Global Re-introduction Perspectives: 2016

Case-studies from around the globe

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IUCN/SSC Re-introduction Specialist Group (RSG)

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Cover photo: Clockwise starting from top-left:
i. Bolson's tortoise, USA @ Turner Endangered Species Fund
ii. Wetapunga, New Zealand @ Richard Gibson
iii. Morelos minnow, Mexico @ Topiltzin Contreras-MacBeath
iv. *Silene cambessedesii*, Spain @ Emilio Laguna
v. Tasmanian Devil, Maria Island, Tasmania @Simon DeSalis
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Re-introduction of eastern bettong to a critically endangered woodland habitat in the Australian Capital Territory, Australia

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Introduction

The eastern (or Tasmanian) bettong (*Bettongia gaimardi*) is a 1 - 2 kg mycophagous marsupial. Once common throughout south-eastern Australia, the species went extinct on the mainland by the 1930s due to fox (*Vulpes vulpes*) and cat (*Felis catus*) predation, habitat modification and human persecution (Short, 1998). Wild populations are now restricted to eastern Tasmania, and the species is listed as 'Near Threatened' by the IUCN (Menkhorst, 2008). This re-introduction was intended to re-establish bettongs on mainland Australia to stock future re-introductions. Two populations were established in the Australian Capital Territory (ACT), one as part of a captive-breeding program at Tidbinbilla Nature Reserve (TNR) (http://www.tidbinbilla.act.gov.au), and one as a wild population within the fox and cat free Mulligans Flat Woodland Sanctuary (MFWS) (http://www.mulligansflat.org.au). The MFWS is part of a larger woodland restoration project which aims to restore ecological function to a critically endangered woodland ecosystem, including research focused on the species' role as an 'ecosystem engineer' (Manning *et al.*, 2011 & Shorthouse *et al.*, 2012 http://www.mfgowoodlandexperiment.org.au).

The re-introduction was undertaken through a partnership between the ACT Government, the Australian National University, CSIRO, and the James Hutton Institute; with support from the Tasmanian Government, the Australian Research Council and the Woodland and Wetlands Conservation Trust.

Goals

- Goal 1: Establish two geographically isolated, healthy and genetically diverse populations in the ACT to provide a sustainable source for future re-introductions on the mainland, and provide insurance in case of further declines in Tasmania.
- Goal 2: Develop trapping and translocation protocols that minimize the risks to source population, and maximizes the probability of long-term persistence in re-introduced populations.
- Goal 3: Research the behavioral and biological responses to different re-introduction techniques and environmental conditions.
- Goal 4: Research the species' ecological function as an ecosystem engineer derived through its foraging and digging behaviors.
- Goal 5: Capture and maintain the genetic diversity present in the wild Tasmanian populations, whilst maintaining wild behaviors.

Success Indicators

- Indicator 1: A 75% survival rate of adults and pouch-young from acquisition in Tasmania to their arrival in the ACT.
- Indicator 2: A 75% survival rate during the initial 3 months post-release, and 80% per annum thereafter.
- Indicator 3: Reproductive activity in all surviving females within 6 months of release.
- Indicator 4: Population growth within both populations (no time limit placed on this due to the use of multiple translocation events over a prolonged period).
- Indicator 5: Maintenance of 95% of the genetic diversity present in founder population in both re-introduced populations after 2 generations.

Project Summary

Feasibility: As predation was recognized as the primary threat to re-introduction success, this project was initiated following the construction of the fox, cat and rabbit proof fence, and the eradication of foxes and cats from MFWS in 2009. The eastern bettong was selected as a priority species, due to its function as an ecosystem engineer, and the environmental suitability of habitat. The subfossil record confirmed historic accounts

Bettong © Stephen Corey, The Woodlands and Wetlands Conservation Trust

Box-gum grassy woodland © Philip Barton

that this species was previously present in the ACT. Environmental suitability was assessed through bioclimatic modeling and expert opinion. The arrangements for the project commenced in August 2010 when contact was established between the ACT's Conservation Research Unit, and the Tasmanian Department of Primary Industries, Parks, Water and Environment (DPIPWE). A license to undertake a sedation trial was granted in April 2011, then successive licenses for a trial translocation, and each collection trip until a total of 60 adults were translocated from Tasmania. Suitable source populations were selected from outside nature reserves and national parks.

To minimize the impact on source populations, the number of bettongs taken from any site was never more than one third of the number trapped. The trapping was targeted in 5 regions separated by geographic barriers. This protocol was based on a previous genetic study by DPIPWE that indicated some genetic differentiation either side of major rivers and between northern and southern Tasmania.

Implementation: In May 2011, a sedation trial was undertaken with four individuals to determine an appropriate dosage of the benzodiazepine diazepam for transportation. The aim was to establish a level of sedation that calmed the animal to reduce its flight response, whilst avoiding excessive sedation e.g. unconsciousness and the risk of an occluded airway. The bettongs used in the sedation trial were returned to the point of capture. In July 2011 three bettongs were translocated from Tasmania to the ACT to trial the translocation protocols. Once the translocation protocols were approved, an additional 57 individuals were translocated over three events between October 2011 and September 2012. In total, 60 adults (19 Male:41 Female) and 28 pouch-young were translocated to the ACT.

