
Journal of the Scientific Expedition Group Inc.
Volume 33 No. 2 September 2017

# Scientific Expedition Group Inc.

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**Cover Photo**:
*Estaingia bilobata*. This is by far the most common species in the Emu Bay Big Gully biota. Length of this specimen is about 3cm.

**Back Cover Photo**: A contemplative Purple Faced Langur, *Trachypithecus vetulus,* Anauradhapua, Sri Lanka.
Photo: Alun Thomas

The Scientific Expedition Group is a not-for profit organisation which began in 1984. SEG undertakes several expeditions each year to record scientific information on wildlife and the environment in many parts of South Australia.

A major expedition to conduct a biodiversity survey occurs each year over two weeks. Scientific experts lead volunteers in surveying mammals, reptiles, invertebrates, vegetation, birds and physical geography. The data collected on each survey are archived with the relevant State scientific institutions to ensure they are available to anyone interested in our State's environment.

In addition to the major expedition, a number of trips for the Vulkathunha-Gammon Ranges Scientific Project are organised annually. A long term study of rainfall on the ranges and of water flow in arid-zone creeks is undertaken. All data are supplied to the Department of Environment Water and Natural Resources and to the Bureau of Meteorology and are available for analysis.

SEG conducts four-day biodiversity surveys at eight different sites each autumn and spring in the Heritage Area of scrub on "Minnawarra" farm near Myponga. Data collected are entered into the Biological Data Base of SA. SEG also conducts annual mallee-fowl monitoring over a weekend in the Murraylands.

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**ISSN 0816 6463**
SEGments is the authorised journal publication of the Scientific Expedition Group Inc., PO. Box 501, Unley SA 5061. It is published four times a year to promote articles about biodiversity, scientific exploration and ecological research.

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# SEGments

## Volume 33 Number 2 September 2017

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## EDITORIAL

At the Butterfly Conservation AGM in August, Associate Professor David Paton spoke about the changes in the abundance of birds in the Adelaide Region over the last 30 years. The Adelaide Region covers an area from Cape Jervis, north to Pt Augusta, east to Waikerie and south to Salt Creek at the Coorong. Bird species have continued to decline even though land clearance stopped in the early 1980's.

The Adelaide Mt Lofty Region is a nationally recognised biodiversity hot spot. It is an isolated woodland system with 10% of the original landscape remaining. David predicts that we will lose half the number of species present at the time of European settlement: this means we could lose 50 species if significant amounts of new habitat are not established. Ten species have already gone.

Although we do not know how to get back to the original native habitat, a different habitat will work, and importantly, remnant patches of vegetation in conservation parks will need to be managed properly. David's message is that it is possible to halt the decline of bird species, but **the community will need to step up and take the lead**, as the Government is investing very little in biodiversity at the present time. In the Adelaide Mt Lofty Region he proposes that the target for native habitat should be an increase to 30% (from the current 10%) in order to save 35 to 40 species. This will be a huge task and if started now will be owned by two more generations. The priority is to revegetate patches of area greater than 100 ha (SEGments June 2013). There are a number of opportunities for people to join a community planting day. Watch out for events advertised on the Friends of Parks website. Also the not-for-profit group BioR aims to reconstruct habitats for biodiversity. You can also contribute financially to BioR to offset your carbon footprint.

A lot can also be achieved by "tweaking" habitats to manage declining species. The Glossy Black-Cockatoo Recovery Program on Kangaroo Island is an example of a successful management strategy achieved by implementing a few important changes (SEGments September 2014). The GBC disappeared from mainland SA when the main food source, the drooping sheoak *(Allocasuarina verticillata)* was cleared. On KI in the 90's although there appeared to be sufficient food, the GBC breeding success was low (GBC only produce one egg per nesting season), and the population had declined to less than 200 . The Common Brushtail Possum was predating on nestlings in the eucalypt hollows used by the birds. The possum threat was greatly reduced by placing corrugated iron collars at the base of nest trees and pruning bridging tree canopies. Plantings of sheoaks and mixed under-plantings have also benefitted the breeding success of the GBC, as has the installation of dozens of artificial nest hollows. Numbers of birds over the last 20 years have increased to 350 - 400, and the distribution range on KI has expanded.

David is also very concerned by conspicuous signs of understory plants being overgrazed by kangaroos, and the impact this has on the plants and seeds that birds and butterflies depend on. In this edition there is an article by David Paton on the serious threat that kangaroos pose for the Mt Lofty Region.

**Helen Johnson**

# EMU BAY SHALE BIOTA

## Dr Jim Jago

One of the most significant Cambrian fossil localities in the world is found at Big Gully, on the north coast of Kangaroo Island, a few kilometres to the east of Emu Bay (Fig. 1).

The Cambrian period extends from about 542 million years ago (Ma) to about 488 Ma. It is the earliest geological period in which animals developed the ability to produce hard parts, (e.g. shells) and hence have a reasonable chance of being preserved as fossils. The early part of the Cambrian saw a remarkable increase in the diversity of life; this is known as "the Cambrian Explosion". Until the early twentieth century almost all known Cambrian fossils were preserved as shells. Fossils included trilobites, brachiopods, archaeocyaths, sponges and hyoliths. Almost no remnants of soft parts of the body (guts, antennae, eyes, etc) were known.


**Figure 1: Locality of Emu Bay on Kangaroo Island**

**Figure 2. *Redlichia takooensis.* This species can be up to 25cm long.**

This all changed in late August 1909 when Charles Doolittle Walcott, the leading Cambrian palaeontologist of the day and Secretary of the Smithsonian Institution in Washington, D.C., discovered the famous Burgess Shale biota high in the Rocky Mountains of British Columbia. As well as the usual trilobites, this comprised a remarkable assemblage of soft-bodied organisms previously unknown to science. These included arthropods with all their appendages (legs, antennae) preserved. These fossils indicated that life in the Cambrian was much more diverse and complex than previously recognized. Since Walcott's discovery about twenty Burgess Shale Type (BST) biotas have been found around the world. The best known ones are the Chengjiang biota of southern China, the Sirius Passett fauna from north Greenland and the Emu Bay Shale (EBS) biota of Kangaroo Island. They are important because they give us an insight into the life in the Cambrian unobtainable at the great majority of Cambrian fossil localities.

