SEGments

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Scientific Expedition Group Inc.

Cover Photo:
Echidna.
Photo by Cecilia Webster, Citizen Scientist, EchidnaCSI.

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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GUEST EDITORIAL

Professor Rob Morrison OAM

My university zoology degree of the nineteen sixties would not have been out of place in the UK. Dissections of fish, pigeons, rats and more were straight from the Cambridge playbook. I enjoyed it but, at the end, could not have told a quokka from a quoll, a bilby from a boodie. As an Australian interested in animals, I remained almost totally ignorant of the animals of my own country.

The books I was reared on didn't help. Like others of my generation I grew up with Mole, Badger, Pooh Bear, Mrs Tiggywinkle and other foreign fauna in books like Wind in the Willows and Beatrix Potter's tales. For many of today's children, television has replaced books, and they are more familiar with animals from the USA – Road runners, Coyotes and more – than Australian animals.

There are a few exceptions. As Chair of Rabbit-Free Australia I had to fight for years to prevent our Easter Bilby, developed to raise funds to conserve Australian ecology threatened by rabbits, from being hijacked by commercial interests that had no interest in conservation. We won the trademark battle but by then there were 18 different chocolate bilbies in the market, only one of which, Haigh's, was contributing to conservation, but at least the bilby is now better known.

In the seventies it looked as though it was going to change. There were several prominent publishers of Australiana and Australian field guides. Jacaranda's Periwinkle books on many natural history topics were extremely popular, and Rigby produced a similar set of mini guides. The Australian Museum had a splendid journal in *Australian Natural History* and Vincent Serventy had built a large subscriber circulation for his very popular Wildlife magazine. Schools were strongly moving into environmental studies in which Australian wildlife was at last being taught systematically to Australian children.

Where has it gone, that natural history movement? Publishers have folded, magazines have been discontinued while popular school programs such as Waterwatch have had their national funding removed and now survive in remnant form if at all. What seemed to be the start of an important environmental movement now looks depressingly like a passing fashion.

Meanwhile, the fate of Australia's animals has steadily declined. Conservation is more important then ever, but people will not fight to conserve something they do not love and they cannot love what they do not know. It seems essential to me that those of us who have an interest in our natural history do as much as possible to kindle that interest in the young and foster it where we can. SEG does a fabulous job in exploring our region, documenting our natural history, and bringing new players to the field. Equally important is the way in which we all use those discoveries to communicate, especially with the young, about the wonders of the natural world that we share.

Fortunately there are fruitful venues for this. Science Alive is, reportedly, Australia's largest science fair. Its visitors are self-selected for an interest in science, very often families whose parents encourage a scientific interest in their children, and they respond in their thousands to interesting displays and hands-on activities. For many children it is their first experience of touching the fur of a living marsupial or handling a snake or an unusual insect. These real experiences are all the more important for a generation that increasingly takes its experiences from computers and mobile phones rather than the real world, and these experiences with living nature are crucially important if we are to see the next generation share with us a love of, and concern for our Australian wildlife.

Editors Note: SEG will be at Science Alive. See notice on Page 9.

BATS - A CAUTIONARY ECHO

Terry Reardon

I just asked Google "what is the weight of a teaspoonful of water?" The answer came back as 4.9 grams. This small amount of liquid is something we are familiar with and it provides a useful perspective when you consider that an adult Inland forest bat (*Vespadelus baverstocki*) can weigh as little as 3g and the species as a whole averages the same as a teaspoonful of water. While not the smallest bat in the world (Kitti's Hog-nosed bat from south-east Asia enjoys that honour at 2.5g), the Inland forest bat packs a lot of body, wing and biology into that small mass.

Remarkable too is that a small mammal like this may live as long as 15 years, fly nightly distances of several kilometres, and somehow thrive in the arid regions of Australia where temperatures get below zero at night and over 45 deg C during the day. I think when you work with animals a lot, it is sometime easy to take for granted how wonderful they are. So, thanks to Helen Johnson for inviting me to share some bat stories with you.

There are 87 bats species in Australia, close to 25% of the full complement of all the terrestrial Australian native mammal species. Worldwide, around 1300 species of bats make up about 22% of all mammal species, and bats are the second largest group in terms of the number of living species (rodents are number one). For convenience bats are divided into two groups, megabats and microbats, although many DNA studies have now shown that these two groups are artificial in an evolutionary sense, that is, some microbat families are more closely related to megabats than they are to other microbat families. One reason for the historical distinction of these two groups, apart from the obvious one of size, is that microbats have evolved sophisticated ultrasound echolocation for finding prey and for navigation.

This article is about echolocation using South Australian bat species as examples: what we can tell from echolocation calls; bat detectors for recording echolocation calls; and why it is difficult to identify some bats from their calls and the implications of those difficulties.

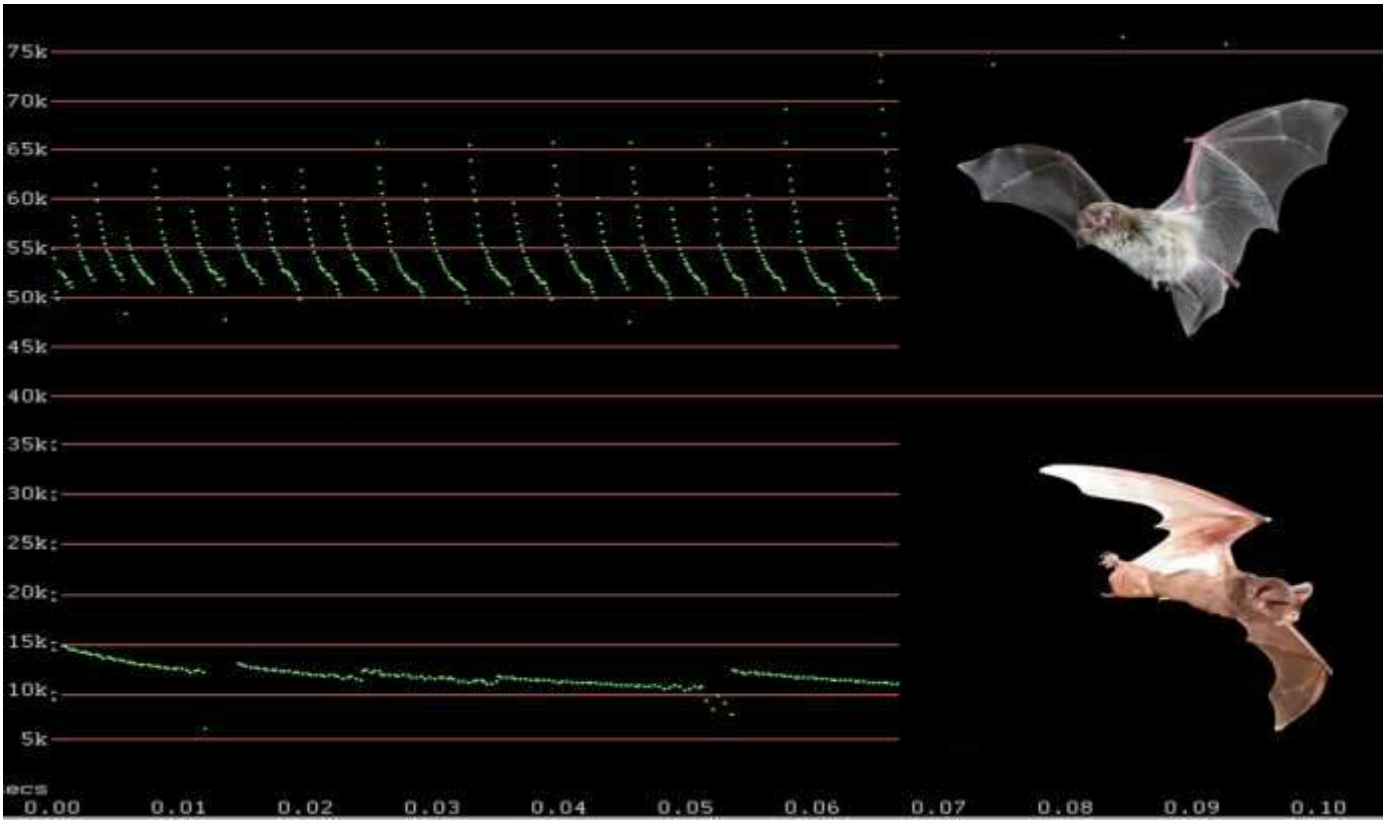
Most people would know that the echolocation calls of bats are high pitched, usually beyond our hearing range (ultrasound). That bats cannot be heard may lead to a belief that bats' calls are quiet. Perhaps a surprising fact then is that bats shout out their echolocation calls with great energy, typically at around 100 -140db (a loudness equivalent to a jack hammer operating in a small room, or Led Zeppelin in concert at full tilt). Calls have to be emitted with high energy because bats have to hear an echo reflected from a small insect several metres away. High-school physics tells us that sound energy reduces by the inverse square of the distance travelled from the source, meaning emitted sound energy is reduced by a factor of $1/d^2$ (this applies to both the bat's call and the reflected sound from the insect).

