Western Wildlife

October 2005 Vol. 9, Number 4

NEWSLETTER OF THE LAND FOR WILDLIFE SCHEME

REGISTERED BY AUSTRALIA POST PRINT POST: 606811/00007

THE WESTERN RINGTAIL POSSUM (PART 2)

(Continued from Western Wildlife, July 2005)

Paul de Torres, Suzanne Rosier, Nadine Guthrie, Jennifer Jackson and Ian Bertram

WHERE TO FROM HERE?

The need for translocation has not diminished. In excess of 100 western ringtail possums are nurtured through the wildlife carer network annually. When suitable for release, these animals need secure release sites where survivorship potential can be maximised. In addition, ringtails are being displaced by developments which result in destruction of habitat. Since January 2004, 119 ringtails have been displaced from development sites in the Busselton and Bunbury area. These possums have been translocated to Leschenault and Yalgorup under a detailed monitoring program. 1080 baiting for fox control was reinstated at Leschenault and has been routinely carried out, commencing prior to the January 2004 releases. An additional, new site has been established at Yalgorup National Park. This site is managed as an unbaited control site.

Figure 4: The western ringtail and common brushtail possum

The current translocation release program has been driven largely by the need to release ringtails displaced from development sites. The developers responsible have provided significant funding support for the translocation program. Long-term monitoring at the release sites will include examination of the importance of predator control (1080 baiting) and the extent of predation by foxes. Predation by other potential predators will also be examined. In particular, the extent of predation by cats in the presence and absence of fox control will be examined, hence the importance of establishing the unbaited control site at Yalgorup National Park. A second unbaited control site is also proposed. Monitoring at all sites will also focus on habitat use and survivorship of the released ringtails, the role of other predators (pythons, chuditch, raptors, owls), competition with the common brushtail possum, the suitability of the habitat at each

continued on page 4

EDITORIAL

Greetings all!

It is good to be back in *Land for Wildlife* after the hectic business of designing and running a funding scheme!

My very great thanks to Anthea Jones for doing a superb job as *LFW* Coordinator for the last six months. Thanks also to all members for the support and encouragement you gave her. The job can be quite stressful – especially persuading authors to complete their promised newsletter articles on time! – and Anthea coped very well indeed. She is currently dividing her time between managing the National Trust's covenanting programme and coordinating Bushland Benefits, reminding successful bidders to meet their milestone reporting obligations.

In July, *LFW* reached a huge milestone - taken all together, our *Land for Wildlife* members manage over 1 million hectares of Western Australia! Even though the specific '*LFW* sites' where nature conservation is a priority are less than that, nevertheless it is a wonderful fact that there is so much private land in WA being managed 'with wildlife in mind'. Together, we can make a difference!

There are some quite detailed articles in this issue, including the continuation of the ringtail possum story from Paul de Torres and crew. Two other articles come together to highlight the plight of our large black cockatoos. Ron Johnson describes the very effective, multi-faceted programme 'Cockatoo Care', which identifies one of the main threats to the birds' survival as loss of nesting hollows. Denis Saunders' paper documents the gradual loss of hollow-bearing large trees in a wheatbelt woodland remnant. Remnant vegetation requires active management; simple benign neglect is not enough ..... how many of you have woodlands that are like a bowls convention – lots of healthy seniors, but not a junior in sight?

Another increasingly serious land management problem is that posed by acid soils. In many areas of the south-west, surface seepages, often high on hillsides, are not just saline but acid as well. Oily black stains or rusty brown ones are characteristic. The currently fashionable deep drains often run acid water. Rehabilitaion of these sites requires special techniques (planted trees often die *en masse* after a year or so) and Steve Appleyard, who introduced us to the problem in peaty coastal soils in 'The Soils that Bite Back' (WW 8/1, Jan 2004) explains how to recognise such a site and how to treat it.

Next year is *Land for Wildlife's* tenth year of operation, and we will be celebrating with some special events. Our actual tenth birthday is in February 2006. The recent questionnaire confirmed that you would like a special issue of Western Wildlife, so, please put together a short story, perhaps with 'before and after' photos, celebrating what you have done and send it to The Editor. Looking forward to hearing from you!

Penny Hussey

INDEX

Contact details for *Land for Wildlife* Officers

Name	Location	phone & email	
Heather Adamson	Merredin	(08) 9041 2488	heathera@calm.wa.gov.au
Avril Baxter	Narrogin	(08) 9881 9218	avrilb@calm.wa.gov.au
Julia Boniface	Nannup	(08) 9756 1465	juliab@calm.wa.gov.au
Fiona Falconer	Coorow	(08) 9952 1074	davidfiona@bigpond.com
Claire Hall	Perth	(08) 9334 0427	claireh@calm.wa.gov.au
Penny Hussey	Perth	(08) 9334 0530	pennyh@calm.wa.gov.au
Rosemary Jasper	Ravensthorpe	(08) 9838 1890	rosemaryj@calm.wa.gov.au
Cherie Kemp	Busselton	(08) 9752 5533	cheriek@calm.wa.gov.au
Zara Kivell	Mundaring	(08) 9295 1955	zarak@calm.wa.gov.au
Sylvia Leighton	Albany	(08) 9842 4500	sylvial@calm.wa.gov.au
Kathleen O'Brien	Katanning	(08) 9821 1296	kathleeno@calm.wa.gov.au
Teagan Smith	Perth	(08) 9334 0404	teagans@calm.wa.gov.au

FAUNA

WHAT'S THE BUSTARD'S STORY?

Mark Ziembicki

The Australian bustard, known commonly out bush as the plains or bush turkey, is a charismatic bird symbolic of Australia's outback. A strong flyer, it spends most of its time walking around on the ground where it also nests, but its claim to fame is that it's Australia's heaviest flying bird with some males reaching up to 15kg!

The bustard's preferred habitat is grasslands, low shrublands and open woodlands and it is often dependent on a mosaic of such habitats for breeding, feeding and shelter. Unfortunately, for a variety of reasons, including altered fire regimes, hunting, predation, pesticides and habitat alteration, the species has virtually disappeared from south-eastern Australia and numbers have declined dramatically in the south-west, inland and in parts of northern Australia.

An interesting aspect of the biology of bustards is what is known as their exploded lek mating system. Leks are areas where males come together to display and strut their stuff which females in turn visit to find mates – sort of like the local pub! The difference being that males are usually well separated from each other and are more spectacularly dressed than the ladies.

Generally, among lekking species it's the larger, more elaborate males that are more successful in the mating game. This has important implications for harvesting bustards, because if bigger birds, that is, the larger more successful males, are preferentially harvested then the breeding performance of the species as a whole may suffer.

Male in lek display
Photo: M. Ziembicki

Just as we have our preferred watering holes so too bustards may have preferred breeding or lekking sites. If this is the case then those areas are of vital importance for protecting the species.

To perform their elaborate displays they prefer open areas of good visibility so females can see them. Hence in the rangelands they may benefit to some extent by grazing and periodic fires, which opens up the country. Females then find nesting sites within more sheltered, vegetated areas highlighting the need for a variety of habitats.

Bustards can be highly mobile, even nomadic, often tracking favourable conditions or resources across the landscape. For example, they may be attracted to fire, follow grasshopper plagues or move to where significant rainfall has fallen. Numbers often increase in southern regions, including the south-west, following unusually large rains, particularly if other regions are in drought. These sudden appearances in areas where they have not been seen for some time is a characteristic feature of nomadic (wandering) or irruptive species (i.e., species that undergo large population explosions in response to favourable climatic conditions).

These features present special problems for their conservation and management since there is no guarantee that traditional conservation reserves set aside for protecting native flora and fauna are large enough or will remain suitable to bustards through time. For this reason the protection of bustards and their habitat off reserves is of vital importance.

Little is known, however, of the dynamics of nomadic or irruptive species because of the few observers that exist over our sparsely inhabited continent and the difficulties of conducting research in remote areas over large scales.

For the past 3 years the bustard has been subject of a research project examining its habitat and conservation requirements. This work has included tracking bustards using satellites by attaching small, solar-powered GPS units to their backs.

Record Your Bustard Sightings!

Several *Land for Wildlife* members in the Great Southern have reported seeing bustards this year after an absence of 20 or more years.

