Establishing new, 'non-traditional' coral palaeothermometers to reconstruct environmental conditions experienced in the southern Great Barrier Reef over the last 8,000 years

James Sadler,
University of Queensland

One of the most commonly discussed environmental issues is the Earth's changing climate; or more specifically the impact of human activity on the natural climate system and the capacity of ecosystems to adapt to predicted changes. Of particular importance to both Australia and the international community is how the Great Barrier Reef (GBR) will react to changes in environmental conditions. Can the reef system cope with the scale of predicted change? Will 'reef migration' further south provide protection from predicted increases in sea surface temperatures? And finally, if the reef does stop growing, can it recover or will one of the seven wonders of the natural world be lost forever? Answers to these questions may be provided by looking back into the history of the reef. The current GBR has been around for 8,000 years, over which it is believed to have

Heron Island. Photo: Gregory Webb

experienced significant changes in climate from the termination of the last Ice Age to the current climate regime of increasing temperatures and declining pH likely induced by human activities. Quantifying these past conditions will help to constrain reef tolerance thresholds as well as improving the data available for modelling future climate and understanding exactly what influence we humans have had on the natural climate system.

Unfortunately, our knowledge of natural variations in climate is severely limited by a lack of instrumental records of temperature and precipitation prior to the latter half of the 20th century. Records of the marine environment are few and far between, with even less data representing the tropics and southern hemisphere. If we are to gain a full appreciation of natural climate variability we require an alternative means of acquiring chronological records of environmental conditions. This is where proxy records come in. Proxies are variables that we can measure to gain an indirect indication of an environmental condition, and are commonly measured in ice cores, tree rings, sediment cores and coral skeletons. Due to the lack of marine records representing the tropics and southern hemisphere, coral skeletons, such as those from the GBR, provide a particularly useful record of environmental proxies.

The chemistry of calcium carbonate skeletons precipitated by corals records several environmental proxies, including the ratio of stable oxygen isotopes (variations in the proportion of oxygen atoms of different atomic weights) and the ratio of strontium and magnesium ions against calcium in the lattice framework. These trace element ratios are related to the temperature of ambient seawater surrounding the coral, whereas the oxygen isotopes are controlled by both ambient temperature and salinity. Combining these records allows the calculation of a high resolution temperature and precipitation/salinity record through time, which can be used to provide a more accurate indication of past climatic conditions and the tolerance thresholds of reef ecosystems to those conditions.

Coral. Photo: Gregory Webb

Unfortunately the relationship between a proxy measurement and an environmental variable is complex and must be calibrated against modern instrumental records. Using the research grant awarded by the Australian Wildlife Society, I aim to calibrate coral proxy signals for the highly abundant branching corals *Acropora* and *Isopora* that dominate reefs in the southern GBR. Currently, coral-based reconstructions are largely based on individually targeted colonies of the coral *Porites*. However, this approach restricts reconstructions to the coral's lifespan, which typically only represent the last several hundreds of years. If we are to delve deeper into the Earth's climate history, which is required to understand natural climate cycles, we need to switch sampling method to collecting older samples from beneath the reef itself. In the southern GBR, the reef extends down approximately 15-20 metres, and contains 'dead' coral skeletons from the last 8,000 years. Whilst this storehouse of coral initially appears to be an ideal source of palaeoenvironmental data, reconstructions are currently limited to *Porites* colonies recovered from reef core. Hence, this research will vastly increase the environmental data recoverable from coral reef cores by allowing the use of *Acropora*, *Isopora* and *Porites* skeletons for reconstructions.

In order to complete this calibration of coral-based proxies, we will conduct fieldwork later this year at Heron Reef, southern GBR, using the facilities at the Heron Island Research Station run by the University of Queensland. We will collect coral samples from specifically selected colonies in the vicinity of the sensor network of the Great Barrier Reef Ocean Observing Network (GBROOS) and Australian Institute of Marine Science (AIMS). Geochemical signals of oxygen isotopes and trace elements can then be calibrated against the instrumental records to construct calibration curves for each coral type that relate the geochemical proxy to the environmental condition. This relationship can then be applied to fossil reef material increasing our understanding of natural climate variability and reef tolerance in the GBR.