The EBS biota was found in late 1954 by Brian Daily, then a PhD student at Adelaide University. The discovery locality was on the shore platform a little to the east of the mouth of Big Gully on the north coast of Kangaroo Island. At the time, the most striking feature of the locality would have been the very large complete specimens, up to 25 cm long, of the trilobite *Redlichia* (Fig. 2) that were exposed on the bedding planes. However, despite the importance of the fauna, the first publication on the soft-bodied organisms was delayed until 1979 (Glaessner 1979). Richard Jenkins and Chris Nedin of Adelaide University made further studies in the 1990s, although only a limited amount of material was published (e.g., Nedin 1995) and there was no follow up work. Much of this work was based on studies of the siltstones exposed on the shore platform and adjacent cliffs.

In 2007 a new project was commenced whereby the fossiliferous beds were traced inland and a new excavation (Buck Quarry) was developed. A second excavation has been commenced in recent years. These new excavations have the advantage of being much more accessible for vehicles. This has been an extremely successful project with over 50 fossil species now known from the new localities. Many of these fossils represent new taxa. Indeed on the twice annual visits to Buck Quarry we are yet to have a visit when a new taxon has not been discovered. The group undertaking the work comprises scientists from the University of New England, the

**Figure 3. *Estaingia bilobata*. This is by far the most common species in the Big Gully biota. Length of this specimen is about 3cm.**

SA Museum, the University of Adelaide, the British Museum of Natural History and the University of South Australia. Outside experts are invited to participate where appropriate. A considerable amount of work has been done by volunteers, both in the field and back in the laboratory. The age of the EBS biota is about 514 Ma; at the time the Emu Bay area would have been close to the equator. The geology of the area is described by Gehling et al. (2012).

Some of the fossil horizons at Buck Quarry are extraordinarily rich—we usually find some fossils within a few minutes. The great bulk of specimens are of the trilobites *Estaingia bilobata* (over 75% of the fauna) (Fig. 3) and *Redlichia takooensis* (Fig. 2). Arthropods dominate the EBS biota and include bivalved arthropods (*Isoxys, Tuzoia*) (Figs 4, 5), the top predator

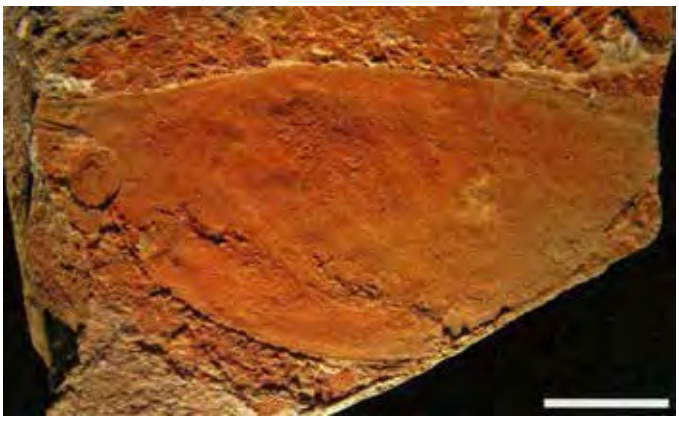

**Figure 4. *Isoxys communis* with a well-developed eye.**

*Anomalocaris* (Fig. 6), several trilobite-like taxa (Fig. 7), and others as well as the trilobites. Many of the arthropods show affinities with those of the slightly older Chengjiang fauna of China. Other fossils include palaeoscolecids (Fig. 8), a vetulicolian (*Nesonektris*), sponges, brachiopods, molluscs, a polychaete and several enigmatic forms (e.g., Edgecombe et al, 2011, Garcia-Bellido et al., 2009, 2013, Jago et al., 2016). Further details are given in Paterson et al. (2016).

One of the most exciting finds has been the recognition of quite complex eyes. These are not the earliest known fossil eyes, but they are much bigger and more complex than anything found previously. One set of eyes belongs to the top predator *Anomalocaris*, and are remarkable for the number of lenses on the visual surface (Paterson et al., 2011). One surface has over 16,000 lenses with probably a similar number on the underside. We have found only a few of these eyes.

The second type of eyes (Lee et al., 2011) is now known from about 15 specimens. They are clearly arthropod eyes, but we are yet to find them attached to a particular species. They are quite large and mainly 7-9mm along their long axis (Fig.9). However, we have found some larger eyes of the same type.

**Figure 5. *Tuzoia australis.* This specimen of a bivalved arthropod shows both valves, as well as the eyes at the right hand end.**

There are over 3,000 lenses on the visual surface which is many more than any contemporary trilobite eyes—indeed trilobite eyes of this size are not found for another 50 million years. The individual lenses are large and the lenses decrease in size away from the centre in a similar manner to some living predatory arthropods, such as robberflies. This indicates that the unknown arthropod had excellent eyesight, which is clearly an advantage for either prey or predator.

As part of this study we have found numerous examples of the vetulicolian *Nesonektris aldridgei* (Garcia-Bellido et al., 2014). As shown in Fig. 10 the body is divided into two subequal elliptical sections. In our view the axial rod structure (not shown in Fig. 10) of the posterior section probably represents

**Figure 6. *Anomalocaris briggsi.* As far as is known this was the top predator in the Emu Bay Shale biota. A detail from an original painting by Katrina Kenny.**

**Figure 7. Two trilobite-like arthropods, *Emucaris fava* (centre) and *Kangacaris zhangi* (top right).**

**Figure 8. The palaeoscolecid *Wronascolex antiquus.***

a notochord (primitive beginning of a backbone), although this is still a matter of conjecture.

The Emu Bay Shale biota differs from all other Burgess Shale biotas in that it was deposited in relatively shallow water. All other Burgess Shale biotas were deposited in relatively deep water (Gaines et al. 2016). In the case of the Emu Bay Shale there was a land mass not far off the north coast of Kangaroo Island. This was being rapidly eroded with sediments shed off the land mass and being deposited in the present area between Cape D'Estaing and Boxing Bay.