Compounding this, sound attenuates (reduces) as frequencies get higher. We know that the higher the frequency of the bat call, the smaller the insect that the bat can detect (explained below). The Little forest bat (*Vespadelus vulturnus*) from south -eastern SA and along the River Murray (a species as small as *V. baverstocki* mentioned above), feeds on mosquitoes and other small dipterans. I still find it amazing that this tiny species has the capacity to continually shout out this very loud sound while constantly listening for what must be an incredibly low-energy echo from its prey.

Little forest bat with a body about the size of a human thumb.

Below is a sonogram showing the echolocation calls of two bat species recorded with a bat detector. The graph has frequency on the vertical axis and time on the horizontal axis. The two species featured are both very common in South Australia, the Chocolate wattled bat *Chalinolobus morio* (top) and the White-striped free-tailed bat *Austronomus australis* (bottom). The calls are represented as sequences of pulses.

By examining the shape of the pulses, their frequency range and duration, and the pulse rate, we can learn a lot about the species producing them. In this example, one species calls at about 10kHz, and the other about 52kHz (note we use the flattest part of the pulse to define the frequency - it is often called the characteristic frequency or Fchar). Since lower frequency sound travels further, this tells us that the bat calling at 10kHz is detecting prey at larger distances than the bat using 52kHz. Because there is an inverse relationship between frequency and wavelength, and the wavelength determines the size of the insect that can be discriminated, a



Sonogram showing calls of the Chocolate wattled bat (top) and the White-striped free-tailed bat (bottom)

higher frequency calling bat will be able to detect smaller insects. There is also a direct relationship between the size of the insect diet and the size of the bat. In the sonogram example, the 10kHz bat is in fact over 4 times heavier than the 52kHz species.

What isn't shown in the graph is the pulse rate – this graph has eliminated the time between pulses. Had it shown the pulses in real time, it would show an almost one second (1000msec) gap between pulses for the White-striped free-tailed bat. This, together with the longer duration of each pulse, confirms that the bat is picking up targets a long way away, and is not needing quick information to chase an agile insect or to avoid clutter or background noise. The time between pulses for the Chocolate wattled bat is 50msec, suggesting that it needs information fast to pursue its nimble prey.

The slope of each pulse is quite different for the two species: the flatter pulse of the White-striped free-tailed bat tells us that it puts a lot of energy into a small frequency range, and we could deduce that it has narrow wings, is not very manoeuvrable, and forages in the open above the tree canopy. It is an air interceptor (fast and straight flight to catch an insect). Conversely the higher frequency and steep pulse slope suggests that the Chocolate wattled bat chases smaller insects (small moths), is agile, is foraging in more clutter or perhaps along vegetation edges, and receives a lot of information about the prey texture from the long steep shape of the pulse.

The relationship between bat acoustics and size and behaviour is far more complex than outlined above, and much more fascinating. There is a vast literature on bat foraging behaviour and acoustics, as well as on the physiology of bats that enables them to produce, hear and interpret ultrasound.

A quick side story - many years ago now, I was approached by defence technology people for an image of the carnivorous Australian Ghost bat (*Macroderma gigas*). These folk had developed a new radar system to detect missiles. About 2 years later, another group contacted me for an image of an arctiid moth…these moths have acoustic jamming ability to avoid capture by bats, and this company had worked out a way to foil the ghost bat radar system! I still have a mug with the company's logo.

It is fortunate that in the late 1980s commercial bat detectors arrived on the market that allowed bat biologists to survey for bats remotely. Bat detectors have evolved enormously over time… the early ones were clunky and needed to be connected to computers in the field. Today for $400 you can buy one as a small module that plugs directly into your Apple or Android phone or tablet. They are excellent detectors.

Current detectors come in two 'flavours' - one is for long-term deployment, just like a camera trap – just turn it on, hang it from a tree, and leave it for a month to record. The other type has a screen to show sonograms in real time allowing immediate call identification (but can also store calls). All use SD cards for storage. These 'professional' detectors cost between $900 and $1800. Detectors used in Australia also come in two recording types, a simple zero-crossing recorder and the full-spectrum recorder. The latter is considered superior as the calls recorded contain more information, but they also tend to be more expensive. There are several

The Lesser long-eared bat (left) and Gould's long-eared bat (right) are difficult to distinguish from their echolocation calls

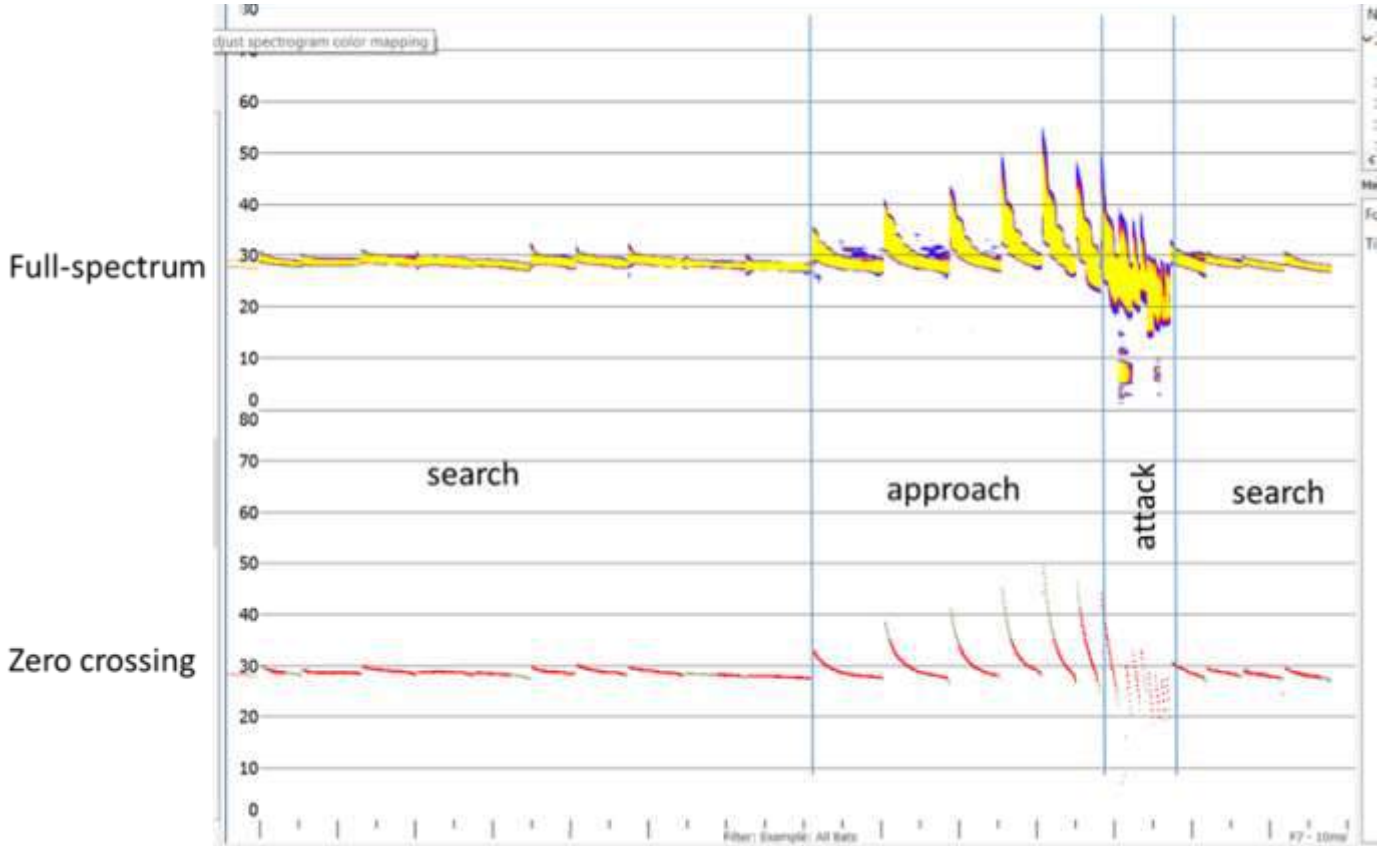
software programs available for viewing and analysing the sonograms of stored files, and some are free to download.

