The western barred bandicoot warts and all!

The western barred bandicoot has been on a roller-coaster ride since European settlement. But its future, although not rosy, is encouraging.

by Neil Thomas and Tony Friend

One of Western Australia's most endearing marsupials is undoubtedly the western barred bandicoot (*Perameles bougainville*)—commonly referred to by its Nyoongar name, marl. The marl is the smallest of the bandicoot family and an adult marl, weighing between 172 and 286 grams, with a combined head and body length of between 171 and 236 millimetres, would sit comfortably in your hand.

Before European settlement, the marl was found as far north as Onslow and over much of the southern half of Australia—from the Western Australian Wheatbelt through the Nullarbor to the arid and semi-arid areas of South Australia, Victoria and New South Wales. Like many other native animals, this species was severely affected by the arrival of the fox and feral cat. By the 1930s, it had disappeared from the mainland, and now occurs naturally on only two offshore Western Australian islands, Dorre and Bernier islands, about 60 kilometres west of Carnarvon. These islands also hold the last wild populations of the banded hare-wallaby

Previous page
Main Western barred bandicoot or marl (*Perameles bougainville*).
Inset Dorre Island, one of only two remaining strongholds of marl.
Photos – Jiri Lochman

Below left Marl are most common in scrub associated with stabilised dunes behind the beaches on Bernier and Dorre islands.

Bottom Bernier Island in Shark Bay.
Photos – Jiri Lochman

(*Lagostrophus fasciatus*) or merrnine and the rufous hare-wallaby (*Lagorchestes hirsutus*) or mala. The Shark Bay mouse (*Pseudomys fieldi*) or djoongari is found only on Bernier Island, and the burrowing bettong (*Bettongia lesueur*) or boodie occurs on both islands, but is also found on Barrow and Boodie islands off the Pilbara coast of WA.

Since 1985, the Department of Conservation and Land Management (CALM) has had an ongoing research program on the ecology of the marl, concentrating on a population at White Beach on Dorre Island. We have shown that activity and breeding change with the seasons. Marl are active throughout the night during winter, emerging after dusk to forage for insects, seeds, roots and herbs obtained by digging or hunting. During summer, this activity ceases several hours before dawn. Marl are polygamous (they have more than one mate) and only get together during breeding. Individuals occupy home ranges with little overlap, with males using home ranges of between 2.5 and 14.2 hectares and females between 1.4 and 6.2 hectares. Breeding tends to cease during the hottest months,

Above Marl, boodies and merrnine on their way from Dorre Island to the Dryandra Field Breeding Facility in 1998.
Photo – Max Lawrence

between November and March, but can occur if there is summer rain. Young are produced from April to October.

On the islands, the only recorded predators have been sand goannas (*Varanus gouldii*), wedge-tailed eagles (*Aquila audax*) and barn owls (*Tyto alba*). On the mainland, the frequent presence of marl remains in the roosts of owls shows that they were a significant natural predator.

Marl on the move

One of the questions we needed to establish was whether the two marl populations on Dorre and Bernier islands were genetically close, or whether 8,000 years of isolation had caused major differences to develop. Specifically, could animals from the two islands breed successfully together? If so, cross-bred progeny could be used for mainland reintroductions with a greater expectation of success.

In 1993, we took several marl off the islands to establish an experimental cross-breeding program at Kanyana Wildlife Rehabilitation Centre, in Gooseberry Hill near Perth. Under the care of volunteers, several generations of marl were bred from pairs from different islands and from their offspring. The project evolved into a very successful captive breeding program, producing marl for reintroduction to the south-west of Western Australia through the Return to Dryandra project (see 'Return to Dryandra', *LANDSCOPE*, Winter 2001). This project aims to re-establish five locally-extinct species in the 23,859-hectare Dryandra Woodland, near Narrogin. In 1998, 18 captive-bred and seven wild Dorre Island marl were released into the Dryandra Field Breeding Facility—20 hectares of woodland surrounded by a 2.4-metre feral predator proof electric fence. To date, 71 marl have been born in the facility.