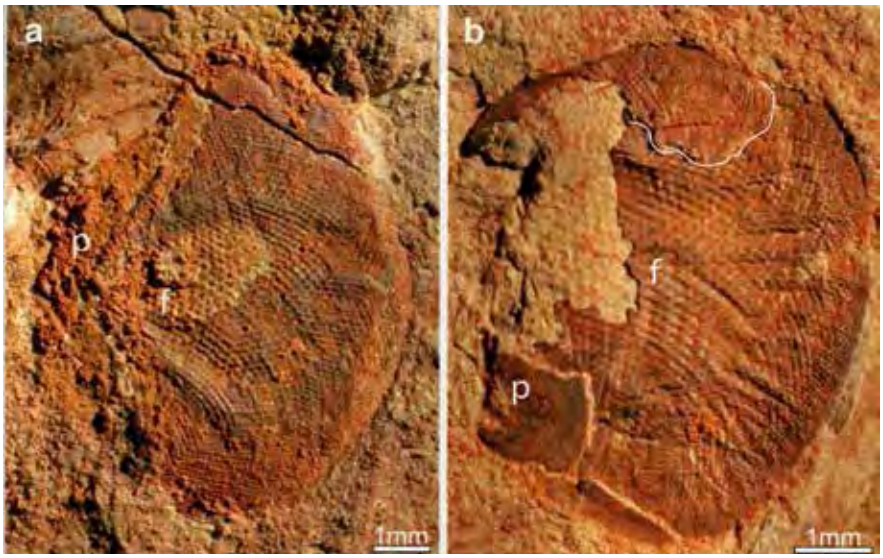


**Figure 9. Compound eye fossils, found at Emu Bay, of an unknown arthropod. The lenses in the centre of the eye are larger than the lenses on the margin and hence form a bright zone, thus indicating that the animal had excellent eyesight. f, bright zone; p, sclerotized pedestal.**

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**Figure 10. *Nesonektris aldridgei*. This vetulicolian comprises two subequal sections. In this specimen the anterior section is to the right and the segmented posterior section is to the left. The trilobites *Redlichia takooensis* and *Estangia bilobata* are also present.**


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# DIGGING AT EMU BAY, KANGAROO ISLAND

## Alun Thomas

There are fewer things more exciting than levering a lump of rock out of a quarry face, inspecting it for possible cleavage planes, striking it and exposing a fossil trilobite which has not seen the light of day for five hundred million years.

Several years ago, Kathleen and I had the opportunity to join a South Australian Museum trilobite fossil dig as part of a Museum's Waterhouse Club Expedition to Buck Quarry near Emu Bay on Kangaroo Island. The quarry is on private property on an exposed hillside.

**Buck Quarry near Emu Bay showing Waterhouse Club members digging and sorting in the quarry face**

Trilobites (meaning three lobes) are a fossil group of extinct marine arthropods. They were invertebrates with an exoskeleton and a body plan consisting of segments, each with a pair of appendages. They existed from the Early Cambrian to the Late Permian and worldwide there were over 17,000 species.

The Museum scientists on the dig included Dr Jim Jago and Dr Jim Gehling. They told us how to get the rock out of the quarry face and how to split it to expose the fossils. The rock was relatively soft and easy to split. The fossils were generally a red colour on brown rock and so were quite easy to spot if present.

There was a lot of sitting on the ground chipping away but the excitement of what might turn up in the next split kept us going. It was also quite useful to work through the mullock heap at the edge of the quarry as even a small piece of previously discarded rock might have interesting fossils when split.

The most common fossil we found was *Estangia bilobata* and these ranged in size from 5 mm long up to about 30 mm long.

**Portions of *Redlichia takooensis* found during our dig at Buck Quarry**

There were at times several fossils on a single split face. Much rarer were the fossils of *Isoxys* with a bulbous eye at one end. As you can see in the article by Jim Jago in this edition, it has subsequently been found that arthropod eyes found in fossils at Buck Quarry are compound eyes with thousands of lenses.

The largest fossil I found was a portion of a *Redlichia takooensis.* These grew to about 25 cm long.

**A single piece of rock showing at least eight *Estangia bilobata* fossils**

If we located a good specimen of a fossil it was immediately whisked away for the museum collection. One of mine was apparently so good that I hardly had time to look at it before it was taken for the collection. Others were only parts of fossils or poor specimens of common species which we were allowed to keep.

**My specimens of *Isoxys sp. The upper specimen appears to show an eye at its lower end***

**My best specimen of an *Estangia bilobata* fossil**

A specimen we were all hoping to find was at least a portion of an *Anomalocaris*, a predatory arthropod which grew up to a metre in length and predated on smaller trilobites. A small portion of one of its claws was found by one of the Waterhouse Club members on this expedition and much larger pieces have been found at Buck Quarry.

A fascinating thing about the fossil beds is the fineness of the silt originally laid down in shallow Cambrian seas, which allows spectacular detail to be observed in the fossils.

Perhaps fortunately, the fossil beds are not publicly accessible, but if one has an opportunity to visit the Emu Bay fossil beds it should not be missed.

South Australians rightfully should be very proud that not only do we have the Ediacaran fossil beds west of the Flinders Ranges and the type section of the Ediacaran Period in Brachina Gorge, but we also have in the Emu Bay area an internationally significant fossil bed.

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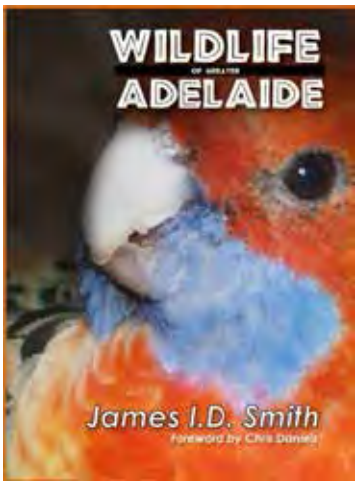
## IMPORTANT REFERENCE BOOK

In 2016 the Trustees of Scientific Expedition Foundation partially funded the publication of a book by author **James I D Smith "Wildlife of Greater Adelaide".**

SEG has copies of this valuable reference book for sale at the discounted price of $55.00 (RR - $69.00). If you wish to purchase a copy please contact Graeme Oats – gdoats@bigpond.net.au




## CONTRIBUTIONS TO SEGments

The editors welcome contributions for SEGments in relation to natural sciences, adventure and SEG activities.

