Science for Saving Species

Research findings factsheet

Project 3.2.2.1

Threatened Species Recovery Hub

National Environmental Science Programme

Using reintroductions and long-term monitoring to unravel causes of decline and extinctions of threatened mammals

In brief

This project trialled the reintroduction of 28 southern brown bandicoots (eastern subspecies) *Isoodon obesulus obesulus* and 60 eastern quolls *Dasyurus viverrinus* to Booderee National Park between 2016 and 2019.

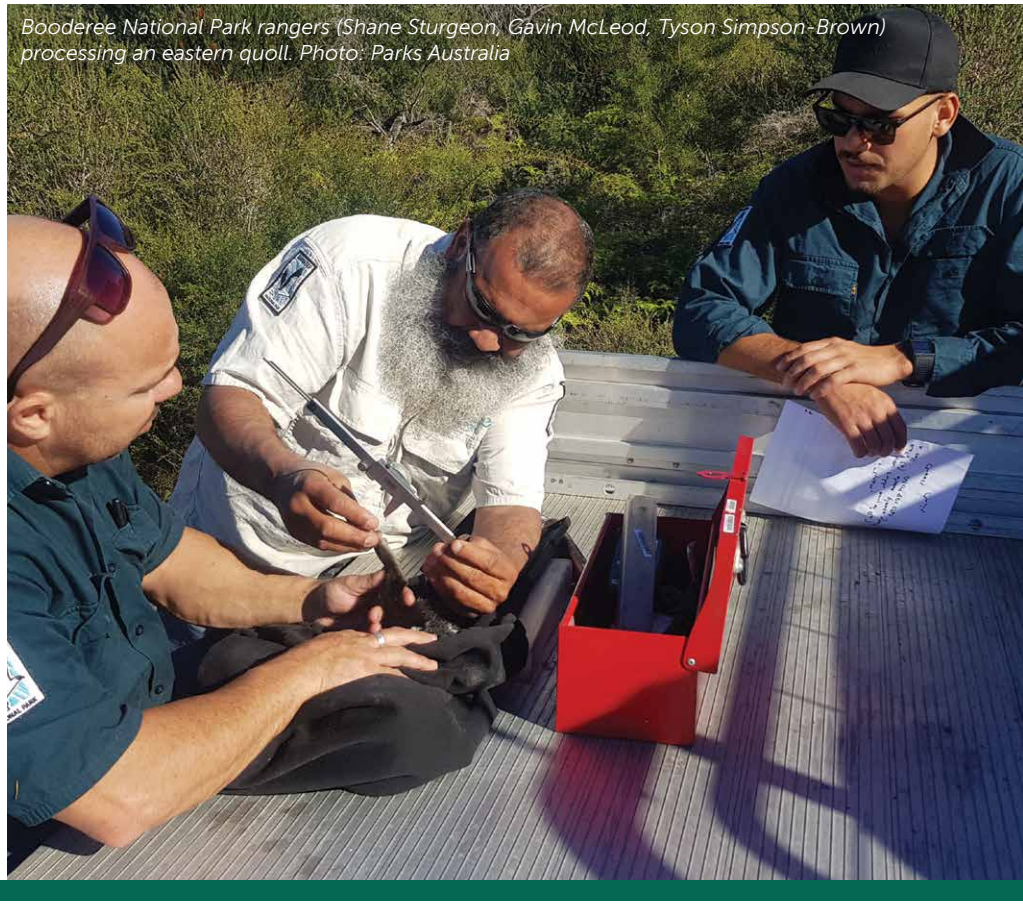
Careful monitoring allowed adaptive management of threats as they emerged and new ecological insights that will benefit the planning of future reintroduction programs.

Southern brown bandicoots preferred heath and woodland vegetation communities over the more widespread forest community. Future reintroductions of bandicoots should release individuals into these preferred habitats. Male bandicoots have larger spatial requirements than female bandicoots. Releases of male bandicoots should allow for adequate distance between other males to minimise antagonistic behaviour and overdispersal of subordinate males.

The founder bandicoot population has good genetic diversity. However, if future supplementation is required, individuals from the Melbourne region would yield the greatest increase in genetic diversity. Maintaining good genetic diversity is important for the long-time viability of the population.