Large surveys of bats based using remote detectors can generate hundreds of thousands of call files. Typically, these files would be converted to sonograms, and each examined in turn, with the species identified by visual inspection of the sonograms. This process requires the analyser to be familiar with the call parameters of all the species expected to be present in the survey region. This 'manual' process is incredibly time-consuming even for 10 000 calls, and definitely not practical for half a million files. Automating the process has become the "holy grail" for bat researchers. There has been a huge effort put towards auto id, but even with sophisticated statistical approaches and powerful computing we are still some way from achieving this goal. Some regional automated identification programs have been developed, but some researchers remain sceptical that they are as reliable as the developers suggest. Most people who analyse calls use a combination of software filters for more basic species, and use manual checking for more difficult species.

So why is call identification of bats so difficult? Well firstly, bat calls are not the equivalent of calls from birds or frogs. Bats use calls to find insects in particular habitat structures - they are not advertising for mates, staking out territory or alarm calling. It is evident then that different bat species occupying similar dietary and habitat niches will have calls that overlap in parameters. At present bat biologists struggle to distinguish between calls from different species of long-eared bats (*Nyctophilus* species). Also the three species of Forest bats (*Vespadelus darlingtoni*, *regulus* and *vulturnus*) in the southern SA have calls that can be difficult to distinguish. In fact in South Australia, depending on the region and suite of species, there are several other combinations of species, even genera that are problematic.

Part of the reason for this difficulty of distinguishing calls is that bat calls are complex. Although they are simple sequences of pulses, the sequences and pulses can vary considerably depending on what the bat is doing and in what space it is operating. The graph below in full-spectrum and zero-crossing format shows a sonogram of a single bat in a search, approach and attack on an insect. During the three phases, the pulse shape and the frequency change, as does the pulse rate. This increase in pulse rate during the attack phase gives a really distinctive sound from the bat detector, and is often called a feeding buzz. A problem with analysing recordings from a passive detector is that we often have no real idea what the bat is doing at the time of recording, as we may only record a few pulses of a bat as it flies by the detector. If for example a sonogram shows only a few attack phase pulses, we may misidentify the species.

Confounding this there are geographic variations of calls in the same species. For example, the Southern forest bat has an Fchar of about 42kHz in the Mt Lofty Ranges but 50kHz along the River Murray. This difference must reflect the insect prey size that the bats are feeding on. We are lucky in South Australia at least, for as far as we know there is no significant difference in calls between males and females of the same species. In far north Queensland, for the Semon's leaf-nosed bat (*Hipposideros semoni*) the males call at 94kHz while females call at 74kHz – for a long time, we thought these calls came from different species.



Sonogram showing search, approach and attack of an Inland free-tailed bat on an insect

One key message is that we lack good reference calls for many regions of South Australia. Reference calls are those derived from bats that have been captured, identified, light tagged with a small cyalume stick and recorded upon release. The cyalume stick, which allows the person recording to see the bat in flight, is attached by sticky tape to a few hairs on a bat's belly fur and it falls off after a few minutes or so. Reference calls allow us to measure the range of values of all the call parameters for each species in a region. We need lots of reference calls to cover this range of values in order to characterise the differences between species. This is a large undertaking, because we require at least 20 calls from each species from each geographic region. So in a region that has 15 species, that's 300 bats needed to caught and recorded. Typically, about one in five bats that are released, circle around and give good quality long sequence search phase call, therefore the number of bats needing capture escalates considerably.

And now, a cautionary note. Bat detectors of course require no special skill to deploy. They have become the tool of choice for researchers, citizen scientists and environmental consultants. As a result there has been a deluge of bat records based on call data lodged with the Atlas of Living Australia, an important distribution resource for records of bats. The problem is that there is no real way to vet the competence of people who identified recorded calls. Another issue is that old identifications are rarely updated in the light of new taxonomy or new appreciation of call variation (often too the raw data has been discarded, or embargoed under the terms of consultancies). I think many bat records on the ALA that are tagged as from Human Observation (usually from call recordings) are not very reliable. This results in obvious problems, such as rare species being detected everywhere. In one case, hundreds of unreliable call recordings caused a challenge to the status of a threatened species, and rendered the ALA data unreliable for some types of analyses.

Sadly as we get older we lose our higher frequency hearing. I used to love hearing the White-striped free-tailed bat calling (like two 50 cent pieces being tapped together once per second). At 10kHz this bat species' call should be well within the hearing range of humans, well younger ones. I can't hear it now. I often play frequency tones at talks and lectures - many young people can easily hear 19kHz. I understand some kids use a 19kHz ring tone on their mobile phone - smart thinking if you're in a class with an older teacher!!!

Terry Reardon: terryreardon04@gmail.com

Honorary Researcher, South Australian Museum

SEG HAS A FACEBOOK PAGE

SEG has now joined the world of social networking. We now have a Facebook page, along with our long established website. To find our page search for "Scientific Expedition Group" from within Facebook.

SEAGRASS REHABILITATION OFF THE ADELAIDE COAST

Jason Tanner

Since 1949, at least 6200 hectares of seagrass has been lost along Adelaide's metropolitan coast. Many people still remember the 'blue line' that used to exist close inshore, which marked the beginning of the seagrass meadows. In many places this is now 2 km offshore in waters of around 7m deep. Internationally this is unusual, as most seagrass loss starts in deeper waters and then moves inshore. This is because being plants, seagrasses rely on light to photosynthesise, and light levels at the seafloor are lowest in deeper waters, making deepwater seagrasses the most vulnerable to human disturbance. When nutrient pollution and turbidity from storm-water runoff, waste water treatment plant discharges, and industrial pollution reduce water clarity, it is thus the deepwater seagrasses that tend to suffer first. Off Adelaide, however, these pollutants tend to be trapped inshore, thus affecting nearshore seagrasses first. This is especially noticeable after heavy rainfall events, when a discrete band of muddy water can be observed close to the shoreline for many days afterwards. As well as the direct blocking of light by turbid waters, nutrient pollution also leads to increased growth of microscopic plants in the water column (phytoplankton), and of algae that grow directly on the seagrasses (epiphytes); both of which also block light to the seagrasses.

