National Landcare Program

Project TSRF 01: Gilbert's potoroo –

Establishing a new insurance population of the world's rarest marsupial

Report on the first trial translocation of Gilbert's potoroo to Middle Island, July-August 2017

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Cover photo: Corey Mosen https://coreymosen.wixsite.com/naturephotography

Summary

Gilbert's Potoroo Action Group was awarded a grant of $250,000 under the Commonwealth's Threatened Species Recovery Fund for the establishment of a new insurance population of Gilbert's potoroos, on Middle Island in the Archipelago of the Recherche. The funding is to support a project over 17 months commencing in May 2017. This project is being run in collaboration with DBCA.

An approved translocation proposal outlines a two-stage translocation where progress to the second stage depended on the results of two trial translocations, the first in winter and the second in late summer. The criteria for success for each translocation require a) survival of 75% of the translocated individuals after four weeks and b) return to within 10% of release weight after four weeks by all surviving animals.

The winter trial translocation began in July 2017. The group of four potoroos to be used in the trial comprised a male and a female sourced from the Ryedene farm enclosure and a male and a female from the Waychinicup enclosure. These individuals were taken on 3rd July by road to Thomas River then to Middle Island via helicopter. All of the potoroos were fitted with tail transmitters and three also had GPS units attached. Three field trips of up to a week allowed close monitoring of the animals during the four-week trial. The potoroos were radio-tracked every day the team was on the island and attempts were made to trap them each week.

Potoroos Male 428 and Female 395 were released on the west side of Middle Island, on the major granite ridge south of Flinders Peak. M428 remained on the side of Flinders Peak on the granite soils. F395 moved into another gully near Flinders Peak and then moved to M428's area and settled there for the remaining time.

M332 and F216 were released at a site on the east side of the island where there was some granite but mainly sandy soils related to limestone nearby. When captured after a week both had lost a significant amount of weight, so they were brought back to camp, held overnight in cage traps and provided with food. The intention was to release both animals on the west side the following day. However F216 died overnight. A post-mortem showed that she had several pre-existing pathogenic conditions that could have contributed, but none alone was serious enough to cause her death. M332 was released on the west side of the island and moved well south of the other two, where he remained.

All potoroos were readily trapped at approximately weekly intervals during this trial enabling their weight changes to be monitored regularly. Although all lost some weight initially, at the end of four weeks M332 and F395 were heavier than at release and M428 was just 2% below his release weight. The results of the winter trial thus met the criteria for success and the movement data from radio-tracking and the GPS units indicated that the granite habitat was preferred by the potoroos.

The three potoroos were removed from Middle Island on 3rd August. Male 332 was released into the Waychinicup enclosure and male 428 and female 395 into the Ryedene enclosure.

Eighteen scat samples collected from potoroos trapped on Middle Island during the trial were analysed by mycologist Neale Bougher. He found that one scat sample had spores from 16 different fungal species, comparing well with results from Two Peoples Bay and Bald Island. Some of the potoroos were found to be eating epigeal (above-ground) fungi as well as hypogeal (truffle-like) fungi however, which may indicate that the more nutritious hypogeal fungi were difficult to find initially.

The success of the winter trial meant that the summer trial would go ahead. Given the success of the winter trial, the Gilbert's Potoroo Recovery Team supports leaving the four summer trial potoroos on Middle Island if the success criteria are also met for that trial. Given approval, the full translocation would go ahead in July. It would cause less stress to the animals to leave those four on the island and bring over six additional animals to provide the 10 founders proposed for the full translocation.

Introduction

A project to establish an insurance population of the critically endangered Gilbert's potoroo *Potorous gilbertii* on Middle Island in the Recherche Archipelago Nature Reserve on the south coast of Western Australia, was adopted for funding late in 2016 under the Federal Government's Threatened Species Fund, through the Gilbert's Potoroo Action Group (GPAG). Funding was made available for the period May 2017 to September 2018. A Memorandum of Understanding was established between the Department of Biodiversity, Conservation and Attractions (DBCA) and GPAG under which GPAG would forward all project funding to DBCA and DBCA would carry out the project activities and forward required reports to GPAG for submission.