Translocated captive-bred predators are less skilled at hunting than wild-born predators. With this in mind, we provided supplementary feeding stations for reintroduced captive-bred eastern quolls. Monitoring revealed that the quolls used these feeding stations but in addition were able to forage for food in the wild. Their diet was diverse, including mammals, reptiles, birds, frogs, invertebrates and fish.

Predation (by foxes and dogs) and being hit by cars emerged as the greatest threats to reintroduced quolls. In response to these findings, park management and reintroduction strategies were adjusted; this included translocating animals to areas with less traffic, and increasing already substantial monitoring and control for foxes and installing road signs to increase awareness of quolls in the park.



Booderee National Park rangers (Shane Sturgeon, Gavin McLeod, Tyson Simpson-Brown) processing an eastern quoll. Photo: Parks Australia

Australian National University · Australian Government Parks Australia · Booderee National Park · Taronga Conservation Society Australia · WWF · Devils@Cradle · Trowunna · AussieArk · Forestry Corporation · Tasmanian Quoll Conservation Program

Background

Reintroductions are increasingly being used as an effective way of re-establishing locally extinct or declining faunal populations. However, the chances of successful establishment of reintroduced species are often low due to incomplete knowledge of the factors that influence successful outcomes of survival and establishment.

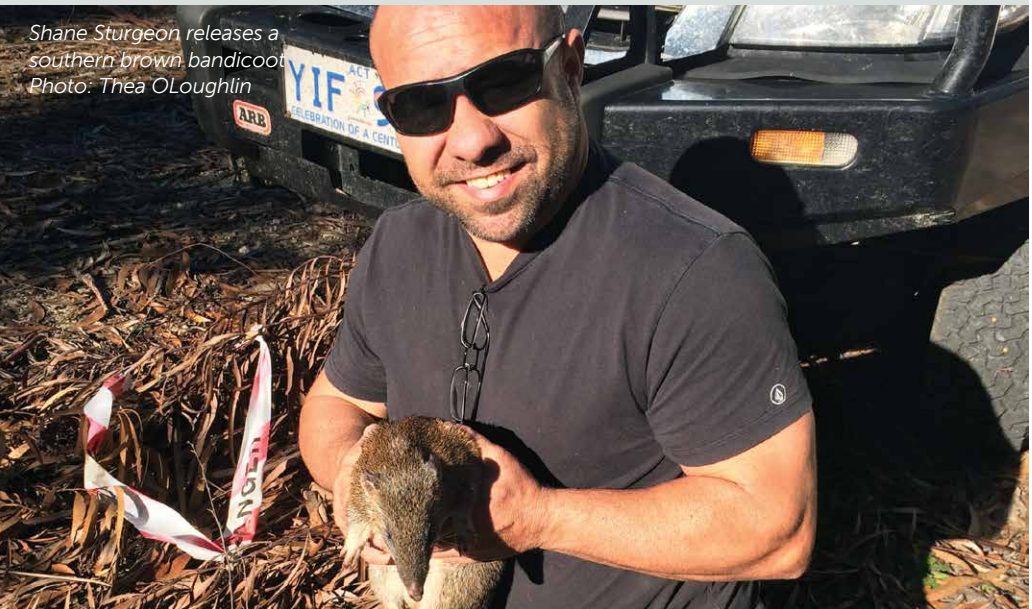
Well-designed and monitored reintroductions can provide insights into the original causes of species decline and local extinction, current threats to their re-establishment, and what the species need to survive and persist in the contemporary environment.

Key to improving the success of reintroductions are careful consideration of threats, identifying and reducing those threats, and monitoring; and then making improvements to management from what is learnt from these actions.

