Factors influencing the reintroduction success and population persistence of brushtail possums (*Trichosurus vulpecula*) in a semi-arid environment

Completion report

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Abstract

After a 70 year absence, brushtail possums were reintroduced to the Ikara-Flinders Ranges National Park, following a successful fox control program. Several studies were undertaken to assess factors influencing reintroduction success and population persistence. Reintroduction success was not influenced by release method or source population (predator-exposed v predator-naïve). Population persistence appears possible as possums found suitable shelter and food, and juvenile survival was moderate. Continued predator management is likely to be key to the long-term persistence of the population, with predation by feral cats the primary cause of death for both adults and juveniles.

Introduction

Brushtail possums (*Trichosurus vulpecula*) have shown a marked range contraction over the past 200 years, particularly in arid and semi-arid areas, where they have become locally extinct over much of their historical range (Kerle *et al.* 1992; Kerle 2004). Brushtail possums were last present in the Ikara-Flinders Ranges National Park (IFRNP) in the 1940s (Tunbridge 1991). The reversal of several threatening processes as part of the *Bounceback* program (Natural Resources SA Arid Lands 2012), particularly the ongoing control of foxes, provided an opportunity to reintroduce brushtail possums to the park in an attempt to expand the possums' current range and restore ecosystem function to the park. Reintroductions, however, are often unsuccessful (Fischer and Lindenmayer 2000; Short 2009). Avoiding predators and finding suitable food and shelter is essential, and population persistence must be achieved by having juveniles survive to reproduce.

The use of delayed ("soft-release") methods such as temporary containment at release sites or the provision of supplementary food has shown to be beneficial for some translocations (Boutin 1990; Hamilton *et al.* 2010) but not others (Hardman and Moro 2006; Short 2009). The suitability of founding populations to the environment at release sites is an important factor. Prey naiveté is a common feature among Australian mammals (Banks and Dickman 2007), and populations that have been isolated from predators may be more naïve than those from areas where introduced predators are present. The choice of source population may therefore have an influence on the success or failure of a reintroduction. By addressing these issues, future reintroductions benefit from the insights gained.

The suitability of release sites for the species being translocated is another important consideration when planning for a successful reintroduction. Sufficient food, shelter and conspecifics should be present. However, it is not possible to meet these requirements if they remain relatively unknown, as is the case for brushtail possums in semi-arid environments. Habitat and diet requirements for brushtail possums vary greatly depending on the environment

they are found in (eg. Clout and Gaze 1984; Foulkes 2001; Cruz *et al.* 2012). A reintroduction should be viewed as an opportunity to test hypotheses regarding habitat requirements and reintroduction methods (Soderquist 1995). Finally, the feasibility of long-term persistence can be assessed by monitoring the survival of juveniles and determining whether they are able to successfully reproduce.

The aims of this research were to identify factors that may influence the reintroduction success and population persistence of brushtail possums in the Ikara-Flinders Ranges National Park. This was achieved by testing various release techniques, assessing the antipredator behaviour of two source populations (one with and one without mammalian predators) prior to and after translocation, monitoring the habitat use and diet of translocated possums and studying the movement and survival of juvenile possums.

Materials and methods

Seventy-nine brushtail possums were translocated from the fenced Yookamurra Wildlife Sanctuary to the Ikara-Flinders Ranges National Park (IFRNP) in June 2015. Forty-eight possums were radio-collared. In May 2016, another 50 possums were translocated from Yookamurra Wildlife Sanctuary to IFRNP (10 radio-collared), and 19 possums were translocated from the southern Flinders Ranges to IFRNP (10 radio-collared, Fig. 1).

Three release techniques were tested—delayed release, nest-box release and immediate release, and the body mass, post-release movements, reproduction and survival of possums in each treatment group was compared over a 3 month period after release.

The behaviour of possums at Yookamurra Wildlife Sanctuary, where mammalian predators are excluded via a floppy top fence, and the southern Flinders Ranges, where introduced cats and foxes are present, was compared prior to translocation using a variety of tests including their response to spotlighting, habitat use, trap success, behaviour at supplementary feeders and predator scent aversion. The survival of 10 radio-collared animals from each group was compared after their translocation in 2016.

Habitat use was monitored by radio-tracking collared possums to their shelter sites and recording various features. Scats were collected from captured possums and were assessed for dietary content; direct foraging observations were also occasionally undertaken at night. Vegetation surveys were conducted monthly to determine whether dietary items were consumed in their available proportions.

Thirteen adult female possums were radio-collared for 22 months and each of their successive offspring was collared during the study period. The growth, movement and survival of the juveniles was monitored until they either died or reached adulthood.