For ease of publication we request that text is supplied in Microsoft Word or text format and that pictures and photographs are supplied separately in jpeg format. If desired captions for figures, tables and photographs can be placed in the text to indicate optimal position.

# CHAIRMAN'S REPORT 2017

## Bob Sharrad

This has been an unusual year in that while the mainstays of our work such as the Minnawarra Survey and the Vulkathuna – Gammon Ranges Scientific Project have continued as usual, we are not running a major survey such as the recent Witchelina surveys this year. The small band of organisers have faced a number of challenges in finding a suitable site for the next survey and have explored options in the Port Lincoln/Coffin Bay area for autumn 2018.

As always the **SEG Committee** deserves great praise for its hard work and dedication. The current members are:

President, Richard Willing; Hon Secretary, Sarah Telfer (Sarah also organises the venue); Hon Treasurer, Graeme Oats; Administration Officer, Alun Thomas; and Andrew Barr, Helen Johnson, Greg Johnston, John Love, Duncan McKenzie, Stuart Pillman, Trent Porter, Jill Tugwell and Chris Wright.

I must acknowledge the particular contribution of the small group that organises the survey, supplies and transport. In particular Trent Porter (the QM), Stuart Pillman (scientific leader), Alun Thomas (Admin Officer), Greg Johnston (science leader) and Graeme Oats (the money).

Like many other volunteer organisations we are having to work out how to add new (younger) members to the committee and working groups. It is becoming clear that some of us are mortal. Indeed four members of the committee have had heart surgery in the last two years! Organising the field work in particular will become more and more of a problem unless we can inspire some fit young people to join us.

Andrew Barr has resigned from the committee. Andrew as editor of SEGments lifted the journal to a "higher standard" and has acted as a backup layout editor. We are grateful for the work he has done on the committee.

**Witchelina** (11 – 23 September 2016): This survey followed a succession of surveys on Nature Foundation SA properties (on Hiltaba as well as Witchelina). It may be that we return to work with NFSA but there is something to be said for varying study sites to attract a range of participants with varying interests.

**The Vulkathuna – Gammon Ranges Scientific Project:** The important monitoring in this remote region seems to keep running despite fire and flood.

**Minnawarra biodiversity survey:** Richard Willing, Janet Furler and helpers keep this long-term study going twice each year in one of the most attractive areas close to Adelaide. The continuation of this work also depends on us finding young, energetic volunteers to do the physical field work.

**Malleefowl monitoring:** The short trips to the mallee for these counts of mallee fowl nests are some of the most accessible forays for our members. Stuart Pillman has ably organised these events for some years now.

**SEGments**: Helen Johnson and Alun Thomas have maintained the high standard of these publications to produce what is in my view the most informative and readable account of local natural history.

This has also been a sad year for long-term SEG people in that we lost Gwen Willing, one of the constants in SEG activities. The Willing family have been at the core of SEG from its inception. Gwen is greatly missed.

## MINNAWARRA BIODIVERSITY SPRING SURVEY 2017

Saturday 30th September to Wednesday 4th October

Come for half a day, one day or several days.

Minnawarra is situated on the southern Fleurieu Peninsula

For further information and registration forms, contact:

Janet Furler Janet on 0419 842 667 or thefurlers@gmail.com

Richard Willing on 0408 807 517 or rwilling01@gmail.com

## MINNAWARRA WEEDING GROUP

You have an opportunity to see other parts of the Minnawarra scrub if you join the Bush For Life weeding group. We meet each month on the 3rd Sunday, 10.00 to 1.00, morning tea (mostly fresh baked) provided.

Janet can give details – 0419 842 667.

# REFLECTIONS ON EXPEDITION FREELING PLATEAU

## John Waterhouse

May 1986 changed my life and I hope, those of many others. The Scientific Expedition Group had an advertisement in the newsletter of the South Australian Science Teachers Association and Alex, my wife, was teaching science at that time. The advertisement, which she was good enough to show me (!), called for candidates as leaders in a scientific expedition to the Freeling Plateau, the northernmost high part of the Flinders Ranges (since named Mawson Plateau). Significantly, it called for people with experience in geology, hydrology and arid zone bushwalking, three of my personal passions. I couldn't believe my luck.

I was selected as one of six leaders, two to each of three groups of expeditioners. My view was always that I'd been selected because I held a bus driver's license, and I drove the expedition group from Adelaide to the Freeling Heights area and back! Regardless of the reason, it was a great pleasure to join a group of enthusiastic leaders, and others in SEG, most with far more relevant experience in running that sort of scientific expedition. We aimed to add to the knowledge of flora and fauna in the Freeling Heights area, north of Arkaroola, by sending three parties out to different parts of the area for several days of bushwalking and scientific work.

**Setting up base camp**

We set up a base camp and spent a few days on basic training in vegetation mapping, geology and so forth, and prepared for the expedition phase. We joined with the "Linkwalk" group on Mount Babbage, as described in SEGments (December 2015); that ascent providing a great photograph of the group. It looks like about 32 of us made the climb.

Our group worked up Hamilton Creek from the wonderful Terrapinna Waterhole, with its colony of yellow-footed rock wallabies. The wallabies are pretty and agile, running up and down steep rock faces with apparent ease, their main activity

**SEG Freeling Plateau expedition group on Mount Babbage**

**Our group on a high saddle near Peppagoona Gorge**

periods being dawn and dusk. We aimed to do various vegetation quadrats, observe wildlife and gain an appreciation of the waterholes that we might find up the Hamilton Creek. The Hamilton drains from the Freeling Heights north to Terrapinna Waterhole, then runs east across the northern end of the ranges, ultimately to Lake Frome.