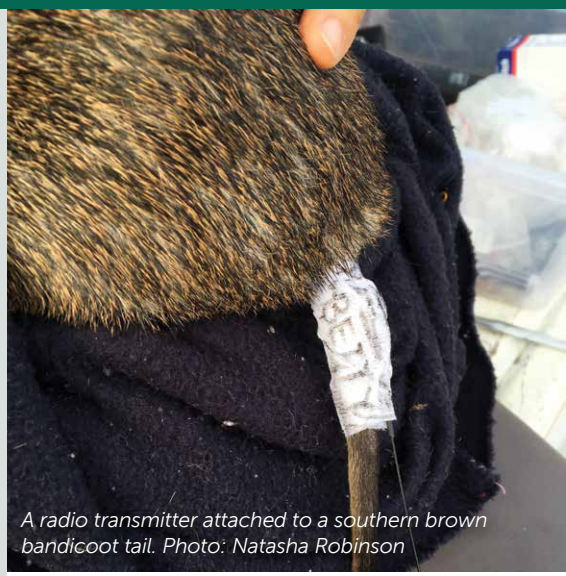
Genetic diversity is an important consideration in reintroductions. Research shows that genetic diversity is not well integrated into reintroduction. Concerns for adverse outcomes such as mating between closely related individuals (inbreeding) or mating between genetically different individuals (outbreeding) both cause a decline in fitness. However, the latter is generally overstated. Reintroduction programs benefit from using source populations with healthy genetic diversity. Supplementing individuals with high genetic diversity relative to the founder population can maintain or augment the genetic diversity of the ongoing population. We went through a process of planning, implementing and reviewing the reintroductions of southern brown bandicoots (eastern subspecies) *Isoodon obesulus obesulus* and eastern quolls *Dasyurus viverrinus* to Booderee National Park between 2016 and 2019.

Both southern brown bandicoots and eastern quolls are nationally threatened ground-dwelling small to medium-sized marsupials. The two species were common in the area before their local extinction in the early 1900s.

Foxes pose a serious threat to both species. Booderee National Park has conducted intensive fox control since 2003. The park is unfenced and co-managed with the local Indigenous community, the Wreck Bay Aboriginal Community.



Shane Sturgeon releases a southern brown bandicoot. Photo: Thea OLoughlin



A radio transmitter attached to a southern brown bandicoot tail. Photo: Natasha Robinson

Main aims of research

The research aimed to:

- trial the reintroduction of southern brown bandicoots and eastern quolls to Booderee National Park
- monitor the survival, dispersal, diet, genetic diversity, breeding, body condition and habitat preferences of the animals released
- test management strategies and make improvements to the reintroduction program (e.g., release methods, supplementary feeding, timing of release)
- measure genetic diversity of the southern brown bandicoot founder population, simulate change in genetic diversity from supplementation of this population from other source populations and provide recommendations for suitable source populations for future genetic supplementation of the population
- understand any risks that either species might pose to other species in the park, for example, the possibility that eastern quolls could threaten southern brown bandicoots via predation.

What we did

This project was a collaboration between Parks Australia, the Australian National University, Wreck Bay Aboriginal Community, Taronga Conservation Society, Forestry Corporation of NSW, Rewilding Australia and WWF Australia.