If you have sighted these nomadic Priority 4 species please give Avril Baxter a call on

9881 9218 or

email: avrilb@calm.wa.gov.au

continued on page 10

FAUNA

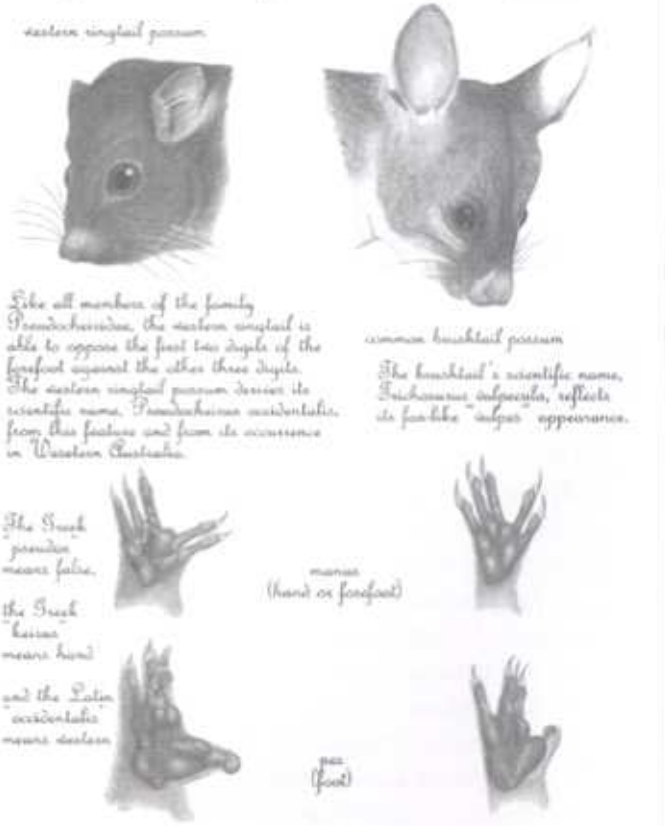
continued from page 1

release site and the role of disease.

Assessing the role of disease is often overlooked in translocation programs. Our interests are two fold. As conservation managers it is important to ensure the wildlife species being translocated, especially those individuals which have been held in care, do not introduce new pathogens to populations of wildlife at the release site. Conversely, we need to determine whether the species inhabiting the release sites are carrying pathogens to which the released animals may have had no previous exposure. Infection with such pathogens could adversely affect the survival of the released animals. A collaborative program is now being developed involving specialist expertise from the School of Veterinary and Biomedical Sciences at Murdoch University. This program will also enable us to examine the wildlife health issues of naturally occurring populations of ringtails. Concurrent with this work, monitoring of the naturally occurring populations will address the suite of issues being examined at the translocation release sites.

Interim results from monitoring the fate of ringtails released since January 2004 at the baited site at Leschenault and the unbaited site at Yalgorup National Park have confounded the issue further. There has been a high rate of mortality at Leschenault. From the 26 radio-collared and monitored ringtails, there have been nine predation events attributed to pythons, seven attributed to cats and one attributed to a fox. From the 21 radio-collared ringtails at Yalgorup National Park, there have been only two predation events, one attributed to a raptor and one attributed to a fox. From these results it seems fox baiting alone is unlikely to be sufficient to ensure the translocated populations become established. The interim results further suggest translocation does not hold all the answers for effective conservation management of this threatened species and the importance of fox and cat interactions needs to be urgently assessed. Similarly, the interactions between foxes and cats with native predators needs to be addressed.

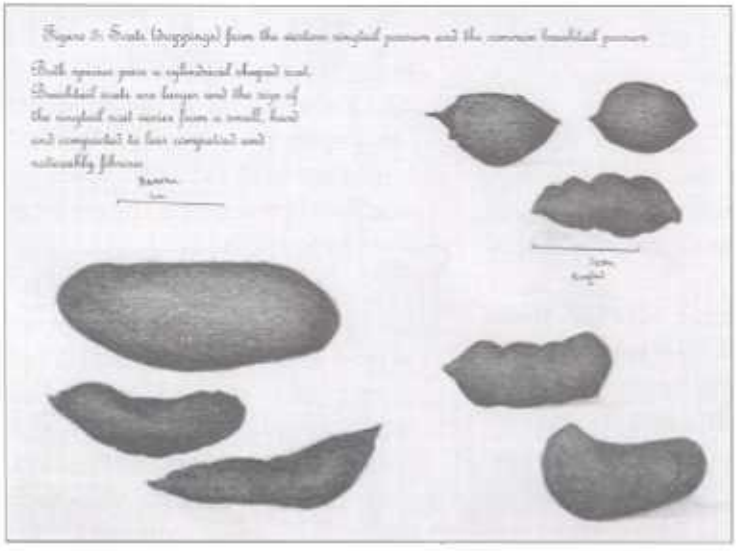
Figure 5: The western ringtail and common brushtail possum



TRANSLOCATION OR IN SITU PROTECTION?

Ameliorating the effects from predation is not the only concern for managers of threatened fauna. In the case of the western ringtail possum, the Busselton, Bunbury and to a lesser extent, the Albany populations are at risk from increasing habitat destruction and population fragmentation. Populations in forest areas are also at risk. Recent research by Adrian Wayne, from CALM, Manjimup, found forest populations of ringtails were threatened by increasing fire intensity at the local scale and habitat and fox predation at the landscape scale.

A major component in effective conservation management is identifying the populations and habitat of high conservation value and ensuring these key populations and areas are adequately protected. Assessing the local, regional and global conservation value of populations, sub-populations and habitat is

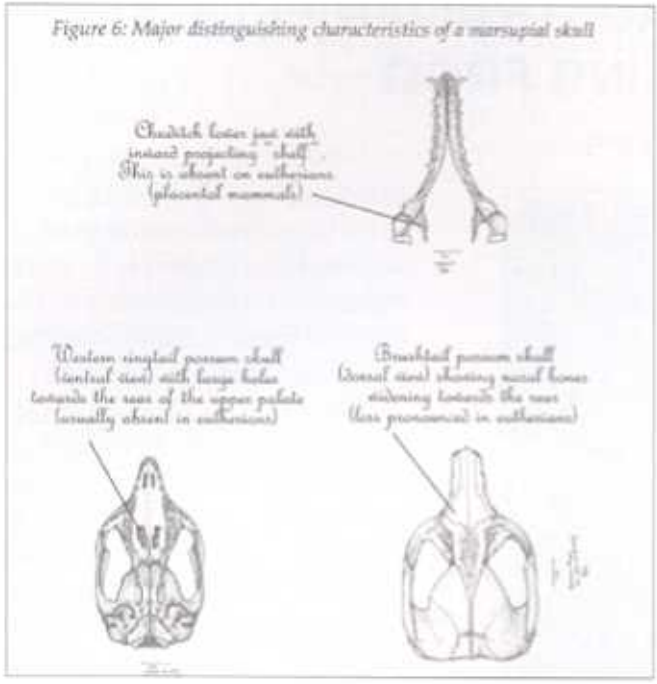


continued on page 5

FAUNA

continued from page 4

Figure 6: Major distinguishing characteristics of a marsupial skull



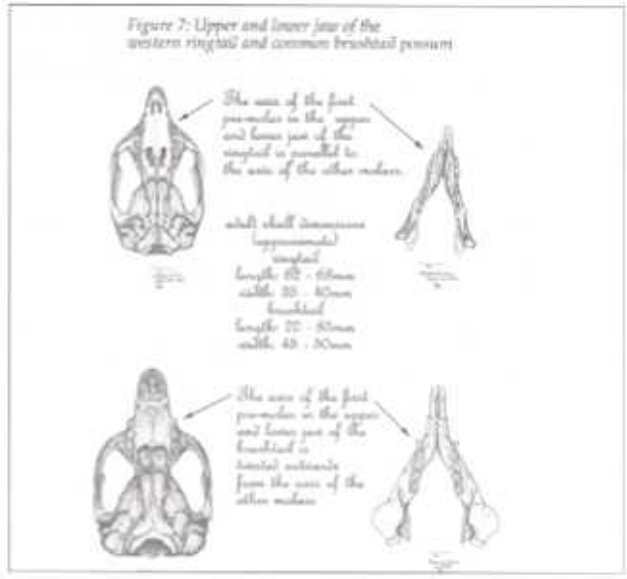
based on the population size and composition, the genetic structure of the population(s) and habitat values.

Identifying presence is the first step in protection. Although distinctive, the western ringtail possum is nocturnal and cryptic and identifying presence is not always straight-forward. In residential and semi rural areas the ringtail and the brushtail are often observed, or heard, in roof spaces, garden sheds and garages. Confirmation of presence of ringtails in these situations may be as simple as confirming whether fresh scats (droppings) are present at the site. Figure 3 shows a comparison of scats from the two possums. The ringtail also has the ability to pass semi-digested faecal material that is eaten and re-digested. This phenomenon is known as caecotrophy.

The presence of dreys can also be determined in daylight hours. However, absolute confirmation of presence is best achieved through nocturnal spotlighting. Figures 4 and 5 show the features used to differentiate between the two possum species. Identification of species presence can also be through indirect means such as identifying the call of a species, as ornithologists do for birds. The ringtail has a distinct, but not particularly loud, call which is best described as being similar to the sound of a bath toy when squeezed, or a zipper when quickly zipped and unzipped.