Middle Island is well east of any historic occurrence of the species so a cautious approach was taken in the design of the project. Seasonal habitat assessment visits were proposed as well as two trial translocations in which four potoroos would be released for four weeks onto the island. A trial in winter, when fungal sporocarps might be expected to be most plentiful, would be undertaken first, in July-August 2017. If the success criteria were met, a second trial, in late summer, would follow. A translocation proposal (Friend and Utber 2017) was submitted and approved in June 2017. The TP proposed that if the success criteria were met in both trials, a full translocation would proceed, with up to 10 animals to be released in winter 2018.

The success criteria for each trial translocation were:

- At least 75% of trial animals are alive after four weeks, and
- All surviving trial animals captured after four weeks are within 10% of release weight.

This document reports on the outcome of the winter trial translocation, carried out in July and August 2017.

All translocation and monitoring methods follow standard operating procedures approved by the DBCA Animal Ethics Committee or specific practices approved under the DBCA AEC project 2015-55 "Recovery of Gilbert's potoroo".

Capture

Two potoroos (male 332 and female 216) were captured from the Ryedene Farm enclosure on 13th June and brought into the captive facility at Two Peoples Bay. Two potoroos were caught in the Waychinicup enclosure and brought into captivity: female 395 on 15th June and male 428 on 20th June. These animals were kept in separate pens and treated for internal and external parasites to reduce the chance of pathogenic organisms being introduced to Middle Island, where a natural population of tammars *Notomacropus eugenii* exists. They were fed on an artificial diet developed previously for holding Gilbert's potoroos in long-term captivity for captive breeding purposes and consisted of fruit, vegetables, mushrooms, nuts, cereals (Farex), mealworms and some native and introduced truffle-like fungi. The parasite treatment involved external application of Revolution® for ectoparasites and subcutaneous injection of Ivomec® for endoparasites.

In order to minimise stress the animals were not captured in their pens for examination prior to the translocation day. Most were rarely seen and the principal means of monitoring them was by food

consumption. The one animal seen more often was F216, who had been in close captivity as a young animal and had become fairly relaxed in the presence of humans. All four potoroos ate well during the period of captivity, with the exception of F216 in the 5-7 days before translocation, when her food consumption declined. As this occurs from time to time with some animals, it was not seen as a serious issue at the time.

Release

The four potoroos were captured in their pens at Two Peoples Bay on 3rd July 2017 for transport to Middle Island. They were all fitted with tail transmitters and three (M332, F395 and M428) were also fitted with GPS loggers. Transmitters and loggers were taped in a single package at the base of the tail. The animals, in individual black cotton drill bags, were placed in two pet packs each containing a male and a female. They were transported by road in the passenger compartment of a 4WD vehicle from Two Peoples Bay to Thomas River, Cape Arid NP, arriving at 1500 in the afternoon. Here they were transferred to a helicopter and flown 30 km to Middle Island. After a brief landing at the campsite, the helicopter flew two potoroos (M428 and F395) to a release site in vegetation on top of the granite ridge of Flinders Peak, south of the summit. The other two potoroos (M332 and F216) were then flown to a release site near a granite outcrop near the eastern end of the island. Both pairs of potoroos were left in their pet packs for 30 minutes to calm down before release into nearby scrub, at around 1600.

Monitoring methods

The monitoring regime on the island involved radio-tracking, GPS logging, trapping and dietary analysis from scats collected from cage traps. A monitoring team was on the island from 3rd to 10th July, 17th to 24th July and 31st July to 3rd August. Tim Button led all monitoring trips.

