first saw it. Helen has some interesting memories and photos from the early days and we are hoping to include these in a future issue of Guidelines.

The CDAA would like to express our sympathy to Alex's family and in particular to his wife Helen (CDAA73) who is still an active diver and CDAA member.



## IMPORTANT NOTICE TO MEMBERS – FUNDRAISING

### "SAVING YOU MONEY & ASSISTING CDAA INCOME"

Dear Member....

The costs associated with running the Association are rising and income is reducing. The National Committee is ever concerned in maintaining the CDAA in a viable position and not letting it "run down".

One obvious way to raise income is increasing members' annual dues and/or striking a levy payable by members. These options have been seriously considered by us over the past 12 months.

There is an alternative which we believe has merit. It would involve you saving money on your phone, gas & and electricity accounts whilst at the same time earning CDAA a "brokerage" on the number of accounts we can "introduce" to a distributor.

The concept has been put to us by long-serving CDAA member David Bird (#827). David advises that in his own household (4 people), as an indicator Gas Account savings per year are \$195, electricity \$316 and phone \$40 plus free calls. Savings of over \$550 per year!

We would be pleased if members would consider this option; the Committee will trial this offer

for 12 months. In a detailed submission to us we have been shown that if, say 300 members changed their phone, gas & electricity provider the annual income to CDAA would be in the vicinity of \$10,000.

Out of interest whilst your distributor may change the service providers would be Telstra (landline) Optus (mobile) and Energy Australia (formerly TRUenergy) for gas and electricity.

We do ask that members consider this option please. Saving you money, raising income for the CDAA and not needing to increase membership dues! Our aim is to get 300 plus members' (or families & friends') accounts as soon as we can.

If this is of interest PLEASE contact David by e-mail **debird57@gmail.com** with your phone number to discuss the matter. Please indicate your interest in either phone/gas/electricity. A competitive quote can be provided to assist your choice.

Thank you in advance for your support of CDAA in this project.

Sincerely yours, The National Committee.

P.S. Of course if other members have proven ideas on fund raising which you are prepared to coordinate on behalf of the National Committee we would be pleased to have them in writing.



Damien Grigg: 0466 912 190

damien@drysuit.com.au

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*Piccaninnie Ponds has just been named as a RAMSAR site on the international register. In the past, Piccaninnie Ponds has been a Conservation Park, not a National Park, due to its unique wetlands vegetation, karst features and near-coastal location where sea and land waters intermingle. To its west, the SA Government acquired the adjacent farmland which had been cleared about a century ago for dairying. An embankment was then built around part of that land, freshwater allowed to build up across it and to everyone's delight, native wetland vegetation began to reappear and flourish! Although dairy cattle had tramped over the farmland for so long, its deeper peaty soils had protected and held seed stock for all that time and once it got a good swampland watering, it's all jumped up again. It's called Pick's Swamp and is an excellent conservation success, driven mainly by local ecologist Mark Bachmann who worked for the SA Government on the project and now runs a consultancy on coastal wetlands. The other reason for raising the water level is to partly restore the natural groundwater flow which ran from Pic's Ponds eastwards across the Victorian Border into the Glenelg River estuary when first settlers arrived. Now the old surveyors' maps have been used to start the reclamation process and redirect some of the flow. Credit should go to the SA Government for taking this action. Also the various observations and reports over the years by CDAA divers have contributed to the decision to preserve and improve the original habitat and the CDAA can be proud of this. Ian Lewis. More information about RAMSAR can be found on Wikipedia.*

## Piccaninnie Ponds added to global list of important ecological treasure

Reprinted with courtesy of The Border Watch, January 29th, 2013.

Written by: Anelia Blakie. Email: [anelia@tbw.com.au](mailto:anelia@tbw.com.au)

**PICCANINNIE Ponds' elevated status as one of the world's most important wetlands was celebrated on Friday January 25th, 2013.**

The unique wetlands has become the sixth site in South Australia to receive Ramsar status, along with sites such as Bool and Hacks lagoons and the Coorong and Lower Lakes. It joins more than 2000 international sites on the Ramsar list, including the famous Everglades National Park in the US and Loch Lomond in Scotland.

Announcing the listing at Friday's function, Parliamentary Secretary for Sustainability and Urban Water Senator Don Farrell said international recognition under the Ramsar treaty ensured special protection of the iconic site into the future.

"There are a number of threatened species that use the wetlands and one of the great advantages is that they continue to have access to water during times of drought," Mr Farrell said. "From a tourism point of view, there are already a lot of international divers that come to dive its beautiful limestone caves and that will be expanded."

The new protection of the site and its fauna and flora will also require Federal Government approval for developments, such as wind farms, near the site. The 862 hectare Piccaninnie Ponds Conservation Park not only includes the main ponds, but also Pick Swamp, an area of hundreds of hectares of paddocks that ecologists have flooded with water to restore to wetlands in the past few years.

In the next few weeks the park will be closed as wetland restoration work continues. The Department of Environment, Water and Natural Resources (DEWNR) will restore and enhance 175 hectares of land and improvements will also be made to infrastructure and amenities while the park is closed from Monday, February 18, to Sunday, March 24.

Funded by the Federal Government's Biodiversity Fund, the works will increase the water levels of the wetland, specifically on the eastern side of the conservation park, which will improve the vegetation and biodiversity of the area.

The restoration works will also return the wetland water level and when water flows closer to what existed prior to settlement and water was drained out to the ocean to create farmland. "In the last 12 to 14 years a weir was put in which raised the water level slightly and diverted water back from the ocean to the land," Natural Resources South East regional manager Tim Collins said.

"The upgrade includes raising the water level and reflooding the wetlands." Grant District Mayor Richard Sage said he hoped the Ramsar status increased the opportunity for the government to internationally promote the park as a tourism attraction. Cave Diving Association of Australia national site director Grant Pearce said the new status further boosted recognition of the importance of the park on an international level. "This is an opportunity for the government to create access for the public to Pick Swamp to see the spectacular wetland system," he said.

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# Water Plan to Extend Wetlands

## World-renowned attraction set to change

Reprinted with courtesy of The Border Watch, Friday 15th February, 2013.

Written by: Anelia Blakie. Pictures: Anelia Blakie. Email: [anelia@tbw.com.au](mailto:anelia@tbw.com.au)

**ABOUT \$350,000 will be pumped into the Piccaninnie Ponds Conservation Park in late february and early March as water levels are allowed to rise and permanently flood large parts of the site. The Ramsar site will be closed for five weeks from Monday February 18th until March 24 to undergo restoration that will permanently change the world-renowned diving attraction.**

Between 30 and 40 megalitres of fresh water flows daily from the ponds into the ocean, but in coming weeks the flow will be restricted, which will divert water into the park to create permanent wetlands. The water flow will be managed from an existing weir with a regulator gate. It is still uncertain exactly how many litres of water will be stopped from flowing into the ocean, but according to Natural Resources South East regional manager Tim Collins, about 50pc of the park is expected to flood and become wetlands.

"The water level in the park will initially rise between 30 and 40cm, but it may rise up to 70cm in the

future," he said. When works start next week, roads and the parking area at the ponds will become flooded, and in the next few years the current camping area may also be under water.

Water will also flood towards the eastern side of the park and part of the Federal Government-funded works will include raising the carpark and roads above the water levels.

"It's about recreating the environment that was once there," Mr Collins said. Historically, more than 45pc of the South East was once wetlands, but when settlers started to arrive in the region in the 1800s, an extensive draining network was established, draining large parts of the land for farming. As a result, only 10pc of wetlands in the region remain, of which 6pc is in a reasonable condition.

### Piccaninnie wetlands set to be returned

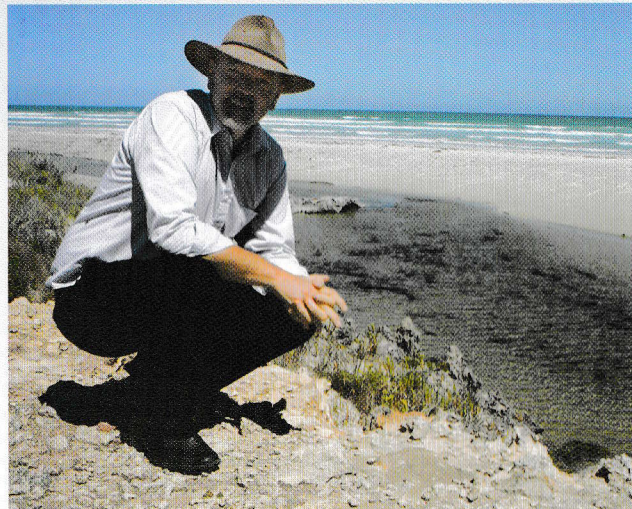
"Over time, and especially since we've had extended periods of drought, people started to realise there is a real benefit in holding some of the water back in the landscape," Mr Collins said.

The flooded areas will become permanently soggy, which is expected to have a significant impact on native vegetation and biodiversity in the park.

"A natural revegetation process will take place," Mr Collins said. "We will see some trees that only survive on dry land die off and we will see more of other trees grow - there will be more tea trees for instance.

"The process will be very quick with some changes occurring in a few months and others within a couple of years."

The newly-created wetlands areas in the 862 hectares park flow on from the adjoining Pick Swamp project a few years ago when farm land was also flooded to create wetlands. Pick Swamp, which was included in the Piccaninnie Conservation Park, quickly attracted previously scarce flora and fauna, including the highly endangered orange bellied parrot.



**FLOWES RESTRICTED:** Tim Collins from Natural Resources South East enjoys the views over the ocean where thousands of litres of fresh water flows daily from Piccaninnie Ponds onto the beach and into the sea. From mid February 2013, the flow will be restricted and water diverted back to the land to create wetlands.

But, with a focus on balancing nature while still allowing public access to appreciate the unique environment, Mr Collins said once works were complete, the flooding would not impact how visitors enjoy the area. More than 20,000 divers and other visitors from around the world frequent the park annually and many access the beach from the ponds for fishing, swimming and other recreational activities.

"Vehicle access to the beach will remain and all other activities will continue unchanged," Mr Collins said.

"We also expect the camping site to be usable for at least the next couple of years."

Meanwhile, discussions are underway on how to give visitors an understanding of the restoration process and its results in the near future.

"We are talking about interpretive signs that explain to the public what they are looking at and walking tracks where they can walk and enjoy the environment," he said.

"Low key and low impact is the thinking and we certainly won't build a large interpretive centre or even bird hides in the park."

**SHUT THE GATE:** Natural Resources South East regional manager Tim Collins demonstrates how the control gate in the park will be partly closed to restrict water from the Piccaninnie Ponds from flowing to the ocean.





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# NULLARBOR CAVE FAUNA & CAVE DIVING

Written by Dr Stefan Eberhard, Director, Subterranean Ecology. Pictures: Stefan Eberhard and Liz Rogers

## What are Stygofauna and Troglifauna?

Stygofauna are aquatic animals that live in groundwater. Most stygofauna are invertebrates, predominantly species of crustaceans (see figure). Troglifauna are air-breathing terrestrial animals that live underground in caves and smaller air-filled voids (meso-caverns) in rocks underneath the soil layer. Typical troglifauna include bats and species of spiders, millipedes, beetles, crickets and cockroaches (see figure). Some species of stygofauna and troglifauna are specially adapted to life in caves, and are blind and pale with elongated appendages to help them navigate in complete darkness. These specialized species are termed stygobites and troglobites. The terms troglifauna and stygofauna generally apply to multicellular animals however unicellular organisms including bacteria and protozoa also play a critical role in subterranean environments. Microorganisms in groundwater are a potential food source for other stygofauna, and are involved in other processes such as nutrient cycling.

