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Further case-studies from around the globe

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Twenty years of captive breeding and re-introduction of the eastern barred bandicoot in Victoria, Australia

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Introduction

The eastern barred bandicoot (EBB; *Perameles gunnii*) is a small (<1kg) nocturnal marsupial. It is solitary, short-lived (2 - 3 years) and highly fecund (i.e. up to 5 litters a year; average litter size 2 - 3). EBBs are omnivorous and opportunistically exploit a wide variety of invertebrates and some plant matter. The EBB was once found across the Basalt Plains of Victoria, Australia. The original vegetation was perennial tussock grassland with areas of grassy woodland, but 99.9% of this habitat has been destroyed or modified for agriculture. The introduction of the red fox *(Vulpes vulpes)* caused a catastrophic decline in the EBB population and by 1989 only 150 - 300 individuals remained. The last wild population was declared extinct in 2008. The first EBB management plan was developed in 1989 and re-introduction has been attempted at eight sites with varying success (Hill *et al.*, 2010). Only two of these sites currently support extant populations. The Victorian EBB is listed as Endangered on the Commonwealth

Eastern barred bandicoot

Environment Protection and Biodiversity Conservation Act 1999 *and* Critically Endangered on the Advisory List of Threatened Vertebrate Fauna in Victoria 2007.

Typical habitat of the eastern barred bandicoot

Goals

- Goal 1: The long-term objective of the eastern barred bandicoot recovery program is to minimise the probability of extinction by establishing at least two self-sustaining re-introduced populations which total a minimum of 2,500 individuals.
- Goal 2: Establish self-sustaining re-introduced populations totalling at least 1,000 individuals, within 5 years (2009 to 2014).
- Goal 3: Prevent further loss of genetic diversity by managing captive and released populations as one meta-population.
- Goal 4: Maintain a viable insurance population in captivity.
- Goal 5: Maintain and enhance community and institutional support.

Success Indicators

- Indicator 1: Self-sustaining populations established at a minimum of two large re-introduction sites.
- Indicator 2: At least 1,000 EBBs in "wild" populations by 2014, and 2,500 EBBs in "wild" populations by 2024.
- Indicator 3: Less than 5% loss of genetic diversity of the species from the inception of the captive breeding program,
- Indicator 4: Multiple captive facilities for holding and breeding EBBs to spread risk and provide a source of animals for re-introduction.
- Indicator 5: Active recovery team with effective working partnerships between government, zoos and university researchers.

Project Summary

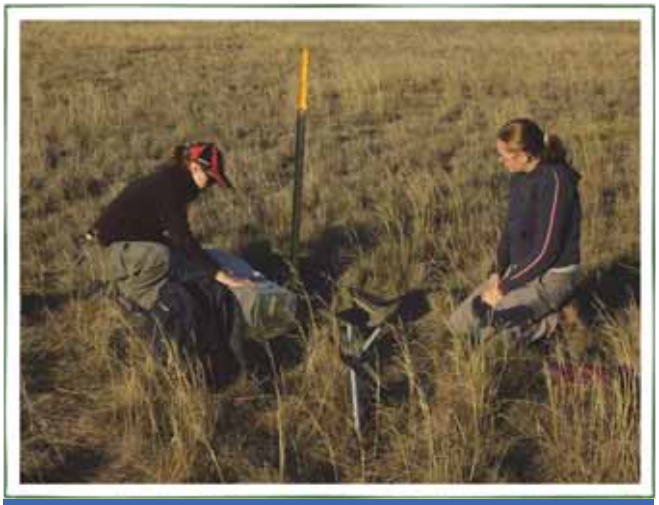
Feasibility: The EBB was formerly widespread in Victoria, occupying a total range of three million hectares. Following European settlement and the introduction of feral predators, in particular the red fox, bandicoots suffered a significant decline. The EBB requires structurally complex habitats with dense cover for nesting, adjacent to open areas suitable for feeding, but 99.9% of the preferred grassland habitat has been cleared or modified for agriculture. By 1972, the EBB was extinct throughout its mainland home range, except for a small population within a 600 ha area in Hamilton, Victoria. In 1982, the first (interim)

management prescriptions and PVA were produced in an attempt to conserve the species and the final plan was released in 1989. In 1988, EBBs were considered at risk of extinction and trapping was conducted to commence a captive breeding program (Hill *et al.*, 2010).

Implementation: In 1988, ~40 EBBs were caught to start an intensive breeding program, in which 19 founders produced 54 young. The first EBB re-introduction site was Woodlands Historic Park in 1989, closely followed by Hamilton Community Parklands in 1991 (Winnard & Coulson, 2008). Both sites are surrounded by a predator barrier fence and had initial success, but both went extinct due to a combination of drought, fox incursions and overgrazing by eastern grey kangaroos *(Macropus giganteus)* and European rabbits *(Oryctolagus cuniculus)* (Winnard & Coulson, 2008). Five unfenced re-introduction sites were also established on public and private land with fox control conducted regularly. All sites failed quickly, with the exception of Mooramong, a working sheep farm. This population persisted for 17 years, but is now undetectable by trapping. Due to the devastating effect foxes have on small re-introduced populations of EBBs, the Victorian Government's Department of Sustainability and Environment Animal Ethics Committee halted all releases into areas that could not be maintained fox free. Although sensible, this limits the number of sites in which EBBs can be released and significantly increases the expense of re-introductions, as building and maintaining predator barrier fences is costly.