**Typical "Triodia country" high in the landscape**

David West, from our group found a hitherto unidentified colony of yellow-footed rock wallabies (from memory in Peppagoona Gorge). We traversed some truly wonderful granitic terrain, characterised by Triodia occurrence.

Hamilton Creek yielded a total of 22 waterholes, some small but several scoured-out structures like the one illustrated here. We demonstrated a progressive increase in salinity of the water from the high part of the catchment down to Terrapinna Waterhole; some consequence of progressive evaporative concentration at greater distance from the origin. This outcome probably reflects some continuity of surface water and groundwater contributions to the waterholes and remains a fertile subject for further study.

**One of the many Hamilton Creek waterholes**

At the time, Rob Hogan, the expedition leader, prepared an audio-visual presentation of the expedition, and no doubt there are copies around still – perhaps a good item for a SEG general meeting if a VHS player can be found. Conversion to DVD would be sensible! My memory tells me that Jill Tidemann was the deputy leader. Of the other four, Liz went on to teach outdoor education at Geelong Grammar, one name escapes me, and Louise Grandfield was tragically killed a few months later in a road accident near Port Wakefield. We decided to dedicate the then "Gammon Plateau Project" (now the long-lived Vulkathunha Gammon Ranges Scientific Project) to Louise Grandfield.

**Geology training for Expeditioners**

Naturally most of us have lost regular contact, not least because of movement around Australia. We live in Perth, David West in NSW, for example. A reunion anyone?

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# VALE PROFESSOR MICHAEL BULL

## Bob Sharrad

On the 24th of November 2016 South Australia lost one of its most dedicated and important scientists when Prof Mike Bull died suddenly and completely unexpectedly. He was at the acme of his 43 year career at Flinders University with a team of postgraduates; popular undergraduate courses; an ever expanding list of refereed publications, several research projects in conjunction with local and international scientists; continuing work as managing editor of the international journal, Austral Ecology; and, administrative responsibilities as Associate Dean of Research in his faculty.

As a **researcher** he has helped change our understanding of the living world. We know now for example that reptiles are not all dumb almost machine-like creatures, that some of them live in social groups where they recognise other group members and where they exhibit different personalities. Some like the sleepy lizard show a high degree of monogamy. It is worth noting that his work attracted David Attenborough here to film his lizards.

Perhaps he was most proud recently of his work to apply his ecological knowledge to help save endangered species. In the past there have been many conservation projects around the world on a great range of organisms which have too often met with mixed results. He was determined that he and his collaborators would do things properly by applying the best up to date science. His work on the endangered pygmy bluetongue lizard, centred on the Tiliqua Reserve at Burra, is practically a primer for how such studies should be carried out.

As a **teacher** he has greatly influenced a substantial set of postgraduates and also hundreds of undergraduates. While the knowledge he imparted is important of course, I believe it is the other often intangible things that may be more important: a desire to discover; a love of nature; a respect for history and the evolution of ideas; and a strong work ethic. Of course his students also learned some awful jokes.

Mike's success can in part be attributed to: an almost childlike love of discovery (always a scientist); an insatiable quest for knowledge not only in the realms of science – he was a great reader; patience and persistence; a recognition of the importance of long-term field based studies; discipline, routines and team work; keeping abreast of intellectual and technical developments in genetics, behaviour and statistics; and, a high level of skill as a writer and in mathematics – the value of these last attributes must not be underestimated.

But you mustn't think he was a dour scientist and academic. Mike loved jokes and plays on words. I should have been forewarned when driving with him early in our Honours year when he pointed to a sign ahead and said "see that repair over there, there is a road under that"! Some of you may have suffered from his jokes about the sand crab and the mud crab or the wide-mouthed frog or the cat that chewed Roy Rogers' new shoes. Generations of students have groaned at his illustration of a receding hare line and similar "Dad's jokes". But his quips and puns always got a laugh partly because he laughed at his own jokes.

Mike played competitive, pennant squash for many years and proudly displayed his broken racquets in his office. He was actually quite a good player but I suspect he particularly liked the supper that followed the game when the opposing teams ate, drank and chatted into the wee hours. The thing was that on these occasions people from all walks of life met on equal terms and discussed all manner of things. He also enjoyed watching cricket and once, he claimed, bowled Greg Chappell as a schoolboy and of course he took up swimming later in life.

He was a great scientist, a conservationist and an academic leader but those of us who knew him will remember his keen sense of humour, his humanity, and in particular his great love for his wife June and their family (his greatest legacy).

**BBC Filming near Burra. David Attenborough with Mike Bull and a pygmy blue-tongued lizard**

# KANGAROOS IN THE MT LOFTY REGION

## Dr David Paton

There has never been enough habitat set aside for woodland birds in the Mt Lofty region, and as a consequence the changes in abundances and species distributions are staggering for this region. It beggars belief!

I have been visiting many of our conservation parks across the Mt Lofty region for more than 40 years and I am just staggered with how much these parks have changed in that time, particularly in the last couple of decades. Rather than droughts and control burns, widespread over-browsing by kangaroos is eliminating the understorey in our parks. This has serious consequences for our birds. For example, visit Sandy Creek and observe the grazing out of the heathy shrub layer.

Some 15 years ago I had a series of fenced enclosures established on some of the areas that had lost their understorey. The heathy shrubs, notably Flame Heath (*Astroloma conostephioides*) have re-established along with other species. Inside these small plots is now a healthy understorey of small trees, shrubs and grasses (as I remember the place from 40 years ago). Outside the plots there are none and if one finds a live Flame Heath nearby it will be heavily defoliated, a bonsai plant or nearly dead. These are plants that are hard to re-establish from seed.

Ultimately, if the grazing continues then there will be no heathy understorey and the park will look like poor quality grassy woodland, because even the grasses are heavily grazed to the point of producing no seeds. There is comparable evidence of heavy grazing in other parks. Look at what is happening at Cromer or Charleston and elsewhere to plants like *Banksia marginata*, *Acrotriche depressa*, *Pultenaea*, *Dillwynia*, *Leptospermum*, *Allocasuarina,* grasses, *Lepidosperma* – all heavily grazed.