## Why are they important?

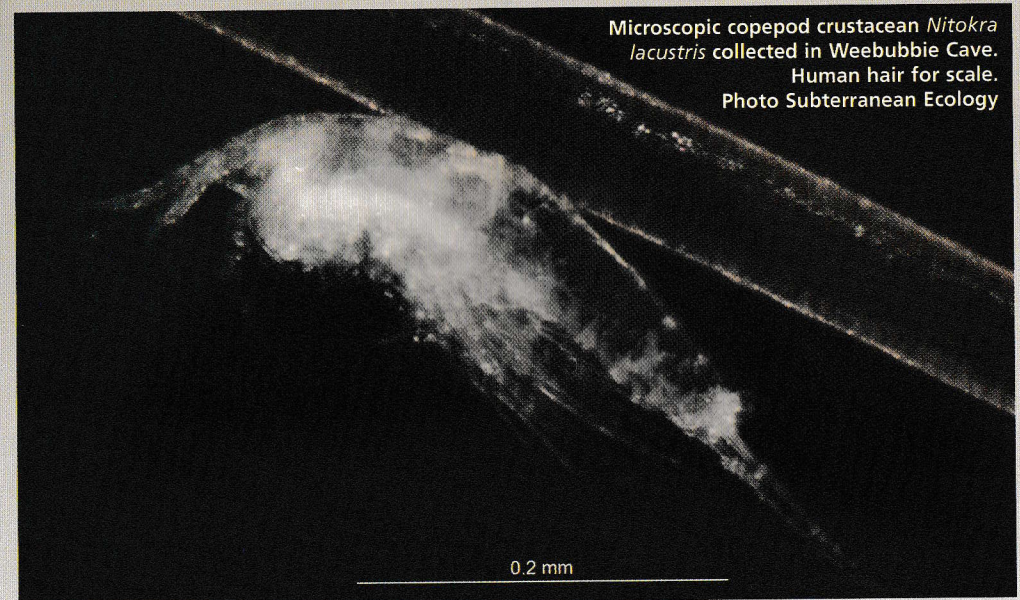
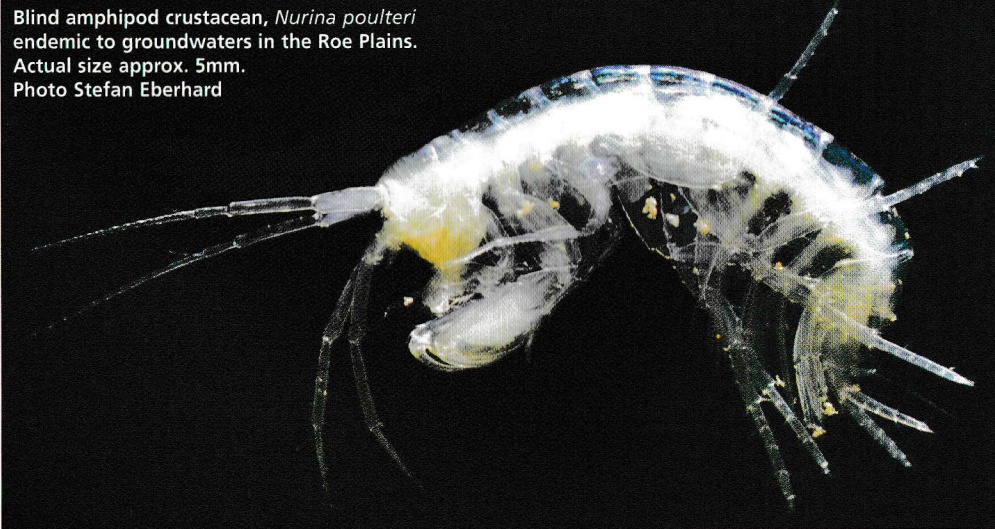
Subterranean fauna are important because they comprise an inconspicuous but important compo-

nent of world biodiversity. A recent review estimated more than 4,000 species in Western Australia, making it a global hotspot for these organisms. They contain many ancient lineages of high scientific value and conservation significance as outstanding examples of adaptation and ongoing evolution. Many species have small distribution ranges, and are vulnerable to environmental changes and human impacts. Stygofauna provide 'ecosystem services' by grazing on microorganisms and contributing to nutrient recycling, and are biological indicators of groundwater health. They include species and ecological communities that are protected under state and commonwealth environmental legislation.

## Nullarbor Karst

Most of the Nullarbor karst consists of a high limestone plain that has been emergent from the sea since the Middle Miocene approximately 14 million years ago. The high plain ends abruptly in 90 metre sea cliffs that extend more or less continuously for nearly 900 km along the Great Australian Bight, interrupted only by the Roe Plains, a coastal lowland less than 30 m above sea level extending a distance of 300 km and up to 40 km wide. The Roe Plains are an old sea-bed formed by a marine incursion during

Blind amphipod crustacean, *Nurina poulteri* endemic to groundwaters in the Roe Plains. Actual size approx. 5mm. Photo Stefan Eberhard

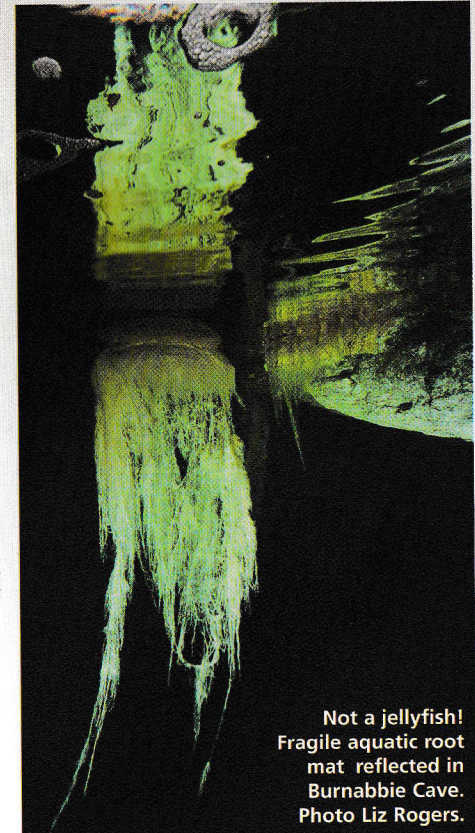


Microscopic copepod crustacean *Nitokra lacustris* collected in Weebubbie Cave. Human hair for scale. Photo Subterranean Ecology

the Pliocene between 1.6 and 5 million years ago. Besides the obvious differences in elevation the Roe Plains are also distinctly different in regards to their styles of cave development and their cave ecology. These differences are important for conservation of their natural values and management of access for cave divers.

In 2007 the Department of Environment and Conservation (Western Australia) commissioned Subterranean Ecology to undertake a desktop review of Nullarbor karst features and subterranean fauna. The purpose was to document, assess and identify important conservation values, knowledge gaps and management issues. When the review was undertaken the Karst Index Database South Australia (KIDSA) contained 3,567 karst feature records, of which 687 were caves and the remainder being blowholes, dolines, rock shelters etc. The aggregate plan length of surveyed underground passage (wet and dry) approached 94 km, of which approximately 12 km was submerged or partially inundated. Flooded cave passage therefore represents a significant portion (13%) of the total Nullarbor karst estate. Another important statistic is that there are only

**'Stygofauna are aquatic animals that live in groundwater. Most stygofauna are invertebrates, predominantly species of crustaceans'**



Not a jellyfish! Fragile aquatic root mat reflected in Burnabbie Cave. Photo Liz Rogers.



about a dozen caves with flooded passages which means that visitation by divers is concentrated at this small number of sites. These wet caves also contain vulnerable animal populations and habitats, as well as fragile sediments, formations, and bone deposits.

## Nullarbor Subterranean Fauna

Our review identified more than 280 invertebrate species from 185 caves, of which about 30 species were true stygobites or troglobites. All of the stygobites and troglobites are endemic to the Nullarbor karst. Most of them are known from only one or a few caves and their restricted distribution ranges make them vulnerable. To identify priority sites for conservation each cave was ranked according to its biological richness. Four of the top five most biologically significant caves occur on the Roe Plains, and

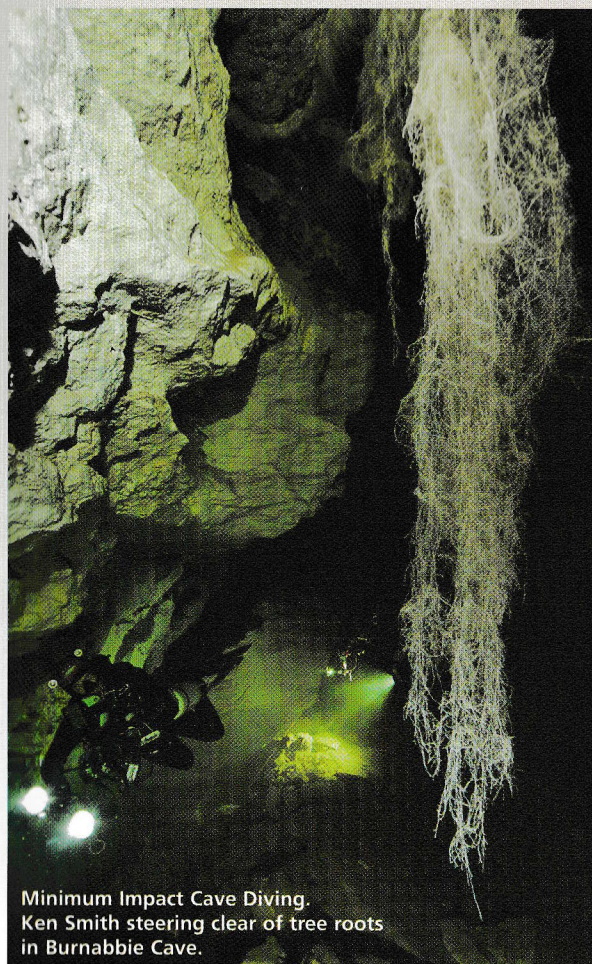
three of these are caves visited by divers – Nurina, Olwogin and Burnabbie Caves.

## Why are the Roe Plains caves so biologically rich?

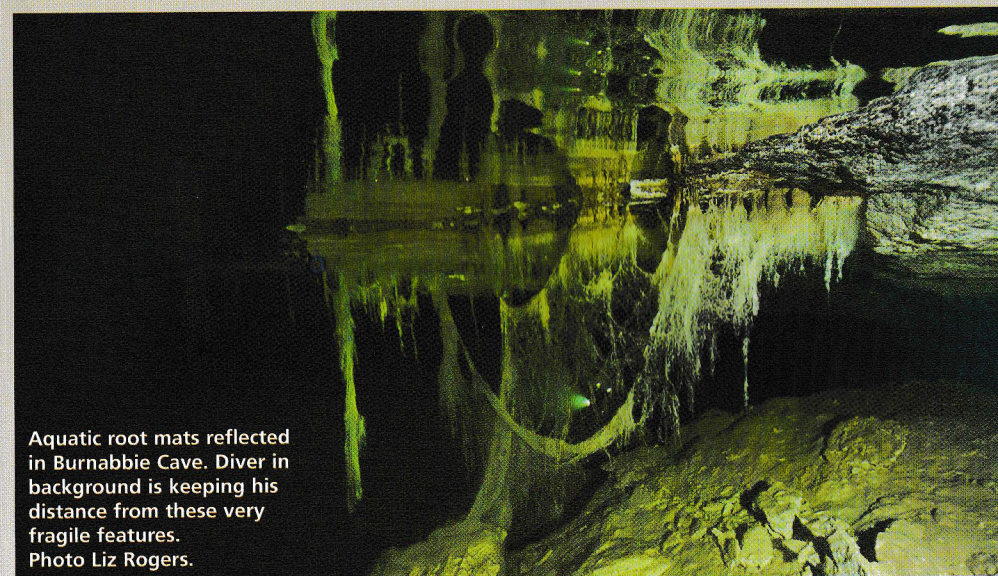
Possible reasons include: (1) Intersection with the watertable providing habitat for both aquatic and terrestrial species; (2) Shallow cave depth and abundant penetrating tree roots which provide a rich food source for both stygofauna and troglifauna. (3) For troglifauna, the small and constricted cave entrances and passages, and semi-sealed air chambers, limit air and moisture exchange with the surface and thus maintain a high relative humidity essential for troglobite survival; (4) For stygofauna, the Pliocene marine transgression which inundated the Roe Plains probably enabled the marine ancestors of the stygofauna to colonise the karst groundwater.