Currently two sites hold healthy populations of bandicoots and are considered to be at carrying capacity. Mt. Rothwell, a 400 ha fenced reserve established in 2002 currently houses the largest EBB population, but the exact population size is unknown. In 2005 the Hamilton Community Parklands predator barrier fence was upgraded, bandicoots were released in 2007 when all foxes had been removed, and EBBs are now spread throughout the reserve. The first island trial introduction commenced on fox-free French Island, Victoria, in mid-2012 and releases into fenced areas at Woodlands Historic Park and Werribee Open Range Zoo are planned to commence in late 2012. Genetic analyses of the 20-year breeding program, in which 1,078 young have been produced, show that there was a significant loss of genetic diversity within EBB populations prior to the commencement of the captive program, with slight, but steady, reduction in genetic diversity during the breeding and release program (Weeks, 2010). Investigations into techniques to maintain or improve genetic diversity and reproductive fitness, including mate choice research, are underway. Based on genetic and population analyses, a meta-population management plan with an increased number of captive breeding pairs is proposed, but further research into the success of translocated bandicoots when re-introduced into an established population is required.

Post-release monitoring: Post-release monitoring generally occurs quarterly over two nights, with cage traps set on established grids. In large or unfenced reserves, trapping is focused on the area with the most EBB activity (i.e. foraging digs and/or spotlight sightings). However, the Mt. Rothwell reserve contains other small mammals that saturate the traps and reduce EBB capture rates. Here,



Monitoring of released bandicoot

camera traps have been deployed annually to monitor the population, but animals need to be caught in order to implement the new meta-population management plan. Radio-tracking has been used to determine foraging and nesting locations, but attaching radio transmitters to this species is problematic. Bandicoots have a low tolerance for collars, and several other methods of attaching transmitters have all resulted in short attachment times (5 days – 5 weeks). Tail mounted transmitters have been the most successful method to date, but provide only short-term data (<35 days). Intraperitoneal transmitters are currently in use for a 12-month trial on French Island. Whilst they provide several months of battery life and overcome the attachment problems, their short operating range (about 50 m) limits their value. Despite these difficulties, tracking shows that bandicoots usually nest within woodland areas, changing nest location regularly, and forage at night in the open grasslands. After release into an empty reserve, male bandicoots investigate large areas before settling, whilst females tend to stay in the area of release. Trapping has shown that bandicoots are heaviest and produce the most young during the cooler wetter months, whereas in summer, the numbers trapped decreases and animals are more commonly in poor condition.

Major difficulties faced

- The introduced red fox is the major threat to EBB populations. Foxes are widespread throughout Victoria and are difficult to control, making predator barrier fences essential. Constructing and maintaining predator fences significantly increases the costs of EBB recovery and reduces the number of sites available for release.
- There is a lack of suitable habitat to establish release sites because 99.9% of native grasslands have been destroyed or modified.
- Herbivore populations can increase rapidly in fenced reserves causing significant habitat degradation by overgrazing. Kangaroo control is difficult because there is a strong protective response towards these iconic species and rabbit control can negatively affect EBBs, which have been known to occupy rabbit burrows.
- Captive breeding facilities are limited. Bandicoots can live to six years old in captivity, but do not breed past ~3 years old. Post-reproductive animals can fill enclosures required by breeding animals. Furthermore, if release sites are not available, the housing of young bred in captivity can halt future breeding.

Juvenile (joey) eastern barred bandicoot

- The presence of many other small mammal species that saturate the traps at Mt. Rothwell make monitoring and trapping EBBs difficult. New trapping techniques are required to monitor the population, to trap animals for translocation as part of the meta-population and to increase the genetic diversity of the captive breeding population.

Major lessons learned

- The Victorian EBB would be extinct without the captive-breeding program initiated by Melbourne Zoo. All recovery potential has been driven by the success of captive-breeding and release. This highlights the importance of early intervention in collecting founders to establish captive populations of threatened species.
- Foxes are the key threatening process for the EBB. Populations are unable to maintain themselves unless foxes are permanently eradicated from the area. This involves surrounding reserves by a predator barrier fence, as well as continuous fox monitoring and control. The quality of habitat is less critical to this species.
- Managing each re-introduced population as a separate entity has not been ideal. The small size of reserves increases the likelihood of stochastic events having a detrimental effect on populations and can contribute further to the loss of genetic diversity. New release sites that can sustain large populations plus managing as a single meta-population will assist in the conservation of this species.
- Successful long-term captive breeding programs for marsupials are rare. This is an example of a long-term program in which animals have not decreased in reproductive rate for more than 20 years. However, careful management of space is imperative, as breeding is restricted by lack of suitable enclosures when young cannot be released. The meta-population model for the EBB requires breeding animals to be cycled in and out of the wild every two years to maintain genetic diversity. This model is also being applied to several other threatened species.
- The EBB recovery team was restructured in 2011 and three groups were formed: the science, operational and business groups. These groups meet on an as-needed basis and are overseen by a strategic group. A review day is held annually in which members of all groups discuss progress and future

directions. This reorganization has led to more effective decision making and implementation.

Success of project

Highly Successful	Successful	**Partially Successful**	Failure
		√	

Reason(s) for success/failure:

- Early re-introductions of EBBs failed due to a combination of the presence of the introduced red fox, overgrazing by native and exotic herbivores, and persistent drought.
- Mt. Rothwell and Hamilton Community Parklands have remained fox free and have been successfully managed to maintain healthy EBB populations. Both are now considered to be at carrying capacity and new release sites are sought.
- The long term captive breeding program for the EBB has been intensively managed to maintain reproductive fitness and genetic diversity.
- Strong relationships between different partners in EBB conservation have been imperative for the survival of this species.

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