While all this was happening, two other projects were underway. Between 1988 and 1995, Jeff Short of the CSIRO was researching the ecology of marl and boodies on both Dorre and Bernier islands, with the idea that they might be able to be reintroduced to the mainland. In 1995, Jeff, and Jacqui Richards also of the CSRIO, released 12 marl into a nine-hectare breeding enclosure on Heirisson Prong, at Shark Bay. In 1996, two more marl, provided by CALM, were also released into the enclosure. In the meantime, introduced predators were removed from a 1,200-hectare area behind a barrier fence, built across the peninsula to prevent reinvasion. The marl soon bred up and, in 1997, were released into the predator-free prong. Within two-and-a-half years, trapping results indicated that at least 175 marl had been born there.

Further east in Shark Bay, CALM started a similar project, but on a grander scale. Project Eden (see 'Return to Eden', *LANDSCOPE*, Autumn, 1995) aims to re-establish a number of locally extinct animals on the 1050-square-kilometre Peron Peninsula. In 1995, a barrier fence was built across the narrow neck of the peninsula, and the huge task of removing introduced animals began. Foxes were soon eradicated and numbers of feral cats and goats were greatly reduced. In 1998, 28 marl were captured on Bernier Island and moved to captive breeding pens on the peninsula. More than 50 marl have been bred at this facility.

In 2000, the opportunity arose to move the marl interstate. The Arid Recovery Project (ARP) aims to reintroduce locally extinct mammal species to a 6,000-hectare fenced reserve—from which introduced animals had been removed—20 kilometres north of Roxby Downs in South Australia. With financial support from the project, CALM and ARP staff captured 19 marl at Red Cliff Bay on Bernier Island. Founder animals moved through quarantine at Adelaide Zoo and, in May 2001, 10 marl were released into an eight-hectare pen on the reserve. Young have been produced and additional releases have been made. In April 2002, the release pen was opened to allow the animals to move into a larger 1,400-hectare fenced area.

Predation and drought

The great advantage of using fenced reserves is that, once introduced species have been removed, it is far easier to maintain them feral free. However, if predator control is inadequate, or if there is a breach of the fence, it can have devastating results for the introduced native fauna. Both these scenarios have occurred in recent times.