Stygofauna were first collected from the Roe Plains in 1982, a new genus and species of amphipod subsequently described with the name *Nurina poulteri* (Bradbury and Eberhard 2000) (see figure). Since then at least six more new species of stygofauna have been collected from Nurina and other shallow wet caves on the Roe Plains, including an unusual oligochaete worm (Pinder et al. 2006) and some very interesting crustaceans. The most interesting of these crustaceans is a microscopic copepod, *Speleophria nullarborensis* (Karanovic and Eberhard 2009).

This creature is of great interest to biogeographers because all of its closest relatives have only ever been found in anchialine caves in just a few highly separated localities – the Mediterranean, Bermuda, Mexico and Australia. Anchialine caves are near-coastal caves with fresh or brackish water overlying more saline waters with strong hydrologic connections to the sea. The world distribution of these so-called anchialine 'Tethyan' relict species has been hypothesised a result of vicariance – a process by which the geographical range of an animal group is split into discontinuous parts, in this case by the separation of tectonic plates which formed the margins of the Tethys Sea during the Mesozoic. Speleophriids are in a sense 'living fossils'.



Minimum Impact Cave Diving.  
Ken Smith steering clear of tree roots  
in Burnabbie Cave.



Aquatic root mats reflected  
in Burnabbie Cave. Diver in  
background is keeping his  
distance from these very  
fragile features.  
Photo Liz Rogers.

While the Roe Plains caves are salinity stratified, we have not found tidal influences or a connection to the sea so these caves do not appear to be anchialine. The discovery of *Speleophria nullarborensis* significantly extends the known range of 'Tethyan' species to the southern continental margin of Australia, and it challenges the hypothesis for their anchialine origins.

## Microbial Mantles

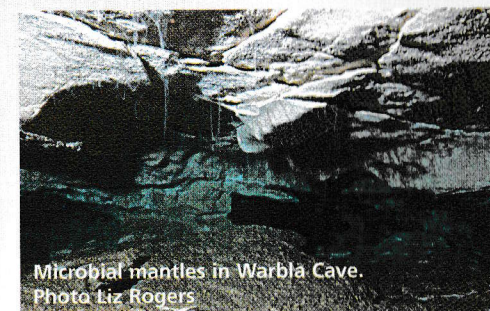
Microbial mantles or 'slime curtains' are present within lakes and water filled passages of both the Nullarbor high plain and Roe Plains caves. The most spectacular examples are in Weebubbie Cave, where the mantles are associated with snowfields of biogenic microcrystalline calcite (Contos et al. 2001). The Weebubbie mantles are comprised of mucoid mats, sheets, or tongues composed of biochemically novel communities of bacteria (Holmes et al. 2001). Research just published has confirmed that the

microbial slime community is driven by inorganic nitrogen metabolism (Tetu et al. 2013). These bacteria get their energy from chemicals (nitrite and ammonia in this case) that occur in the rock or the groundwater. Similar extremophiles (organisms living in extreme environments) are found in deep sea hydrothermal vents, hot springs, and in a few 'sulphur caves' which are isolated from organic carbon sources. The Weebubbie microbial community is analogous to these chemically-based ecosystems, but it is significantly different both in terms of the types of bacteria and the peculiar absence of macro-invertebrates which could be utilizing the bacteria as a food source. Holmes et al. (2001) suggested that low levels of organic carbon in the high plain cave lakes, or their geographic isolation, may explain the absence of macro-invertebrate grazers.

## Conservation

The major threats to Nullarbor cave fauna and their habitats are mostly due to human visitors. Cave dwelling bat populations are very vulnerable to repeated human disturbance, especially in maternity caves and over-wintering sites. Three caves visited by cave divers (Weebubbie, Murra El Elevyn, Warbla) are critically important maternity sites for the Chocolate Wattled Bat, *Chalinolobus morio*.

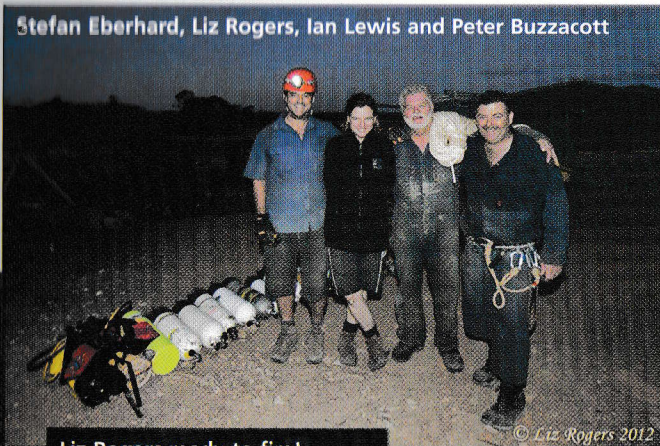
Two other caves visited by divers are the type localities for two rare and vulnerable invertebrates which are listed on Schedule 1 of the Wildlife Conservation Act 1950. These are the Pannikin Plains Cave Isopod *Abobaosia troglodytes*, and the Nurina Cave



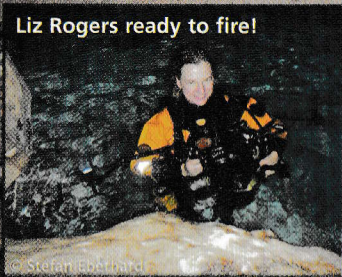
Microbial mantles in Warbla Cave.  
Photo Liz Rogers



Stefan Eberhard, Liz Rogers, Ian Lewis and Peter Buzzacott

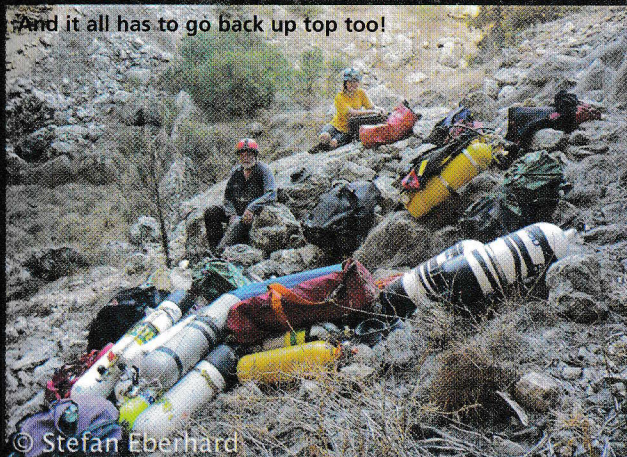


Liz Rogers ready to fire!



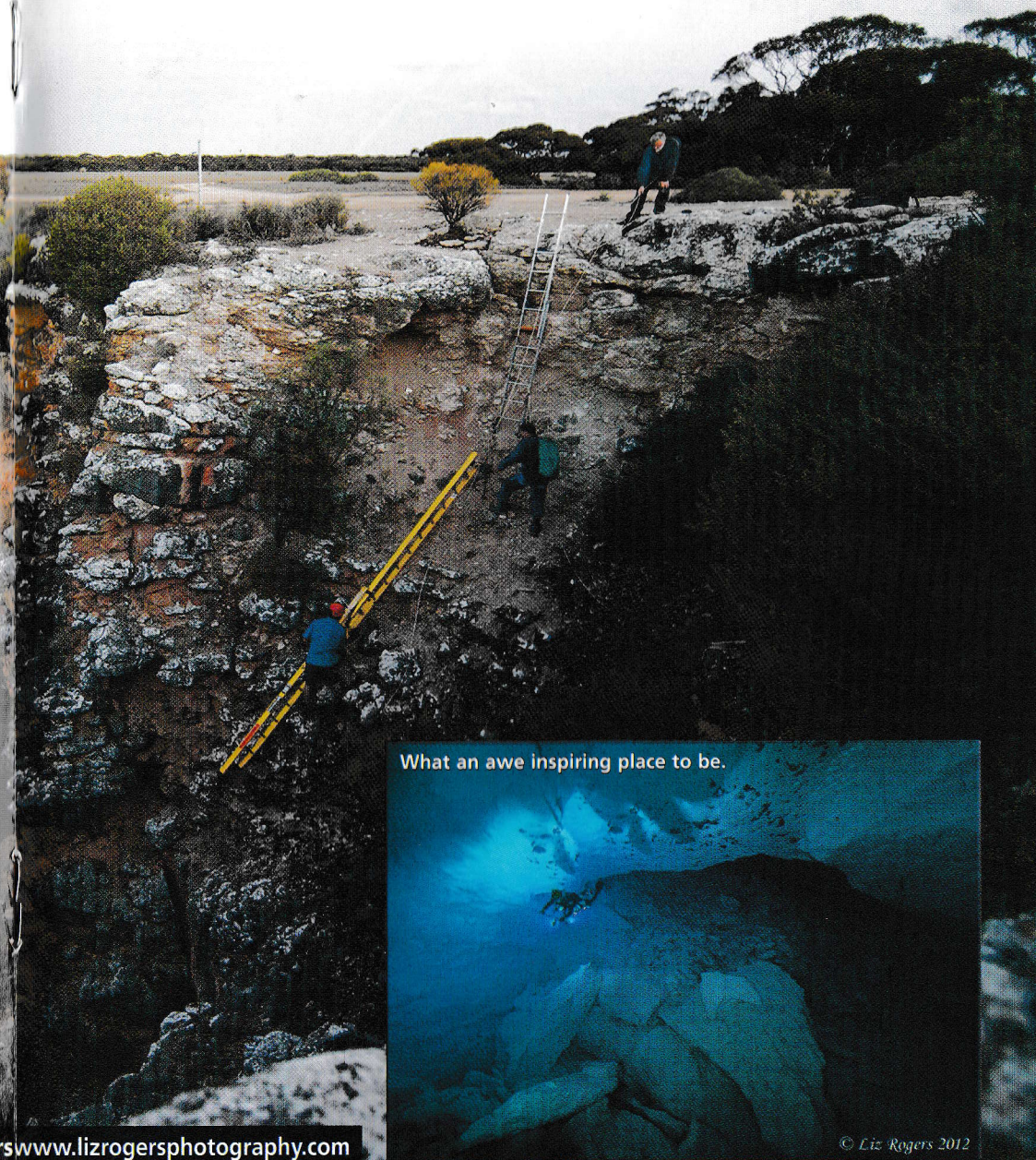
© Liz Rogers 2012

And it all has to go back up top too!