Disease-resistance-gene diversity in the tawny dragon (*Ctenophorus decresii*)

Jessica Hacking,
Flinders University of South Australia
Supervisors: Dr Mike Gardner, Dr Mike Schwarz and Dr Devi Stuart-Fox

Genetic diversity acts as a buffer against disease. Species with depleted genetic diversity may be more vulnerable to pathogen assault and less able to resist disease, especially if lacking in genetic diversity at disease-resistance-genes. For example, the prevalence of cancerous facial tumours in the Tasmanian devil populations has been linked to low diversity at key disease-resistance-genes. Despite the importance of understanding the mechanisms surrounding disease in wildlife, insufficient attention has been paid to the role that disease, and the ability to resist disease, plays in wildlife endangerment and population decline. This is especially the case for some animal groups, such as reptiles, more so than others. In fact, this study will be the first investigation into dragon lizard (*Agamidae*) disease-resistance-gene diversity **worldwide**.

I started my PhD project this year and I'm really looking forward to the field season, which started in September. My field work involves collecting blood samples for both DNA analysis and pathogen identification, and cloacal swabs for pathogen identification, from tawny dragons (*Ctenophorus decresii*) throughout South Australia. One of my field sites is located right near the beach on Kangaroo Island – how lucky am I?! These samples will allow me to assess diversity at key disease-resistance-genes (which I am developing genetic markers for) and determine how past and present population demographics as well as pathogen diversity and distribution influence diversity at these genes. This information is essential for a better understanding of the mechanisms underlying disease resistance in wildlife.

Funds kindly provided by the Australian Wildlife Society will help cover costs associated with field work.

Male tawny dragon at study site

Detecting ecosystem change in temperate Australian grasslands: remote sensing tools

Chris Watson,
University of Technology, Sydney

The ecological integrity of grasslands throughout the world has suffered historically due to long-term coexistence with agricultural land use. In Australian temperate grasslands, this is particularly true, especially when combined with the addition of fertilizers to the landscape which favours exotic, weedy species at the expense of native grasses and forbs. When in good condition, these grasslands provide critical services such as carbon sequestration, erosion control, and provision of habitat for endangered and sensitive wildlife. However, native temperate grasslands are among the most disturbed and fragmented biomes in the country, with many communities occupying less than five percent of their pre-1788 range. In fact, over 30 grassy ecosystems are listed as endangered or critically endangered by Australian legislation. These ecosystems will face unprecedented threats under climate change scenarios, including increases in woody vegetation and invasive species, seasonal growth (phenology) changes, altered ecological dynamics, reduced water availability, habitat envelope shifts, and greater fragmentation. This has major ramifications for the conservation of grassland diversity and there is an acute need to identify high-quality grassland areas and to understand their ecosystem dynamics.

Themeda-dominated native temperate grassland on the outskirts of Canberra

Remote sensing, particularly through satellite imagery, has been used to identify different land use and vegetation types, spot outbreaks of invasive species, determine areas of foliar stress, to name just a few applications. As the technology used within these sensors develops, we are able to 'see' the ground at a smaller scale, obtain a greater frequency of repeat images, and separate the light signal into more discrete wavelengths. This increases our ability to separate one vegetation community from another, and also allows us to track how these communities are behaving over time. However, each vegetation type presents its own challenges: in Australian grasslands, this is exemplified by their highly dynamic nature, which can result in greatly different vegetation expression from season to season, and between years. Perennial grasses also tend to have a high proportion of dead vegetation retained on the plant, which can mask remotely sensed vegetation signals.

With the assistance of an Australian Wildlife Society Student Research Grant, my project is using a variety of novel remote sensing methods to determine the differences that species composition, climate variability (eg drought), management techniques, and have on remotely sensed vegetation signals. Through investigation of different spatial scales (ie ground-level, landscape-level and satellite-level) across seasons, we aim to improve the detectability of high-quality native grasslands, and to determine time-series markers of grassland ecosystem change. This will strengthen our understanding of grassland ecosystem dynamics and enable informed conservation and management priorities for these endangered communities into coming decades.