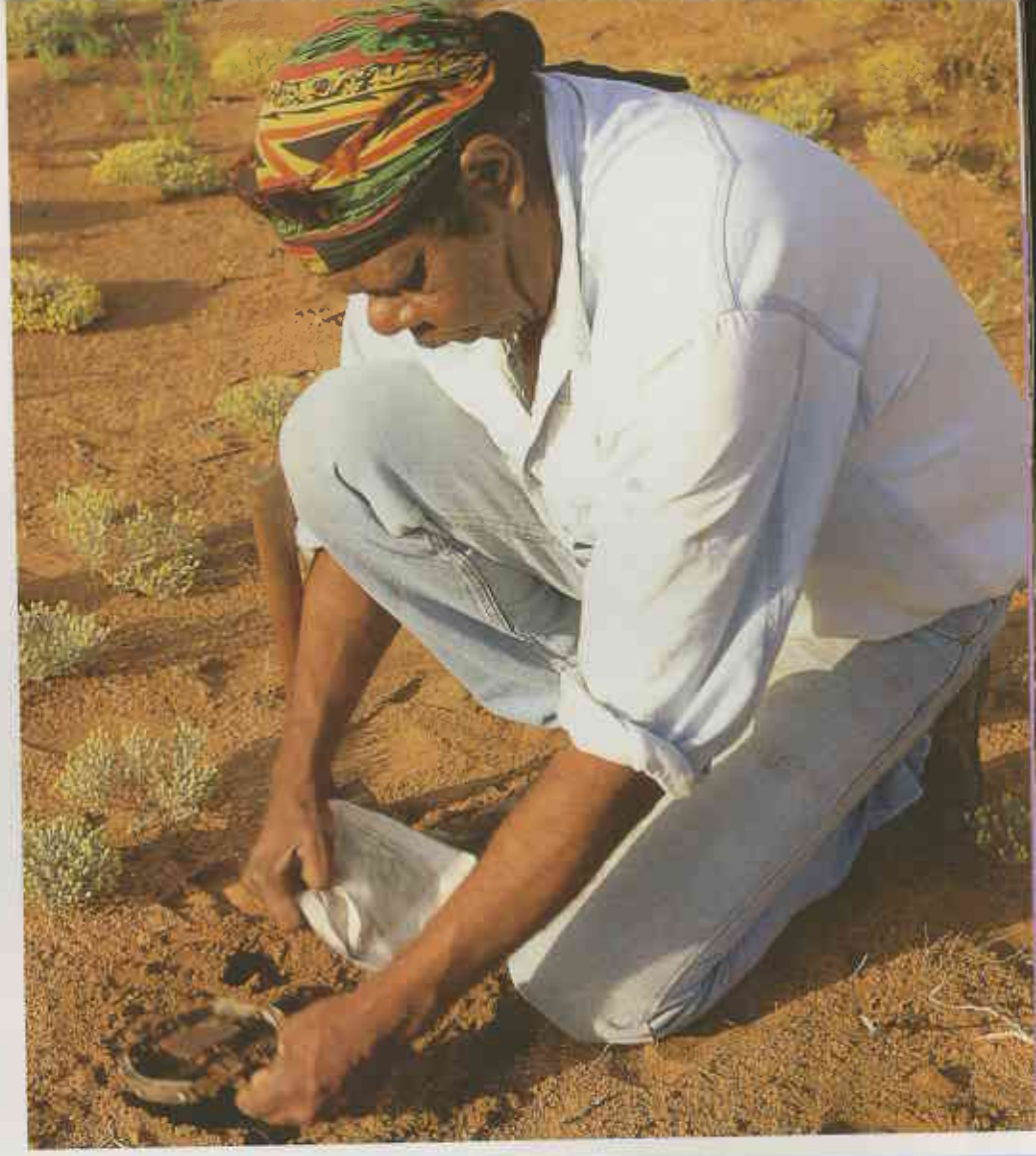
CSIRO's work at Heirisson Prong had a recent setback when, due to a cyclone, a single fox and a number of feral cats breached the fence. As a result, the marl were nearly wiped out. The fox was rapidly dealt with, but the cats are proving harder to get rid of. The surviving marl were caught and returned to the breeding enclosures. There have been similar problems on Peron Peninsula, through the unexpected impact that the few remaining cats have had on released fauna. Recent experimental releases of mermine and mala at Peron Peninsula failed because of feral cat predation. The mermine and mala survived well for the first few months, but it appears that cats take time to become familiar with new prey items, and need to learn how to hunt them. It is now obvious that lower cat densities, or even total eradication, must be achieved to allow successful reintroductions of certain species to the mainland. Current CALM research (see 'Approaching Eden', *LANDSCOPE*, Winter 1998) is looking into better baits and baiting strategies to control feral cats, but, until this is achieved, any releases of marl or additional releases of mermine or mala are unlikely.

In South Australia, the problem has not been predation but prolonged

Top left Reintroductions of marl to the mainland are underway at Dryandra, Heirisson Prong, Peron Peninsula and Roxby Downs.

Centre left Burrowing bettongs also inhabit Dorre and Bernier islands.

Left The Shark Bay mouse (*Pseudomys fieldi*) is endemic to Bernier Island. *Photos – Jiri Lochman*



Above CSIRO technical officer Reg Carnamah setting a soft jawed trap for humanely capturing feral cats.
Photo – Jiri Lochman

Top left Project Eden staff Colleen Sims (left) and Nicole Noakes check a marl for signs of warts on a vessel off Bernier Island.

Above left An example of the wart-like syndrome on the leg of a marl.
Photos – Stephanie Hill

Right An electric fence surrounds the 20-hectare enclosure where marl are bred at Dryandra Woodland.
Photo – Michael James/CALM

drought. Although the released marl established themselves and, in the past, were breeding well, the current drought has caused breeding to cease. If the drought continues, the Roxby Downs population may even die out.