As this species is known to readily throw large pouch young when stressed, females observed to be carrying furred pouch young were excluded from the translocation. Females with an elongated teat were also excluded due to the likelihood that they had a dependent young-at-foot which was not trapped. Twenty -eight of the adults were housed permanently at TNR (captive group), 16 were temporarily housed at TNR for between 3 - 12 months before being transferred to

MFWS (delayed-release group), and 16 were released directly into MFWS within 24 hours of initial capture (immediate-release group). Twenty adults were also transferred from the captive group to MFWS during 2013 to manage the population density at TNR, and increase population growth at MFWS. The captive group and the delayed-release group underwent a 30 day quarantine period at TNR remote from other animals. All individuals underwent anaesthesia for complete health evaluation and disease screening upon arrival in the ACT. At TNR, all individuals were provided with their daily requirements of food and water, and mating interactions are controlled to ensure genetic mixing among individuals from the five collection areas. At MFWS the population received no supplementary resources, and mating interactions were not controlled.

Post-release monitoring: At TNR, capture events are scheduled every 3 months for each individual to conduct full health and physiological assessments. All founders were monitored using remote cameras when released at TNR to conduct behavioral assessments and to test protocols and equipment. Any new animals encountered are pit-tagged, and DNA samples are taken for genetic analysis. In November, 2014 the population at TNR was estimated to be 51 individuals. At MFWS, with the exception of one individual, every founder was fitted with a VHF or GPS/VHF radio-collar when released, and these were removed at approximately 1 year post-release. The remaining individual was not collared due to a neck injury. Each founder was monitored daily for the first 30 days, and then at least weekly until the collar was removed to evaluate survival using the radio-collar's mortality function. Each founder was scheduled to be trapped a 1, 3, 6, 9 and 12 months post-release and given full health and physiological assessments; however, the actual timing of these events varied due to logistic constraints. Fecal and hair samples were collected during health assessments for dietary and hormonal analyses (e.g. cortisol). Following the removal of all of the collars the population will be monitored at least annually using Capture-Mark-Recapture. Any new animals encountered are pit-tagged, and DNA samples are taken for genetic analysis. In November, 2014 the population at MFWS was estimated to be 179 individuals. The DNA samples taken from both populations are being analyzed to assess genetic diversity and genetic progression.

Major difficulties faced

- Two pouch-young died after being evicted from the pouch either in the trap, or during trapside handling in Tasmania. The risk to the pouch-young was significantly reduced through changes to trapping protocols such as clearing traps before midnight, and approaching the trap rapidly. Four additional adults died within 1 month of release at MFWS due to pre-existing health conditions or misadventure with radio collars. The design of the collars was modified in-house to reduce the risk of future collar in response to these incidences of misadventure.
- Lower than expected capture rates at certain locations in Tasmania. This was attributed to lower than expected population densities at these locations. This impacted on the ability to obtain the desired number of founders especially given one-third harvesting rule, the exclusion of females with large pouch-

Staff undertaking fieldwork © Stephen Corey, The Woodlands and Wetlands Conservation Trust

young and young-at-foot, and the desired 2:1 sex-ratio. We improved the efficiency of subsequent events by undertaking prospective surveys.

- Difficulty designing and fitting radio-collars that did not cause injury or interfere with foraging ability. Multiple prototypes were tested at TNR to identify a suitable design and fitting method.
- Logistic difficulties relating to the translocation of wildlife interstate. Obtaining the relevant approvals and licenses was a lengthy process and required a long lead-in time for the project.
- Releasing bettongs at MFWS impacted on other on-site management activities at MFWS. For example, the presence of bettongs made broad-scale poisoning and trapping unacceptable options for controlling rabbits and resulted in the use of less cost efficient methods.

Major lessons learned

- Baseline health and disease data were determined for this species and can be used for the conservation management of the source and translocated populations. Administration of diazepam at 1 mg/kg appeared to effectively mitigate the effects of capture myopathy.
- Trapping, transport and monitoring protocols must be specifically designed, and tested within an adaptive and experimental frameworks. Without pre-release trials the probability of success would have been substantially reduced. Many of these trials would not have been possible without access to the captive facilities at TNR. All individuals fitted with radio collars must be regularly captured to reduce the risk of injury.
- The probability of successful establishment is high when this species is released into suitable, fenced and predator-free environments following the protocols developed during this project. The risk of inbreeding can be considered low given the high rates of pouch-occupancy, and lack of genetic assortment at MFWS.
- Uninjured pouch-young can be successfully taped back into the pouch, or alternatively hand-raised and returned to the wild following a pouch-eviction.

Wild founders can also perform favorably when released after a temporary period in captivity for quarantine.

- Wild-sourced bettongs assimilate well into captivity, but with supplementary feeding captive bettongs have shown a tendency to become overweight. Quantity of food, animal condition and stress needs to be monitored as it may impact on the breeding success.

Success of project

Highly Successful	Successful	Partially Successful	Failure
√			

Reason(s) for success/failure:

- All indicators of success relating to survival and reproduction were met or exceeded in both populations. This can be attributed to the development and testing of management protocols with adaptive and experimental frameworks. As of November 2014 the ACT population was estimated to be 230.
- The successful establishment of population at MFWS indicates that the habitat at the site can be considered as high quality for this species. The environmental characteristics that are assumed to have contributed to success include the absence of foxes and cats, and the abundance and diversity of vegetation and mycorrhiza.
- The successful collaboration of multiple stakeholders including government, academic and community organizations. The group also included experts from diverse array of disciplines including scientist, wildlife veterinarians, captive breeders, and environmental practitioners. Those involved shared a willingness to adopt adaptive approaches to problem-solving which was critical to success.
- Housing animals in specialized captive facilities enabled quarantine, and equipment trials to be conducted within a controlled environment before conducting large translocations and releases into the unmanaged site. This reduced the risk of post-release mortality and disease/pathogen/parasite co-introductions.

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