Climate change in a stable thermal environment: effects on the performance and life history of a coral reef fish

Giverny Rodgers,
James Cook University

Global climate change is one of the biggest threats to marine and terrestrial biodiversity. Coral reef ecosystems, particularly at lower latitudes, are likely to be significantly impacted by the large changes in sea surface temperatures associated with climate change and this is due to their narrow thermal ranges. In my study, I will examine how a near-equatorial population of damselfish (*Acanthochromis polyacanthus*) may respond to the chronic increases in water temperature predicted with climate change.

Past research has shown that elevated sea temperatures may influence reproductive output, growth rates and physiological performance of coral reef fishes; however, the majority of these studies have been undertaken on fishes from the middle and southern sections of Australia's Great Barrier Reef. Some fish species span large geographical ranges and would therefore naturally experience different local environmental conditions. These regional differences are important because populations are often adapted to their local conditions and this may limit generalised predictions relating to the impacts of climate change on marine organisms.

Physiological measures can provide a useful tool for assessing thermal sensitivity and determining an organism's performance over a range of temperatures. My research to date has examined physiological characteristics and survival in adult fish, collected from study locations in Torres Strait. The results have already shown that the predicted temperature increases associated with climate change could have a devastating effect on low-latitude coral reef fish populations. These findings, however, do not tell the full story. It is the capacity for acclimation and adaptation to a rapidly changing environment that will be crucial for coral reef fishes to persist. Southern populations of *A. polyacanthus* have demonstrated the potential for physiological and reproductive acclimation; the question that I hope to answer now is whether or not this ability also exists in near equatorial fish, for which the effects of increased temperature are much more severe.

To answer this, I will use newly hatched juveniles that will be collected from the Torres Strait. The potential for developmental (non-genetic) acclimation of *A. polyacanthus* will be tested by comparing the metabolic and life history attributes of these juveniles at various temperatures. The research conducted here will assist researchers in further understanding the environmental implications of predicted climate change and aid in the decision-making process when developing management and conservation strategies for the Great Barrier Reef.

Giverny Rodgers

Reducing the impacts of roads on high-flying wildlife

Kylie Soanes,
University of Melbourne

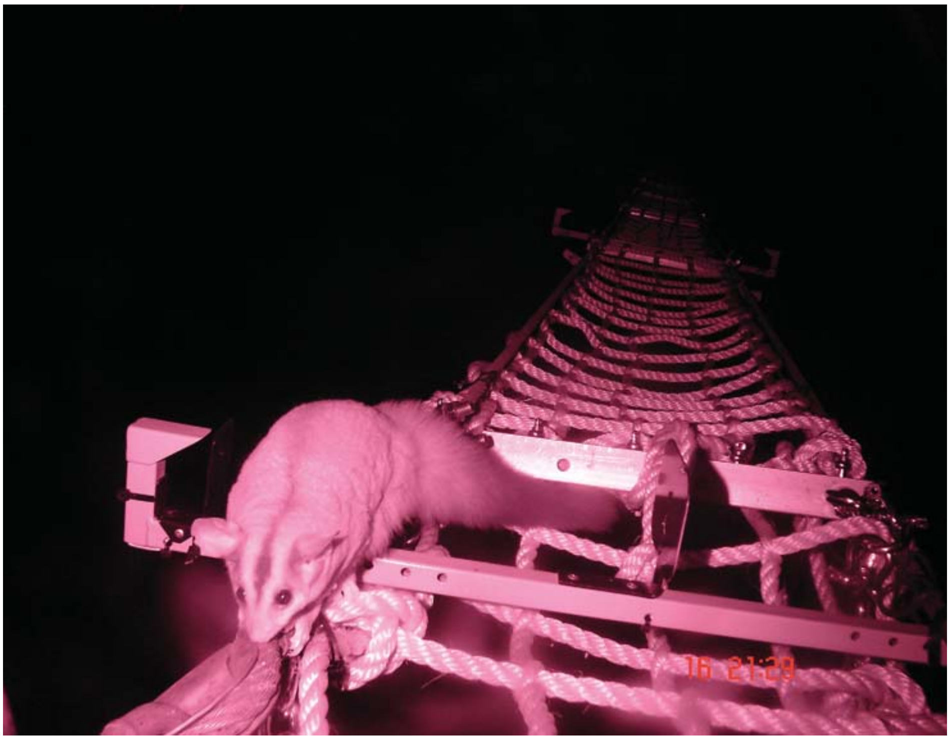
Roads can cause a lot of problems for wildlife. For many species wide, noisy roads are difficult (or impossible) to cross. This creates a barrier, restricting wildlife movement, dispersal and gene flow. Animals that do try to cross risk being killed by traffic.