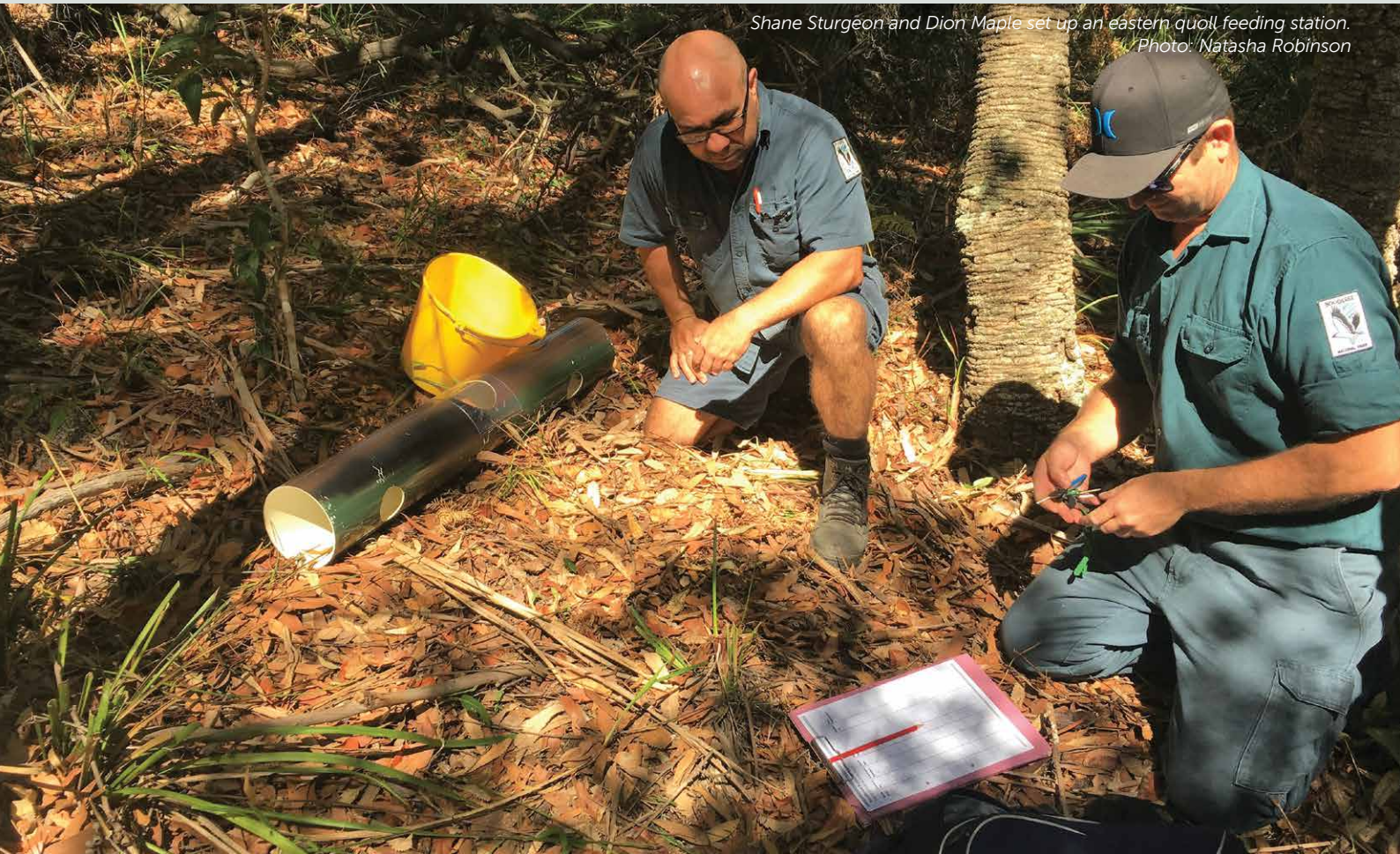
The southern brown bandicoots were sourced from the nearest viable wild population, in New South Wales, from state forest around Eden, around 250 km south of Booderee National Park.

Over three years we caught and released 28 wild southern brown bandicoots: 2016 (11 individuals), 2017 (12 individuals) and 2018 (5 individuals). The release locations were approximately evenly distributed between three primary vegetation types assessed as suitable habitat: heath, woodland and forest. Post-release monitoring revealed that bandicoots preferred heath and woodland over forest.

We sourced the eastern quolls from three captive-breeding sanctuaries: Devils@Cradle, Trowunna and Aussie Ark. Sixty captive-bred eastern quolls were released over two years: 20 individuals (10 male, 10 female) in 2018 and 40 individuals (21 male, 19 female) in 2019. Quolls were transported by air and land vehicle to Booderee National Park.

For both species of reintroduced animal, the research team monitored survival, dispersal, habitat preferences, body condition, breeding, genetic diversity and diet. We investigated the diet of reintroduced eastern quolls by collecting scats and analysing their contents. We also took ear biopsies of all individuals of both species released to assess genetic diversity.

We monitored the movements of translocated animals via GPS and or VHF transmitters. We mounted VHF transmitters on the tails of southern brown bandicoots; and monitored animals day and night for four weeks from the initial release date. Quolls had GPS/VHF collars. We tracked the quolls daily for four weeks then two to three times per week for up to three months post-release. Both methods allowed us to monitor survival, movement and habitat use of the animals. In addition, we used cameras to detect individuals and visually check their health, and cage-trapping to physically check health (e.g., for body weight and parasite load) and breeding status (checking for pouch young).



Shane Sturgeon and Dion Maple set up an eastern quoll feeding station. Photo: Natasha Robinson

Key findings

Our findings contribute new knowledge about how to improve translocation methods for these two nationally endangered small mammals, and by extension to other species.

Reintroduced southern brown bandicoots and eastern quolls survived and successfully bred in the park. Offspring were captured before their natal dispersal. The founding populations of the two species are still small. Ongoing monitoring and management will be required to help ensure these species remain in the park over the long term.