Although fenced plots inform they do not solve the issue of overgrazing and we are not going to fence every reserve. Ultimately the kangaroo populations in the region (and the koalas) will need to be culled.

Some people will be offended by culling, but from my perspective overgrazing by kangaroos is now the most serious threatening process for conservation reserves and the biota- including birds that these reserves are meant to conserve- in the Mt Lofty region at least.

**Extract from the President's Message in "The Birder", reprinted with kind permission from the Editor.**

**One of the fenced enclosures at Sandy Creek Conservation Park showing the re-established shrub layer following exclusion of herbivores and bare ground outside the fenced enclosure. Photo David Paton**

# VALE GWEN WILLING

Our dear friend Gwen Willing passed away on 27th June 2017. Gwen and her husband Richard (SEG's President) were married for 50 years. They shared a love of animals and of the outdoors, and imbued their children Stephen and Janet (Furler) with their passions, and latterly the next generation of their family.

In 1984 the Scientific Expedition Group was formed, embodying Richard's and Gwen's ideals for their own children. Secondary school students were given the opportunity to experience scientific field work in adventurous outdoor locations. From the earliest days of SEG Gwen was a great supporter, offering her home for monthly committee meetings for over 20 years and welcoming visitors to Minnawarra Farm twice a year for surveys running over five days.

Charming, friendly, generous, hospitable and cheerful. Gwen was all these as SEG visitors swirled in and around her house. The visitors could catch glimpses of a family of three generations working together.

Occasionally one would be favoured with an anecdote, told with wry humour. Gwen wanted to maintain her independence. To this end, she looked at a small four-wheel-drive car for getting about on the farm. The salesman seemed to have difficulty bringing together in his mind a middle-aged lady and such a vehicle. Gwen bought what she wanted. When she took it back for the usual after-sales service, the conversation went something like this: "How often have you used it in four-wheel-drive?" "Oh, not since yesterday."

Gwen will be greatly missed by the SEG community.

## NATURE FOUNDATION - SCIENTIFIC EXPEDITION GROUP RL & GK WILLING GRANT

### NEW HONOURS SCHOLARSHIP

The Scientific Expedition Foundation (SEF) in partnership with Nature Foundation SA is pleased to announce its latest student scholarship offering, the Nature Foundation - Scientific Expedition Group RL & GK Willing Grant. The SEF-NFSA scholarship will be an annual $1500.00 grant awarded to an Honours student, at a South Australian University, focussed on advancing the understanding of:

1. Trends in the abundance and distribution of native populations of South Australian fauna and flora; or
2. Soil, water, geology or climate where it will affect abundance and distribution of native populations of South Australian fauna and flora.

Applications should be made to Nature Foundation SA and will close on 27 Oct 2017. Application forms can be obtained at https://www.naturefoundation.org.au/conservation/grants-(1)

# ARCOONA CREEK FLOOD JANUARY 2017

## Dr David Kemp

**Introduction**

The Vulkathunha Gammon Ranges are situated in the far northern Flinders Ranges and consist of a deeply dissected quartzite plateau with steep gorges and spectacular cliffs. The annual rainfall of the Arcoona Creek catchment area, which lies within the western Gammon Ranges, varies from approximately 250mm to 330mm, based on 23 years of recorded data.

This area was selected for the SEG Gammon Ranges Project (V-GRaSP) because it is less popular than the eastern part of the park, which means that the scientific equipment is less likely to be disturbed, and the data collection trip is in an area of near wilderness which adds to the experience for participants.

The program has gradually expanded to now include six activities:

- Servicing of pluviometers at eight sites.
- Botanical monitoring at six sites.
- Human impact monitoring at three sites.
- Stream-flow monitoring and electrical conductivity recording at one site (Arcoona Creek).
- Yellow footed rock wallaby colony monitoring.
- Feral animal counts and locations.

All the 23 years of stream flow and rainfall data from the gauging station at Arcoona Creek is stored on the DEWNR Water Connect website.

In January 2017 a flood occurred that exceeded all previous recorded levels. This report places the 2017 flood in the context of the overall record, and provides an estimate of the potential frequency with which such a flood can occur. The peak depth measured at the gauging station on Arcoona Creek was 2.16m, leading to a peak flow estimate of 113$m^3$/sec. To put this into context, this means that at the peak 113 tonnes of water was passing the gauging station every second.

**Rainfall**

The rainfall that occurred in January 2017 was very significant. Figure 1 shows the cumulative mean catchment rainfall commencing on the 18th January at 00:00 hours. It was