A less ambiguous method of determining the species is identification from bone material, and in particular, identification from skulls or skull fragments. Many rural landholders, naturalists and bushwalkers who encounter bone fragments and skulls seek confirmation of the

Figure 7: Upper and lower jaw of the western ringtail and common brushtail possum



identity of the species found. Critical to identifying the species is first determining whether the skull is from a marsupial or placental mammal, see Figure 6. Figure 7 shows the differences between the skull of a western ringtail possum and the common brushtail possum.

REPORTING PRESENCE OF THE WESTERN RINGTAIL POSSUM

We would be very keen for readers to give us detailed location records for the western ringtail possum, forwarded to Paul de Tores (details below). Verified and validated records will be added to the ringtail distribution database, which we hope to eventually make available on the internet. These data form the baseline information required to determine the populations of high conservation value, and ultimately to ensure better conservation management of this threatened species.

Hoping to hear from you!

Paul de Tores is a Research Scientist with CALM's Wildlife Research Centre at Woodvale. He can be contacted by telephone on 9405 5150, or by email at: pauld@calm.we.gov.au
Nadine Guthrie is also a Research Scientist based at Woodvale and Jennifer Jackson is a Project Officer, with CALM's species and Communities Branch, Kensington.
Ian Bertram is a Masters student from The University of Glasgow, Scotland and has spent the past 10 months involved in the ringtail program.
Suzanne Rosier has been involved as a volunteer in the western ringtail possum research since its commencement in 1991. In 1995 Suzanne was awarded "Volunteer Of The Year – Wildlife Research and Management", largely as a result of her involvement in this project.

FAUNA

MATING SYSTEMS IN AUSTRALIAN FROGS: THE QUACKING FROG

Dale Roberts

Mating quacking frogs. Photo: Michael Smith

What do we have in this photo? Look closely and you can clearly see there are frogs and eggs. Look more closely and you will see there are four frogs: one female and three males. Why so many males? Good question and one where we have a few but not all the answers.

We all know about the life cycle of a frog: male frog calls in a pond, attracts female, frogs mate, eggs deposited in water, neat black and white eggs that hatch into tadpoles then metamorphose into a miniature version of the adult frog. Yes, but let's look a little more carefully at that third bit: frogs mate.

In most frogs, eggs are released by a female then the male deposits sperm directly onto the eggs – external fertilisation. Sounds simple and in most frogs it is: one male and one female and all sorts of tricks used by males to be that one male. Males who call faster, who have deeper croaks, longer calls, call before other males, have call sites where eggs will develop better, in different frog species, all do better. But in almost every frog species there is also another set of males who adopt different tactics to get a mating: sneaks and satellites!

In the north American bullfrog, large males defend calling sites where eggs are less likely to be eaten by leeches but from time to time, small, young males sit by silently and intercept females attracted to larger males. Satellite males are common in many frog species and get exclusive access to a female's eggs. They are often, but not always, smaller or younger males who cannot defend a calling site either because their calls are too wimpy or, they themselves are too wimpy! Satellite males sit close to calling males and intercept incoming females. In some studies satellites males do almost as well as callers in mating successfully. But what about sneaks?

Sneak males have been observed in many fish species. A large male builds and defends a nesting site and attracts a female - and may also attract a set of sneak males. Sneaks slip in and deposit sperm onto eggs a female is releasing at the same time as the large male is releasing sperm. A behaviour comparable to sneaks but not quite as stealthy is now also known in frogs: in the quacking frog, *Crinia georgiana*.

The picture alongside is a fairly typical mating in the quacking frog, which occurs in the forested areas of southern WA and across the south coast east of Esperance. It breeds in winter with males calling from shallow water. Eggs are deposited at the sites where males call and tadpoles metamorphose in spring. But that is about where conventional behaviour stops!

The average number of males per mating is two – for most frogs it is one. Who mates? That depends on circumstances. If frog numbers are low, large males call, small males take on a "sneak" role. Calling males attract females and the pair mate then one or more sneaks join in. The calling male mates in the conventional frog position – on the back of the female. The first sneak male joins the pair underneath then other males hang on almost anywhere. Only the first two males mated actually fertilise eggs – hangers on are missing out! When there are more frogs out, bigger males dominate matings often finding females by searching rather than attracting females with their call. Up to 9 males may try to mate with a single female.

Outcomes? The first two males to mate share paternity, but, as more males join a mating, less eggs are fertilised dropping to about 70% of eggs developing. One in 50 females are killed in the chaos! So there are big potential costs to females and to

continued on page 7

continued from page 6

FAUNA

individual males in getting involved in multiple male matings. So, why do it? There may also be benefits to females:

- males might be sperm depleted so mating with more than one may be an insurance policy
- not all sperm-egg combinations work – incompatibility – so again more than one might guarantee at least one male who is a match
- the improved genetic variability might give developing eggs an edge in unpredictable future environments
- if some males are super quality their sperm might improve quality of the offspring

Why share your eggs? Not good for males as we would expect natural selection to have led to the evolution of mating systems that maximise individual reproductive success. We know that in the quacking frogs, sex ratios at the breeding site are heavily skewed towards males and on high density nights that skew is even more extreme. We do not know why that skew occurs but we think the overall sex ratio is about one to one so the skew at breeding sites presumably reflects simple things like males stay around longer and try to mate again and again (because they can) while females may take several weeks or a whole summer to take in enough energy to develop a second clutch of eggs. So males might tolerate extra males, not because they are benevolent but the costs of displacing extra males might be even higher – e.g. reducing the number of eggs fertilised even lower.

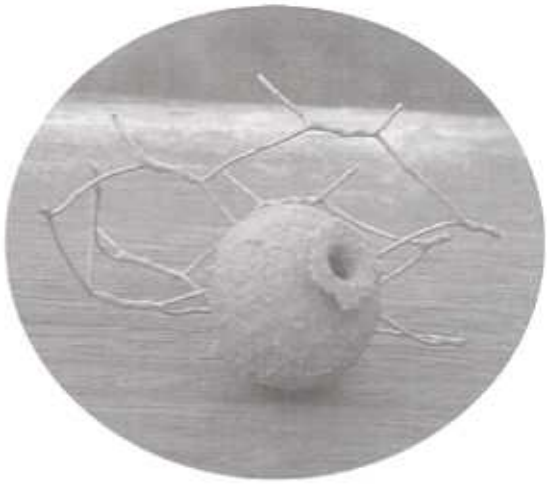
Is the quacking frog unique? No. There are a number of frog species around the world where several males may fertilise eggs from a single female including one of the commonest frogs in Europe, *Rana temporaria* and even the cane toad, *Bufo marinus*. But most people, including me the first time I saw it, have either ignored this phenomenon or at least not reported it. We know that in Australian frogs, if there is a greater risk that several males will be involved in a mating, then males have evolved much larger testes leading to more sperm per ejaculate so in a competitive mating situation they may win out. If you "buy" more tickets in the lottery the better the chance to win where the tickets are sperm and winning means more eggs fertilised. We know of a lot of Australian frogs with relatively large testes and for several of those there are some hints that they might also engage in matings involving more than one male: polyandrous matings. Many *Neobatrachus* species found in south-western Australia often form groups involving one female and more than one male but we have not followed them right through the egg deposition process. The motorbike frog, *Litoria moorei* has also been reported with several males associated with a single female. Some *Cyclorana* and *Litoria* species in northern Australia often have single males sitting next to mated pairs or females depositing eggs – maybe waiting for an opportunity.

Can you contribute to our knowledge of frog natural history? Yes! If you know your local pond and its frogs you may well have seen things that fly-by night scientists like me have missed. What species have you seen where more than one male tries to mate with a single female? Pictures or recordings of calls would make those identifications easier. Or, go to http://www.frogsaustralia.net.au/ for help with sorting what frogs you have. So get out and start looking – that frog pond might be a little more interesting than you ever imagined! You might also wake biologists up to thinking a little more carefully about mating systems where we thought we knew it all!

A/Prof. Dale Roberts is at the School of Animal Biology, UWA. He can be contacted on: droberts@cyllene.uwa.edu.au

Bush Detective

Nature's Potter!



Avril Baxter photographed this at "Knotwood" near Williams. The 13mm-hole aviary wire to which it is attached gives the scale. She asked, "Who made it?" (Answer on page 16)

REVEGETATION

DECLINE IN A REMNANT OF SALMON GUM AND YORK GUM WOODLAND, 1978 TO 1997

Denis A. Saunders

As a result of changes to native vegetation cover since its settlement by Europeans over 200 years ago, Australia now poses an interesting conundrum in relation to the supply of hollows in trees for nest sites for birds and other fauna. Eighteen percent of Australian land birds nest in hollows in trees and 11% are obligate hollow nesters. All depend on a continuing supply of what, in many areas, is a rich and diverse array of hollows in a wide range of tree species. However, what of the future?

