Sleepy lizards guard mates

ALTHOUGH monogamy is common enough in birds and mammals, lizards tend to have more promiscuous or polygynous breeding systems in which males attempt to mate with several females in a defended territory. Only two lizard species are known to form monogamous relationships, of more than a few days, in a breeding season. Both are Australian skinks: the gidgee skink and the sleepy lizard, the latter a close relative of the blue-tongued lizard.

Dr Travis How and Dr Michael Bull, of Flinders University, say that sleepy lizards, large herbivorous skinks of semi-arid lands, form monogamous pairs each spring that last six to eight weeks before mating. The bond is strong. One male lizard remained close to his partner for two days after she died.

In many species monogamy is thought to improve survival of offspring because males stay around to help raise young. But this does not occur with sleepy lizards. Another hypothesis is that males guard females to keep rival males at bay. Males have wider heads and stronger jaw muscles than females and these are used in male-to-male combat, especially when females are close to mating. Genetic analysis also shows that most monogamous pairs of sleepy lizards produce litters fathered by one male, suggesting successful mate-guarding.

But doubts about the function of the pair bonds remain. Why do males guard their females for so long before mating? Were rival males a threat?

The scientists tested two predictions of the mate-guarding hypothesis in sleepy lizards: that females should play a passive role in maintaining the pair bond, and that males should become more attentive as the time of mating draws near. In experiments over three breeding seasons, in the shrublands of South Australia, they separated lizard pairs and observed the re-uniting behaviour.

The males were found more likely to return to females than vice versa, and reunion vigour was greater in males as mating-time approached. This supports the mate-guarding explanation, but other results suggested this might not be the only function of monogamy in the lizard. Females were active in maintaining the relationship, often seeking re-union. They may also gain some advantage from pair-bonding, perhaps guaranteed access to a fertile male or better vigilance against predators.

How TL and Bull CM (2002) Reunion vigour: an experimental test of the mate guarding hypothesis in the monogamous sleepy lizard (*Tiliqua rugosa*). *Journal of Zoology, London*, 257:333–338.

Steve Davidson

Although outback pastoral lands superficially resemble wilderness, grazing can restructure the vertebrate fauna.

near the base of the tail, minimising the energy lost when their tails are shed to escape predators.

Weedy wattles

A COOTAMUNDRA wattle draped in golden flowers is a magnificent sight, yet it is now regarded as a weed in many parts of south-eastern Australia and South Africa.

While its natural range is restricted to the Cootamundra region of New South Wales, it has been cultivated as a garden ornamental since the 1800s and, with ample time to invade native ecosystems, it is now an established weed at locations as far-flung as the Adelaide Hills and Canberra Nature Park.

Both the green-leaf form of *Acacia baileyana* and the variety 'purpurea', in which new growth is purple, are classed as environmental weeds: plants that invade native vegetation and have the potential to destroy an ecosystem. So far, however, only the green-leaf form appears to have established in natural bushland. Why is it so invasive?

Ann Morgan, Dr Susan Carthew and Professor Margaret Sedgley, of the University of Adelaide, examined the weed potential of the wattle in terms of its breeding system and seed production. They also compared the reproductive efficiency of the two colour forms to investigate why the purple form has not yet 'gone bush'.

They found that plants of both colour forms have impressive growth rates, reaching three metres high in three years, and flowering at two, with each tree producing up to 8000 seeds. Both forms breed by exchanging pollen, and germination rates in pre-treated seeds exceeded 90%.

So the ability of Cootamundra wattle to invade native bush can be attributed to its early maturity and high production of viable seed. The seeds are also known to be long-lived and can mass-germinate after fire.

But why is the purple form of the wattle proving less invasive? It may be because the purple variety, cultivated commercially only since the 1970s, is yet to catch up. Or it may be that the offspring of purple trees have green leaves, meaning any weedy misdemeanours go unnoticed.

Morgan A, Carthew SM and Sedgley M (2002) Breeding system, reproductive efficiency and weed potential of *Acacia baileyana*. *Australian Journal of Botany*, 50:357–364.

Steve Davidson

Wildlife in the firing line

PASTORALISM is the dominant land use in Australia's vast tropical savannas, yet its impact on biological diversity is poorly understood.

Scientists have noticed a perplexing decline in animal biodiversity in this relatively intact landscape and they suspect subtle environmental changes associated with land-use are responsible. Military training is another expanding activity up north and even less is known about how this affects savanna wildlife.

Ecologists at the Parks and Wildlife Commission of the Northern Territory and Tropical Savannas CRC and at CSIRO Sustainable Ecosystems, Dr John Woinarski and Dr Andrew Ash,

have sampled mammals, birds, reptiles and frogs in various landscape types in military and grazed land, and in undisturbed savanna. The study area was west of Townsville in north Queensland.