© Stefan Eberhard

Topside as the crew start the process of lowering equipment into the Cave

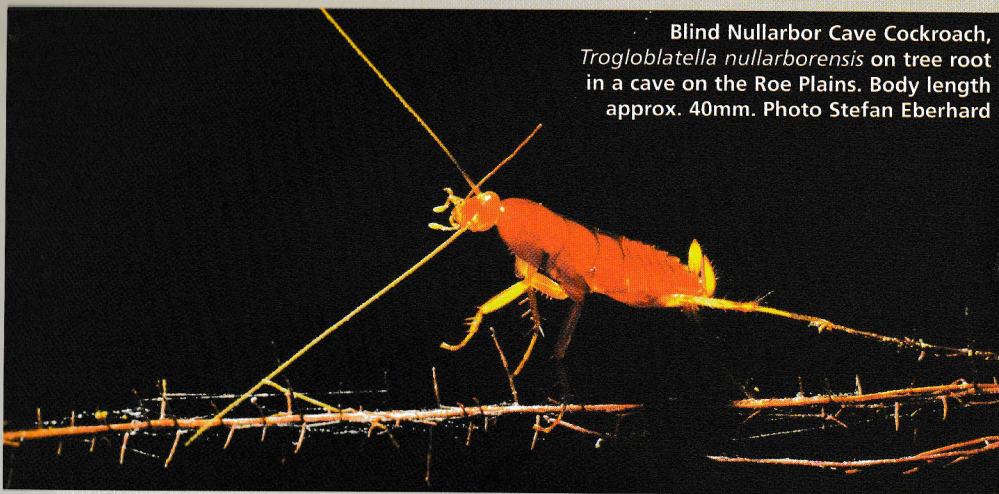


What an awe inspiring place to be.

© Liz Rogers 2012



**Blind Nullarbor Cave Cockroach, *Trogloblatella nullarborensis* on tree root in a cave on the Roe Plains. Body length approx. 40mm. Photo Stefan Eberhard**



Spider *Tartarus nurinensis*. These species are vulnerable to trampling underfoot (in the case of the isopod) while the spider spins an extremely delicate sheet web that is almost invisible and easily broken. Some populations of *Tartarus* spiders have declined or even disappeared subsequent to human visitation. Conservation of non-biological features is also a matter for consideration for cave divers. Nurina Cave contains soft sediments and fragile speleothems which are vulnerable to progressive and irreversible degradation. The most notable impact in the air-filled passages is the trampling and destruction of fragile calcite raft deposits, calcite crusts, guano and other sediment deposits. The transport of heavy diving equipment along the passage leading to the water has exacerbated degradation in this section of cave, and damage is also evident in the underwater sections. The constricted nature of the underwater passages in all of the Roe Plains caves means that it is difficult to avoid causing damage, and advanced diving skills are required to minimise impacts.

Diving may not adversely impact stygofauna directly but it certainly has the potential to cause indirect impacts to fragile habitats through turbulence caused by finning movements and regulator exhaust bubbles. The aquatic root mats in the Roe Plains Caves are especially vulnerable. In Olwolgin and Burnabbie Caves, Paul Hosie has adapted route-marking and other techniques used in dry caves to protect delicate underwater formations and habitats.

In the high plains caves the most significant and vulnerable biological value under the Nullarbor is undoubtedly the microbial mantles. Where cave diving activities have disturbed or destroyed microbial mantles their recovery appears to be very slow

(Holmes et al. 2001). Early dive explorers recall much greater extent and development of microbial mantles than can be seen today. In popular and accessible sites such as Weebubbie, high priority needs to be given to conserving remnant populations and encouraging regrowth in impacted areas. Encouragingly the mantles evidently appear capable of recovery if left undisturbed, as noted by Peter Buzzacott in Murra El Elevyn and which is a current topic of research by Pippa Waterworth.

### Weebubbie Stygofauna

The exciting discoveries on the Roe Plains in recent years have reinvigorated interest in the biology of other Nullarbor cave lakes. While unicellular organisms in the form of microbial mantles occur in nearly all of the wet caves, the apparent absence of larger, multi-cellular stygofauna in the deep caves of the Nullarbor high plain has long puzzled cave biologists. The deep cave lakes would appear to provide an ideal habitat for stygofauna with a huge habitable space and benign water chemistry including potential food sources of the microbial mantles and other organic matter such as bat guano and vegetation.

Any macro-invertebrate (being an invertebrate that is large enough to be seen without the use of a microscope) is likely to have been spotted and reported by keen-eyed divers during the last four decades of diving and research. Many species of stygofauna however are microscopic and invisible to the naked eye, so with a permit from DEC and the enthusiastic assistance of Peter Buzzacott we used fine-meshed plankton nets to sample for microfauna in Cocklebidy, Murra El Elevyn, and Pannikin Plains in 2012. Initial sampling tests in these caves

did not yield any micro-fauna although they can be difficult to collect even when present. Still it was a pleasant surprise when we finally succeeded in Weebubbie Cave in November 2012. The stygofauna collected in Weebubbie was a species of microscopic copepod, *Nitokra lacustris* (see figure). In contrast to the Roe Plains stygofauna, this species is recorded from a wide range of habitats, and very widely distributed (Australia and Pacific) predominantly in surface waters, and occasionally groundwater. It evidently has good dispersal powers.

How did it colonise Weebubbie Cave? Some copepods have drought resistant eggs, so it could have been transported to the cave by wind, birds, bats or humans. The species is known from the deserts to the north in South Australia and also Western Australia, so source populations are not that far away. Either way, this interesting discovery prompts two further research questions: (1) What are they eating in Weebubbie Cave? (they could be feeding on biofilms associated with the bat dung or other organics in the lake, and/or the microbial mantles), and (2); Are microscopic stygofauna present in other Nullarbor deep cave lakes? Both of these questions are open for future investigation.

### References:

Bradbury, J. H. and S. Eberhard (2000). A new stygobiont melitid amphipod from the Nullarbor Plain. Records of the

Western Australian Museum 20: 39-50.

Contos, A. K., J. M. James, B. Heywood, K. Pitt, P. Rogers (2001). Morphoanalysis of Bacterially Precipitated Subaqueous Calcium Carbonate from Weebubbie Cave, Australia.

Geomicrobiology Journal 18: 331-343.

Holmes, A. J., N. A. Tujula, M. Holley, A. Contos, J. M. James, P. Rogers, M. R. Gillings, (2001). Phylogenetic structure of unusual aquatic microbial formations in Nullarbor caves, Australia." Environmental Microbiology 3(4): 256-264.

Karanovic, T. and S. Eberhard (2009). Second representative of the order Misophrioida (Crustacea, Copepoda) from Australia challenges the hypothesis of the Tethyan origin of some anchialine faunas. Zootaxa 2059: 51-68.

Pinder, A. M., W.F. Humphreys, S. Eberhard (2006). New phalloporilines (Annelida: Clitellata: Tubificidae) from Western Australian groundwater. Zootaxa 1304: 31-48.

Subterranean Ecology (2007). Subterranean biodiversity of the Nullarbor karst - desktop study. Report to the Department of Environment and Conservation, Western Australia. August 2007, 117 pp.

Tetu, S. G., K. Breakwell, L. Elbourne, A.J. Holmes, M. Gillings, I. Paulsen (2013) Life in the dark: metagenomic evidence that a microbial slime community is driven by inorganic nitrogen metabolism. The International Society for Microbial Ecology Journal (2013), 1-10.

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# Karst Geology

By Ian Lewis #258

## The 'Catalyst' for Weebubbie Cave Revealing More Secrets

### The Deepest Cave on the Nullarbor

Weebubbie Cave has the largest clear underground lake in Australia and is the deepest cave on the Nullarbor. It was the first cave dived out there and revealed walls festooned with the mantle growths for which it is now renowned. Its depth reaches further into the bottom of the limestone than any other cave on the Nullarbor and gives us our best view of the possible reasons for large caves forming out under such a dry flat desert landscape. This is because in large flat limestone areas like the Nullarbor, Mount Gambier, Florida and the Yucatan, caves form from the "Bottom Up". In a general sense most of the world's caves form from the "Top Down" by streams wearing them away as they cut down through the limestone. But our best cave diving sites have been formed by water dissolving the limestone from below. That is why the bottoms of our caves are so interesting as they may tell us how the whole cave system began. It also gives clues about where other similar caves might form and how we can find them!

Being the deepest cave on the Nullarbor, Weebubbie not only offers the chance to understand and hopefully find more passages but the waters contain important information about temperature and biology. And now that Weebubbie has been known by settlers for over 100 years (since 1900) we can examine its condition and how its environment has coped with visitation over that time. Did you know that for at least 40 years it had a large diesel engine in it by the edge of the small lake belting out fumes and pumping water up to Eucla through a series of pipes? And that it had a borepipe drilled directly into the lake not far across from the gearing-up ledge? And that before that there was an epic story about the original borehole which explains why the Eucla telegraph Station's big wooden table was in the lake for about 50 years? I'll tell that story in a later Guidelines...

### ABC Catalyst hear about Cave Divers

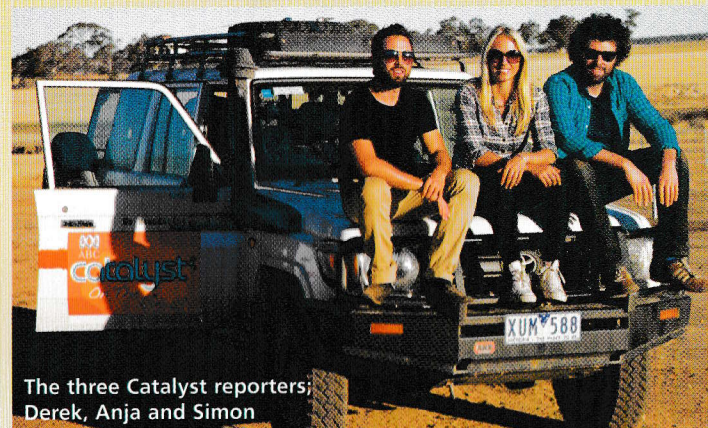
So although Weebubbie is so popular with visitors and cave divers, there is still more to learn about it and we are finding out bit-by-bit. In November 2012 quite a lot of this came together when the CDAA was contacted by the ABC Catalyst team who were doing a number of "On The Road" science reports for the beginning of this year's series. Catalyst usually do a number of separate science-based reports at different locations and combine three of them for the weekly telecast. But this year they decided to send a team to travel from Perth to Melbourne and document different scientific events and activities across Australia outdoors along the way. Apparently someone in Sydney during the planning discussions said "What a long boring drive between Kalgoorlie and Port Augusta. There's nothing but the Nullarbor in between!" Fortunately somebody else in the discussion said "Wait a minute, what about those huge caves out there with their underground lakes? There must be some science about them!" So they contacted our Grand Pooh Bah (Vanders) who said "Buzza's doing some warm water temperature work in the lakes, Stef's always out there trawling for beasties in the water and Lewy's got more theories on the geology. Try them!"