In many countries, environmental regulations mean road agencies must reduce the impacts of roads on wildlife, particularly on threatened species. This is typically done using wildlife crossing structures, and millions of dollars are spent installing tunnels under roads, or bridges over them, to help wildlife cross safely. Given this is a pretty important task, you might be surprised to learn that we often don't know how well crossing structures work. This is because monitoring programs are usually too short or poorly designed, and studies directly evaluating population impacts are scarce.

So how well <u>do</u> they work? I'm attempting to find out for a threatened gliding mammal, the squirrel glider. Squirrel gliders move by gliding from tree to tree, but struggle to cross gaps in tree cover larger than 40 metres. This is where roads like the Hume Freeway in south-east Australia can cause problems. Previous research has shown that the 50 metre gap across the freeway is a barrier to glider movement (van der Ree et al. 2010) and that

A goanna crosses a canopy bridge over the Hume Freeway in north-east Victoria glider populations living adjacent to the freeway have a 60 percent lower survival rate than those living further away (McCall et al. 2010).

Three types of crossing structure have been trialled to reduce the impacts of the Hume Freeway on squirrel gliders. One is a kind of natural crossing structure called a 'vegetated median'. Tall trees are kept in the centre median as a stepping stone, allowing gliders to cross the freeway in a few short glides. Where that's not possible we can install glider poles – tall, wooden poles which act as fake trees to do the same job. The final option is to use canopy bridges, or rope ladders, to connect trees on either side of the road. I'm trying to find out whether squirrel gliders will use these structures to cross roads, and if these help preserve roadside populations.



A squirrel glider crosses a canopy bridge over the Hume Freeway in north-east Victoria

I first looked at animal movement by placing motion-triggered cameras and microchip scanners on canopy bridges and glider poles. Cameras showed squirrel gliders were crossing, but they weren't alone. Common ringtail possums, common brushtail possums, sugar gliders, brush-tailed phascogales and even a goanna also crossed the freeway using our structures. The microchip scanners gave us even further insight. By recording the unique microchip of each squirrel glider crossing the canopy bridges, we can see that several gliders cross almost every night. This tells us they can now safely reach food, shelter and mates on both sides of the road – something they couldn't do before.

I also teamed up fellow student Melissa Carmody on a radio-tracking study. We found that all three crossing structure types increased the probability that a squirrel glider would cross the freeway, while sites with no structures remained a barrier (Soanes et al. 2013). However, movement across the freeway was lower than across control sites – quiet, narrow roads away from the freeway – so while having crossing structures is certainly better than doing nothing, it's not as good as not building a freeway in the first place.

But does all this movement mean squirrel gliders are better off when crossing structures are installed? To find out, I'm now comparing data from surveys conducted before and after the crossing structures were installed, and including freeway sites with no structures and non-highway sites to act as comparisons. These surveys tell us how long gliders survive at different sites, and whether or not glider populations on opposite sides of the share genetic material. If sites with crossing structures help squirrel gliders survive longer, and promote gene flow across the road, we'll know that installing these structures is worthwhile.

References

McCall et al. 2010. Evidence that a highway reduces apparent survival rates of squirrel gliders. *Ecology and Society* 15.

Soanes et al. 2013. Movement re-established but not restored: Inferring the effectiveness of road-crossing mitigation for a gliding mammal by monitoring use. *Biological Conservation* 159, 434-441.

van der Ree et al. 2010. Large gaps in canopy reduce road crossing by a gliding mammal. *Ecology and Society* 15.