Figure 1: Tree T027 in July 1981 and the same tree in August 1997. Although there has been little apparent change over 16 years in the condition of the tree there is marked thinning of the shrub and tree layers, increase in paddock weeds and lack of regeneration of the woodland species.

In May 1978, as part of a study by CSIRO on the ecology of two species of black cockatoo, a 15 ha remnant of salmon gum and York gum woodland on a farming property at Nereeno Hill in the northern wheatbelt of Western Australia was examined. Before clearing for agriculture, the vegetation consisted of salmon gum-York gum woodland on the red loam soils, with tamma thicket on the stony and lateritic ground. The vegetation of the patch was dominated by salmon gum with smaller numbers of York gum and morrel interspersed. The understorey was dominated by jam and there was an area of mallee at the southern end of the patch. The density of the dominant vegetation was typical of mature salmon gum-York gum woodland of the area.

The property containing the study patch was selected for farming in the mid-1920s and wheat was the first agricultural product after the native vegetation was cleared for its establishment. Sheep were introduced to the area in 1929 and were allowed to graze on most of the uncleared vegetation on the property. The rabbit invaded the area and was common throughout most of this period. The last clearing of native vegetation on the property, carried out in the early 1970s, isolated the patch of woodland under study. No attempt was made to keep sheep out of the woodland, which provided shade and shelter, particularly after shearing.

The patch under study was an important nesting area for cockatoos in the district. These included (in decreasing numerical order): the galah, the red-tailed black cockatoo, the long-billed corella, the little corella, Carnaby's cockatoo and the Major Mitchell cockatoo. In the northern wheatbelt, all of these are obligate tree hollow nesters. In May 1978 the woodland was searched for trees possessing hollows of at least 90 mm diameter and at least 90 mm deep. This was the minimum-sized hollow thought to be used as nest sites by the galah, the smallest of the cockatoos breeding in the area. The sizes of the trees were not measured, however the condition of each of these trees was noted. Condition was rated according to the following categories: good – tree apparently healthy; staghorn – dying back from

continued on page 9

continued from page 8

REVEGETATION

the top and showing a "staghorn effect"; broken top – broken off along the trunk, but not showing any staghorn effects; and dead. In addition, the dimensions of each of the hollows large enough for one of the species of cockatoo to nest in were recorded.

In July 1981 the location, condition and circumference (cms) at breast height of every eucalypt tree (including the hollow trees examined in 1978) in the woodland patch were recorded. A photograph was taken of each tree. On this occasion, a condition category of "fallen" was added. Each tree was marked with an aluminium disc onto which an individual number had been stamped. The data from 1978 and 1981 were analysed and formed the basis of a paper (ref 1) on the availability of tree hollows for cockatoos and the twenty-eight parrot and on the condition of trees in the woodland patch.

In August 1997, the area was visited again and the condition and circumference of every tree that could be identified were again recorded. A photograph was taken of each tree. Analyses of the changes showed that there had been a decline in the number of trees in the good category over time, see Table 1, and the decline occurred in all size classes. The drop in the number of healthy trees was particularly marked.

The decline in condition was far greater in the period 1978 to 1981 than from then until 1997. The trees declined at an average rate of 27% per year in the early period and 1% per year for the latter period. Damaged trees also declined proportionately more in the early period than the latter. Obviously environmental conditions in the period 1978 to 1981 were very much more unfavourable for the trees than the period 1981 to 1997.

What of the survival of trees with large hollows? Using probabilities of survival over time based on the rate of decline for the period 1978 to 1997, predictions indicate that by 2016 there would be no salmon gums with large hollows in the good category. By 2016 there would be only 44 (23%) of the salmon gums with large hollows alive and only 4 (2%) by 2092. By then, predictions are that only 12 (6%) trees with large hollows would be standing, over two thirds of them dead.

There is no doubt that the salmon gums and York gums in this patch were deteriorating rapidly and the growth rates of those trees indicating signs of stress were about half those of healthy trees. The earlier period between 1978 and 1981 was the second half of a prolonged period of drought. These years of low rainfall placed extreme pressure on agricultural production in the district and also had a major impact on the social fabric. They also had a major detrimental effect on the woodland patch under study. An increase in average annual rainfall for the period 1982 to 1997 explains the lower rate in decline of the condition of the trees in the latter period.

Predictions of future condition of trees in the patch based on results of the dry period 1978 to 1981 illustrate the danger of using relatively short-term data sets. Predictions based on the 19-year data set, incorporating a range of environmental conditions, are more reliable, but nevertheless they are of great concern for the future of the woodland patch. However, the effects of low rainfall on tree condition are dramatic, as witnessed by the decline in salmon gums with large hollows between 1978 and 1981, and an equivalent period of drought could shorten these long-term predictions.

The smallest of the trees in the patch probably predated 1929, when sheep were first introduced to the area. There is no indication of any regeneration of eucalypts in the patch in the period between 1981 and 1997 (Fig. 1). It is obvious that under the present management regime, with only 13% of all of the salmon gums in the patch predicted to be alive by the 2092, the future for this woodland patch is bleak, as it is for any species dependent on the trees in the patch for food, shelter or nest sites.

Clearing of native vegetation and its replacement with cereal crops and pastures and the provision of water throughout the wheatbelt have created the equivalent of riverine plain. This clearing pattern has left many trees scattered across the agricultural landscape in patches, like the one at Nereeno Hill, and as individual paddock trees. So there are still many trees with nest hollows to provide nest sites. However, species dependent on trees for nest sites are going to be threatened by the loss of woodland, as without

Table 1.

	1981		1997	
	good %	dead or fallen %	good %	dead or fallen %
salmon gum	24.0	23.8	16.2	34.5
York gum	46.7	7.1	39.8	17.6

continued on page 10

REVEGETATION

continued from page 9

nest sites they, and other species dependent on tree hollows, have no future in the area. The fact that dead trees remain standing for many years means that for species that will nest in hollows in dead trees (and not all obligate hollow nesters will do so), this resource will be available for some time after the trees have died. However there will be very few trees surviving the minimum 130 years required for a eucalypt to grow to a size sufficient to support a hollow for the smallest of the cockatoos to nest in, or for the longer time frames required for bigger hollows.

The results of this study are for one 15-ha patch of woodland on private property in the northern wheatbelt of WA. How much credence should the results of this study be accorded when extrapolated over much larger areas? As European development of the wheatbelt proceeded, woodlands were regarded as indicators of better quality agricultural soils. Accordingly, they were preferentially selected for farmland and cleared. For example, in south-western Australia, 94% of marri-wandoo woodlands, 72% of mallet-powderbark wandoo woodlands, 97 % of York gum-salmon gum-wandoo woodlands, and 78% of salmon gum-gimlet woodlands have been cleared for farmland. The remainder is distributed mainly on private land and is being degraded by a variety of threatening processes. It is clear that the decline and lack of regeneration of this patch at Neereno Hill is typical of woodland patches throughout the wheatbelt.

The first rule of management of woodlands in the wheatbelt should be to protect all remaining vegetation. In the first instance this should be fencing remnant patches to exclude grazing. However, active management beyond fencing to reduce grazing pressure will be required. Management regimes that foster regeneration need to be developed as do incentives to encourage land holders to engage in active management, instead of the benign neglect that characterises much of the management of rural woodlands.

Without a major change in attitudes towards rural woodlands, their future and that of their dependent fauna is exceedingly bleak.

ACKNOWLEDGMENTS

I am grateful to Doug and John Wilson on whose properties this work was carried out, John Ingram who carried out much of the field work and Penny Hussey who persuaded me to translate a scientific paper into something useful for conservation.

REFERENCES

(1) Saunders, D. A., Smith, G. T. and Rowley, I. (1982). The availability and dimensions of tree hollows that provide nest sites for cockatoos (Psittaciformes) in Western Australia. *Aust. Wildl. Res.* **9**: 541-56.

(2) For the full story, read: Saunders, D.A., Smith, G.T., Ingram, J. A. and Forrester, R. I. (2003). Changes in a remnant of salmon gum *Eucalyptus salmonophloia* and York gum *E. loxophleba* woodland, 1978 to 1997. Implications for woodland conservation in the wheat-sheep regions of Australia. *Biological Conservation* **110**: 245-256.

Denis Saunders is a consultant ecologist, formerly with CSIRO. He can be contacted on: denis.saunders@csiro.au

FAUNA

'Bustards' continued from page 3

Complementing this has been an assessment of bustard distribution patterns as reported by landholders across Australia by means of mail surveys. This has proved a successful and valuable source of information and highlights the vital role rangeland users and landholders can play to safeguard the future for bustards, and other similarly highly mobile species across their continental range.