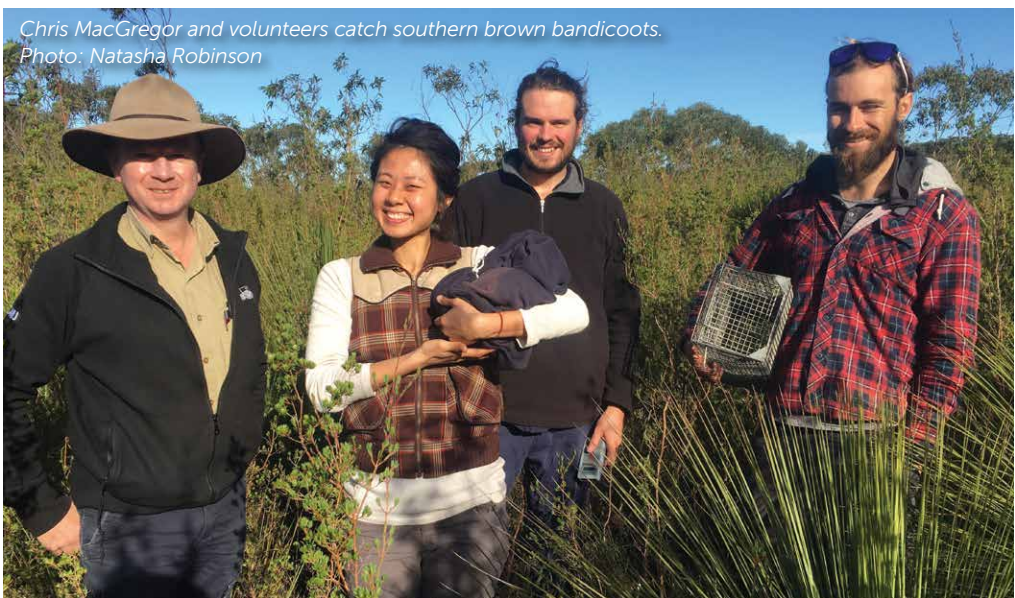
We found that reintroduced bandicoot males dispersed twice as far as females, but that the home ranges of the sexes were similar in size. We also found that bandicoots preferred heath and woodland vegetation communities and avoided forest. Our monitoring revealed that eastern quolls rarely use the same habitat as southern brown bandicoots. The different habitat preferences of the species indicates that the threat of eastern quolls predating on bandicoots is minimal.

Predation by the introduced red fox was a known threat to translocated eastern quolls. Parks Australia implement intensive fox control. However, even low densities of foxes (and dogs) can be problematic. Monitoring revealed predation and vehicle collisions to be a major threat to translocated quolls. Targeted monitoring allowed us to quickly identify these threats and to revise and adapt mitigation strategies for them. Founder quolls have bred each year since their release.