Canopy bridges and glider poles help squirrel gliders cross the Hume Freeway

Can project management improve mammal conservation success in Australia?

Madelon Willemsen,
University of Technology, Sydney

My research will focus on recovery projects. These are projects to save a species from extinction in its natural habitat through different measures and actions.

If you have been part of a recovery team or worked on implementing actions of a recovery plan, you know that recovery projects can be cumbersome, concern a wide range of different stakeholders and require joint action from different angles. Recovery projects are defined as complex projects for the above reasons and are, unfortunately, usually not all that successful for a host of different reasons.

With a background in conservation and project management, my research focuses on bringing these two disciplines together. We know commercial companies and multinationals can successfully run their projects. They plan, design, implement, monitor and phase out projects (these five phases are called the project lifecycle) successfully. Why is it so hard for conservation recovery projects to be successful? We know there could be a host of different reasons, such as threat status, budgets, and individual project management skills. But even though we have worked hard and continue to work hard to find the reasons behind our failing, we are not successful in slowing down this extinction wave.

I will use an inductive qualitative method and talk to people who have been involved with Australian and overseas recovery projects. The Grounded Theory method will be used to develop theories on the problems and successes of recovery projects. These theories will be the foundation on which I will build a project management framework, bringing together project management knowledge and experience. This framework is aimed to enhance the Australian Recovery project success. I also hope to provide a recovery project management handbook that will help recovery experts, practitioners, academics and others to slow down the Australian extinction wave.

The AWS grant I received will support me to travel and talk to recovery specialists at the IUCN Conservation Breeding Specialist Group Annual Meeting in Orlando, Florida, USA.

Eastern barred bandicoots were thought to be extinct until 1991 when a small population was found living at the Hamilton tip in western Victoria. Habitat destruction and introduced predators such as cats and foxes have significantly contributed to the decline in Eastern barred bandicoot numbers.

The vast unknown: assessing the conservation of soft-sediment fish diversity

Lachlan Fetterplace,
University of Wollongong

Sand. That grainy stuff that covers vast swathes of the ocean floor. Although perhaps to the casual observer this habitat isn't as exciting as coral reefs or seagrass meadows, delve a little deeper and you will discover that there is a whole lot happening out in the vast sandy stretches of the ocean. Sand or soft sediments underlie most of Australia's state and national waters and are heavily exploited by commercial and recreational fishing.

Surprisingly, there has been little research into fish ecology on these habitats, with most effort expended on assessing fish found on coral reefs, rocky reefs, estuaries and seagrass. For a habitat that is so heavily exploited, there is a serious and immediate need to determine the basic ecology of the fish species present, the effects of fishing and also to examine the success of conservation efforts in place. More than 70 percent of Australia's marine protected areas cover soft sediments, yet to my knowledge, both nationally and internationally, there have been no studies looking at the effectiveness of marine protected areas in conserving soft-sediment fish.