Radio-tracking

Each potoroo was fitted with a Sirtrack ZV2T 123A tail mount transmitter weighing 8-9 g, with a rated life of 83 days and featuring activity and mortality options. Radio-collars cannot be used on Gilbert's potoroos due to the risk of forelimb entrapment. The small roughly cylindrical transmitter has a whip aerial 200mm long and is taped with Leucoplast tape along the potoroo's tail near the rump so that the aerial hangs freely parallel to the tail. With this type of attachment, the transmitter drops off at between four and eight weeks after deployment, depending on weather and vegetation density, amongst other factors. Once the transmitter drops off (or the animal dies) and remains stationary for 6 hours the signal goes into mortality mode (a faster signal at 60 beats per minute). Live mode is 50 bpm, or 40 bpm if the transmitter hasn't moved for 15 seconds. The reception range of the signal to a hand-held Yagi antenna is at least 500 m on flat ground and over 2 km to an aircraft fitted with an external antenna flying at 2500' above ground.

An attempt was made to find the location of the resting site (nest) of each potoroo on each day the team was on the island. The position of the nest was determined by triangulation from 20-30 metres away, if it was possible to approach the animal so closely without disturbing it. The aim was to take a bearing on each stationary animal from three points at widely separated directions in order to calculate the position of the nest site later. The status of the signal (live/mortality mode, active/inactive mode) was also recorded.

During each of the two periods when the team was not on the island, the animals were tracked once by helicopter fitted with an external antenna to get an approximate location and to check for mortality signals.

GPS logging

GPS loggers (Advanced Telemetry Solutions, UltraLite model G10) were used to collect additional location data, particularly to record nocturnal movements of the animals. Only three units were available at the time of release and these were fitted to M332, M428 and F395. The G10 unit weighs 11g and is thin and flat, measuring 30 x 20 x 9 mm, with a thin antenna 125 mm in length. Each unit was taped over the VHF transmitter, rendering a total package weighing around 25g. The data are stored on board and can only be downloaded after retrieval of the unit. Attachment to the VHF transmitter allows recovery of the logger when the package falls off. The loggers were programmed to collect two fixes one second apart every two hours. With the rechargeable battery fully charged, under this program the unit should function for five weeks.

Trapping

Capture of each animal each week for the four-week period was attempted by setting Mascot cage traps during each trip until each animal was caught. Traps were set in lines of five or ten traps, near the potoroos' diurnal rest sites discovered through radio-tracking. The traps were baited with a peanut butter/rolled oat/pistachio essence bait and checked within three hours of sunrise. Standard measurements including weight and body condition were recorded at each capture and animals were released at the capture site unless other movements were planned.

Five traplines were established during this trial. The "Release East" trapline was located near the release site on the east side of the island where F216 and M332 were released. "Middle Valley" traps were located near M428's nest area at the head of the gully later dubbed Golden Gully and "Flinders Gully" traps where F395 was found first. "Flinders Midway Gully" traps were set at a site in a narrow strip of woodland at the base of a granite cliff where M332 was found once, shown by the isolated green dot in Figure 1. He subsequently moved to a site near the south coast and the "Southern Vista" trapline was established there.

As proposed in the Translocation Proposal, all surviving potoroos were captured and removed from Middle Island by helicopter at the end of the four-week trial, on 3rd August. They were transported by road from Esperance back to Two Peoples Bay and placed in individual cages within the captive breeding facility. They were released on 18th August 2017 into the Ryedene Farm and Waychinicup potoroo enclosures.

Dietary analysis

Scats were collected from the cage traps at each capture. Neale Bougher later examined a sample from each collection in the laboratory using methods described in Bougher and Friend (2009), with the exception that three, rather than five subsamples from each scat collection were examined. The different spore-types in each sample were described in detail.

Results of monitoring

Radio-tracking

Table 1 shows the number of diurnal locations determined for each potoroo by radio-tracking as well as the origin and immediate source of each animal. The locations are plotted on the orthophoto in Figure 1.