Mark Ziembicki is completing a PhD on bustard ecology while working in Darwin on a project documenting Aboriginal knowledge of mammals across northern Australia.

Praying Mantis eats Brown Honeyeater!

An amazing detailed record of a preying mantis killing and eating a brown honeyeater is given in the latest edition of 'The Western Australian Naturalist'; **4**: 247-249. The honeyeaters were feeding in a flowering *Grevillea agrifolia* on El Questro Station when one was grabbed by a lurking mantis. It removed feathers from the neck and ate the flesh, including the eyes and sucking out all the brain. Several other instances of vertebrates being killed and eaten by preying mantis in the Kimberley were also reported in the article.

Have any of our northern readers seen this? If so, please let *LFW* have the details!

The WA Naturalists' Club's Journal 'The Western Australian Naturalist' has many interesting articles of local relevance. You can subscribe by contacting the Club on: email wanats@iinet.net.au or visit the web site:

www.wanats.iinet.net.au

FAUNA

'COCKATOO CARE' - A PUBLIC PROGRAMME

Ron Johnstone and Tony Kirkby

Since the launch of 'Cockatoo Care', a joint initiative of the Water Corporation and the Western Australian Museum, in 2001, there has been an overwhelming response to help the survival of cockatoos in Western Australia. Visits to the Cockatoo Care website have averaged over 300,000 per annum, the Cockatoo Observation cards and Frequent Sighting forms, forums, school programs, newspaper articles and radio and television events have all helped promote community support for this program.

The forest red-tailed black cockatoo, Baudin's cockatoo and Carnaby's cockatoo are all endemic to the south-west of this State and all have undergone a marked decline in range and status over the past 50 years. All of these spectacular, iconic birds are still losing feeding and breeding habitat through factors such as land clearing for agriculture, forestry and mining; through salinity; through competition with invading native species and through the introduction of exotic pest species.

All of these cockatoos live for about 50 years, begin breeding at 4 years of age, mate for life, tend to use the same nest hollow each breeding season, lay only one or two eggs but rear only one young each breeding season. In many areas the cockatoos that you see are from an ageing population with little or no recruitment.

'COCKATOO CARE' OBJECTIVES

The main objectives of this joint project are:

- Research into the distribution and ecology of each of the three species of cockatoos and the threats to their survival,
- Habitat enhancement through habitat planting and installation of artificial nest boxes,
- Assessing the impact of feral honey bees on hollow-nest sites in south-west forests and the development of effective eradication and control methods, and
- Community education and involvement.

ABOUT THE COCKIES

Forest Red-tailed Black Cockatoo

The forest red-tailed black cockatoo, *Calyptorhynchus banksii naso*, is a very distinct subspecies, named by John Gould in 1837. This population is confined to the jarrah-marri and karri

forests of the deep south-west. Its distribution is closely tied to that of its main food and nest tree, the marri and ranges north to Gingin (formerly to Dandaragan), and south and east to the Green Range.

Formerly common but now rare to uncommon and very patchily distributed, it has disappeared from about 30% of its former range. This cockatoo is listed as 'Near Threatened' but its conservation status is currently under review.

Major threats

These include the loss of feeding and breeding habitat and the competition for nest hollows, especially by feral honey bees, but also by invading galahs at edges of forest. In addition, there appears to be a retraction westward in its distribution into higher rainfall areas, perhaps due to climate change.

There has also been a dramatic change in its feeding ecology in the northern part of its range since their discovery in 1995 of Cape lilac as a new food resource. Small flocks are now regular visitors to suburban gardens that have Cape lilac trees, leaving the Darling Scarp in early morning and returning the late afternoon. What impact these sometimes exhausting flights are having on their breeding success is as yet unknown.

Of the 42 nest sites being monitored by the WA Museum, only one was successful in raising a chick in 2004!

Baudin's Cockatoo

Baudin's cockatoo, *Calyptorhynchus baudinii*, was named after the French explorer Nicolas Baudin.

This species is confined to the humid south-west corner of the State, including the Coastal Plain from Perth

continued on page 12

continued from page 11

FAUNA

southwards, north to Morangup and east to Kojonup and the King River, as well as the Stirling and Porongurup

Ranges and east along the south coast to Waychinicup National Park.

It is a post-breeding nomad, aggregating into large flocks after breeding and moving between March and September from the deep south-west to the central and northern Darling Range and adjacent Coastal Plain. Along with the forest red-tail this is our rarest cockatoo. It is most numerous in the deep south-west during the spring breeding season and in the northern Darling Range during the autumn-winter. It is usually in small flocks (up to 15) occasionally in larger flocks (up to 50) or loose aggregations (up to 1200) at drinking sites or roosts. The estimate of total population is 10,000. It nests during spring in large deep hollows of marri, karri and wandoo. We have very few breeding records and judging from our work so far, it only breeds every two years like the forest red-tail.

It feeds mainly on the seeds of marri and other eucalypts, banksias, hakeas and dryandras, also the flowers of banksias and eucalypts as well as fruiting apples, pears and persimmons. They also like the seeds of weeds such as corkscrew, and insect larvae from live or dead trees and shrubs.

Major threats

Currently illegal shooting by orchardists is no doubt the most important threat. Both Baudin's and Carnaby's cockatoos were proclaimed as vermin in many south-west districts from 1926 to the 1980s and many thousands were shot. Baudin's cockatoo has an interval of seven years between generations and an annual reproductive rate of 0.6 chick per pair, so it cannot replace the large number shot by orchardists. Although now protected, illegal shooting continues with anecdotal evidence of up to 200 birds shot in one day in early 2005.

Other major threats include the loss of feeding and breeding habitat and the impact of feral honey bees taking over breeding hollows. Last year 2 of our 14 known breeding hollows of Baudin's cockatoo were lost to feral bees, one of these with the female cockatoo apparently blocked from leaving the hollow by the invading swarm (her fate unknown).

Carnaby's Cockatoo

Carnaby's cockatoo, *Calyptorhynchus latirostris*, was named after the Western Australian naturalist Ivan Carnaby. This species ranges north to the lower Murchison, across the wheatbelt to Lake Cronin, south

to the Ravensthorpe Range and east along the south coast to Cape Arid. It is also casual on Rottnest Island.

Carnaby's cockatoo is also a postnuptial nomad tending to move west to cooler coastal areas after breeding. It is usually found in pairs or small flocks, also large flocks (up to 7000) in non-breeding season (late spring to mid-winter) especially on the Coastal Plain in pine plantations. For many Perth residents the appearance of migrating flocks in the autumn, with their distinctive wailing call, has earned them the reputation as harbingers of rain. It breeds in large hollows of mature, mainly smooth-barked, eucalypts especially salmon gum and wandoo. The one or two eggs are laid from early July to December but usually only one young is reared. They feed mainly on the seeds of banksias, dryandras, hakeas, grevilleas, eucalypts and pines, also fruiting almonds and macadamia, wild geranium and wild radish.

Major threats

Carnaby's cockatoo has lost the bulk of its feeding and breeding habitat in the past 60 years and what remains is generally in decline. Currently listed as 'Endangered', its population is believed to have halved in the past 30 years, the current population is about 50,000 and still declining. The major reasons for this continuing decline are habitat fragmentation, the degradation of surviving woodland and competition for hollows. Many bush remnants have become too small or too isolated to support

continued on page 13

continued from page 12

FAUNA

viable populations of this cockatoo. As a consequence of this, and possibly in tandem with other impacts such as climate change, the centre of gravity of this cockatoo's distribution has shifted considerably southwards and westwards since the middle of last century. It has now colonised parts of the Darling Scarp, Coastal Plain and many southern forest areas including Nannup and Northcliffe.

Competition for nesting hollows especially from invading galahs, western long-billed corellas and feral honey bees is of great concern. Galahs and corellas have greatly increased their range and numbers since the 1950s and were both originally absent from much of the wheatbelt until the 1970s. The impact of feral honey bees has also greatly increased since the 1970s. Galahs and corellas remove eggs and chicks of cockatoos from hollows and galahs in particular cause tree death by scarring and ring barking at nest sites.

'COCKATOO CARE' RESCUE PLAN

1. Monitor cockatoo numbers and nesting success.
2. Locate and monitor nest hollows.
3. Identify the problems and causes of decline.
4. Provide information to the public about cockatoos through 'Cockatoo Care'.
5. Improve habitat management to protect feeding and nesting areas and so also benefit other threatened fauna and flora communities.
6. Revegetate degraded areas and promote eucalypt regeneration.
7. Increase potential nest sites with the provision of nest boxes suitable for cockatoos and repair substandard hollows. Conduct ongoing experiments with nest boxes, especially PVC tubes.

HOW CAN YOU HELP?