### Taking Science Seriously

So a team was thrown together within about a fortnight - Peter Buzzacott, Stefan Eberhard and myself - and we all wanted Liz Rogers to come and do the filming as she is brilliant at it and that would give the ABC a good look at her photographic work. So it all happened. The Catalyst team met us at Weebubbie after filming at the Kalgoorlie Pit (so they already knew about giant holes in the ground!) and a salt lake somewhere (so they also knew about salty water) but of course this did not prepare them for the size and magnificence of Weebubbie! But credit where it's due - Anja Taylor, our reporter for the program, had done a large amount of reading about the scientific research that's been

going on in the Nullarbor caves for more than 20 years and she checked each of us out (scientifically speaking!) before they'd even commenced their road trip. In fact, it was a very professional approach to the task and was similar to having the draft of a scientific paper or presentation properly reviewed before accepting the ideas we three were working with. This was no scientific report on the run and it is a compliment to Anja, Director Geraldene and her team that they did such a thorough preparation. After all, how credible would a national science TV program be if they'd just cruised up to three grotty cave divers lounging around a campfire at Weebubbie and spilling on about our latest wild ideas and interviewed us by plying us with alcohol!? Nope - Catalyst were very professional and presented the CDAA and the cave diving scientific research as organised and responsible, making a valuable contribution to our understanding of the natural world through careful underwater observations, measurement and research. This is an important branch of CDAA activities - the capacity to provide important cutting-edge environmental observations, hydrology, biology, geology, physiology and photo-documentary evidence as insights for the world at large. This may be an expanding area of CDAA work as consultants in environmental, science and engineering issues. Similar services are being valued in the USA with regard to sinkhole stability, groundwater resources and biological uniqueness.

Anja coordinated the Weebubbie filming with her photographers and director. She also did her CDAA training with Tim Featonby in Sydney (thanks, Tim!) before the trip so she could dive in the open lake and see the magnificence of the place. Accompanying her were Derek Muller (a Physicist turned science reporter) and Simon Pampena (a Mathematician and would-be stand-up comic turned science reporter) who also interviewed all of us at several stages through the filming. Clearly physicists and mathematicians (and stand-up comics) aren't paid enough. So each reporter had their own different perspective as well as each of us cave divers, which gave an excellent mix of dialogue and ideas for the final presentation. If you haven't seen it, it is on-line at the ABC Catalyst website under "Downloads", listed in the episodes as "Weebubbie Part 1" and "Weebubbie Part 2". We were interviewed about all aspects of Weebubbie science by all three reporters so there



The three Catalyst reporters: Derek, Anja and Simon

was a lot going on! The final program has a ton of spare footage which we are keen to utilise if we can for a future longer doco on Nullarbor cave diving, science and the sheer beauty of that Lake.

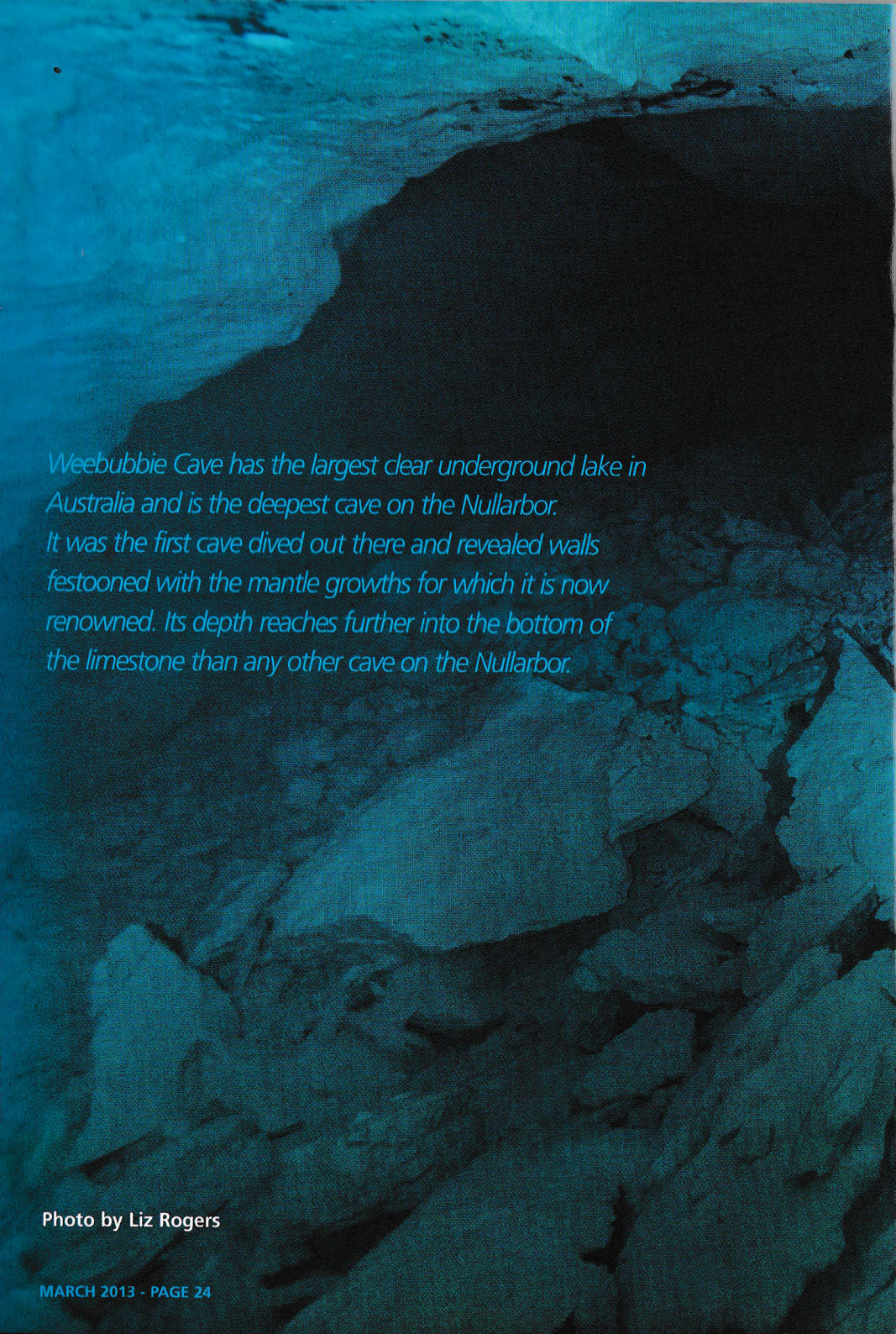
### What they learned from us

Anja was blown away by the clear visibility and really got a good reporting story working with Pete Buzzacott on his water temperature observations in Nullarbor caves as her attention came from his original publishing of a "Hot Springs" theory out here. Her voiceovers through the program are of excellent quality and clear explanations. Derek quizzed me back and forth about the "Bottom Up" and "Top Down" cave formation theories while we stood on millions of tonnes of rubble in the entrance sinkhole surrounded by the evidence. He also hauled me into the "Hot Springs" debate, which I tended to describe more as a "Warm Dribble", much to Peter's and everybody's amusement. But I acknowledged the significance of the phenomenon Pete has discovered. Simon did a couple of beautiful interviews with Stefan about the little creatures with no eyes which live underground and one night at the campfire produced a brilliant pasta meal which we have named "Pasta Nullarbor-e!". This was followed by my M&M chocolate cake which I used to demonstrate sinkholes dotted all over the Nullarbor (but didn't get onto the screen! We'll have to re-shoot that).

### The "Hot Springs" Theory

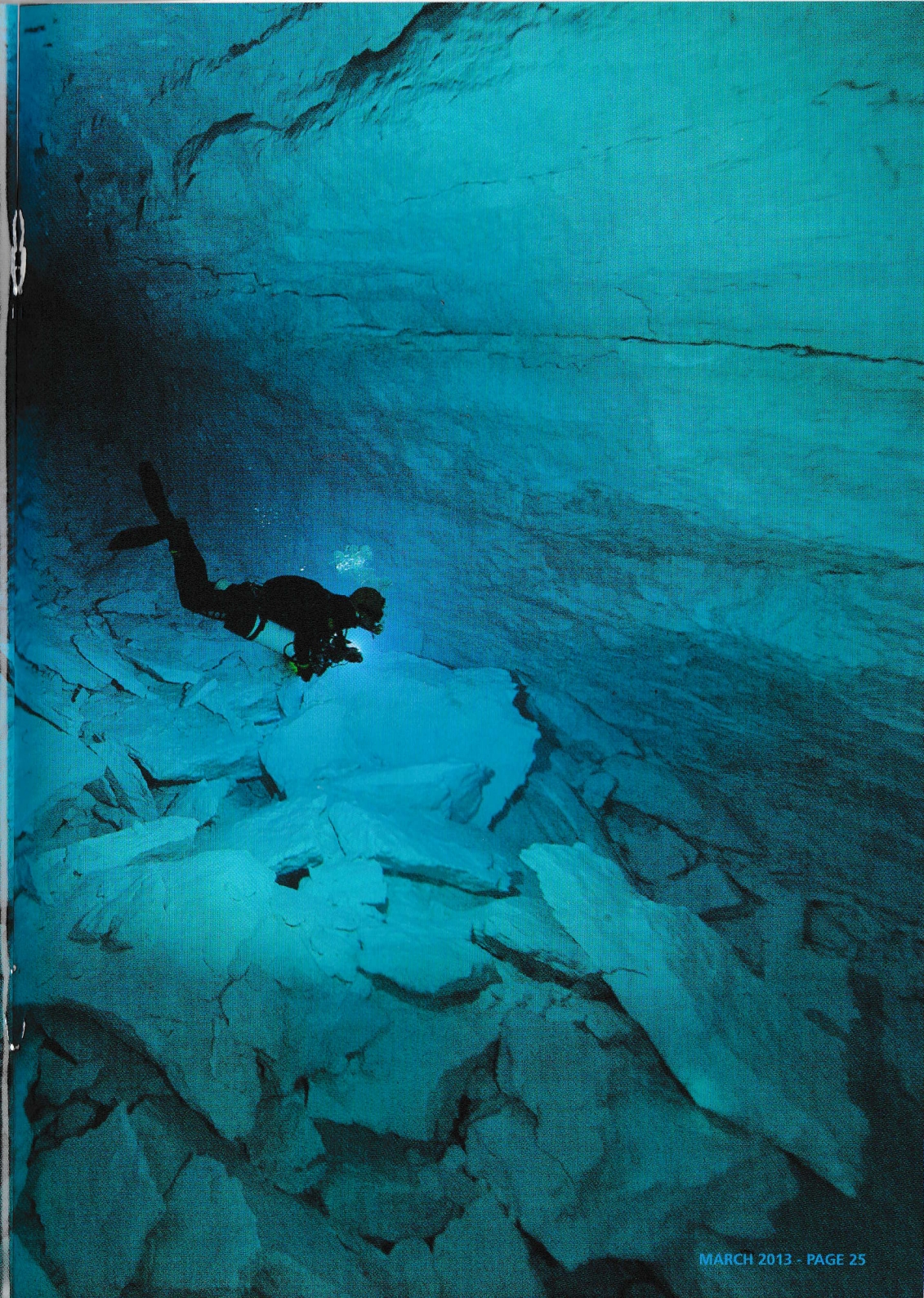
What about the science and the secrets of Weebubbie? The connecting theme was Pete's observations that several Nullarbor dive sites have slightly warmer water temperatures and these are in what we call the "western group" of Murra, Pannikin, Tommy Graham's and the inner segments of Cocklebidy. We are only talking about a couple of degrees here but it is statistically significant that four caves





*Weebubbie Cave has the largest clear underground lake in Australia and is the deepest cave on the Nullarbor. It was the first cave dived out there and revealed walls festooned with the mantle growths for which it is now renowned. Its depth reaches further into the bottom of the limestone than any other cave on the Nullarbor.*