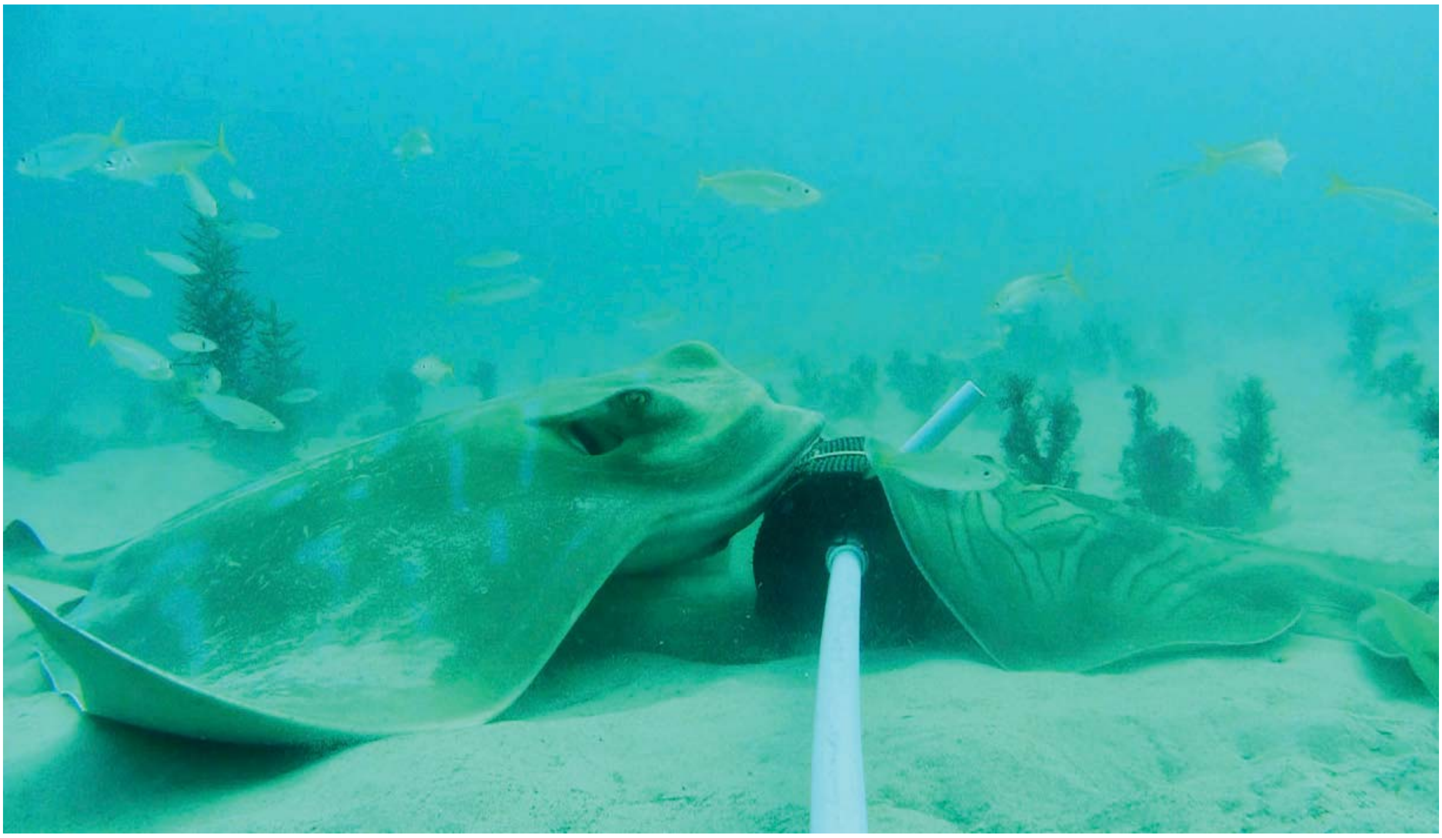
My PhD aims to examine the ecology and conservation of soft-sediment fish assemblages in temperate waters of south-eastern Australia. Baited remote underwater video (BRUVs) will be used to provide a clear assessment of fish communities found on soft sediments, including in NSW marine park sanctuary zones (no-take zones), habitat protection zones (recreational fishing allowed) and areas outside of the marine park (that are targeted by both recreational fishers and commercial fishing vessels). In addition, I would like to further investigate issues surrounding the movement patterns of some of the soft-sediment fishes in these assemblages using acoustic tracking.

Often it has been argued that spatial closures such as marine parks will be of little conservation value over soft sediments as the fish are thought to show little site attachment in this

A frame grab from baited underwater video footage showing a whaler shark (*Carcharhinus* sp.) followed by a yellow-tailed kingfish (*Seriola lalandi*) attracted to the bait

Blue-spotted flathead (*Platycephalus caeruleopunctatus*) ready for release after tagging

habitat type. It is fairly common to hear people say, “they’ll just swim in and out of the reserve and we’ll catch them on the outside”, but is that really true? In contrast to this view, my initial research inside Jervis Bay suggests that blue-spotted flathead (one of the major commercially exploited species found on sand) move less than 500 metres within a 12-week period of acoustic tracking. Now that might sound like they aren’t moving around much and over the short term that is true, however without longer-term data I can’t yet rule out that they do roam much further for spawning movements or other seasonal migrations. The next stage of tracking over 18 months will allow me to determine whether or not these longer-range movements occur.