The loss of seagrass has a number of important consequences for the coastal ecosystem. Perhaps one of the most noticeable to many Adelaide residents is the need for sand carting for beach replenishment. Whilst seagrass loss isn't the only reason this is needed, it has contributed, as seagrasses are good at trapping sand particles and slowing their movement along the coast. Indeed, in many areas, seagrass meadows are actually a source of sand, as coralline algae and other organisms growing on the seagrasses turn into sand when they die. Shallow water seagrasses can also reduce wave action by increasing the friction between the water column and the seabed, which helps to reduces coastal erosion. Indeed, off Adelaide it appears as though not only has the loss of seagrasses had a direct impact on wave activity, but this loss has also led to an increase in water depth close to the shoreline because of erosion, which also increases the size of the waves breaking on the shore.

Another important role of seagrasses is in providing habitat for many other species, as well as primary production to support the coastal food web. Many popular fished species, such as King George whiting and blue swimmer crabs live in seagrass meadows for at least part of their lives, and many use shallow estuarine seagrass meadows such as those in Barker Inlet as nursery grounds. While not many South Australian species feed directly on seagrasses, many small invertebrates feed on the epiphytes that naturally grow on them, and then in turn become food for larger species. Over autumn and winter seagrasses naturally lose their older leaves, as light levels and water temperatures decrease, and large amounts of dead seagrass washes up on our beaches, which helps to provide nutrients for coastal vegetation and supports other important animal communities including resident and migratory shorebirds. This seagrass wrack also has a coastal protection value, as it helps dissipate wave energy on the beach and provides a physical barrier between the sea and dune system. Due to its fibrous composition it is thought to enhance the formation and stabilization of coastal sand dunes by binding drifting sands and reducing sand erosion during winter and storm events.

Seagrasses are also important in terms of blue carbon sequestration, which refers to the carbon stored in coast and marine ecosystems. Seagrasses store large quantities of blue carbon in both the plants and in the sediments that they trap. Seagrasses slow down water movement, which encourages particulate matter in the water column to settle, and once it has settled, seagrasses tend to bind it in place with their root systems. A lot of this particulate matter is organic. Seagrasses also accumulate organic matter that forms in place e.g. from dead seagrass leaves, and the organisms living on and around them. So, as is the case with terrestrial ecosystems, seagrasses store large quantities of blue carbon in both the plants and in the sediments that they trap.

In part because of concern over the loss of seagrasses, there has been a lot of focus in the last decade or so on reducing anthropogenic inputs into our ocean. SA Water has invested heavily in waste water treatment plant upgrades, key polluting industries have shut down or modified their practices, and the Adelaide and Mount Lofty Ranges Natural Resources Management Board (AMLR NRM Board) along with councils, have improved storm-water management. While we have seen some regrowth of seagrasses as a consequence, these plants are often very slow to recolonize. Other changes to the environment as a result of the initial loss, such as increased sand movement, also reduce recolonization. Thus it is necessary to give the seagrasses an additional helping hand if we want them to return to their original state.

In 2002, the South Australian Research and Development Institute (SARDI) and the then Department of Environment and Heritage (now Department for Environment and Water) held an international seagrass restoration workshop to kick-start a seagrass rehabilitation program. The program initially focused on small-scale trials of techniques that have been successful elsewhere, such as transplanting mature plants and planting lab grown seedlings. These trials were disappointing, as survival was very low or non-existent, which we attributed to the high levels of water movement and sand erosion. However, some of these trials used hessian matting that is sometimes used to stabilize terrestrial embankments while they are being vegetated, and it was noticed that seedlings of

one seagrass species became entangled in this matting. This species, *Amphibolis antarctica*, releases seedlings that have a miniature grappling hook that evolved to entangle in other seagrasses, and the hessian provided a substrate for the seedlings to hook on to. This led to a series of experiments funded by the AMLR NRM Board using hessian sand bags to try and help facilitate natural recruitment. These bags not only provide the seedlings with a substrate to attach to, but they last long enough (1-2 years) for the seedling to get its roots down and become established. Subsequently, when the bag rots away, the seedling is able to survive the high levels of water and sand movement that it experiences. As well as being biodegradable, another key advantage of this technique is that the bags can be deployed from a boat without the need for divers, which offers a much more cost-effective solution than traditional techniques that require expensive divers to plant seagrasses.

Initially, these bags can attract hundreds of recruiting seedlings, although numbers rapidly decrease over time. In fact after the first few years, we thought that the bags were a failure as well, because so few plants survived on them. Consequently, we spent a number of years trying to improve on the method to increase survival. Luckily, however, we persisted with monitoring our earlier bags, and after 5 -7 years, stem numbers on them increased rapidly, and eventually the patches of seagrass that represented individual bags coalesced and became larger patches of functioning seagrass meadow. It seem that the original few survivors had to mature over this time before they were able to send out underground rhizomes and establish new plants.

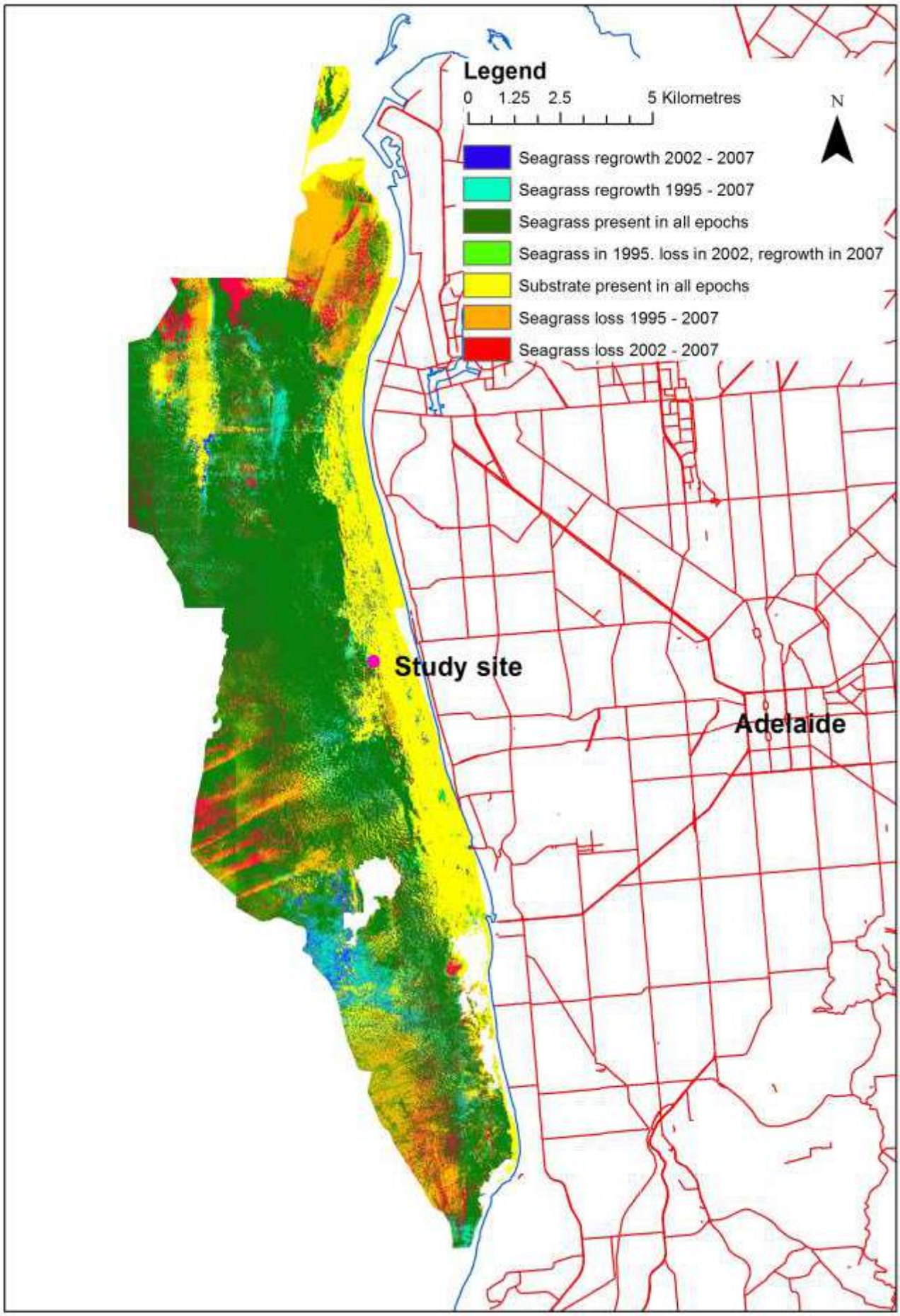
With further funding from the AMLR NRM Board we have now established three trial plots each covering one hectare, with 1000-2500 bags for each plot, in an attempt to scale up the method to a more meaningful area. Our earlier trials were based on usually 10-20 bags at a time, and the total area covered over some 10 years would only have been a few hundred square meters. These plots currently have very low densities of seagrasses on them, although we are hoping for the same pattern as was observed in our small-scale trials, in which case seagrass density should start to increase in a few more years.