Photo by Liz Rogers

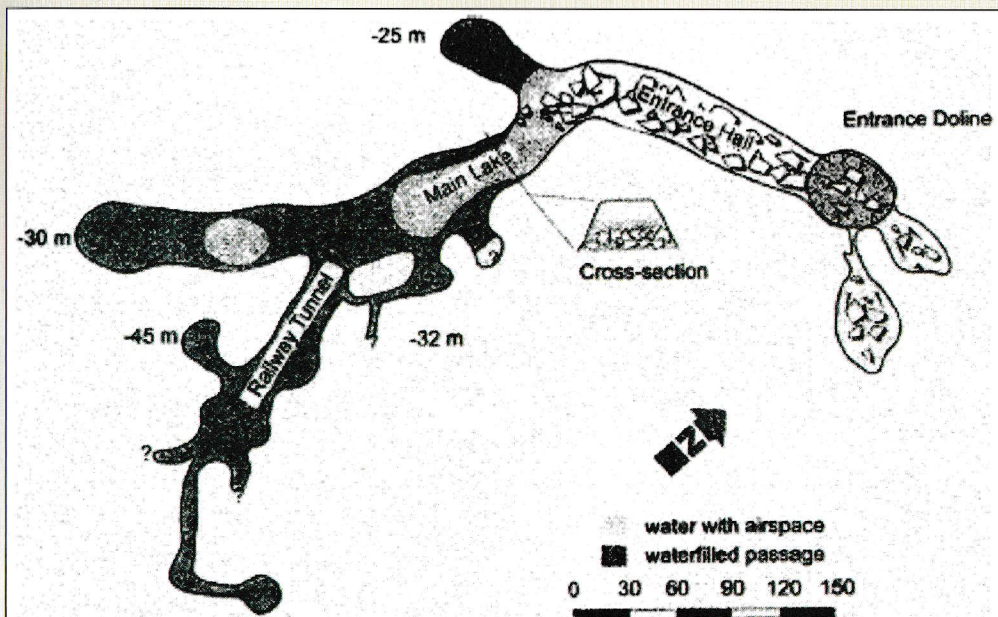




within 50kms of each other show this increase. Anyone who has dived in Tommy Graham's will know the warmth in there which is what we detected when Keith Dekkers and I first discovered it in January 1974. When we first surfaced in the Inner Sanctum room there I figured it was possible that we were breathing air that had been trapped there since the last sea level and cave lake level rises maybe 18,000 years ago so we were breathing Ice Age air. To this day, we haven't been able to explain the increased CO2 level in there as there are no rivers to wash in organic material which decays - these are caves which form from the "Bottom Up". Right across the other side of South Australia, I have been working on explaining the huge size of the underwater sinkholes in Mount Gambier, although there is no question of warmer water there, as every diver knows! Peter and I started looking at whether the size of the Nullarbor caves and the increases in water temperature are somehow linked.

So when Catalyst enquired, we chose Weebubbie as the best location to get new evidence and offer excellent film-

ing opportunities without confined space to work in. And Weebubbie also contains the mantle life which extends right down to the 50-metre zone which may be another scientific clue to how these different phenomena combine to give us an explanation about deep Nullarbor caves. We concentrated all week on the Catalyst program and Weebubbie Cave must have decided that we were so keen and the Catalyst team were such excellent scientific reporters that the cave would reveal several of its secrets for us while we were out there. Indeed, the Catalyst program was a true "catalyst" for some excellent and unexpected discoveries. If Catalyst had not brought us together as a team for the doco event, then it is quite likely that Pete, Stef, Liz and myself would not have been all together in one fantastic site and our separate ideas and experiences would have continued in individual directions, possibly never combining. As all researchers know, a good old gasbag between people over several reds (and a Pasta Nullabor-e) can trigger a great deal of exchange of ideas, powered along by plenty of reds and the excellent questioning by Anja, Derek and Simon. We should all do this more often!



Weebubbie Cave map showing the outline of several "bulges" in the wall of the Main Lake at -32m and along the railway Tunnel. These will be resurveyed with accuracy to determine their actual shape and nature. There are currently no accurate diagrams of the various small side tunnels off the Railway Tunnel. Can anyone provide some sketches of these? Source: The surveyor is unknown and I'd like to talk to him or her about this map if anyone knows who? It came from a paper on the study of the mantles in the cave - K. Contos, J. M. James, B. Heywood K. Pitt, P. Rogers (2001): Morphoanalysis of Bacterially Precipitated Subaqueous Calcium Carbonate from Weebubbie Cave, Australia, Geomicrobiology Journal, 18:3, 331-343. Link to Abstract: <http://dx.doi.org/10.1080/01490450152467822>

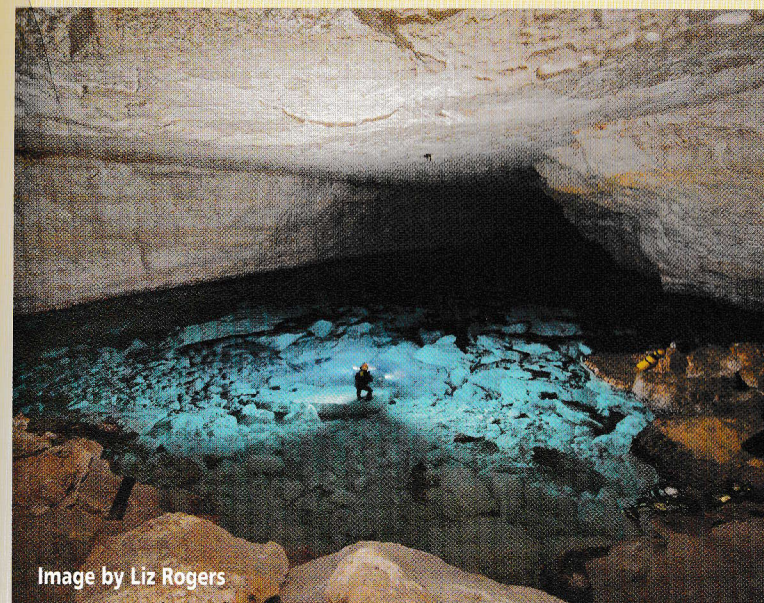


Image by Liz Rogers

**Weebubbie Lake:** Almost exactly above Stefan's head in the roof is a small black spot which was the site of the borehole. The borepipe used to come straight down into the lake until it rusted through and broke. For years, long lengths of pipe lay around this end of the lake looking very ugly until they were removed. Fortunately there was no oil or grease associated with it. However, for 50 years there was also a diesel engine to the right of the photo and it is possible that the pollution and oil etc from it contributed to the generally poorer condition of the small lake there.

## Water temperatures

During the trip, then, Peter recorded some temperature changes in the water going in from the end of the lake into the Air Dome, but particularly in the water immediately under the Dome itself where warmth could actually be felt by the divers as well as recorded. Why is the water warmer under there where there is only a large bubble of air 50m x 30m? Pete also did a temperature column from the lake down to 30m near where the Short Cut is to the Railway Tunnel which shows a 1-degree difference and we are still analysing the data for a conference paper which Pete will present in Europe this year.

## Underwater Geology

With the use of Liz's (and Harry's and Dalla's - thanks, guys!) borrowed floodlighting, I was able to see the shape and structure of the giant submerged tunnels in Weebubbie in a way not observed before, and never by a geologist. The little map in this article by a biological research team in 2001 shows some bulging chambers off the left-hand end of the main Weebubbie Lake that my old map in 1972 did not record at all (probably due to tiny lights then - see the centre-spread map in the last issue of Guidelines). These side chambers are unusually arc-shaped, like half a circle, which is a large chamber shape not recorded on the Nullarbor before. Even the wall of the Railway Tunnel to the left just past the corner where you enter it and where the short cut comes out is another large arc-shape so there are several close to each other at 30m and more-or-less in a line. The

lighting gear also showed up big circular patches (~ 20m across) at various intervals along the Railway Tunnel floor with much flatter smaller rock pieces in them as compared to the normal larger, higher and more angular usual rock blocks and collapse zones. Have a look next time - you'll spot the obvious difference. The same small slabs are piled up under the Air Dome and divers go straight past them into the further extension of the main tunnel there, possibly not noticing them. All these features would not have been observable if it wasn't for us carting out every light in the country for Liz to be able to produce such excellent and beautiful wide-scale photography which appeared in the Catalyst program and in this and the last Guidelines and on her website.

## Aquatic Biology

As if that wasn't enough, Weebubbie saved the best secret till last for Stefan. Nobody in more than 80 years of serious cave exploration on the Nullarbor has ever found any aquatic creature in the big underground lakes. In early years this was thought to be so just because of the darkness but as aquatic creatures were found in other caves around the world, people began wondering why not the Nullarbor?? Then in January 1972 when we first discovered Weebubbie's underwater tunnels, we saw the vast arrays of mantles growing everywhere on the walls and under ledges, together with several other darker and clumpier types of algal or bacteria growth scattered throughout both lakes. This meant there was a potential food source but



nothing had been found feeding in on it. Then during our trip Stephan, who specialises in "Stygofauna" - aquatic microscopic aquatic creatures which live underwater in darkness - swished his ultra-fine mesh sampling nets in the lake and found a tiny crustacean. For biologists, this is a fantastic discovery. Stephan explains about it in his excellent main article in this Guidelines issue. It is a Copepod. But as I am no biologist and a total bio-amateur, I call it a "Weebubbiepod" and hope that Stefan is not too horrified by such a trivial name! And why are these also so important? Because divers move through their living domain. And now we know they are there and we are studying rare life out under the desert, we need to ensure their habitat is cared for, as all cave explorers and divers have been learning over the last few decades in underground environments. Stygofauna live in hostile environments and the race is on to see if other such micro-life forms exist in fluids under ice on Mars, Titan, Europa, the warm volcanic surface of Io and other planets in our Solar system. How these Stygofauna manage to arrive in such environments and are distributed among them can also give geologists and hydrologists quite unexpected information on water movements and cave development processes.

### Bringing the discoveries together

So Pete's "Hot Springs" ideas now combine with my air-room observations which may be the site of much earlier warmer spring waters seeping up and forming a large and much longer original Railway Tunnel first, before parts of its roof caved in to create the Lakes, Air Dome and the Entrance today by a "Bottom Up" process. Stefan's discovery shows there's been a food chain in Weebubbie for a very long time and may have been possible due to warmer chemically-charged water thousands or even several millions of years ago. The three scientific secrets which Weebubbie revealed to us on the Catalyst trip may combine to produce a totally new view of big cave formation on the Nullarbor. And all this knowledge is created by cave divers! So we are planning a couple of follow-up trips to Weebubbie to make many more measurements, observations, filming and sampling to see how all this information might combine.

I must make a vital point that Liz's photography is so good that I can sit and look at in Slo-mo and interpret underwater geology in a way that I couldn't do while on a dive, even with the huge lights, as there is only a limited time to ponder these things in 30 m of water while keeping track of a buddy. Her film record is helping to re-write our geology here as there is time to think about it all, frame-by-frame. The same thing is happening with Richard Harris's filming in

Pics and other sinkholes a Mount Gambier. (I only now have to train them what to film!). My message to all cave divers is that anything at all you record and let me/us know may be really significant and fit into a much bigger picture. The message to the outside world is that on a planet where water is of vastly increasing importance, cave divers are an incredible asset in discovering, observing, measuring, recording and understanding our aquatic resources.

### A couple of extra points -

1. Please do not be too loud at the end of Weebubbie Lake when the small colony of chocolate Wattled Bats (*Chalinolobus morio*) bats are in there - they may be pregnant females clustered together for warmth and safety above the very far end of the lake and their species has very limited numbers throughout the Nullarbor. Their ancestors almost certainly lived away down the far end of Railway Tunnel 18,000 years ago when the water level was way down and the Railway Tunnel was dry for a few thousand years! Millions of years before at other dry cycles, they may even have brought in some of the organic material which generated life in the water.

2. Please take care to avoid mantle growth areas in Weebubbie wherever possible throughout the system. Sometimes they re-grow but not back to the quantities that we earlier divers remember from the 70's. People cave diving on the Roe Plains need to take critical care in those far more confined spaces there.