Results of the sampling indicate that, although outback pastoral lands superficially resemble wilderness, grazing can restructure the vertebrate fauna. This is particularly the case for reptiles, and mammals and birds associated with the ground and understorey layers.

The researchers concluded that, considering the extent of pastoralism, the industry seems to have contributed to some change in savanna fauna species composition. On the other hand, low-intensity military land-use, in this case at the Townsville Field Training Area, has led to little change.

A companion paper on the responses of ants and spiders to military and pastoral land-use indicates that species richness in these invertebrates is reduced in grazed areas, but similar in undisturbed and military areas.

Woinarski and his colleagues suggest that low-frequency military training is, for tropical savanna animals, a far more benign land-use than cattle grazing and that where land is turned over from pastoralism to military use, the outcome is a conservation benefit.

Considering that the entire study area had been grazed for 100 years, until three decades ago, the recovery following removal of cattle in the military and undisturbed areas has been substantial. This suggests that, where pastoralism is discontinued for some reason, ecological recovery is swift.

Woinarski JCZ and Ash AJ (2002) Responses of vertebrates to pastoralism, military land use and landscape position in an Australian savanna. *Austral Ecology*, 27:311–323.

Steve Davidson

Tail loss in skinks

THE cunning manner in which some lizards can cast off their wriggling tail to escape a predator has an immediate survival benefit, but what about the undesirable consequences of this drastic self-amputation? Until regeneration is complete, tail loss in lizards can hamper movement, lower the animal's social status and diminish the chance of surviving subsequent encounters with predators.

Lizards also accumulate fat-bodies in either their tail or abdomen, or both. These energy reserves are handy for reproduction, for periods of food shortage and for general growth and maintenance. This raises the intriguing question: if tail loss means the loss of fat bodies, doesn't this defence mechanism conflict with the strategy of fat storage in the tail? One species, the ground skink, gets around this by eating the shed tail, but this is an unusual solution!

When honours student David Chapple and associate professor Roy Swain, of the University of Tasmania, investigated energy reserves and tail loss in the metallic skink, a shy inhabitant of rocks, logs and litter in Tasmania and south-eastern Victoria, a different picture emerged. In this species, most of the fat reserves occurred in the tail, yet 78% of the lizards in the wild population studied had experienced tail loss. This suggests that the lizards are paying a considerable energetic cost for their tactic of autotomy. But the scientists found the losses were not too severe.

Most of the tail or caudal fat occurred within the proximal third of the tail, the part nearest the skink's body, the remainder occurs in the middle third, with none in the tip section. Tail breaks occur at fracture planes in the tail vertebrae, and are due to muscle contractions and the grabbing force of the predator. The researchers recorded that 76% of the tail breaks happened in the two-thirds of the tail nearest the tip. So a shedding event generally results in no more than 10% loss of tail fat.

This fortunate combination of fat storage towards the tail base and the usual site of self-amputation provides a plausible explanation for how the defensive strategy of tail shedding and the storage of energy reserves in the tail can coexist in the metallic skink, and probably in other lizards as well. The metallic skink's method of dealing with persistent predators has a minimal direct cost in terms of energy loss. So the habit of storing hard-earned fat in the tail is not as silly as it sounds.

Chapple DG and Swain R (2002) Distribution of energy reserves in a viviparous skink: Does tail autotomy involve the loss of lipid stores? *Austral Ecology*, 27:565–572.

Steve Davidson

Weevils worth millions

SCIENTISTS from Charles Sturt University and CSIRO Entomology have modelled the economic benefits of using the crown weevil to control the widespread agricultural weed, Paterson's curse.

The crown weevil is the most successful of the six biological agents introduced to control the weed in Australia. It is limiting weed populations at two early-release sites and is approaching control in many other locations.

The researchers found that while $14 million was spent on the control program between 1972 and 2001, the annual benefits are projected to increase from near zero in 2000 to some $75 million by 2015, and to $90 million by 2025. New South Wales will benefit most, followed by Victoria and Western Australia.

The authors conclude this a very respectable return on investment. If still greater profitability is attributed to sheep grazing, the benefits of Paterson's curse control rise accordingly. So the analysis gives the biocontrol program the thumbs up: the little weevil in question will more than repay the entomologists' faith in its potential. The authors are extending their bio-economic analysis to see where further releases of insects are best targeted.

Nordblom TL Smyth MJ Swirepik A Sheppard AW and Briese DT (2002) Benefit-cost analysis for biological control of *Echium* spp. (Paterson's curse and related species) in Australia, 1972–2050. *Proceedings, 13th Australian Weeds Conference*, 8–13 September 2002, Perth, pp. 753–756.

Nordblom TL Smyth MJ Swirepik A Sheppard AW and Briese DT (in press) Spatial economics of biological control: investing in new releases of insects for earlier limitation of Paterson's curse in Australia. *Agricultural Economics*.

Steve Davidson

The biological control of Paterson's curse is well worth the investment.