A frame grab from baited underwater video footage taken in Jervis Bay Marine Park showing a southern eagle ray (*Myliobatis australis*) and an eastern fiddler ray (*Trygonorrhina fasciata*) investigating the bait

Mitigating the impact of cane toads through land management and an innovative conservation strategy

Georgia Ward-Fear,
School of Biological Sciences,
Faculty of Science, University of Sydney

One of the greatest threats to biodiversity globally is the invasion of ecosystems by non-indigenous species. Such species can send a wave of destruction through ecological communities, via novel interactions that include competition, predation, parasitism or transmission of pathogens and disease to naïve native fauna. In turn, those direct impacts of the invader can set off far-reaching trophic cascades.

Many invaders are deliberately introduced; 30 percent of the world's ice-free land surface is utilised in livestock production. Large browsing herbivores can drastically alter vegetation structure, which has ramifications for entire ecosystems, affecting faunal and floral guild composition and landscape hydrology. In Australia, the link between livestock occupancy and the reduction of ground cover and loss of perennial grass in rangelands is well established. This phenomenon has subsequently been associated with general declines in vertebrate fauna diversity, specifically a reduction in mammal abundance. These conditions could potentially facilitate further biological invasions.

One invasive species is expanding its range westwards across northern Australia at a rate of 50 kilometres per year and has just breached the Kimberley: *Rhinella marinus*, the cane toad. This large toxic anuran, native to South America, was first introduced to Queensland in 1935 to control pest beetles of the sugar cane industry and has since rapidly spread. Because Australia has no native bufonids, cane toads (and their associated bufadienalide chemical defences) are a novel and deadly prey item to most Australian animals if consumed, particularly large predators such as quolls, goannas, and freshwater crocodiles. Removing this guild of apex predators may have far–reaching consequences for faunal populations of the tropical northern savannahs. For example, the resultant meso-predator release of cats may increase predation on already vulnerable small mammal and reptile populations.

In species that are affected by cane toads, population declines typically occur immediately after the toads invade (eg flood plain monitor, blue-tongue lizard and death adder). Nonetheless, impacts vary geographically and across species. Research by the University of Sydney and the Department of Environment and Conservation in Western Australia has shown that several mammal and reptile species are at high risk from toads, whereas others have the capacity to learn not to eat toads (eg freshwater crocodiles, small dasyurid marsupials, and preliminary work on varanid and scincid lizards). The research has also suggested that we can exploit this 'conditioned taste aversion' (CTA) response by purposefully exposing toad-naïve predators to a sub-lethal dose of toad tissue. A native predator that eats a small toad will receive a sub-lethal dose of toad toxin, making it feel ill, but not killing it. Learning from this experience, animals like quolls exhibit a marked aversion to consuming toads thereafter. The problem for naïve native predators is that the first toads they are likely to encounter (those on the invasion front) will be large and hence, full of bufotoxin. Any predator that attempts to eat such a toad will die. If these predators had encountered small toads with sub-lethal doses of toxin *before* the main toad front arrived, they may have had an opportunity to learn to avoid subsequent larger toads (and hence, could survive even in the presence of toxic toads).

'CTA therapy' is currently being used

A female yellow spotted floodplain monitor (*Varanus panoptes*) at a burrow in the Kimberley, caught on remote sensing camera

Above: Georgia Ward-Fear in the Kimberley with a magnificent tree frog (*Litoria splendida*). Photo: Andrew Morton successfully in a program with quolls in the Northern Territory. CTA has not been trialled with the goanna species of northern Australia; if we could employ this technique we could potentially 'buffer' populations of these large predators populations that are rapidly vanishing.