Animal ID	Sex	Age (yrs)	First capture	Site prior to translocation	Diurnal locations recorded
216	F	7.5	Two Peoples Bay	Ryedene Farm enclosure	5
332	M	5.5	Bald Island	Ryedene Farm enclosure	9
395	F	3.5	Waychinicup enclosure	Waychinicup enclosure	11
428	M	2.5	Waychinicup enclosure	Waychinicup enclosure	11

Table 1. Details of potoroos used in the winter trial translocation to Middle Island, showing sex, age, source and number of diurnal locations on the island recorded through radio-tracking.

Potoroos M428 and F395 were released on the west side of Middle Island, up on the major granite ridge south of Flinders Peak. M428 moved initially to the eastern side of Flinders Peak in the granitic soils. F395 moved into a small gully on the western side of Flinders Peak (the isolated red dot in Figure 1). As M428 was in poorer condition than F395 when they were first recaptured on 9th February, he was transported to F395's gully and released there. A week later, however, both had returned to the east side of Flinders Peak where M428 had been, and remained there for the rest of the trial.

M332 and F216 were released into dense scrub beside a low granite surface on the east side of the island and both remained in the general area of the release for the first week, although M332 roamed further away than F216. When captured after a week both had lost significant amounts of weight (see Figure 2 and Trapping, below), so they were removed from the site, brought back to camp and held overnight in cage traps provided with food. The intention was to release both animals on the west side the following day. However F216 died overnight. A post-mortem showed that her stomach and intestines were full and her rectum contained pellets. Neale Bougher's examination of her stomach and gut contents found two spore types in her stomach and five in the faecal pellets, indicating that she had been successfully finding fungal food recently. However she had no body fat and had lost over 100 g body weight since release. The pathologist's findings indicated several pre-existing pathogenic conditions that could have contributed, but none alone was definitely serious enough to cause her death (see excerpts in Appendix). M332 was released on the west side of the island and moved well south of the other two, close to the south coast of the island, where he remained.

GPS logging

The three G10 units used had functioned well when delivered in April 2016. Although the predicted life of the unit on the program applied was five weeks, the three units only ran for 3, 6 and 11 days

respectively, of which one day was while the units were running prior to the release on the island. However in order to be sure they were running when deployed the built-in LED was programmed to flash at every fix and this may have caused some reduction in life: this effect should have been more even across the units, however. It is suspected that for some reason the batteries were not taking the full charge.

Animal ID	Days GPS operative		Total no. of fixes		No. of independent fixes	
	Total	After release	Total	After release	Total	After release
M332	6	5	28	24	17	15
F395	3	2	18	13	12	8
M428	11	10	54	46	35	32

Table 2. Performance of GPS units fitted to potoroos on Middle Island. The units were programmed to take a batch of two fixes one second apart every two hours, but many programmed fixes were not successful. An independent fix is either the average of the two successful fixes or a single fix if only one of the batch was successful.

The GPS fixes (including both single and averaged fixes) are plotted on the orthophoto in Figure 1. This record shed some light on the movements of the animals over the few days the units functioned. The best record was that of M428, showing that although the diurnal nest locations revealed by radio-tracking were all near the head of the gully running north down to the coast, his nocturnal movements ranged down the gully, taking in both sides of the gully and including exploratory excursions onto Flinders Peak to the west and the wooded hillside to the east. Male 332's GPS unit had failed by the time he was moved to the western side of the island.

Trapping

The potoroos proved to be quite readily trappable during this trial. All four potoroos were captured during the first monitoring trip, and the three surviving potoroos were captured during each of the other two monitoring trips. The dates and locations of the captures are shown in Table 3.

Changes in weight of the potoroos over the duration of the trial are shown in Figure 2. M332 lost significant weight after release, but regained this over the next three weeks, surpassing his release weight by 3.3% by the end of the trial. Weight losses over the first week by M428 and F395 were more moderate and M428 steadily regained the lost weight, ending up only 19g or 2.3% under his release weight. F395 was 1.7% above her release weight by the end of the trial.

