

Down but





not out:

solving the **mystery** of the

WOYLIE POPULATION CRASH

After staging an incredible comeback in the 1990s, the woylie population is again plummeting. What has gone wrong for this embattled native marsupial?

by Samille Mitchell
and Adrian Wayne

In 1996 the recovery of the woylie (*Bettongia penicillata*) was hailed a resounding success. Populations of this native marsupial had recovered to the extent it was removed from both State and Commonwealth threatened species categories—the first species in Australia to be delisted. Scientists and managers congratulated each other on the success of recovery programs and conservationists rejoiced—finally a good news story amid a sad chapter for many native animals battling predation by introduced animals and habitat loss. On the back of its success, the woylie achieved iconic status and became the ‘pin-up’ for conservation efforts around Australia. It also acted as a flagship for the achievements of the Department of Environment and Conservation’s (DEC’s) *Western Shield* conservation program (see ‘Bouncing Back: *Western Shield* update’, *LANDSCOPE*, Spring 1998).

But the success story was not to last. In 2001 an alarming chapter was starting to develop. Woylie numbers began plummeting. Consequent research found they had crashed by 93 per cent at Dryandra, 95 per cent in the Upper Warren River Catchment east of Manjimup and 97 per cent at



Batalling east of Collie—devastating blows to once vibrant populations (see ‘Bountiful Batalling’, *LANDSCOPE*, Winter 2004). Woylie numbers had only remained intact in relatively small and isolated populations. Overall, the number of woylies across the country had plunged between 70 and 80 per cent between 2001 and 2006. And where the declines occurred they were rapid—numbers reduced from 25 to 95 per cent each year. Such was the blow to woylie populations that it was re-listed in WA as endangered (more specifically, as Schedule 1 fauna: rare

or likely to become extinct) in January this year. Puzzled and alarmed, scientists could only wonder what on earth had gone wrong.

Joining forces

So drastic was the decline that a host of different organisations joined forces to determine a cause for the decline and, hopefully, start preventative action. Together these groups—DEC, Murdoch University, the Australian Wildlife Conservancy (AWC) and Perth Zoo—set to work on the Woylie Conservation Research Project. The project is focused on understanding the declines in the Upper Warren region and has three main components. Firstly, it combined existing datasets into a single database containing 25,479 woylie research and monitoring records spanning 33 years. This helped to characterise the patterns in population change, examine whether demographic changes were associated with woylie declines and thrash out any other circumstantial evidence or clues as to ‘who dunnit’.



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Main Woylie feeding on fungi.
Photo – Jiri Lochman

Above Preparing a sand-pad used to monitor predator and woylie activity by detecting their footprints.
Photo – Marika Maxwell/DEC

Left Releasing a woylie.
Photo – Adrian Wayne/DEC

Right Woylie feeding.
Photo – Ann Storrie



Secondly, the project closely monitored Upper Warren fauna to build on, enhance and coordinate previously independent existing studies to provide information on population changes at the regional scale, while also collecting information on demographics, health, disease, diet and genetics.

And thirdly, the project established a population comparison study designed to work out which factors could be associated with the population crash. Six populations became the core focus of the work, each at different stages of decline. They included the AWC-managed Karakamia Wildlife Sanctuary (see 'Karakamia Sanctuary', *LANDSCOPE*, Summer 1997-1998), which supports the last remaining high-density woylie population in Western Australia, the last three remaining areas in the Upper Warren still supporting healthy woylie populations and two other areas in the Upper Warren that provide examples of populations that have currently or recently declined. The study had five main lines of enquiry—woylie density and demographics, woylie survival and mortality, predators, resources and disease.

Aside from the core group of collaborators, individuals from the South Australian Government, The University of Western Australia, Manjimup Aero Club, Data Analysis Australia and the University of Adelaide have lent a hand. More than 85 people have been involved and contributions by volunteers have also been extremely important—more than 123 individuals have collectively contributed more than 500 days and 4,000 hours of volunteer service so far. But what has their work unearthed?

What's to blame?

Although it's too early to point the finger at a definite source, early results are providing some clues and paving the way for future works. The study so far has indicated that habitat loss and change is probably not to blame, nor fire or human interference.

What's a woylie?