Detail of *Amphibolis* seedlings, showing the 'grappling hook' that allows them to entangle in the hessian.

Hessian bags immediately after deployment

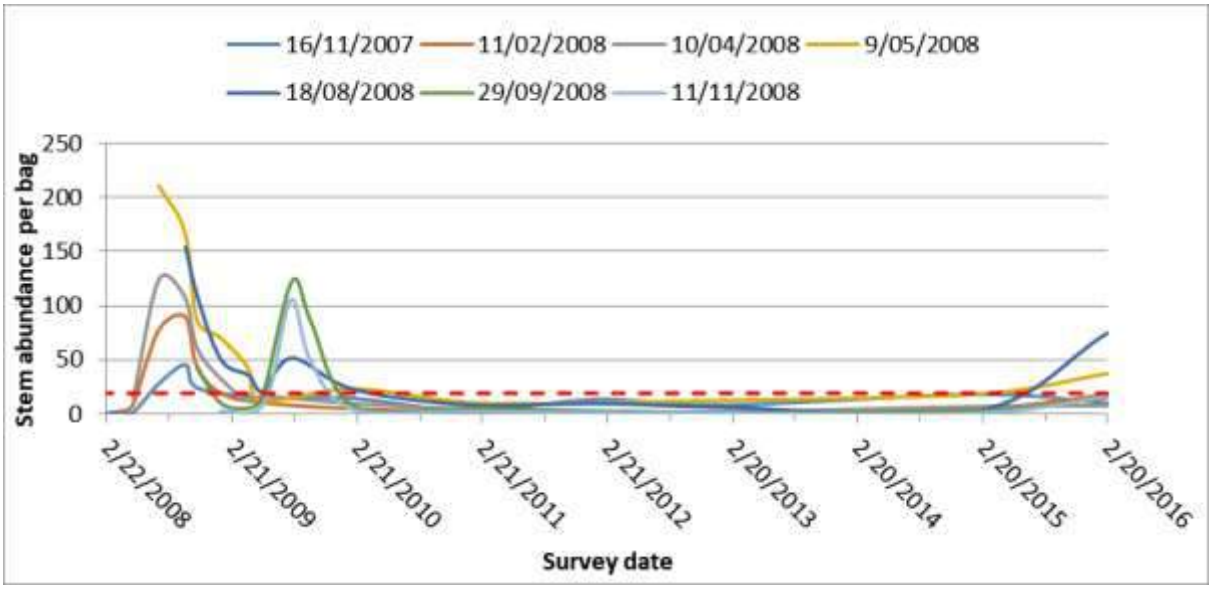
Amphibolis seedlings

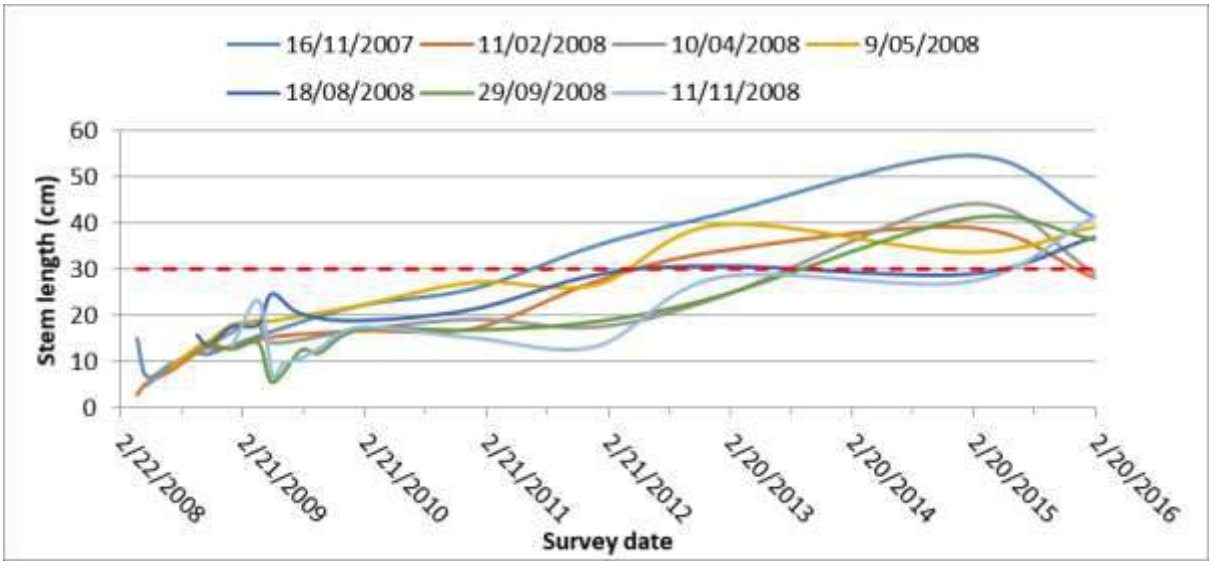
Hessian bags after 1 year covered in baby seagrass.



Map of seagrass cover and loss off the Adelaide coast. Data courtesy of Department for Environment and Water.

Note about yellow section on Map above: Substrate means bare sand, and 'in all epochs' means every time it was surveyed (but this does not mean that there wasn't seagrass present before formal surveys began, and anecodotally, we know that there was a lot was seagrass present).





Mean stem abundance (top) and stem length (bottom) of *Amphibolis* on bags deployed in 2007/08. Legend indicates date of deployment. Horizontal red dashed line indicates mean values from the adjacent natural meadow in January 2013. Notice that bags deployed in August and later attracted a second pulse of recruits at the start of their second year.

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EchidnaCSI: CITIZEN SCIENCE AND MOLECULAR BIOLOGY TO HELP ECHIDNA CONSERVATION

Isabella Wilson, Tahlia Perry, Frank Grutzner and Peggy Rismiller

Short-beaked echidnas are iconic Australian animals – in fact, they are considered to be Australia's most widespread native mammal. Together with the duck-billed platypus they comprise the unique class of egg-laying mammals. However, despite this, there are still major knowledge gaps in terms of distribution, biology and ecology of these fascinating animals. Addressing these fundamental questions is imperative as numbers have been decreasing, with one of the best-studied populations of echidnas on Kangaroo Island (SA) now under threat, recently listed as Endangered.

A community based EchidnaWatch project has been collecting information about echidna sightings for many years. With the Echidna Conservation Science Initiative (EchidnaCSI) we are combining the public's passion for echidnas with new technology and molecular biology to gain a greater understanding of echidnas across the whole of Australia. In order to accomplish this, we have created a smartphone app, called EchidnaCSI, which encourages the participants to take photos of wild echidnas.