- Record your black cockatoo sightings by completing an 'Observation card' or 'Frequent Sighting form'; both are obtainable either from the Cockatoo Care 'downloads' web page or the Water Corporation on 9420 2182. Observation cards are also available at selected water supply dam sites.
- Help promote eucalypt regeneration and be involved in tree planting.
- If you live on the land, develop a cockatoo-friendly property.
- Lobby your Shire Council to protect local remnant vegetation.
- Protect your local bushland and large trees, particularly veteran and stag trees.
- Visit the www.cockatoocare.com website – more ideas, details of events and lots of other useful information is available.

Ron Johnstone is Curator of Ornithology at the WA Museum. Tony Kirkby also works at the Museum.

Revitalising your landcare group

In WW 9/1, Jan 2005, we mentioned the problem of 'Landcare Burnout' – when people get tired of doing the same old thing – and we asked if anyone had any good ideas to rekindle enthusiasm. Mike Griffiths (from WWF's Woodland Watch at Northam) suggested a couple of CLCs who have successfully done this:

York LCDC had one of its regular meetings in a nature reserve, followed by a picnic and bushwalk with ecological experts. It generated a lot of interest in bushland management. (Organised by Liz Manning, former CLC.)

Quairading LCDC is arranging for helicopter 'scenic flights' over landholders' own property and surrounding catchments. There is nothing like a bird's-eye view for enabling people to appreciate the big picture issues, and see very clearly what is happening beyond their own boundaries. It is an expensive exercise, but the costs come down if lots of people are interested. (Contact: Cyndi Mulders, CLC, phone 9645 0236.)

There must be more good ideas to share?

Did you know?

... that tiny white flower spiders, small enough to hide under the labellum of spider orchids, are often seen on spider orchids? Many orchid lovers wonder if this spider is the pollinator and if this is why these orchids are called spider orchids. In reality this tiny spider, colour coordinated for incredible camoflauge, is an opportunist. It lies on the orchid with its fangs ready to catch the unsuspecting pollinator and is known to catch bees which are many times its weight and size!

Mark Harvey, WA Museum

REVEGETATION

IDENTIFYING AND MANAGING ACID SCALDS ON YOUR PROPERTY

Steve Appleyard

Acid scalds are the most visible indication that acid sulfate soils have been disturbed and are causing environmental harm. They are areas of bare land where vegetation has been killed by sulfuric acid, mineral salts and toxic metals drawn to the surface by capillary action as a result of the reaction of natural iron sulfide minerals with air in the soil profile. They typically start out as small bare patches a few metres across, but if not actively managed, they can expand to cover areas of more than 10 hectares over time intervals of as little as 5 to 10 years. Acid scalds as large as 200 hectares in area are known to occur in New South Wales and Queensland.

Acid scald near Yunderup, Peel Region. Photo: S. Appleyard

On the eastern seaboard, acid sulfate soils usually only occur in coastal areas at elevations of less than about 5 metres above sea level. However, in Western Australia they have a much wider distribution. Acid sulfate soils are known to be associated with wetlands across the Swan and Scott Coastal Plains, and occur in groundwater discharge areas near the Whicher, Darling and Gingin Scarps. They are also found in some parts of the Wheatbelt.

Acid scalds may resemble (and are often mistaken for) saline seeps that result from the discharge of salty groundwater in areas affected by dryland salinity. Soils in acid scalds are also often very saline, and may be covered by a salt crust. However, acid scalds cannot be rehabilitated in the same way as ordinary salinised land. Attempts to revegetate acid scalds with trees or other deep-rooted perennials usually only accelerate the expansion of the scalds due to the lowering of the water table, and planted trees typically die *en masse* after a few years because of the effects of acidity and metal toxicity.

IDENTIFYING ACID SCALDS

Fortunately, there are a number of visual indicators and simple field tests available to help you identify acid scalds on your property.

Typical visual indicators of acid scalding include:

- *Iron staining* – bare soils in scalds are often (but not always!) covered by a precipitate of iron oxides which are a rusty red-brown colour. Water in drains near scalds is also often turbid and yellow-brown to red-brown in colour due to iron, and iron staining often occurs on fence posts and near the base of trees in affected areas.
- *Surface deposits of black, oily-looking material (iron monosulfides)* – scald surfaces often have patches of black, oily material in waterlogged areas, particularly in winter. Occasionally the entire soil surface in scalds turns jet-black in winter, and then dries to a white or pale-brown colour in summer. The black material contains iron monosulfide minerals that are formed by bacteria in waterlogged conditions when there is a large amount of iron available.
- *Butter-yellow deposits (jarosite)* – Dry surface crusts on scalds often have streaks or small patches of yellow material that consist of iron sulfate minerals such as jarosite. These mineral deposits also form along old root channels below the ground surface where air percolates into the soil profile. These yellow minerals are a by-product of the reaction of iron sulfide minerals with air and only form when the soil pH is less than about 3.7.
- *"Fluffy" salt crusts* – salts that accumulate in dry periods on acid scalds are mainly soluble sulfate salts rather than the chloride salts that accumulate in

continued on page 15

continued from page 14

REVEGETATION

areas affected by dryland salinity alone (both issues can occur together!). Sulfate salt crusts often have a "fluffy" appearance and resemble the deposits on corroded car-battery terminals rather than the more typical "sugar-crystal" like appearance of chloride salts.

- *Wetland plants* – wetland sedges and rushes often grow in areas underlain by acid sulfate soils. Tree species associated with wetlands such as *Melaleuca* species may also occur in these areas.
- *Ponded water clarity and colour* – Water that collects in pools or in excavated dams on highly acidic soils often appears to be crystal clear and have a turquoise or milky-blue tinge as the acidic conditions cause suspended sediments to precipitate out of the water column. The blue colour is caused by a fine precipitate of aluminium minerals and indicates that the water is likely to be highly toxic to aquatic organisms and vegetation.
- *Smell* – there is often a faint "burnt sulfur" or "gunpowder" smell in areas with acid scalds due to the release of small amounts of sulphur dioxide gas from oxidising sulfide minerals in shallow soil near scalds. Grey or black coloured soil beneath the water table in these areas typically has a "rotten egg" smell due to the presence of small amounts of hydrogen sulfide gas in this material.

Iron monosulfides covering an acid scald, Leschenault Inlet
Photo: S. Appleyard

In addition to these visual indicators, soil pH tests are helpful for identifying acid scalds. These can be simply carried out with pH test strips by mixing about one teaspoon of soil with five teaspoons of deionised water in a small plastic container and measuring the pH of the slurry. A second test is carried out in the same way using concentrated (30%) hydrogen peroxide instead of water (handle hydrogen peroxide with care, as this is a highly corrosive chemical - wear plastic gloves and safety glasses when using!). It is recommended that soil samples are tested at depth intervals of about 25 cm to ensure that any acid sulfate soil materials are identified. Hydrogen peroxide with a concentration of 19% can also be used, although reactions may take longer to occur. Solutions of hydrogen peroxide with this concentration are readily available from pool and spa supply shops (usually called "spa protector" or "spa sanitizer").

Soil pH values of less than 4 tested with water or after reaction with hydrogen peroxide are clear indicators of current acid sulfate soil conditions or the potential for these conditions to develop. Other indicators that acid sulfate soil materials may be present are: a "volcanic" reaction of soil with hydrogen peroxide (may take up to 10 minutes for the reaction to take place – be patient!), and; a pH drop of more than 2 between water and peroxide measured soil pH values. Further details of testing methods for acid sulfate soils can be found on the Department of Environment web site (www.environment.wa.gov.au).

REHABILITATING ACID SCALDS

Drainage management

The first step for rehabilitating acid scalds is to assess the extent to which land on your property has been drained.

Although a number of factors contribute to the formation of scalds (including fire, erosion, stock trampling etc.), the primary cause is often excessive drainage which drops the regional water table and exposes iron sulfide layers in the subsoil to air. This initiates a chain of chemical processes that generate acidic water which is then drawn to the soil surface by capillary action.

To prevent this happening, it is important to keep the water table above the iron sulfide layers (i.e. above the depth where there is a positive reaction of a soil sample with hydrogen peroxide). In the short term, this can be done by installing drop boards or temporary weirs in drains (sand filled bags can be quite effective) to effectively raise the base of the drain which controls the height of the local water table. If there has been extensive disturbance of acid sulfate soils in a catchment, regional drainage may have to be altered to reduce soil oxidation and the export of acid from the catchment. This has been done successfully in acid sulfate soil areas in New South Wales and Queensland and involves both reducing the number of drains in the catchment (i.e. reducing drainage density) and changing deep drains into broad shallow drains which do not penetrate beneath the water table.

continued on page 16

continued from page 15

REVEGETATION

Guidance on drainage management in areas with acid sulfate soils is available in a recent publication by Land and Water Australia and New South Wales government agencies called "Restoring the Balance: guidelines for managing floodgates and drainage systems on coastal floodplains". The document is available in PDF format at the following web site:

http://www.agric.nsw.gov.au/reader/floodgate-guidelines.