Dietary analysis

A total of 29 spore types were found by Neale Bougher in the scat samples. The number of spore types found in each sample is shown in Table 3. These values are plotted against sampling date in Figure 2 and it is clear that the species richness in the potoroos' diet increases with time since release. Some of the potoroos were found to be eating epigeal (above-ground) fungi as well as hypogeal (truffle-like) fungi however, which may indicate that the more nutritious hypogeal fungi were difficult to find initially.

Potoroo ID	Date	Trap site	No. spore types in scats
F216	9/07/2017	Release East 7	5
F395	9/07/2017	Flinders Gully 5	14
F395	18/07/2017	Middle Valley 1	9
F395	23/07/2017	Middle Valley 1	10
F395	2/08/2017	Middle Valley 4	15
M332	9/07/2017	Release East 1	8
M332	19/07/2017	Flinders Midway Gully 5	9
M332	2/08/2017	Southern Vista 3	16
M428	9/07/2017	Middle Valley 4	8
M428	18/07/2017	Middle Valley 5	9
M428	1/08/2017	Middle Valley 4	10
M428	3/08/2017	Middle Valley 5	13

Table 3. Details of trapping potoroos on Middle Island during winter 2017 trial translocation showing the number of spore types found in potoroo scats recovered from the traps. The location of the trap sites is described in the text.

Discussion

The translocation and monitoring protocols employed in this project were developed specifically for Gilbert's potoroos on the basis of previous experience in both successful and unsuccessful translocations to Bald Island, the Waychinicup and Ryedene enclosures, Mermaid Point and Michaelmas Island. This translocation covered close to 450 km straight line distance, the furthest translocation of this species so far. The main issue this raised concerned the apparent distress observed in these animals when transported by helicopter, presumably due to the high noise levels generated in take-off and flight. This was minimised by using the helicopter only to cross over to Middle Island from Thomas River, the closest convenient point on the mainland. It was considered preferable to transport the animals by 4WD vehicle for seven hours during the day when they are likely to sleep, than for two hours by helicopter.

The choice of animals for the trial was made on the basis of ease of capture, given that the project was starting much later than planned due to delays in the commencement of funding, yet it was essential that the winter trial was not delayed. Hence the decision was made to use animals from the Ryedene Farm and Waychinicup enclosures near Albany, rather than from Bald Island, the only other possible source. This reduced the choice of individuals somewhat and consequently an old animal, F216, was used for the trial when it may have been preferable to use only younger individuals.

Once released, the animals were relatively easy to locate by radio-tracking: the signals were always strong enough to pick up as long as the animals were within line of sight. The rated life of the transmitters was greater than the time required and the attachment method was appropriate for the time frame of the trial. Triangulation within acceptable accuracy limits was achieved in most cases, although care was needed if the animals were not to be disturbed, making them move between readings. A lack of dense nesting habitat was noted and this probably caused the animals to leave their resting site more readily than at sites with dense areas of sedges like Two Peoples Bay

and Bald Island. The activity function of the transmitters assisted by making it obvious if the animals were disturbed by the presence of the trackers.

The unexpectedly short working life of the GPS units limited their contribution to the monitoring program and emphasised the importance of daily radio-tracking by field staff. Further testing of these units and possibly rebatterying will be necessary before they are used again.

Although mapping of the triangulated bearings generally worked well, it was noticed that signals appeared to bounce near the granites, giving false readings at times. Care was then needed to resolve this by persisting in taking bearings until sensible results were gained.

Although the ultimate aim of the trial translocations is to provide data by which to assess the ability of Middle Island to support a Gilbert's potoroo colony, a critical issue regarding the initial trial was whether the criteria for success set out in the approved Translocation Proposal were met. This was important as these criteria had to be met for the project to proceed to the next stage, the late summer trial translocation. The criteria required that 75% of the trial animals survived at the end of four weeks and that overall weight loss in animals captured after four weeks was less than 10% of release weight. Both criteria were met.