Photo by Jaecinter Peddie, Citizen Scientist

The biology of echidnas is unique. They are found in all climates and habitats throughout the country, surviving equally well in rainforests, deserts, coastal areas, as well as alpine regions. Despite their ubiquitous distribution echidnas are often extremely difficult to find which makes field work challenging. A citizen science approach to echidna conservation is therefore a great way to establish distribution maps of these animals in Australia.

Community based projects have been around for many decades but with the internet and social media this approach has become much more powerful and can reach many more citizen scientists.

Since launching eight months ago, EchidnaCSI has had over 4000 app downloads and 2300 recorded sightings. As we gather more data, we aim to create a continent wide distribution map of echidnas to gain a better understanding of where they are found and where they may be under threat.

One of the most obvious results so far is that sightings are mainly around urban areas. There is a lack of information in rural regions (see map below). Organisations like the Scientific Expedition Group can address this gap in our distribution map by adding valuable information in significant geological and ecological regions, like the Flinders Ranges.

EchidnaCSI is unique in that it also requests participants to identify and submit scat samples (see poster below for more information). Echidna scat samples are easy to identify and contain a wealth of information about the animal, its diet and other aspects of biology including breeding and stress levels.

Echidnas are seasonal breeders. Breeding season across the continent is between late June and September. However, data indicates there are some differences in different populations. Hormones in the scat samples can actually reveal if an echidna is reproductively active or not. Other hormones inform us about stress levels or general health of the animals.

EchidnaCSI
Echidna Conservation Science Initiative

Another important question is diet. Echidnas are erroneously referred to as anteaters but a broad diet of invertebrates have been recorded in field studies. Many of these may not be identifiable by looking at scats under the microscope. Characterisation of the DNA in scat samples should provide a much more comprehensive picture of the diet of these animals and how this may change in different times of the year and in different environments. Analysis of the DNA in scat samples will tell us a lot more about the echidna's menu which

Submitted echidna sightings in South Australia (June 2018).
Source: Atlas of Living Australia

Photograph by Peter Hastwell, Citizen Scientist

is important for conservation and also captive management of these animals in Zoos. These are only a few examples of what molecular analysis can reveal about animals. New sequencing technologies allow wholesale analysis of DNA in such samples and has already provided fundamental novel insights about several endangered and rare species.

From the scats collected from wild echidnas around Australia we are analysing hormones to measure reproductive activity and stress; while DNA present in echidna scats will tell us their diet, microbiome health and genetic variability. Using the molecules in scats is a great way to non-invasively gain significant insights into the unique biology of this monotreme. But of course, this project would not be successful without the thousands of citizen scientists who have contributed to helping our beloved echidnas.

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Authors are with Environment Institute, University of Adelaide

EchidnaCSI wants to learn about echidnas - but we need your help!

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- Download on iPhone or Android

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ASSESSING THE IMPACT OF HABITAT AVAILABILITY AND PREFERENCE FOR LITTLE PENGUINS' DISTRIBUTION

Nature Foundation — Scientific Expedition Foundation RF & GK Willing Grant Recipient: Larissa Iasiello

Over the past decades, some populations of little penguins have seriously declined in Australia and New Zealand. On Granite Island (South Australia), for example, the population has fallen from 1,548 individuals in 2001 to 22 individuals in 2015. Despite over 50-80% decline in some colonies, the little penguin status is still considered as "least concern". But to date many little penguin populations are still data deficient, particularly in South Australia ("Conservation risk assessment report for little penguins in South Australia" DEWNR Technical Report 2016/33). Efforts to gain baseline data and accurate information on population numbers, locations and habitat preferences across a wide range of locations is clearly needed to get a better understanding of the extent of this decline.

Larissa Iasiello, a recent graduate at Flinders University, began her Honours project in February 2018 and intends to better quantify the extent of the little penguin decline across their South Australian distribution. Her project will also attempt to determine habitat preference and spatial characteristics of little penguin nesting sites to predict presence and absence of little penguins across various offshore islands.

Larissa will survey a mixture of well-studied, little studied and data deficient islands to help resolve these considerable gaps in little penguin conservation research, and help us gain an understanding of the status of the little penguins to inform conservation priorities.

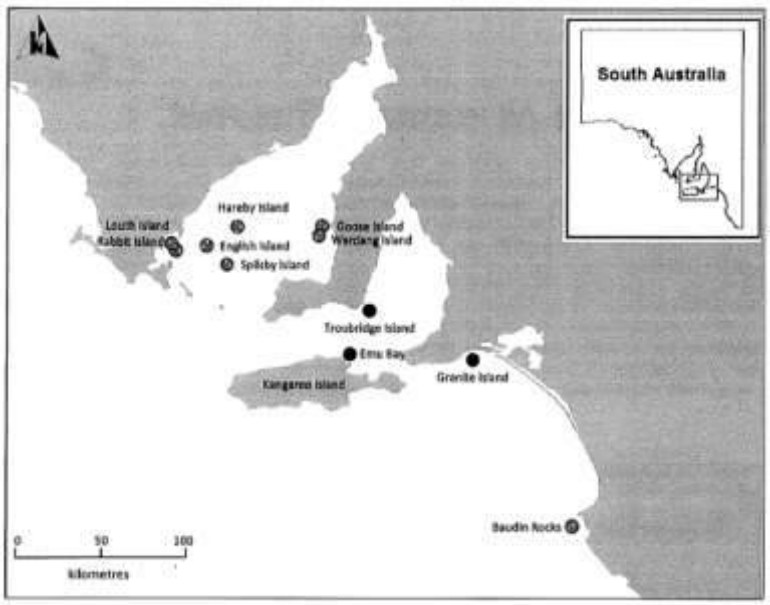
Eleven colonies will be surveyed in South Australia: English, Louth, Rabbit, Hareby and Spilsby Islands (Eyre Peninsula); Wardang, Goose and Troubridge Islands (Yorke Peninsula), Emu Bay (Kangaroo Island), Granite Island (Encounter Bay) and Baudin Rocks (South East). The colonies shown in the map below with a black dot have been surveyed recently and their status is known. The colonies with a grey dot have not been surveyed recently or regularly, and hence their status is unknown.

Larissa is the inaugural Nature Foundation-Scientific Expedition Foundation RF & GK Willing grant recipient. The $1500.00 grant, awarded to an honours student, focusses on advancing the understanding of trends in the abundance and distribution of native populations of South Australian fauna and flora; or on soil, water, geology or climate where it will affect abundance and distribution of native populations of South Australian fauna and flora.

The Nature Foundation Science and Conservation Committee, charged with the responsibility of administering the grant, determined in conjunction with SEG, that Larissa's project was of a suitably high calibre to be awarded the first Nature Foundation-Scientific Expedition Foundation RF & GK Willing grant.

Congratulations Larissa and all the best with your project. We look forward to learning of your results in future editions of SEGments.

Larissa Iasiello holding a baby bird



Distribution of little penguin colonies to be surveyed

MINNAWARRA BIODIVERSITY PROJECT - AUTUMN SURVEY 2018

Janet Furler

There is a lot of data on the changes in native vegetation once domestic grazing animals are removed from scrub. There is very little data on the changes to fauna in the same circumstances. When SEG President Richard Willing fenced off scrub on his private property "Minnawarra" farm, the opportunity was too good to pass up. A long term monitoring project was started in 2001 and has been checking 8 sites, twice per year, ever since. The project is also designed to give a taste of biological monitoring practices to anyone (child, teen, grown up, grandie) who has half a day to spare.

The autumn survey was scheduled from Thursday to Monday, 12 to 16 April. Due to a forecast of bad weather mid-survey an executive decision (Richard and Janet) was made to open some sites one day early. We managed the three most active and hard to reach sites on the Wednesday. Help arrived on Wednesday night and the remaining five sites were completed easily on Thursday, as well as the monitoring round. All settled into the routine, the weather wasn't as bad as threatened, so we carried on through and had a staggered closing time.