Revegetation of scalds

The following measures for revegetating acid scalds have been developed by Mark Rosicky at Southern Cross University in Queensland and have been successfully used to rehabilitate scalds near Capel:

Changes in rehabilitation density in a scalded area near Capel one year after rehabilitation measures were implimented *Photo: Christine Webb*

(i) *Fencing* – scalded areas are very sensitive to disturbance. Trampling of bare soil by stock can increase the oxidation of iron sulfide minerals and disrupt plant germination and growth. Fencing allows stock to be excluded from degraded areas until they are rehabilitated, and then allows access to these areas to be controlled to prevent a new scald developing.

(ii) *Surface disturbance* – scarifying or rotary hoeing the soil surface in scalds helps prevent acid solutions being "wicked" to the surface and accumulating as toxic salts. It also helps create vegetation germination sites.

(iii) *Ridging and furrowing* – creating linear ridges about 30 cm high and 1 – 2 m wide with adjacent furrows in scalded areas helps create a variety of germination sites, and provides some drainage for seedling roots.

(iv) *Liming* – the amount of stored acidity in badly scalded areas is generally too large to be managed by liming. However, lime application in newly planted areas can locally reduce acidity near roots and help plants get established.

(v) *Mulching* – mulching is the single most effective treatment for scalds. It prevents evaporation from the soil surface and slows the accumulation of acidity and salinity in shallow soil which encourages the regrowth of vegetation.

(vi) *Plant selection for revegetation* – local wetland sedges (NOT tree species) are usually the best plants to establish in scalded areas. These can be planted directly into a mulch layer on ridges constructed on the scald. Sedges will stabilise the soil sufficiently to allow other vegetation to become reestablished from the soil seed bank or by ingress from adjacent land.

For more info. contact Mark Rosicky on 0418 495 714, or email: mrosic10@scu.edu.au.

Steve Appleyard is the principal officer involved with acid sulphate soils at the Department of Environment.

continued from page 7

Bush Detective answer from Terry Houston, WA Museum:

The lovely piece of work in your photograph was made by a potter wasp belonging to the genus *Delta* (familiy Vespidae, subfamily Eumeninae). Delta wasps are black and orange and have a stalk-like first segment of the abdomen.

At this stage of the construction, the female wasp provisions the pot with a number of caterpillars (naked type). After laying an egg, she seals the chamber in the 'neck' with mud and breaks down the rim. She may add one to a few more chambers in the same way before finally covering the whole lot with a layer of mud to form a simple smooth body. She then deserts the nest. Photos: WA Museum.

HYDROLOGY

GROUNDWATER TRENDS IN THE NORTHERN AGRICULTURE REGION

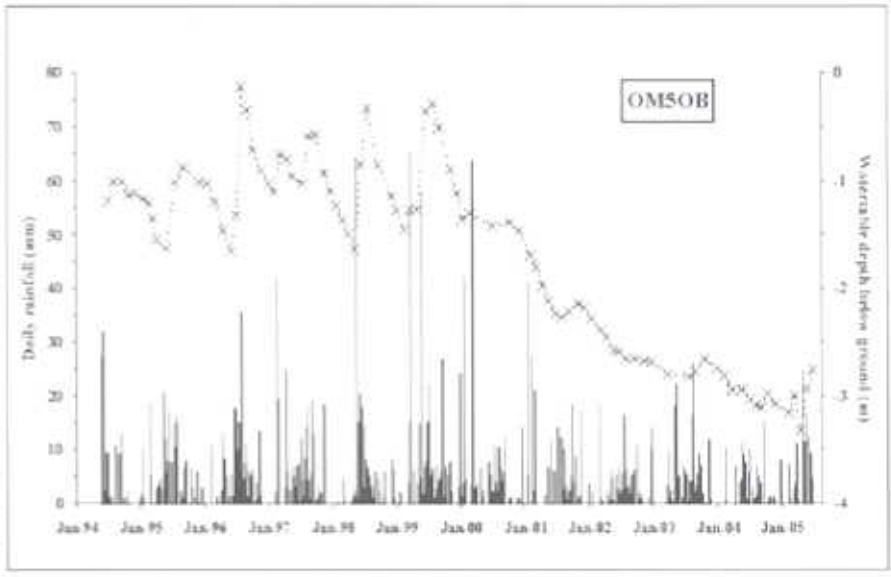
Russell Speed

The past five dry years have had a significant impact on groundwater trends throughout much of the Northern Agricultural Region. The only area where rising groundwater trends persist is within cleared portions of the Perth Basin. Elsewhere, including the northeastern wheatbelt, most groundwater levels are either similar to where they were a decade ago or in some cases, significantly lower.

Reduced rainfall and a reduction in the number of significant rainfall events have resulted in reduced recharge. This effect becomes more pronounced to the north and east of the Northern Agricultural Region. It is less significant to the south and west, for example at Dandaragan.

Where there are reasonable topographic gradients, such as occur in Chapman Valley, many groundwater levels have been observed to significantly decline over the last five years. Groundwater contributes to base flow in many of the streams in this region. As groundwater has drained to the streams, reduced recharge has failed to maintain watertables and declining groundwater trends are observed.

In flat wheatbelt valleys groundwater levels have been significantly lowered by evaporation. The figure shows the watertable hydrograph for an observation bore in a wheatbelt valley about 10 km northwest of Morawa. The valley was severely salt affected and had not been cropped for at least a decade before the bore was installed. Groundwater quality at this site is about 4000 millisiemens per metre (about two thirds seawater). For the first six years of monitoring (1994 to 2000) the watertable seasonally fluctuated between the surface and about 1.5 metres depth, typical of saline valley floors. From 2000 the watertable declined to a depth of just over three metres below the surface. The improved seasonal conditions in 2005 have resulted in some recharge and upward kick at the far right of the graph. The valley is very flat and there are no drains. The decline in the watertable is due to evaporative loss of shallow groundwater during a particularly dry period. It appears the watertable has approached a limiting depth of evaporation of about three metres.



Watertable hydrograph for observation bore OM5OB located in a typical wheatbelt valley floor affected by secondary salinity near Morawa. Columns show daily rainfall at Morawa

Evaluation of salinity management options (e.g. drains or trees) needs to demonstrate management outperforming simple evaporation in a reduced rainfall, low recharge environment. Such evaluation requires sufficient data highlighting the importance of maintaining monitoring programs.

The other implication of the groundwater trends observed, providing an even stronger imperative for monitoring, is the impact on groundwater resources and groundwater dependent ecology. If the drier conditions persist, or worse, our climate continues to become drier, salinity may fade as a priority, as far more serious consequences emerge.

Russell Speed is a hydrologist with the Department of Agriculture at Geraldton. He can be contacted on: rspeed@agric.wa.gov.au

Keep up with the monitoring!

It is really important that, if you have a monitoring bore installed, you keep up with regular recording of water levels. Only with long-term records can we start to understand what effect our management actions are having.

MEMBERS' PAGE

A HAPPY TADDY TALE!

Meg Wilson

Alison Doley's article 'Should tadpoles be moved when the pond dries up?' (WW9/2 Apr 2005), prompts the telling of a happy tadpole tale.

We moved two years ago to a Mundaring property with a dam alongside a severely degraded creekline reserve. The most 'wildlife' encountered were some resident black ducks, an occasional heron, some furtive quendas holding out in dense tangles of buffalo grass, the occasional sighting of frogs (motor bike, tree and green-and-gold bell varieties) and a few, fat marron. But in a clear position of dominance in the dam was a huge school of restless tiny fish. Over the first two summers I was astounded by the capacity of these fish to populate – the water literally churned and rippled with them whenever I came near. They appeared to occupy every watery niche. The bottom of the dam was visibly bare of vegetation. How were the frogs breeding? With so many fish, even in the shallows, it seemed unlikely many tadpoles would survive.

Armed with valuable information from a water-quality monitoring course I'd attended, some sampling gear and a microscope, I was able to establish that although water quality was fairly good, macroinvertebrate numbers were low. Tadpoles were seldom seen – at most two or three hiding below the grassy margins of the dam. Were the fish our native western minnows (wishful thought!) or the dreaded introduced gambusia? (They are wrongly labeled 'mosquito fish' as they are not an effective control. It is our native fish that do this job admirably.)