Disease, a major setback

Disease in Australian native wildlife is poorly researched and understood. Recent events have caused more focus to be directed to disease issues in our native fauna. In 1999, the first inkling of a problem with marl arose. At Kanyana, it was noted that a few captive marl had developed warts on various parts of their bodies. Initially, little significance was attached to this, as the animals were still breeding and appeared healthy. However, by mid-2000, several animals had warts over substantial parts of their bodies and their condition was deteriorating rapidly. Breeding had ceased and death eventually resulted. Veterinary advice was sought and Murdoch University researchers Ralph Swan and Kris Warren became involved in the investigations.

The seriousness of the disease assumed greater significance as a result of the trip to Bernier Island to collect marl for the ARP. Seven of the captured animals appeared to have injuries to their eyes, and were held at Kanyana for treatment and examination. One of these animals also showed early signs of the disease now referred to as a 'wart-like syndrome'. The remainder were sent to Adelaide Zoo to be held in quarantine before they were sent to ARP. The apparent eye injuries turned out to be a chlamydia infection, which, although successfully treated, was of concern because similar infections in other species can result in infertility. However, the wart-like syndrome was not responding to any treatment. Both diseases were also noted in the captive breeding facility at Peron Peninsula and at Dryandra. At Dryandra, three animals with warts were removed to Kanyana. At Kanyana and Peron, it was decided

Above Young marl suckling in their mother's pouch.

Left An adult marl asleep in its nest.
Photos – Jiri Lochman

that the best course of action was to euthanase the most severely debilitated animals, and to observe the progression and transmission characteristics of the disease in the other animals. Some of the animals held at Adelaide Zoo also started to show warts. Subsequently, it has been found that the syndrome has a long incubation period, as marl held in isolation at Kanyana and Adelaide Zoo developed the syndrome after 18 months to two years away from contact with affected animals.

More questions

A number of questions about the wart-like syndrome need to be answered before further translocations or reintroductions of marl can occur. Where did the disease originate? Was it introduced to the island by researchers? Is it present on both islands? Is the disease at Heirisson Prong? Does it occur in other species? What is the transmission mode? Can it be controlled?

We are partway to answering many of these questions. Follow-up visits to the islands have established that the disease is present on Bernier Island but not, apparently, on Dorre Island. Examination of museum specimens by CALM technical officer Stephanie Hill has shown that animals collected in 1982 from Bernier Island had the disease, so it appears to have been established on this island before any research into the ecology of marl was undertaken. Again, no sign of the disease was found in any Dorre Island specimens. There is no evidence of the syndrome at Heirisson Prong, where all the founder stock originated from Dorre Island. The syndrome appears to be specific to marl, as no other animals housed at Kanyana, Peron Peninsula or Dryandra have shown any symptoms, and it has not been seen in any other species on Dorre or Bernier islands. We do not know the transmission mode, but it appears to be through physical contact. Nevertheless, an insect vector cannot be ruled out. Finally, we do not know how to treat the disease, and there is no effective test for it as yet. Promisingly, however, three years after the removal of affected animals, the Dryandra population has not shown any further sign of the syndrome, so removal and quarantine may be one way to control it.

The future

It may appear that the marl's future looks grim, but this is not the case. Dave Algar, a senior research scientist with CALM, is well on the way to developing an effective bait for controlling feral cats, which are notoriously fussy about taking baits. When effective baits become available, CALM will be able to release both marl and a whole swag of other species threatened by feral cat predation. Researchers and veterinarians from CALM, Murdoch University Veterinary School, Adelaide Zoo, Queensland University of Technology, the Universities of Sydney and Queensland, the WA Department of Agriculture and the CSIRO are looking into the two diseases, with many of these researchers donating their time and resources. The Dryandra and Heirisson Prong populations appear to be free of the syndrome, and these two 'arks' may form the nucleus for future captive breeding. Dorre Island also appears to be free of the syndrome and the population there may be used to augment the Dryandra and Heirisson Prong populations. Early signs indicate that the marl in ARP are also syndrome free.

The biggest threat to marl is now a lack of funds to undertake research into the two diseases, and to carry out translocations and introduced predator control. Although the future is not bright for the marl, it is nonetheless encouraging.

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contents

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