The death of one of the trial animals should be considered in more detail, in case it was related to the suitability of Middle Island for potoroos. It transpired that, as well as being old (~7.5 years, when the oldest potoroos recorded have only reached 10 years), F216 had some pre-existing medical conditions that may have affected survival (see Appendix). Other observations should be taken into account, however. On release this animal was slow to move away, although such behaviour by this individual was not unusual. She was generally found nesting at the same site, very close to the release site. Only on the second day after release was she further away, near the lake (Figure 1). On capture six days after release she had lost much more weight than the other animals, implying lack of food, although her stomach and gut contained a good quantity of ingesta. It is possible that this animal was affected by stress and this reduced her movement and feeding activity. Scats from the trap in which she was caught contained the lowest number of spore-types of all the samples collected in the field during the trial (Table 3).

All trial animals clearly had difficulty finding sufficient food in the first week, but over the next weeks the two males steadily regained weight and were able to include more spore-types in their diet. F395 continued to lose weight and even found fewer types of fungi until the fourth week, when her weight increased dramatically. At this time she was trapped very close to M428.

The increase in the range of fungi in the scats over the first few weeks on the island is likely to be due to the time taken by individual potoroos to find the most productive sites in which to forage for hypogeal fungi. Similar results were found on Bald Island by Bougher and Friend (2009), where the richness of spore-types in the diet of translocated potoroos was lower in the first few days after release on the island than after months or years on the island. It is likely that the number of fungal types consumed by the potoroos in a new site will continue to rise during the first few months after translocation.

If the condition of F216 was compromised by pre-existing conditions, or by stress, it may be that the physical challenge of adapting to a new site was too much. The fact that the younger animals were

able to overcome this challenge within a month indicates that the island can provide sufficient food for potoroos, in the short term at least.

The impression gained during monitoring that the vegetation associations used by the trial animals lacked dense nesting habitat was confirmed by searches carried out under the habitat assessment activities of the overall project. Although seven species of Cyperaceae (sedges) have been recorded on the island, well-developed sedge clumps are rare. We did find clumps of *Lepidosperma* and *Ficinia nodosa* of limited extent, however, and much of the island remains to be searched. The clump-forming grass *Poa poiformis* is also present but no large clumps have been found in our searches so far. It may be that the presence of grass or sedge clumps is not essential for potoroos, especially in the absence of predators.

Recommendations

In light of the results of this trial in which the animals found suitable habitat, returned to release weight and demonstrated good survival, it is recommended that:

1) the late summer trial proceeds as planned, and

2) if the criteria for success are also met in the late summer trial,

a) the four (4) animals translocated to the island in the summer trial be left on the island, and

b) the full translocation should go ahead, but with the transfer of six (6), rather than ten (10) animals as stated in the original translocation proposal.

Acknowledgements

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References

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APPENDIX

Excerpts from Potoroo F216 post mortem report:

Drs Dave Forshaw and Anne-Marie Horwitz

Necropsy findings

No body fat.
Stomach and intestines – full of ingesta.
Rectum – pellets present.
Liver – small white lesion (size and position not stated).
Left kidney – bruising/darkness to ½.

Morphological diagnoses

1. Hepatic cyst – larval ascarid.
2. Hepatic küpffer cell haemosiderosis, diffuse, mild.
3. Pulmonary haemosiderosis, multifocal, extensive, mild – moderate.
4. Nephrosis with interstitial nephritis and renal tubular degeneration.

Aetiological diagnoses

None made.