The woylie is a native Australian marsupial that resembles a miniature kangaroo and is about the size of a rabbit. It once occurred across much of southern and central Australia but land clearing and feral predators reduced its range to pockets in the south-west. Successful translocations have enabled woylies to re-establish elsewhere in Australia where feral predators are intensively controlled or absent (such as islands).

The woylie lives in forest and woodland areas with sufficient undergrowth to provide cover and nesting sites, as well as some open areas for feeding. This nocturnal animal is very important to forest and woodland ecosystems. By feeding on above-ground mushrooms but particularly below-ground fungi (i.e. native truffles) as well as seeds, the woylie plays an essential role in spreading these plants and fungi throughout the ecosystems in which they live. While commercially important to industries such as sandalwood harvesting, it is the woylie's ecological role in spreading mycorrhizal fungi that is especially important. Mycorrhizal fungi have important symbiotic relationships with trees and plants (helping them to access much-needed nutrients). By helping spread these fungi, the woylie helps keep the forests and woodlands healthy and productive.

The woylie is also one of Australia's natural 'earth movers'. While digging for its food, each woylie moves about five tonnes of soil a year. This helps in nutrient recycling, reducing fire risk (by burying leaf litter cover as it digs) and creating nutrient-rich seed beds for plants to germinate. It also influences the way water percolates into the soil.

Female woylies usually give birth to their first young when they are 170 to 180 days old and continuously produce subsequent young about every 100 days thereafter for the rest of their life (about four to six years). Like kangaroos, woylies can carry a pouch young ('joey') while having an embryo in suspended animation in the womb, awaiting birth. Joeys live in the pouch for about 100 days before leaving to make room for the next young. Having left the pouch, joeys share their mother's nest and spend several more weeks at their mother's side being weaned, before becoming fully independent and sexually mature. If a female woylie is threatened, she may sometimes eject the young from her pouch, allowing predators to make an easy meal of it, while she makes a quick escape. While this may seem harsh, such behaviour makes good biological sense. The mother already has an embryo 'in waiting' and it is better that she survive to breed another day, rather than die along with her offspring.

Climate change and extreme weather events may be associated with woylie declines at Venus Bay Peninsula in South Australia, where populations have also crashed, and cannot yet be ruled out as a factor in WA.

Foxes are unlikely to be the main culprit in the Upper Warren region

given that, during the project, foxes only accounted for 15 per cent of the predators or scavengers associated with observed woylie deaths. In addition, none of the mortalities at the Balban study site in the Upper Warren (which underwent a decline during the study of more than 80 per cent in 12 months)



Above Wandoo woodland in Dryandra supports a woylie population.
 Photo – Marie Lochman

Right The common native truffle *Hysterangium* sp. forms part of the woylie diet.
 Photo – Richard Robinson/DEC



was attributed to foxes. However, a parallel research program lead by DEC Senior Research Scientist Nicky Marlow in Dryandra and Tutanning has shown foxes to be a real problem in these areas.

The research in the Upper Warren has shown that the decline involves increased mortality rates of adult woylies and, although it appears woylies continue to breed despite the decline, it remains unknown at this stage how many young survive through to adulthood.

So what is to blame? Multiple interactive factors are probably responsible. Predators and scavengers, especially cats, have been associated with almost all observed woylie deaths in the Upper Warren. While in stable populations this is likely to be the usual fate of the old, the weak and the unlucky, it seems no woylies are safe in those populations in decline. This may be due to an increase in predators but there is some evidence that disease

may be the main culprit. While some of the key evidence remains elusive at this stage (not helped by predators and scavengers eating the woylies and all the evidence of disease along with it), some key suspects have been identified—namely two parasites called *Toxoplasma* and *Trypanosoma*. Together these parasites have proven a particularly devastating mix for other species. The same may be true in this case. Other stresses that help trigger the diseases, or different diseases altogether, may also be involved. While there are some very tantalising clues that have already been

unearthed, more is needed to get to the bottom of this mystery.

Understanding disease

Disease is a primary threat associated with at least 11 per cent of declining vertebrate species. The Tasmanian devil is threatened by a facial tumour disease, *Chytridimycosis* attacks many frog species and koalas are often stricken with *Chlamydia*. In addition, western barred bandicoots battle against the *Papilloma* virus and Gilbert's potoroos can become infected with *Treponema* (similar to human syphilis).

Below Woylies.