With the wonderful help of the Centre for Fish Research at Murdoch University, the fish were confirmed

to be gambusia. Not only were these pest fish disabling our dam and all wildlife that depended on it but, left to rule the pond, they would continue to infest the downstream reaches of the creek all the way to the Swan River every time the dam overflowed. I dreamed of bringing back the native fish and longed to see what would happen when we did. In preparation, our Murdoch team assisted by trawling the dam from end to end. The 'catch' yielded a bucketful of fish, little else. On the advice of our experts we let the dam dry out over the next summer and waited to see what would happen. Rocks were brought in to line the sides and bottom of the dam to provide future habitat and refuge.

The following spring brought a sight to behold, one I will always remember. There were no fish. At first I felt uneasy about our seemingly dead waterbody. Then to my wonder and utter delight I discovered that each day, shortly before noon for a few hours*, a beautiful water dance took place. Numbering in the thousands and spread across the dam, tadpoles of all shapes and sizes seemed to rise from nowhere and with gentle, graceful movements, drifted between sun and shadow. It was mesmerizing and enchanting all at the same time. Visitors were captivated. From where did the tadpoles so mysteriously come and go? A closer look revealed a soft, dense forest of algae across the entire floor of the dam – something new, possibly the native *Nitella*. Happily too, macroinvertebrate numbers had swelled dramatically, especially among the backswimmers.

As summer set in, like Alison Doley, I anguished over what would happen to the tadpoles if we let the dam dry up again. As the water level dropped lower, the heron appeared more and more often. It was her nesting time. I concluded that the tadpoles she took would soon be transformed into sleek, elegant waterbirds and that was alright by me. Still further into summer, our neighbours began to remark at the surprising numbers of froglets appearing in garden beds, flowerpots and even hanging baskets. Then in March with the early rains a new sound, a delightful nightly serenade, was heard from the direction of the creek. Moaning frogs! Secretly, I was as proud of those babies as if they had been my own!

(* Might this suggest these tadpoles were responding *en masse* to water temperature and light?)

Meg Wilson can be contacted by email: meg.wilsonii4@bigpond.com
(Drawing: Emma Bramwell)

Did you know?

... that Captain James Stirling, when he was surveying Western Australia in 1827 looking for a site for settlement, wrote "... it was not the season for whales, but their wrecks strewed the shore of Geographe Bay". Clearly, whale strandings at Busselton are not just a modern phenomenon!

IN BRIEF

Did the first Australians contribute to the desertification of Australia?

Can humans really change the climate? Well, it seems that the first settlers in Australia did just that, all of 50,000 years ago .....

Northern and Central Australia derive an important part of their rainfall from the summer monsoon. Recent research from the Lake Eyre Basin has provided a continuous record of the lake filling and drying that can be interpreted as a proxy for Australian monsoon intensity over the past 150,000 years. During this time there have been periods when the rainfall has been high, and Lake Eyre was a permanent, deep-water lake, and other periods when it has been dry. By looking at past climate indicators on a global scale, researchers have been able to determine that the fluctuations in the Southern Hemisphere monsoon are caused by events happening in the Northern Hemisphere (1). The researchers were surprised to find, however, that the last monsoonal 'wet phases' (three of them, between about 40,000 years ago to the present), were not as wet in Australia as they should have been, given other global indicators. What could have happened in Australia to cause less rain?

Decreasing the transfer of moisture from the biosphere to the atmosphere during the monsoon season would inhibit the penetration of monsoon rainfall into the Lake Eyre catchment. Changing the vegetation from trees and shrubs to savanna grassland would do this. The researchers suggest that the regular burning practice by early humans, who settled in Australia around 50,000 years ago, caused this change (2). They conclude:

"Such an ecosystem change would have reduced convective activity over the interior and the onshore flow of moist air, resulting in long-term desertification of the continental interior, even during periods with strong monsoon forcing. Our results imply that continental-scale changes in moisture balance may have been the outcome of low-technology hunter-gatherer activities of early modern humans."

If such a low technology as simply burning off has caused such an enormous and prolonged effect on Australia's vegetation and climate, what effect are present-day humans and our technology having? Is it any surprise that we are changing the world's climate?

Penny Hussey

(1) Continuous 150k.y. monsoon record from Lake Eyre, Australia: Insolation-forcing implications and unexpected Holocene failure. 2004. JW Magee, GH Miller, NA Spooner & D Questiaux. *Geology*. **32**: 885-888

(2) Sensitivity of the Australian Monsoon to insolation and vegetation: Implications for human impact on continental moisture balance. 2005. G Miller, J Mangan, D Pollard, S Thompson, B Felzer & J Magee. *Geology*. **33**: 65-68.

Permits for herbicide use

In case you were unaware, John Moore, John Pierce and co-workers (Dept of Agriculture, Albany) applied for a minor use permit for "Environmental Weeds" in WA and it is all encompassing. See http://permits.apvma.gov.au/PER4984.PDF. So, community groups will be safe from having to pay an annual permit as long as this permit is valid (renewed by either John Moore or Kate Brown). Contact Kate Brown at Urban Nature for more info: katebr@calm.wa.gov.au

Ozzie wattles stay *Acacia*!

Congratulations to Bruce Maslin and all the concerned people (including the Wellstead Wattlers!) who have convinced the world taxonomic community that the name '*Acacia*' should stay with the Australian group of plants. Good result, folks! If you'd like the full story, consult: www.worldwidewattle.com

WATCH OUT FOR CANE TOADS
www.naturebase.net

Give a chick a chance!

Increase our understanding of malleefowl chick survival by helping to fund this innovative chick tracking programme organised by the Malleefowl Preservation Group. Donations are tax deductible. For more details visit the MPG website: www.malleefowl.com.au

WATCH OUT FOR CANE TOADS
www.naturebase.net

A review of the Western Shield programme

Western Wildlife readers have already heard about the review of Western Shield (WW 8/1, Jan 2004), the very successful feral predator control programme run by CALM with industry sponsors. Professionals in the field of feral predator control may, however, be interested to read the compendium of scientific papers detailing the operation and effects of the programme. They can be found in:

Conservation Science Western Australia. Vol 5. No 2. Dec 2004.

WATCH OUT FOR CANE TOADS
www.naturebase.net

NEW BOOKS

Western Australian Exploration Vol. 1 1826 – 1835
Ed: Joanne Shoobert
Hesperian Press Cost: $100.00.
email: books@hesperianpress.com

Finding out about farm and urban landscapes before development is of interest to owners and land managers, not just the research professions. If we want to learn about what the landscape and environment was like before development and habitat fragmentation, the original reports and letters written by the first explorers are a good source of information. In addition, these accounts of exploration also contain 'snapshots' of the environment at a particular place and time.

The occurrence of plants and animals was noted by the explorers as well as the patterning of vegetation communities and the presence of wetlands. The explorers also recorded their encounters with the Aborigines and the names the Aborigines gave to places, living things and people.

These 'snapshot' descriptions taken at the time of the first European contact can serve as a baseline for comparisons with present-day conditions, and might provide a guide for restoring native vegetation. But finding this type of historical material from the colonial days is not always a straightforward task. Archived papers are not accessed in a hurry, and published extracts from 19th century letters and reports are not necessarily accurate or complete.

However, the release of a new book, Western Australian Exploration 1826-1835 Volume I, will make the exploration record more accessible for everybody. The book is the first of a series which brings together, for the first time, all the documents narrating original expeditions of discovery in Western Australia from the time of European settlement until Federation.

Marion Hercock, Dept of Geography, UWA.

Guide to the Wildlife of the Perth Region
Simon Neville et al
Simon Neville Publications
Cost: $39.90 Available from good bookshops

If you are looking for just one book to start you off identifying the biodiversity in the Perth area, this is it!

Fully illustrated in colour, and covering mammals, birds, reptiles, frogs, invertebrates, flowering plants and fungi, this book is remarkably comprehensive and easy to use. (Though, of course, not everything you may come across is shown - only 200 wildflowers, for example, of the 1100 or so that are found here – but it does cover the more conspicuous kinds.) The photographs are small but they are generally clear enough for preliminary identification, although there are occasional colour anomalies, such as Blind Grass which appears to be magenta rather than sky blue. Most of the organisms illustrated are native, but some introduced animals are shown, for example the rainbow lorikeet, oleander aphid and brown garden snail. Weeds are not covered.

Throughout the book the authors emphasise the problems that can be caused by inappropriate human activity and suggest methods for observing wildlife without harming the environment. There are also brief descriptions of 32 places to visit.

The book comes in a handy size for backpacks, and has a strong plastic cover. It would make a good Christmas present for anyone interested in natural history!

Penny Hussey

This Newsletter is a compendium of articles written by many different people. The views expressed are those of the authors, not necessarily those of the Department of Conservation and Land Management.
Published by the Department of Conservation and Land Management, Perth. Address all correspondence to: The Editor 'Western Wildlife', Department of Conservation and Land Management, Species and Communities Branch, Locked Bag 104, Bentley Delivery Centre, WA 6983.