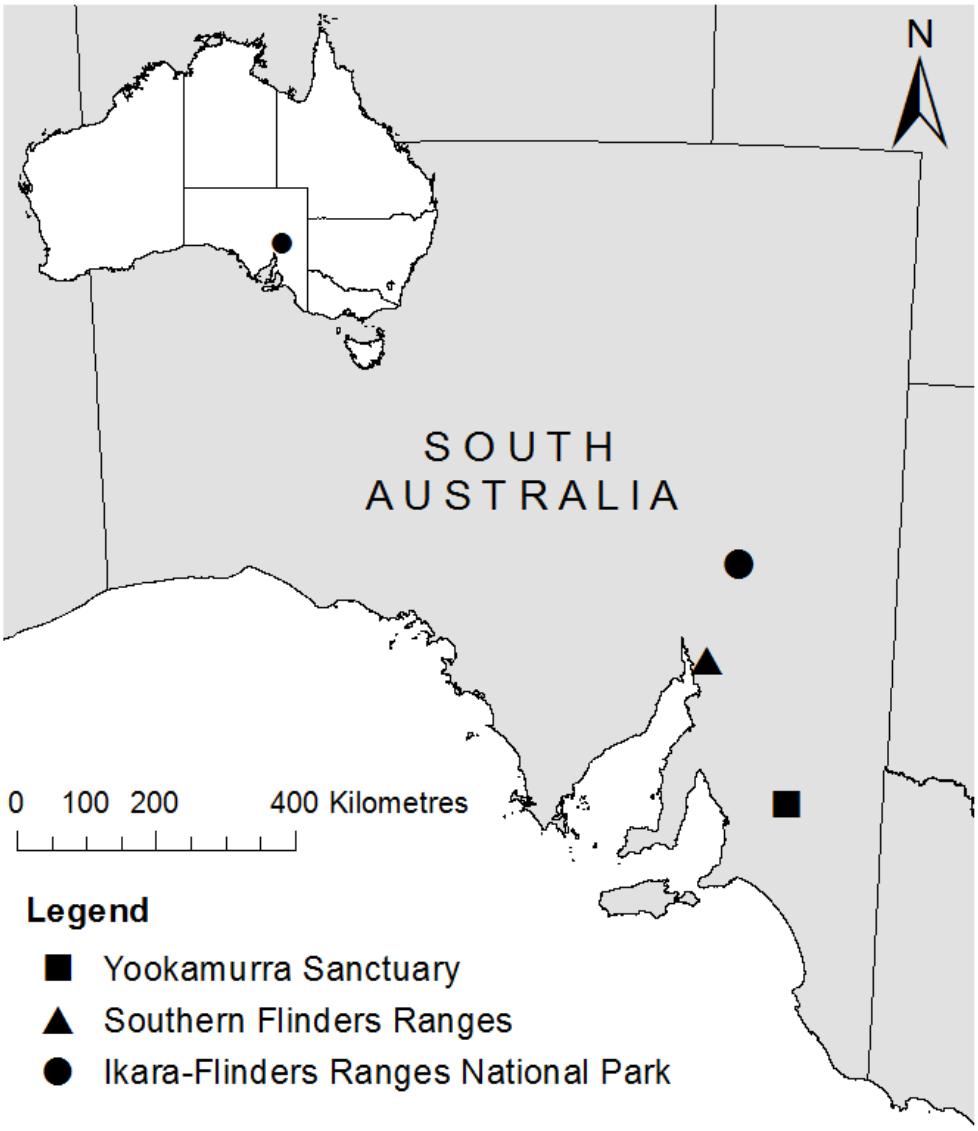

Figure 1: The location of source populations (Yookamurra Wildlife Sanctuary and southern Flinders Ranges) and the reintroduction site (Ikara-Flinders Ranges National Park). The general location within Australia is also shown.

Results

Possums in all three release treatments lost weight after release, but eventually regained it. Release method had no effect on body mass, reproduction, survival or post-release dispersal distance, but possums that underwent a delayed release took significantly longer to settle into a stable range.

Predator-exposed possums in the southern Flinders Ranges showed significantly better antipredator responses than predator-naïve possums found at Yookamurra Wildlife Sanctuary. In addition, they were difficult to trap and handle and showed an aversion to foreign objects (neophobia). This did not translate to a survival advantage, with high survival of both source populations after release.

Possums mostly used eucalypt tree hollows (*Eucalyptus camaldulensis* and *E. intertexta*) for diurnal shelter after release, occasionally using rock crevices, hollow logs, *Callitris* hollows

and rabbit warrens. They were found foraging in eucalypts (including mallee spp.), acacias and native pines (*Callitris* sp.), but were also observed consuming small annual species on the ground.

Adult females raised/gave birth to up to 5 joeys each during the study period. Data were collected for 40 juveniles, 26 of whom were radio-collared. Juvenile mortality was 42% and most deaths were a result of predation by feral cats. Several mothers were also killed by feral cats during the study period. Possums showed male-biased dispersal, with males dispersing 15x further than females, who established a range adjacent to their mother. Survival during the male dispersal phase was 100%. The survival of juveniles was not significantly different to the survival of adult females.

Discussion

In a fox-controlled environment, alternative release methods and predator-exposed source populations may not be essential for a successful brushtail possum reintroduction. Had foxes been present at the release site, these recommendations would likely be different, as predation by foxes has been a problem for previous brushtail possum translocations (Pietsch 1995; DEC 2012; May *et al.* 2016). We found that the habitat use and diet of brushtail possums did not differ to what was expected based on limited previous arid zone studies (Evans 1992; Foulkes 2001), although a more detailed diet analysis is still underway. Feral cats were identified as the key threat to both adult and juvenile survival. Ongoing management, in addition to continued fox control, is required to enable a high enough proportion of juveniles to survive to adulthood. In contrast to other studies, we did not find dispersal to be risky phase, with all males surviving long-distance dispersal (Byrom and Krebs 1999; Avril *et al.* 2012). At the current rate, persistence is likely given the high reproductive output of females. Release site characteristics including predator control and the widespread availability of food and shelter has likely been the reason that the reintroduction of brushtail possums to the IFRNP has met medium-term reintroduction success, and if these characteristics can be maintained then long-term persistence of the population may be possible.

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