3. Has anyone got any survey data at all which I can use, or can even make a rough sketch of the small tunnels that lead left, right and off the deep end of the Railway Tunnel? These are the deepest points and hold all the clues as to how the cave formed in its deep early "Bottom Up" stages. Heaps of you have dived in these locations so please scribble some data down (depth, height of passage, passage shape, direction, description - slab floor, small tubes in the walls etc etc - anything). I will not always get to these extreme locations now but I can interpret what you are seeing, discovering and recording. The more info I can get, the better I can explain it for everyone.

### "Hot Springs" Theory in action

Lastly, one excellent scene shot during the Catalyst filming somehow didn't get into the final cut, unfortunately. In it, Derek and Simon plunged into the main lake in their boardies and nearly froze when they hit the water! After several gasps, the dialogue (all filmed) went like this -

**Derek:** "Did you know that Pete has this theory that these lakes and caves may have Hot Springs in them and that lan

is looking for geological evidence?"

**Simon:** "Hey that's amazing, but God it's cold in here so I don't know what they are talking about!"

Then Simon takes off swimming up the lake.

**Derek** yells "Hey, where are you going?"

**Simon:** "I'm freezing, so I'm heading off up this lake to find its Hot Spot!"

**Derek** starts swimming after him, then suddenly stops in the water and yells, "Hey, I've found the Hot Spot!"

**Simon** stops in the water and says "Err, sorry, no you haven't mate - that was me!"

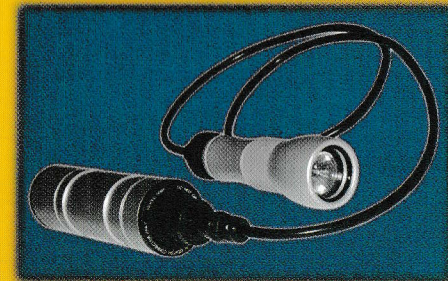
In one exchange these two managed to reduce all our exotic and respectable theories to ridiculousness. Thanks, guys! I hope that scene gets to air one day.

*Thank you to the Catalyst team - you were great company, great to work with and we'd love to do it again some time. Thanks to the CDAA Committee for putting Catalyst in touch with us. And who would have thought that Weebubbie Cave would decide to let out some of its important secrets for us on this particular trip, leaving many more to be unravelled in the fascinating story of how the giant caves of the Nullarbor were formed. So, a special thanks above all to Weebubbie Cave.*

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Sinkholes in Florida appear from time-to-time as the Florida limestone is very similar to ours in color, strength, age and groundwater aquifers, as many of you will know. Florida aquifers flow strongly whereas the Mount Gambier aquifer appears stationary and has only a very slow coastward movement. Florida has a large population which is always increasing with a number of very large cities across it, many sizeable towns and a great draw by cities, agriculture and industry on the water resources. A pattern is slowly emerging that sinkhole collapses occur as aquifer levels are lowered with increased irrigation in hot weather, removing the hydrostatic support of the larger chambers in the limestone. The event described here only recently occurred and is tragedy for the person involved and his family. I only know of two small collapses about 30 years ago in the Mount Gambier area and before that, Allendale Sinkhole in about 1890. Even though our water levels have dropped in recent years, Mount Gambier has nothing like the Florida problems as the demand on water here will never be like the huge effects in thirsty Florida. Ian Lewis

## 'Sinkhole season' has only just begun in Florida

By Tamara Lush. Reproduced with permission of The Miami Herald, USA - March 5th, 2013 (via Ian Lewis).

### SEFFNER, Florida.

Across Florida this time of year, it's the start of what's unofficially considered the "sinkhole season," State Geologist Jonathan Arthur said. It coincides with the beginning of the state's rainy season and usually lasts until the end of summer. As crews entombed a man who was swallowed by a sinkhole near Tampa, the earth opened up again just a few miles away. On Tuesday, in a neighboring county, officials investigated reports of a home cracking, perhaps due to another sinkhole.

"Florida is famous for bugs, alligators, pythons, hurricanes and now sinkholes," said Larry McKinnon, a Hillsborough sheriff's office spokesman. "I think our salvation is that for most of the time, our weather is picture-perfect." But it's also the weather - along with man-made factors - that exacerbate sinkholes, experts said. Arthur said February is usually when the state is at its driest, but it's also the start of the rainy season. Acidic rain can, over time, eat away the limestone and natural caverns that lie under much of the state, causing sinkholes.

Both extremely dry weather and very wet weather can trigger sinkholes, said Arthur. "An extensive drought can cause soil and sediment over a cavity to be extremely dry and collapse." On the other hand, following Tropical Storm Debby in 2012, dozens of sinkholes formed in counties north of Tampa because of the rain.

In Hillsborough County, an area particularly susceptible to sinkholes, 37-year-old Jeff Bush was killed last week when a hole opened up underneath his bedroom. Engineering experts have said it is too dangerous to retrieve Bush's body, so they demolished the home and filled the hole with gravel.

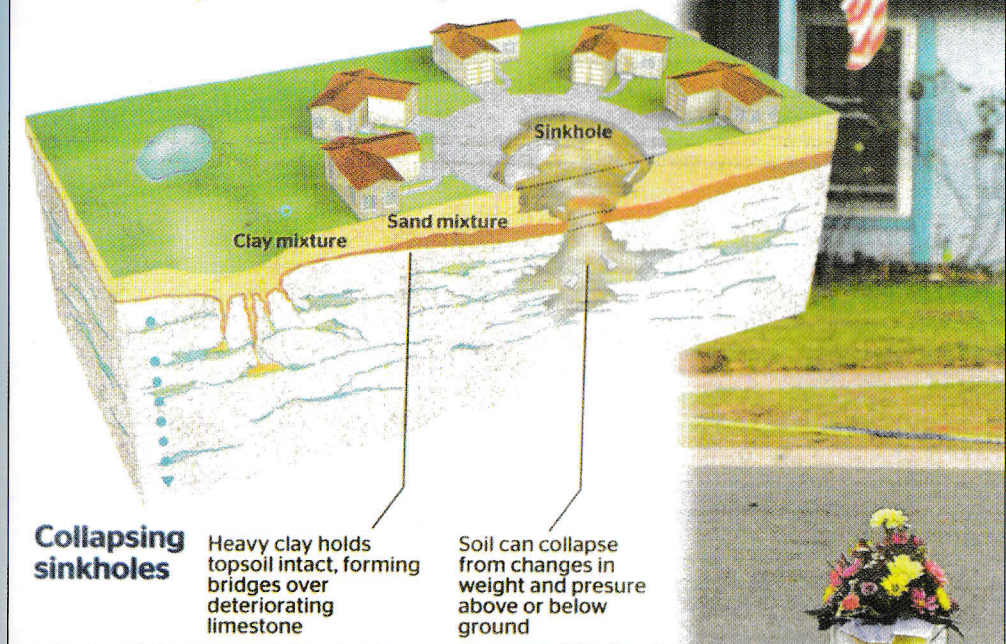
Hillsborough County is in a moderate drought, but engineers and county officials don't know exactly why the sinkhole formed in Seffner, and said they will likely never know. The county has had 1.56 inches of rainfall since Jan. 1; it usually averages about 5.41 inches, according to the National Weather Service.

In Pinellas County, about 30 miles away from Seffner, fire-rescue workers in the community of Palm Harbor said they asked two people to evacuate a home after the residents reported "extensive cracking on the interior and exterior of the home." A county building inspector said the home was safe to live in, but the homeowner was seeking an engineer's opinion.

Arthur said he looked at 50 years of data and found that there is usually an uptick of reported sinkholes in February, with an increase until about July, when activity tapers off. December and January have typically low sinkhole activity. Florida tracks naturally-occurring sinkholes and other ground collapses following a busted water main, development and groundwater pumping for crops. In 2010, strawberry farmers in eastern Hillsborough County pumped water from the aquifer onto their crops during cold weather so that the water would freeze on the crops, creating a layer of ice that protects the berries. So much water was pumped that more than 65 sinkholes opened in the area and wells went dry.

"When they take water out of the ground it's like taking air out of a balloon," said Bill Fernandez, a Florida sinkhole repair expert. "When you suck water out of the ground, you change the hydrostatic pressure underground and that's what can cause sinkholes." Arthur added that mov-

Sinkholes form as limestone gradually dissolves and collapses. This is accelerated by construction, such as building structures and drilling.



ing a lot of dirt around for development can also trigger sinkholes. On Sunday in Largo, a failure in a pipe in a mall's stormwater control system under the parking lot caused the ground to collapse. "There are a lot of variables," said Arthur. "Sinkholes are naturally occurring. Regardless of human activity they would occur."



This Aerial photo shows demolition workers picking up the remnants from the home of Jeff Bush, Tuesday, March 5, 2013, in Seffner, Fla. A huge sinkhole opened up under a bedroom in the home last Thursday, Feb. 28, and swallowed Jeff Bush, 37. Officials gave up hope of finding Bush alive and filled in the hole with crushed rock. (Associated Press Photo/The Tampa Bay Times, Dirk Shadd)

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# CDAА INSTRUCTORS

NAME	Deep Cavern	Cave	Adv. Cave
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## A.C.T.



APPS, Heike (CDAА 2776)  
Phone: 0407 230 108  
E: heike.apps@ga.gov.au

Yes Yes Yes

## SOUTH AUSTRALIA



PAYNE, Timothy (CDAА 2640)  
Phone: 0448 147927  
E: payne.tim@bigpond.com

Yes

## VICTORIA



ALLEN, Terri (CDAА 3483)  
Mob: 0419 176 633  
E: terri.allen@baker.edu.au

Yes Yes



BARCLAY, Gary (CDAА 1735)  
AH: 03 5565 8793  
E: garinda@bigpond.com

Yes Yes Yes



BOWMAN, Jane (CDAА 1880)  
BH: 03 9579 2600  
E: janelbowman@hotmail.com

Yes Yes Yes



CHAMBERS, Geoff (CDAА 3484)  
Phone: 0438 059 886  
Email: geoffie1@gmail.com

Yes



CLARIDGE, Linda (CDAА 2214)  
Mobile: 0408 052 070  
E: garinda@tpgi.com.au  
AH (03) 5565 8793

Yes Yes Yes

NAME	Deep Cavern	Cave	Adv. Cave
------	-------------	------	-----------

## VICTORIA Continued



DALE, Steve (CDAА 3926)  
Mobile: 0468 417 211  
Email: scuba-steve@jycos.com

Yes



DALLA-ZUANNA, John (CDAА 236)  
Penetration instructor  
Phone: 03 9480 1316  
E: jdz@paintandcustom.com.au