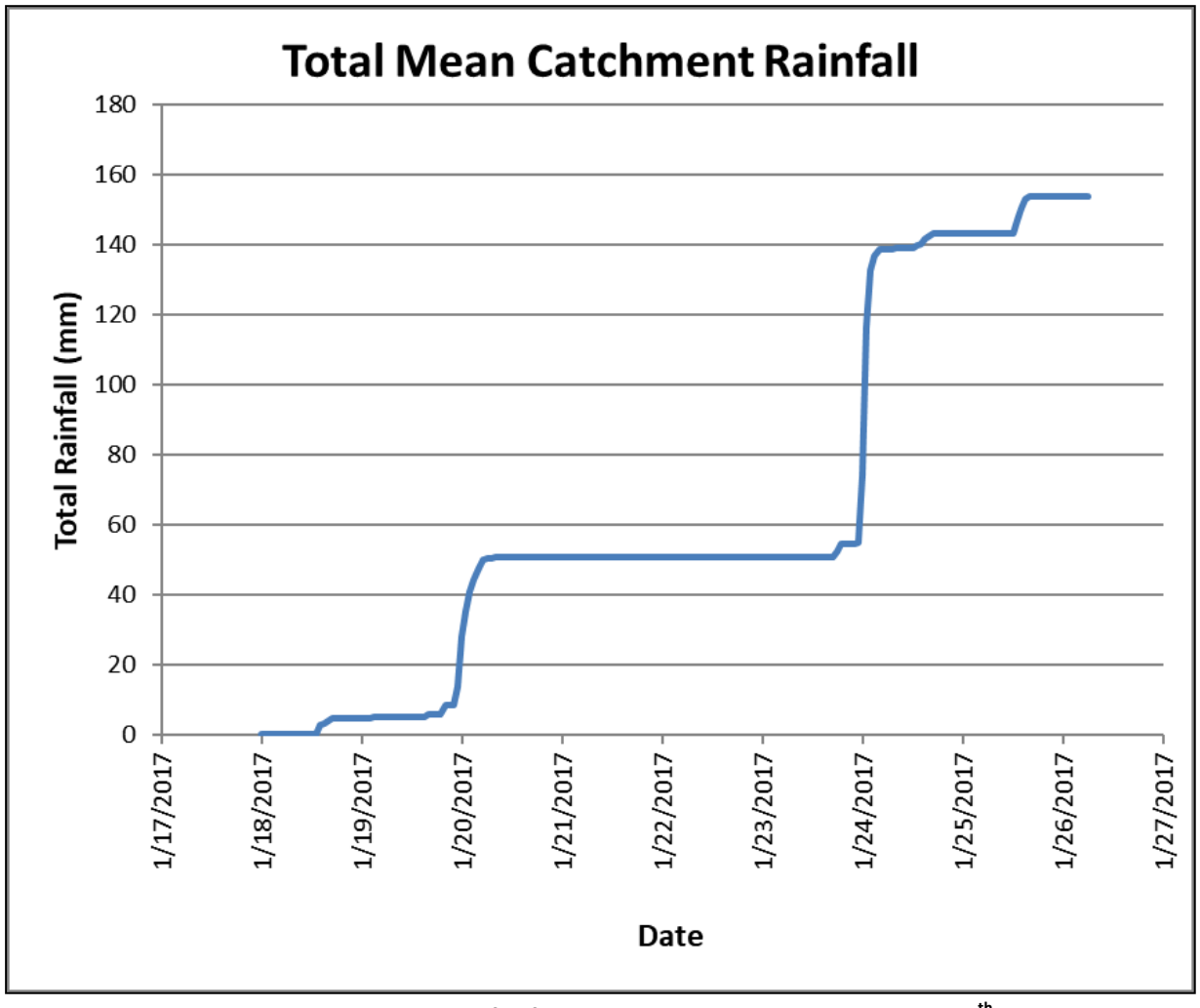


**Figure 1. Total Mean Rainfall for January 2017 Commencing January 18th**

derived as a simple average of the recorded rainfall at four stations: the Exclusion Zone; Arcoona Bluff; Arcoona South and The Plateau. From 10:00pm on the 19th January until 6:00am on the 20th an average of about 45mm of rain was recorded across the catchment. There was then a break until 11:00pm on the 23rd, when a very intense storm occurred that caused the flood which peaked in Arcoona Creek at 2:00am on the 24th January. The highest rainfall intensities occurred over a 3 hour period, where nearly 100mm of rain fell on the Gammon Plateau. Generally, rain of this intensity is estimated by the Bureau of Meteorology (BOM) to occur less than once in 100 years on average.

**Flow**

The gauging station on Arcoona Creek (number A0040520) commenced recording in December 1993. It records flow from a catchment area of 49.7km$^2$. Approximately 10% of the record is missing, most of which is in the early years of monitoring. The reliability of the instrumentation has improved over the years.

The station has no fixed control such as a weir, and the stream bed contains a significant gravel deposit. The catchment is quite mountainous, with an elevation ranging from 540m to 930m.

In the 23 years of records there have been only 12 significant flows exceeding 3m$^3$/sec. There have also been 11 years with no recorded flow. Two day rainfalls of up to 70mm have occurred without stream flow. Table 1 lists the highest recorded flows in the period of record.

**Table 1. Arcoona Creek - 12 Highest Recorded Peak Flows**

| Date | Rank | Peak Flow (m$^3$/sec) |
|---|---|---|
| 24/01/2017 | 1 | 113 |
| 15/03/1996 | 2 | 55.4 |
| 16/01/1995 | 3 | 24.4 |
| 29/02/2012 | 4 | 16 |
| 4/11/2015 | 5 | 15.1 |
| 12/02/2010 | 6 | 11.2 |
| 8/09/2016 | 7 | 10.3 |
| 14/03/2011 | 8 | 9.3 |
| 6/02/2011 | 9 | 4.32 |
| 8/03/2011 | 10 | 4.23 |
| 20/02/2000 | 11 | 3.33 |
| 19/07/2016 | 12 | 3.1 |

An estimate of the frequency of occurrence of the 2017 flow can be made by plotting the flow magnitude against a measure of the average time between each flood of that magnitude, termed Average Recurrence Interval (ARI). Figure 2 shows a plot of Average Recurrence Interval vs. flow. Table 2 gives a summary of the estimated flow for each recurrence interval, based on the analysis and resulting graph (Figure 2). The 2017 flow using this analysis has an Average Recurrence Interval of between 20 and 50 years.