Photo – Sallyanne Cousans

Wildlife diseases can also pose significant human health issues, by potentially transferring from animals to humans. Avian influenza, SARS, salmonella and Ross River virus are just some examples of this. Surprisingly little is known about the present disease status of WA's native fauna, including the woylie, let alone what implications there may be for humans.

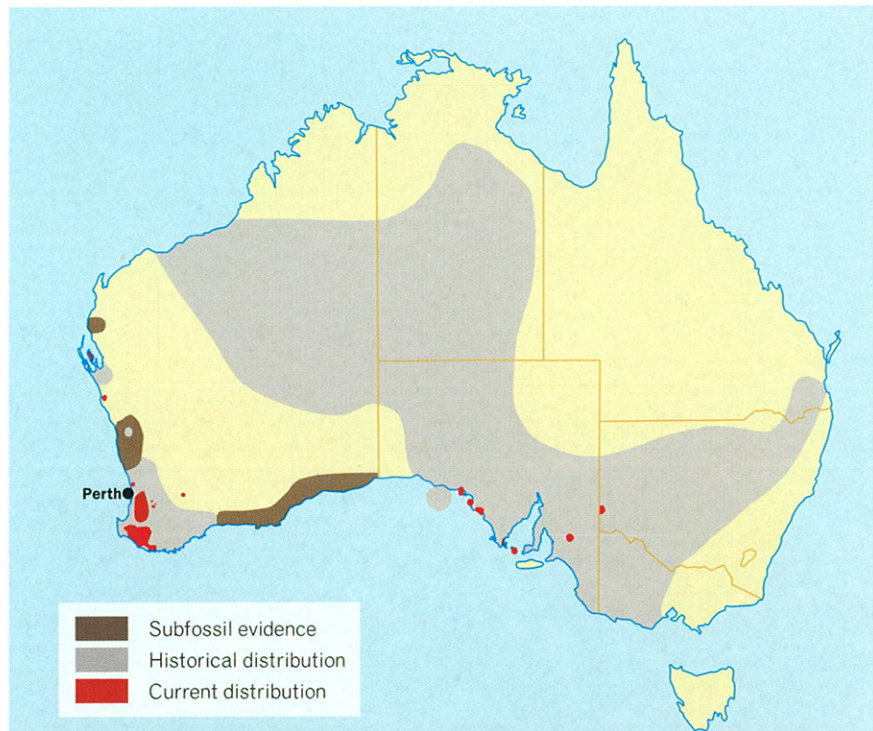
The Woylie Disease Reference Council was established with experts in their field from Murdoch University and Perth Zoo. This highly talented group is charged with the task of trying to understand what diseases woylies may have and, more importantly, what role they may play in the current woylie decline.

Where to from here?

Equipped with such findings, key players met at a major symposium and workshop at Murdoch University in February this year to discuss the problem. Environment Minister David Templeman, WA Chief Scientist Lyn Beazley and DEC Director General Keiran McNamara attended, as well as experts from around Australia and as far away as New Zealand and Canada. As well as sharing their findings, participants considered the priorities and worked out how best to respond to the situation based on the current evidence.

Given the rapid and substantial decline, it is clear that researchers and conservation managers need to build on the achievements of the initial rapid response to give the woylie the best chance of a full recovery. The chances of solving this mystery are immeasurably greater while the declines are occurring and the culprits are still at the 'crime scene'.

Despite the unknowns, people working on the project remain quietly confident about the woylie's future. Armed with this optimism, they are faced with the task of rallying further financial support from government and non-government sectors. With such resources and hard work, scientists remain hopeful the latest chapter in the woylie story will conclude with a happy ending.



Brief history of woylie distribution and abundance

- 1800s The woylie is distributed across much of southern and central Australia.
- 1960s Only three remnant woylie populations remain—Dryandra, Tutanning and Upper Warren. The rest have succumbed to the effects of land clearing and feral animal predation.
- 1970s Isolated increases in woylie populations start in response to fox control and translocations.
- 1996 The Department of Conservation and Land Management begins its *Western Shield* conservation program, targeting foxes and resulting in more woylie translocations.
- 1996 Woylie populations have recovered to the extent they are de-listed from State and Commonwealth endangered and threatened species lists.
- 2001 Woylie populations start to decline at Dryandra.
- 2002 Populations start to decline in the Upper Warren and Batalling.
- 2008 The woylie is re-listed as endangered in Western Australian.



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