Yes Yes Yes



EDWARDS, Chris (CDAА 2247)  
Email: cedwards@aanet.com.au

Yes



HIGGINS, Andrew (CDAА 3329)  
Mobile: 0413 569 164  
E: ah3329@gmail.com

Yes Yes Yes



McDONALD, Warrick (CDAА 1882)  
BH: (03) 9579 2600  
E: info@oceandivers.com.au

Yes Yes Yes



MONACO, Rubens (CDAА 1731)  
Phone: 03 5984 1799  
E: info@idscuba.com.au

Yes Yes

## WESTERN AUSTRALIA



PAYNTER, Geoff (CDAА 3784)  
Mob: 0407 445 112  
E: gpaynter@geo.net.au

Yes

# CDAА SITE ACCESS - www.cavedivers.com.au

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Gouldens	CN	DEWNR	
2 Sisters Fossil	CN C	DEWNR	
Piccaninnie Ponds	S	DEWNR	
Horse & Cart Tea Tree	CN CN	Peter Cunningham PO Box 2168, Mt Gambier 5290	Permission not required - must carry card. Obtain key from Lady Nelson Tourist Information Centre. Visit the house before diving. If no one is home - no dive! Maximum 3 divers all weekends between May & November inclusive (check and update on CDAА website). At least 4 divers in group - 1 with previous site experience. Unrestricted days or numbers - Cave rated divers must not enter Penetration sections (stop signs) Unrestricted days or numbers.
Little Blue Allendale	S	District Council of Grant	
Ela Elap	C	District Council of Grant	
One Tree	S	Mr. Peter Norman	
Dave's Cave	C		
Hells Hole	S		
Pines	C/P		
Mud Hole	C		
Nettle Bed	P		
Stinging Nettle Cave	P		
Iddlebbidy	P		
		<b>Forestry South Australia</b> Fax: (08) 8724 2870 Phone: (08) 8724 2876 or book on-line via the CDAА website to arrange permit.	<b>email: conservationandcreation@forestrysa.com.au</b> Divers must advise FSA of their online booking. Collect permits from the Forestry Office, RHS of driveway to Carter Holt, Jubilee Hwy, Mt G. <b>IMPORTANT:</b> • No diving on Total Fire Ban Days. • Permit also required to run compressors during fire danger season. • Keys for Hells Hole, Nettle Bed, Iddlebbidy and Stinging Nettle Cave can be obtained from Lady Nelson Visitor Centre on presentation of Forestry SA permits.
Kilsby's	S	Landowner leased to CDAА	<b>Access - We have access fortnightly. Minimum of 3 divers in the water at one time. Refer to CDAА website. Twin Tanks - Maximum depth of 40 metres on Air. Meet at gate of property at 8.55am or 12.55pm. Book on-line at <a href="http://www.cavedivers.com">www.cavedivers.com</a> or contact Craig at <a href="mailto:kilsby@cavedivers.com.au">kilsby@cavedivers.com.au</a></b> <b>No animals, visitors or mid-week diving allowed. No diving on Total Fire Ban Days.</b> For access dates refer to Guidelines or the CDAА web page. Nitrox as a diving mix is not allowed in the Shaft unless a trimix endorsement is held but deco mixes attached to the shot line are permissible. Refer to Shaft access bulletin within CDAА Regulations. Divers applying to dive in the Shaft for the first time must document dive experience with twin tanks. <b>Download form off website.</b> Obtain key from Mt Gambier Tourist Information Centre. Access agreement must be signed prior to diving. 2 divers must sign out keys, all divers must sign in advising which groups they are diving with. Diving should be avoided after heavy rain due to possible water contamination. Diving hours are now restricted to 8am to 8pm CST. Download Indemnity from Web Page. Access available for experienced Penetration divers only. Access agreement must be signed prior to diving. Allow 4 wks for indemnity process. Contact Email: <a href="mailto:site@cavedivers.com.au">site@cavedivers.com.au</a> . Access Manager: David Fielder. Email: <a href="mailto:tankcave@cavedivers.com.au">tankcave@cavedivers.com.au</a> Access Manager: Matthew Skinner. Email: <a href="mailto:bakers@cavedivers.com.au">bakers@cavedivers.com.au</a> Climbing equipment required.
Shaft	S/C	Generally open one weekend a month. Trevor Ashby	
Engelbrechts - East - West	C P	Mt Gambier Council. Lessee Ph: 08 8723 5552 Contact: Brenton & Kemelev	
Three Sisters	P	Millicent Council	
McKay's Shaft	S		
Tank Cave	S		
Baker's Cave	C	CDAА Manager: Brad Dibble	
<b>NULLARBOR - WA</b>			
Cocklebbiddy	C/P		
Murra El Elevyn	P/C		
Tommy Grahams	C		
Weebubbie	S/C	DPI	
<b>WELLINGTON CAVES - NSW</b>			
Limekiln	P/C		
(McCavity)			
Water (Anticine)	C		
Rum Jungle Lake	S		
Burrinjuck	S/C/P		



# Portfolio

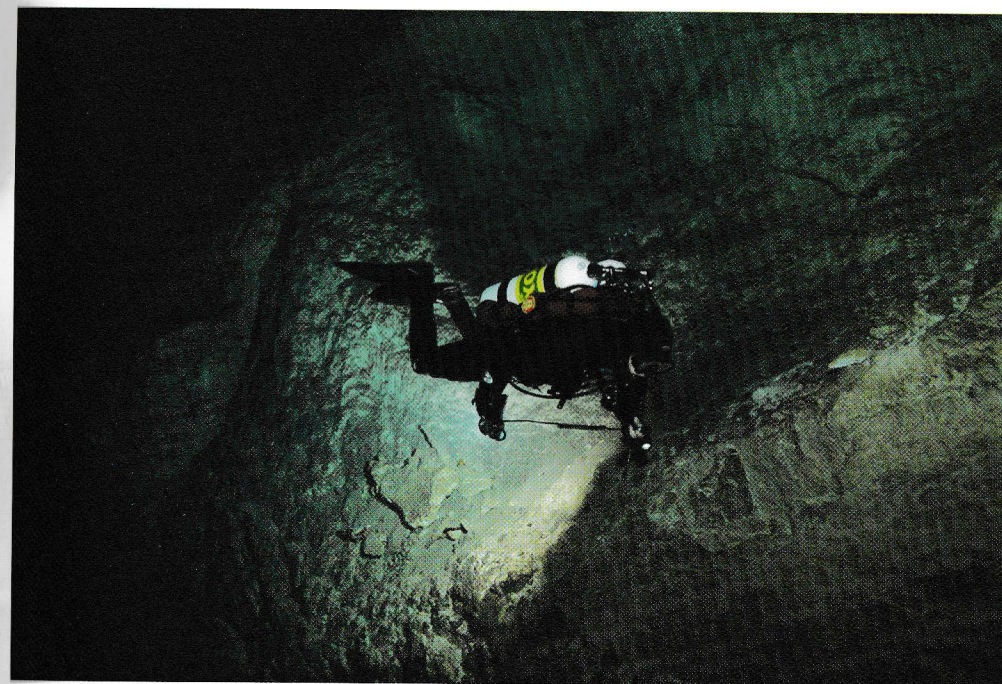
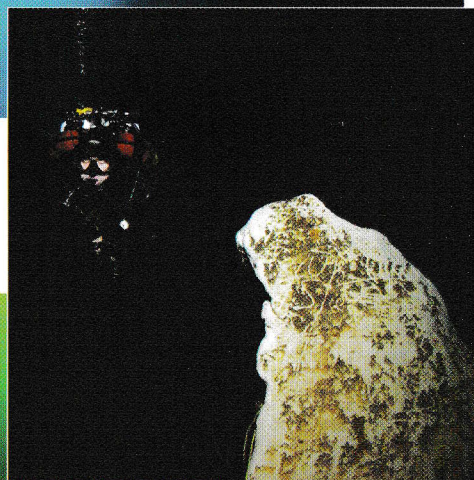
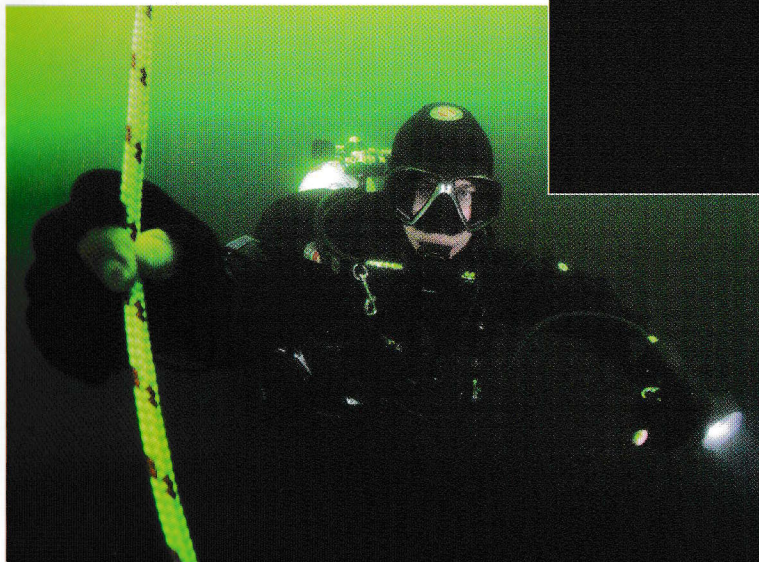
by Toby Passauer



Above: Lucas Ford in Kilsbys.

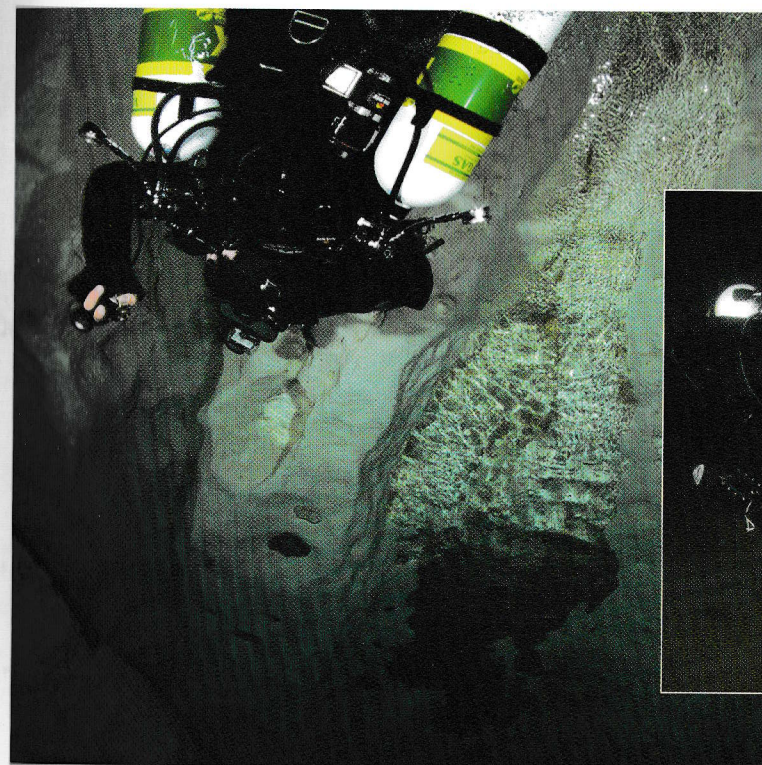
Centre: Lucas Ford in The Shaft.

Below: Self Portrait in One Tree.

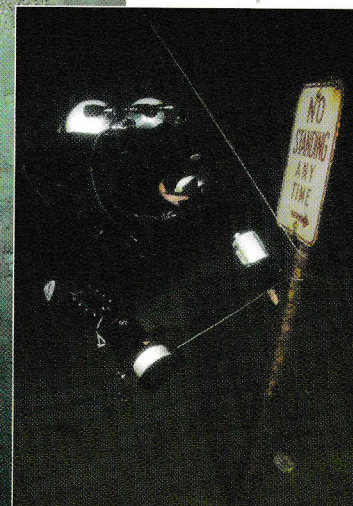


Above: Lucas Ford in Kilsbys.

Middle: Lucas Ford in Piccs.

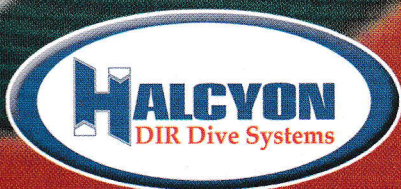


Above: Lucas Ford in Little Blue.





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