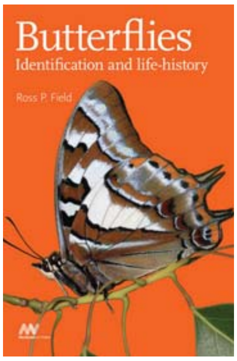
The idea of using 'teacher toads' to save native predator populations utilises the ability of native predators to learn not to eat toads. Predators that are strategically exposed to small live toads at the front of the advancing invasion have the opportunity to develop a 'toad taste aversion' prior to the arrival of the main invasion front. This method obviously cannot save all of the predators in an area, but it can save enough to allow for subsequent population recovery in surrounding areas.

For my PhD I will be trialling the teacher toad technique with populations of wild goannas in the remote Kimberley. The idea of bolstering defences of native animals by prior exposure to their oncoming enemy is an exciting and innovative approach to conservation. This strategy is well suited to incorporation into impact management plans. Thus the outcomes of this work have direct conservation management implications and would need to be acted on as soon as possible. Not only are my trials likely to save many goannas, but if successful, the methodology can be used elsewhere to buffer other populations ahead of the invasion front, to prevent the overall collapse of tropical goanna populations in the wild.

I will also be exploring the interactions between cane toads, goannas and feral stock in the Kimberley. I believe this will yield some interesting information about the context-dependent nature of invasion dynamics and the life history ecology of the goannas of northern Australia. These results could potentially aid conservation land management practices.

My work also has substantial social significance. The plight of these goannas strikes a chord with the traditional owners of the Kimberley. Goannas are very important to these people. For thousands of years these goannas have been a reliable source of bush-tucker, integral to complex hunting knowledge and indigenous theology; the presence of goannas is thereby important for maintaining traditional indigenous culture. The preservation of goanna populations also fulfils cultural obligations to 'care for country'. I will be working closely with indigenous groups throughout my PhD to achieve these conservation outcomes. The Kimberley is the last stronghold for many tropical species and the cane toad invasion represents an ominous threat to Australia's north western biodiversity. My work will gain explicit insight into the ecological interactions currently holding this fragile native guild together, including the potentially facilitative relationships between invasive species (livestock and cane toads). Ultimately my work aims to help maintain the faunal integrity of this unique and valuable ecosystem in light of the challenges it faces.

Book Reviews



Butterflies: identification and life history by Ross P Field

This fascinating book provides amateur naturalists, bushwalkers and interested readers with a comprehensive guide to butterflies found in Victoria and the east coast of Australia. Species descriptions are accompanied by stunning colour photographs of all the life stages of the butterfly, as well as their food, habitat and behaviour patterns. The anatomy of the butterfly is described in detail, using both line-art and photography, with the latest imaging technology used to capture the spectacular and diverse array of colours and forms in butterfly eggs. Maps, scientific and common name indexes are also included, along with a checklist of which species can be found in each state.

Unlike other books available, *Butterflies: identification and life history* illustrates the full life-cycle of these fascinating and beautiful insects, making it a must-have guide for naturalists and curious readers.

About the author
Ross Field has a PhD in entomology and has published more than 100 publications on interests such as insect ecology and the ecology, biology and conservation of butterflies. Ross had worked as an entomologist in the Victorian Public Service for the majority of his career.

RRP: $29.95 | Distributor: NewSouth Books

The Art of Science: remarkable natural history illustrations from Museum Victoria By John Kean

Whether they fly, swim, crawl, wiggle or walk, we are endlessly fascinated and inspired by the creatures of our world. *The Art of Science* showcases the uncommon beauty produced from 300 years of exacting scientific observation and illustration. It is a big beautiful book with 204 pages of stunning full colour illustrations, mostly full size. The pictures are so exquisite, and the production values of this book are so good, it is like having an art gallery in your own home.

As exploration and science have expanded our horizons across time and space, the ability to capture and communicate the truths held in nature have become increasingly important. Scientific artwork is as important and astonishing today as it was in the 18th century.

In this exquisite exhibition Museum Victoria presents the development of scientific art from the State museum's seldom seen collection of artworks and rare books, and stunning images produced with microscopes, macro-lenses, and computers.

RRP: $50.00 | Distributor: NewSouth Books