Old habits die hard

Modern Australian bandicoots, such as this western barrred bandicoot, may be more closely related to South American marsupials than to any other Australian family.

Charles Darwin and others have assumed that the diversity of marsupial species in Australia reflects the absence of competition from placental mammals during the early Tertiary period.

Was this really the case? Why didn't marsupials share Australasia with placental mammals? Why, after surviving 55 million years, have so many marsupial species declined since human occupation, while placental introductions such as rabbits and foxes have thrived?

Dr Hugh Tyndale-Biscoe, of the Australian National University and an honorary fellow at CSIRO Sustainable Ecosystems, has been weighing up the evidence relating to these questions. One finding pertinent to his research was the discovery of an ancient tooth and bone near Murgon, Queensland, of an animal provisionally identified as a placental. If this is the case, the argument that early marsupials thrived in Australia due to the complete absence of placental competitors loses much of its force.

The possibility that placental mammals once inhabited this land is also supported by fossil and DNA evidence of interchange between mammals of South America and Australia when the continents were connected via Antarctica. Our bandicoots, for example, seem to be more closely related to South American Caenolestids than to any Australian family.

Tyndale-Biscoe argues that the small, early marsupials prevailed because they were pre-adapted to the arid environment that developed in Australia after it separated from Antarctica about 45 million years ago.

Two features distinguish living marsupials from placentals. The basal (resting) metabolic rate of marsupials is, on average, about 30% lower, and their manner of reproduction is radically different.

Tyndale-Biscoe points out that the lower basal resting metabolic rate is probably a definite advantage in extreme, unpredictable environments. It allows the animal to conserve its energy and other resources at rest, without limiting its metabolism when active. This also means that marsupials have lower food and water requirements than placentals.

The low investment in pregnancy and the prolonged investment in lactation typical of marsupial reproduction also enable females to be much more responsive to adverse or unpredictable conditions.

Marsupials can use limited food resources over a long period without exhausting them and the female marsupial can terminate her pregnancy in the face of unfavourable conditions without too much loss of reproductive investment. She can resume breeding within a short time.

Maternal investment in pregnancy in the rabbit is 600 times greater than in the similar-sized quokka, and the time from birth to weaning is 10 times greater in the quokka. In that time, the rabbit can produce three more litters.

'This slow-and-steady reproductive strategy served marsupials well for all the Tertiary period, but was fatally flawed when human populations entered Australasia,' Tyndale-Biscoe says. 'First the megafauna succumbed, probably to hunting and changed fire regimes, and, much later, the small-to-medium sized species succumbed to European pastoralism.' Introduced predators provided the final act of extinction for many species.

'Mind you, the contest is not over yet!' Tyndale-Biscoe says. 'Marsupials have an enviable track record, having survived here for 55 million years, and there is no assurance that we newcomers are using the land in a sustainable way and that big exploiters, such as the rabbit and sheep, will survive in the long term. There are already signs of profound damage to the environment, which may be inimical to their future survival. Maybe we should try to learn from marsupials how best to live on this continent long term.'

More about marsupials

Tyndale-Biscoe CH (2001) Australasian marsupials – to cherish and to hold. Reproduction, Fertility and Development, 13:477-485.

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