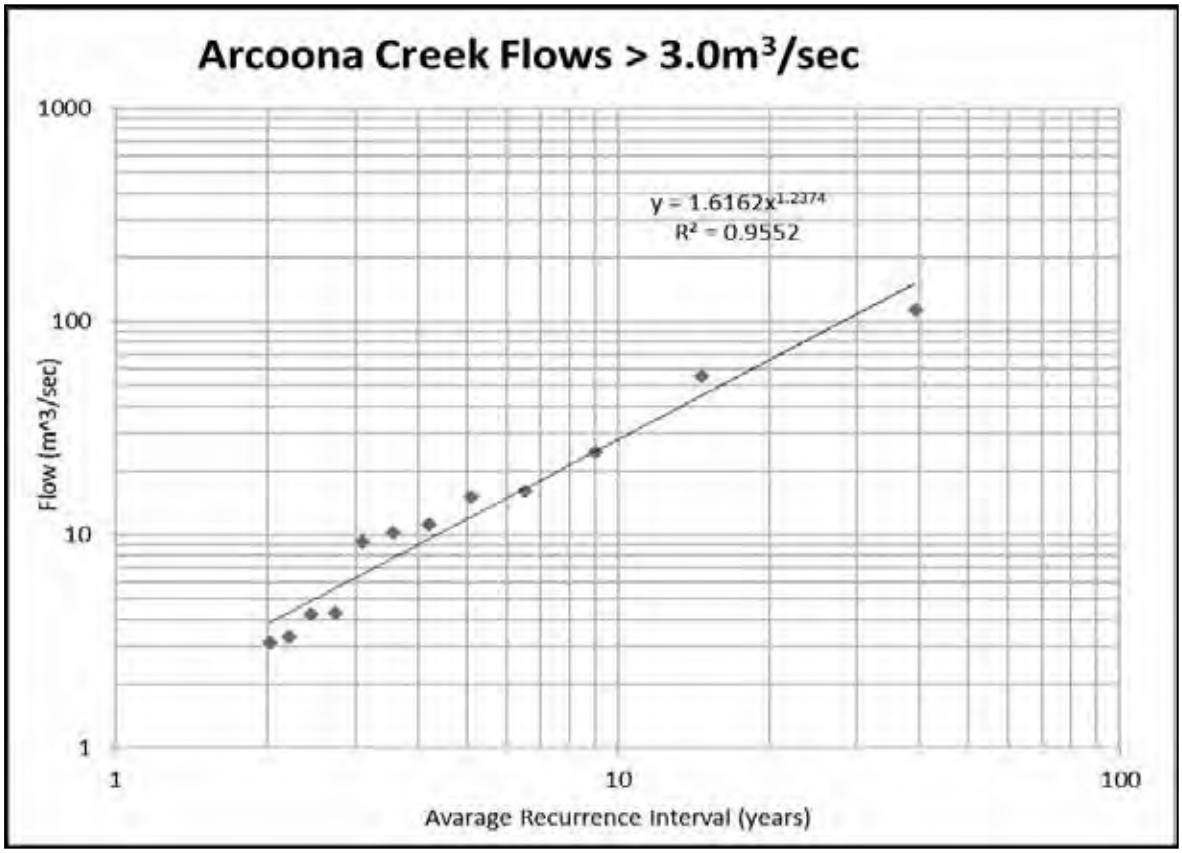


**Figure 2. Arcoona Creek Flood Frequency Plot (Partial Series)**

It is also of interest to see how the 2017 flood has changed the estimate of the flood frequency. A further frequency analysis was carried out in exactly the same manner, but now assuming that the 2017 flood did not occur. Table 3 shows that the flood frequency estimates would be much less frequent, with the January 2017 flood now having a recurrence interval of between 50 and 100 years (rather than 20 to 50 years). This shows the sensitivity of the flood frequency estimate to the few floods that have occurred during the period of record, and the continuing need for monitoring.

**Table 2. Estimated Arcoona Creek Flood Frequency**

| ARI (years) | Arcoona Creek flow ($m^3$/sec) |
|---|---|
| 10 | 27.9 |
| 20 | 65.8 |
| 50 | 204 |
| 100 | 482 |

**Discussion**

The flood in Arcoona Creek peaked at 2:00am on the 24th January 2017. The estimated peak flow was 113$m^3$/sec. It was caused by a storm that produced 75mm to 100mm of rain across the catchment within a 3 hour time period.

It should be noted that the Average Recurrence Interval is a probability that the flow rate is exceeded. This is not to be interpreted to mean that a 100 year Average Recurrence Interval flood occurs every 100 years, rather it has a probability of occurring in any year of close to 1%. This is also termed Annual Exceedance Probability (AEP). In fact, floods exceeding the 100 year Average Recurrence Interval have occurred at the same location within a matter of weeks.

It is estimated that the 2017 flood, having an ARI between 20 and 50 years, occurs more frequently than the rainfall event that produced it. Rain of the intensity that occurred (nearly 100 mm over a three hour period at the plateau) is estimated by BOM to occur less than once in 100 years on average.

This discrepancy between the estimates of the probability of the rainfall and flood flow may be as a result of:

- The rainfall not being of the duration that produces the highest flood.
- Catchment conditions prior to the storm even (antecedent rainfall) not being as wet as when the largest flood will occur as a result of a given rainfall.
- Errors in the estimation of design rainfall intensities.
- Errors in the translation from flow depth to estimated flow for the gauging station (the rating).
- Uncertainty caused by the limited time that flow and rainfall have been recorded.

Of these the greatest uncertainty is probably caused by the length of record, followed by the rating of the gauging station. Inclusion of the January 2017 flood in the flood frequency analysis has resulted in a significant change in the flood estimates, particularly for rare events. A longer period of record, with more floods will result in more certainty. This confirms that it is necessary to continue this monitoring if the behaviour of arid area streams such as Arcoona Creek is to be understood.

**Summary**

The January 2017 flood in Arcoona Creek was caused by a very intense storm which produced nearly 100mm of rainfall within 3 hours on the Gammon Plateau. The resultant flood was the highest in the 23 years of record at the Arcoona Creek gauging station, and is estimated to have an average recurrence interval of between 20 and 50 years.

The mismatch of the estimated frequency of the rainfall and resultant stream flow is significant. The continuation of monitoring will provide a better understanding of the frequency of flows, and the behaviour of the catchment. Only in this way will it be possible to improve the prediction of the magnitude of flood flows in arid zone catchments.

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**Editors Note:** The article by Garry Trethewey in SEGments 33-1, June 2017 describes significant changes in topography further up Arcoona Creek due to the January 2017 flood event that has substantially affected the stream bed.

**Table 3. Estimated Arcoona Creek Flood Frequency With and Without January 2017 Flood**

| ARI (years) | Arcoona Creek ($m^3$/sec) Without 2017 flood | Arcoona Creek ($m^3$/sec) Including 2017 flood | With flood estimate / without flood estimate |
|---|---|---|---|
| 10 | 17.7 | 27.9 | 158% |
| 20 | 35.1 | 65.8 | 187% |
| 50 | 87.0 | 204 | 234% |
| 100 | 173 | 482 | 279% |

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