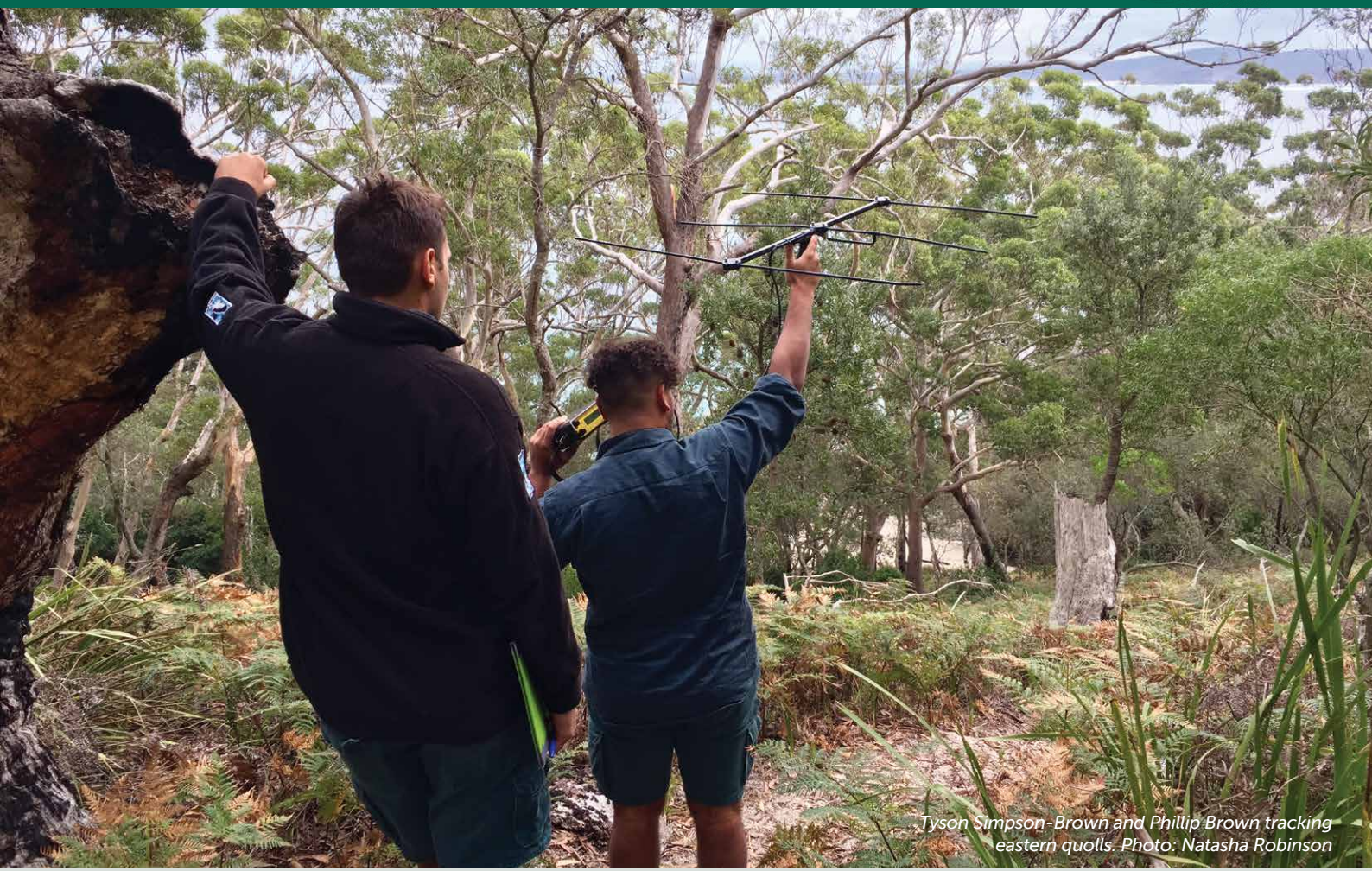
The southern brown bandicoot founder population at Booderee National Park had good genetic diversity relative to other populations across their range. We used genetic data from different potential source populations to simulate supplementation scenarios and the resulting genetic diversity within the Booderee population. This modelling identified the Melbourne region population as the most suitable future source of bandicoots; supplementation of individuals from this source population would yield the greatest increase in genetic diversity within the Booderee bandicoot population.

Translocated captive-bred predators are less skilled at hunting than wild-born predators, and therefore more prone to starvation post-release. Knowledge of the diet and foraging behaviour of the translocated captive-bred eastern quolls was therefore an important consideration in their reintroductions. We found that the diet of the translocated eastern quolls in Booderee National Park includes a variety of prey: small mammals, birds, invertebrates, fish, reptiles and frogs. Eastern quolls also consumed larger mammals (e.g., macropods); however, this was likely quolls consuming macropod carcasses that were provided at feeding stations and scavenging from other sources. The quolls used the supplementary feeding stations, indicating that this may be an important strategy to assist with their establishment in the wild. Quolls also foraged freely and we observed them hunting small prey, for example, insects.

Evolutionary theory was used to investigate the survival, dispersal and change in body condition of reintroduced eastern quolls. Theory was found to make useful predictions. Smaller quolls were found to disperse further than larger quolls, in support of the "social subordinate" hypothesis. Female quolls had marginally higher rates of survival than males, and regained body condition following release; this supports the senescence (or ageing) theory, which predicts that ongoing survival and body condition are influenced by evolutionary drivers (e.g., factors that maximise breeding potential). Evolutionary theory was found to be useful for predicting translocation outcomes. More informed predictions can improve the design of future releases and improve the likelihood of successful outcomes.