The daytime maxima temperatures were 32 on the first day, 18 – 22 for the rest of the time, except the last morning which was 14. Overnight temperatures ranged from 12 to 14. This helped with the decision not to close traps overnight on day 3 as it was warm but wet. The last three days were damp.

We had a small core of people throughout, with extra visitors on the weekend. Numbers for rounds ranged from 6 (minimum comfortable) to 18.

The headline news is the first **recapture** of a previously micro-chipped bandicoot. He was the small male we caught last spring. He was in an Elliott trap both times, but this time he had to come out backwards. He will have to take the bigger cage trap option next time! He has definitely grown over summer, despite the dryness, with his weight going from 145g to 560g.

The second cutest capture (not that I'm biased at all!) was a *Malurus cyaneus*. If you remember your printer inks, the cyaneus gives a clue that something is blue. It was his chest feathers - a Superb Fairy Wren in full breeding plumage. He told us off in a loud voice, and his backup crew joined in from the nearby shrub.

The warm damp weather brought out the frogs, with 31 Eastern Common Froglets (*Crinea signifera*) and two Banjo frogs (Pobblebonk or *Limnodynastes dumerilli*). We have a very good key for our seven frog species, which some of the young participants were able to work through. The key is from the Upper River Torrens Landcare Group. The skinks were also out, with 11 Garden Skinks (*Lampropholis guichenoti*) and one each of Three toed Earless Skink (*Hemiergis decresiensis*) and Southern Grass Skink (*Pseudomoia entrecasteauxii*).

We caught 191 mammals in total. 18 were feral (13 mice (*Mus musculus*) and 5 black rats (*Rattus rattus*)). 29 were recaptures from previous surveys. 144 were new native animals to be microchipped. The total number of captures was 337 (which include multiple recaptures) during the four day survey. Another male Bush rat (*R fuscipes*) has moved from Site 7, last spring, upstream to Site 8 a distance of about 300 metres.

Bush rats (*R fuscipes*) were the most frequent species, with 93 individuals caught. Swamp rats (*R lutreolus*) were the least frequent, with 33 caught. 46 Antechinus (*A flavipes*) were caught. The rats have increased by about ⅓ from 2017 Autumn survey (65 *Rf*, 20 *Rl*), whereas the Antechinus maintained their number (46). The most obvious indication of this was at Site 1, one of the most populated sites. We caught only one Antechinus at this site for the whole survey, but 19 Bush rats

The southern brown bandicoot (above) in spring 2017 when it weighed 145 g and (below) in autumn 2018 when it weighed 560 g

and 17 Swamp rats. This is also the Bandicoot site. Are they outcompeting the Antechinus? (I really don't think so!)

SPONSOR Required Urgently

The accuracy of individual identification over the last 6 years due to microchipping has vastly increased the value of the data we are able to capture. With the increased numbers we have no other option for individual ID, so chipping is essential for accurate population numbers. We do have a problem though. The cost of each chip ($7 approx), combined with the number we now use for each survey, adds up to a significant cost. Until now we have funded the chips with various grants, but have had no luck in the last 2 years, probably due to the tightening of money for these activities.

If anyone can think of someone who could help, please tell a SEG Committee member soon. We will have to buy more for the Spring 2018 survey.

Another bit of news -

Last year a film crew from the Channel Ten program Totally Wild filmed a segment on the Minnawarra Biodiversity Project. The Totally Wild program has been running for 30 years, filming a range of outdoors, science and interesting stories for an audience of 12-16 year olds. We starred Zac and Harriet, both serial surveyers, with Alex and Janet helping.

The half hour episode is now on their website. We are about 15 minutes in.

http://tenplay.com.au/channel-eleven/totally-wild **episode TW25/052**

Email: thefurlers@gmail.com

Want something interesting to do in the school holidays?

See how bush grows again after the sheep and cows are fenced out? Help trap and weigh bush rats? Sort out the skinks? Record bats? Catch insects? Identify plants in the scrub? See what birds are around? See kangaroos and echidnas?

Then try the Biodiversity Survey held at "Minnawarra", in Heritage Scrub, near Myponga each Autumn and Spring.

The next survey is Spring of 2018. Join other volunteers in this expedition, which is happening right at the beginning of the school holidays - an interesting short break for the family.

Traps are opened on **Thursday 27th September**. The first round of the traps to check on animal captures is on **Thursday night**. The survey continues through to **Monday 1st October** when the traps are closed.

Traps are checked each morning and afternoon, and birds and bats counted at other times. Check the dates now! Come for one to four days, or come up daily.

Accommodation is camping near a large weatherproof shed with electricity, cooking facilities, barbeque, refrigerator and oil heater. Bring your own food and camping gear. Toilet facilities are at nearby farmhouse.

Registration is now compulsory to cover insurance and to limit numbers. The cost is a small donation to SEG to help cover costs (suggested $10 per adult, children $5). So – pack your sleeping bag, food, tent, car or caravan and head this way.

For further information and registration –

Janet 0419 842 667 or email *thefurlers@gmail.com*

Richard 0408 807 517
rwilling01@gmail.com

VULKATHUNHA-GAMMON RANGES DATA RECOVERY TRIP APRIL 2018

Garry Trethewey

Introduction

The Vulkathunha- Gammon Ranges rainfall monitoring project has two trips a year to recover data and calibrate equipment, to undertake the bi-annual photo survey and to survey Yellow-footed rock wallabies and feral animals. The Project is based in the western Gammons and rainfall recording stations have been installed on the Gammons Plateau, in the Arcoona Creek catchment and on the surrounding station country. The project known as V-GRaSP began in 1988.

Nine rain gauges (pluviometers) and the Arcoona Creek water level station (stream gauge) are monitored. Data from five rain gauges (Maynards Well, Pfitzners Well, North Moolooloo, Arcoona Bluff and the Plateau) are reported to the Bureau of Meteorology web-page at:

http://www.bom.gov.au/cgi-bin/wrap_fwo.pl?IDS60163.html

Rainfall data from Arcoona South, the Exclosure, and the Arcoona Creek water level data can be accessed through the DEWNR WaterConnect site at:

https://www.waterconnect.sa.gov.au/Systems/RTWD/Pages/Default.aspx

The last two sites (SAMBOT and Mocatoona) are not online, however the data is recovered during site visits. A copy of all the data from the sites is held by DEWNR.

Trip Details

The eleven participants on the trip were Alex Cornish, Graham Blair, Phil Davill, Janet Davill, Billy Cahill, Trish Williams, Garry Trethewey, Michelle Trethewey, Jill Tugwell, Steve Gatti and John Love. The weather was warm and dry.

Saturday, 21 April: All except Jill (who arrived on Monday) left Adelaide at 6 am, met for lunch at Copley, then drove to Henzell's Camp (Bob's Camp) near Arcoona Creek, in the Gammon Ranges National Park to set up camp. Billy wandered down into the creek and, beginners luck, met an unconcerned Yellow footed rock wallaby posing for photos. The Exclosure pluvio was calibrated and river level data at the Arcoona Creek stream gauge was recorded.

In the morning (**Sunday 22 April**), Graham, Trish, Alex and Steve set off for Upper Vandenberg via the long detour to Arcoona South Branch to calibrate the pluvio. Garry, Michelle, Janet, Phil and Billy went up to the Arcoona Bluff pluvio, and John stayed with the cars at camp. A couple more Yellow foots were seen, including a recently dead one that looked as if it had lain down in a small cave and failed to get up. Notably, there were no Yellow foot scats seen in Wallaby Creek coming down from Arcoona Bluff, and very little sign of goat. And again for a our English friend Billy, a Wedge-tailed eagle sitting in a tree allowed 6 people to approach within 20 metres and take photos before leaving. After lunch back at the cars, we all left John and headed to Upper Vandenburg, eight kilometres up Arcoona Creek. Cars can't be taken on this part of the survey, so all equipment, food and camping facilities are carried in.