Chris MacGregor and volunteers catch southern brown bandicoots. Photo: Natasha Robinson



Tyson Simpson-Brown and Phillip Brown tracking eastern quolls. Photo: Natasha Robinson

Implications

Good planning, monitoring, communication, engagement and responsive management are essential for reintroduction success. Our team conducted a thorough review of threats before releasing animals, found ways to lessen those threats, and monitored the outcomes. The team was also able to quickly respond to unforeseen threats. Good communication and engagement with the community and stakeholders ensured that the program was supported by the local community, and the knowledge gained and shared will be applied to future translocations.

Knowledge of the foraging and hunting behaviour of the eastern quolls will be important for evaluating habitat suitability for future translocations and management.

The findings about the habitat preferences of the southern brown bandicoots point to a recommendation that future bandicoot reintroductions to Booderee National Park take place within areas of heath and woodland, and that future releases consider the potentially larger spatial requirements that male bandicoots have, including their need to be able to avoid each other.

Future translocations and ongoing management of eastern quolls at Booderee will benefit from the knowledge gained about the main threats to their persistence. Ongoing introduced predator control and minimising quoll–vehicle interactions will be integral to supporting the species' persistence in the park.

As our findings support evolutionary theory, it leads us to recommend that theory be better integrated into translocation planning as it can help make more informed predictions, and that translocation programs be adapted accordingly.

Finally, genetic diversity is an important consideration in reintroductions. Our genetic research with the southern brown bandicoots at Booderee will enable managers to make informed decisions about how to maximise the long-term persistence and genetic diversity of reintroduced populations.

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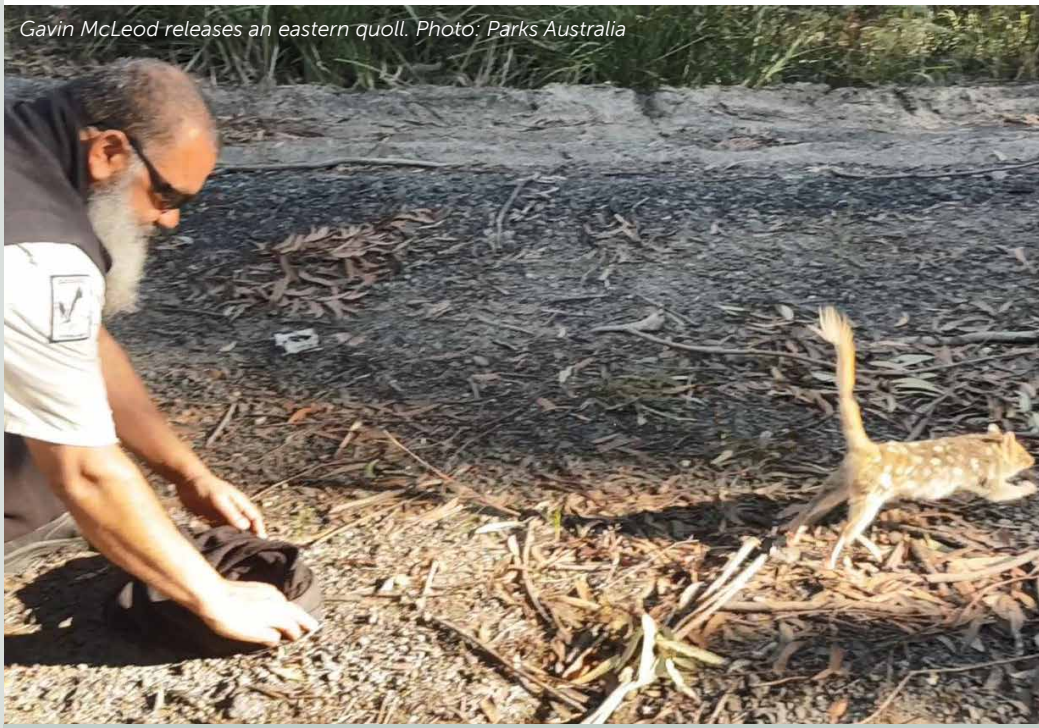
Eastern quoll in trap. Photo: Natasha Robinson



Gavin McLeod releases an eastern quoll. Photo: Parks Australia

Further Information

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