Both Woodcutter's Well and The Seeps were as low as I've seen them. Animals had been digging at the Well surrounds, and two euros had tried to reach water from the top, been trapped in the mesh, and died. The Seeps - a salty spring in a rocky creek bed- also showed signs of desperation. Many corpses were scattered around, both euro and goat (no Yellow foots were identified) and some blood was seen on the rocks where it seemed noses had been injured trying to move rocks, or perhaps it was evidence of fighting.

My overall impression from the Arcoona Creek/Gammon Plateau area is that we are having a short sharp intense drought, if that's possible. Surface water is totally lacking, even the two salty springs are low. There is no germination, nor annuals. The longer lived plants aren't actively growing, but they are not into 'drought mode' anywhere near as much as we've seen previously. *Eremophila freelingii* leaves are only semi-flaccid. *Sida petrophila* still has leaves, and its stems haven't been eaten back nor died back very far. Sennas even have occasional green seed-pods that look healthy and unstressed. Familiar photopoint eucalypts haven't yet become 'see through' - they still have leaves. So it looks as if deeper soil moisture is still adequate.

At Wild Ass Waterhole, the Melaleuca that sprung up after 2010 has died back, and overall, walking is easy with the ground visible and nothing to push through.

Yellow-footed rock wallaby seen in Arcoona Creek near Henzall's camp. Photo: Billy Cahill

After getting water from our cache, Alex's party arrived at Upper Vandenburg carrying 6 or 8 litres each. Billy duct-taped his disintegrating boots. The night was pleasantly warm or cool, depending who you were, with no mozzies, and lots of stars.

Next day (**Monday 23 April**) we all walked up the hill to do our various jobs. Garry and Michelle undertook photo survey activities. The big area on the Plateau to the south, burned in early 2016, is still easy walking. Its regrowth is temporarily on hold because of the lack of rain, but the plants are not too unhappy. The rest of the group calibrated the Plateau pluvio. The Sambot pluvio was also calibrated. We camped at Upper Vandenburg again that night.

On **Tuesday 24 April** we finished off odd jobs and left camp early. We got back to John & Jill at the cars at about 11 o'clock for a cup of tea. Trish, who had joined the group at Copley on Saturday, left the party to get a damaged tyre repaired and return to Andamooka. The rest of the party split into two groups. Graham, Alex, Michelle and Garry left fairly smartly, hoping to include Mocatoona in the day's pluvio checks. At 4 o'clock it was obvious that the light was failing, and so we decided to leave the Mocatoona pluvio until next trip and just do the telemetered ones at Maynard's Well and Pfitzner's Well . Getting towards our destination at North Mooloolloo shearer's quarters, we passed North Mooloolloo Golf Course, a novel arrangement of bare gravel greens and rubble fairways.

The other group, John, Jill, Janet, Phil, Billy and Steve were a bit more leisurely, and went to look at the petroglyph rock art in Red Gorge.

Again, another pleasant evening with just the right temperature, no mozzies, very few flies and a general chat around a table in comfortable chairs!

In the morning Billy and Alex, being English and more used to golf courses having grass, decided to play a few rounds with the antique sets of clubs they found in their rooms in the shearers quarters.

Other Observations

The **hydrological observations** are that there has been low annual rainfall (Apr 25, 2017 to Apr 24, 2018) with 145 mm at the Plateau (36.2 mm of this total being in the rain event occurring during the hours immediately following the 2017 visit). In spite of the rain that fell, there has been no measured flow in Arcoona Creek during the preceding 12 months. The seeps and Woodcutters Well, which are salty underground springs, are low.

I have some thoughts and **ecological observations** about the current drought, and as usual, no clear conclusions. Since the V-GRaSP trip I have been to Mutawintje, 130km NNE of Broken Hill, and have spoken to other people about Arkaroola and Weetootla Gorge in the east of the Gammons. People have made quite different observations. Doug Sprigg at Arkaroola says that some waterholes in Arkaroola have dried up for the first time in European memory. Both Doug (talking about Arkaroola) and Ray Hickman (discussing the still flowing Weetootla) have observed that although water is available, animals are dying from lack of food. Ray observed that it is macropods, not goats that are dying. This is in contrast to my observations at Mutawintje and Arcoona Creek, where there was adequate if reduced feed, and macropods and goats have died in roughly equal numbers. At Arcoona Creek, water is definitely the limiting factor.

At Mutawintji, the situation is a bit less clear. Mutawintje Waterhole held more than a couple of backyard swimming pools, and is only a few hundred metres up a gorge, with adequate feed less than a kilometre away. But as we approached it we passed hundreds of carcasses of goat and euro, at all stages of decomposition or mummification. A couple actually collapsed in front of us as we approached, one of those arising 1/4 hour later and staggering off. Perhaps the water was poisoned? All very strange.

Email: garrytre@gmail.com

trekking through the bush
I spied a waving dragon
as he called g'day

in what world is seen
egg laying, termite eating
pincushion on wheels?

drought in the outback,
cockatoos come in to drink
and strut their status

Seen at iconic Gluepot through the eyes of American Lynda Geller, visiting Gluepot with Annette Vincent and Helen Johnson for an ant survey, March 2018. Photos and Haikus by Lynda Geller.

SCIENTIFIC EXPEDITION GROUP INC.

APPLICATION FOR MEMBERSHIP AND MEMBERSHIP RENEWAL for 2017 —18

Membership is open to any persons, family or organisation interested in the following aims:

* The promotion and running of expeditions of a scientific, cultural and adventurous nature.
* The furthering of knowledge, understanding and appreciation of the natural environment.
* Promotion of the values and philosophy of wilderness.
* Enabling people to learn the skills required for planning and running expeditions, and to develop sound field techniques

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Concession cards/ student - - - - - - - - - $15.00
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Details of scientific, cultural, and adventuring or other relevant skill or interests you may be prepared to share with the group:

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ELECTRONIC PAYMENT

If you have access to the internet, payment can be made using SEG's bank account at Bank of South Australia, details as follows:
Acc Name: Scientific Expedition Group Inc.
BSB: 105-086 Acc No.: 330629440

Please use your last name if possible to identify your payment **AND** also advise us by email that you have made a payment to our bank account via email to – gdoats@bigpond.net.au

PLEASE NOTIFY ANY CHANGE OF POSTAL OR ELECTRONIC ADDRESS

Or send a cheque payable to Scientific Expedition Group Inc. with a photocopy of this page to:

The Secretary
Scientific Expedition Group Inc.
P.O. Box 501
Unley S.A. 5061

EXPEDITION IKARA

This year's SEG expedition will be to Ikara - Flinders Ranges National Park between 16 and 27th September 2018.

Ikara - Flinders Ranges National Park is the traditional home of the Adnyamathamha people who co-manage the area with the South Australian Department of Environment, Water and Natural Resources.

Ikara includes the iconic Wilpena Pound and is at the core of "Operation Bounceback", a landscape scale ecological restoration program. Recently this has involved reintroducing Quolls and Brush-tailed Possums to areas where they had disappeared. This was only possible after over twenty years of controlling feral cats and foxes. Reduction of these introduced predators has also seen the return of good numbers of Yellow-footed Rock Wallabies.

The expedition will undertake a combination of: (1) revisiting long-established sites to monitor animal and plant responses to environmental change brought about by the Bounceback program, and (2) establishing new survey sites in poorly understood areas of the park.

Accommodation will be in the Shearer's Quarters at Oraparinna Homestead, the Headquarters of the park or camping.

Costs : $500 and $350 for students.

To register your interest please phone Trent Porter on 8278 9078 (at home) or email: trentasaurus@bigpond.com. A limited number of student concessions will be available.