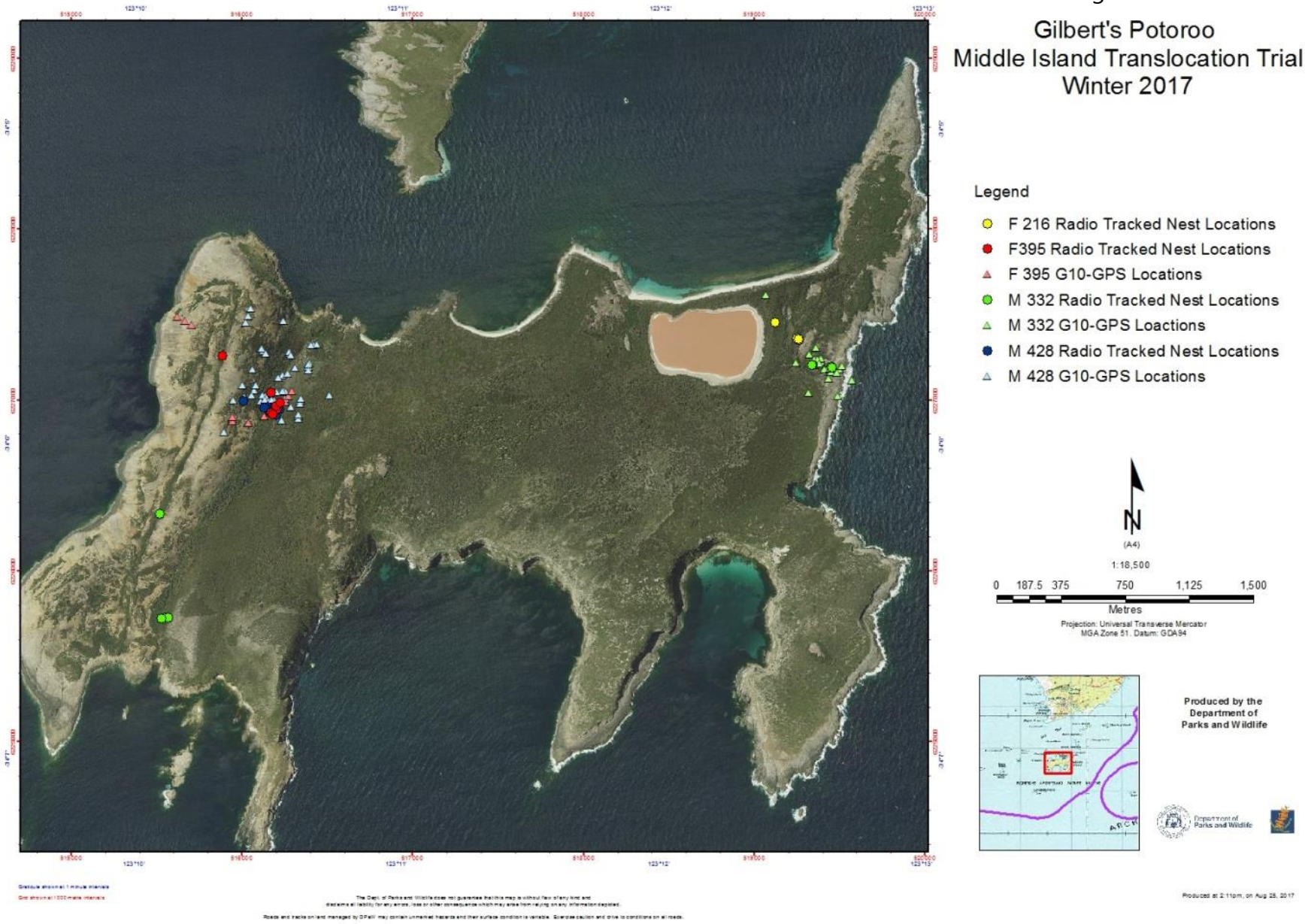
Comments

The cause of death is not certain. There are lesions which are likely to be debilitating but it is not clear if they would be fatal of themselves.

No oxalate crystals were associated with the renal lesions indicating that this is not a case of hyperoxaluria. The renal changes are of some standing and the cause is not apparent. Possible aetiologies would include chronic bacterial infections. The haemosiderocytes in the liver and lung are suggestive of a previous haemolytic episode but there is ongoing necrosis of sinusoidal lining cells or circulating leucocytes in the liver as well. One known potential cause of extracellular haemolysis in potoroos is *Theileria gilberti*, the life cycle of which is not known.

The larval ascarid is likely Ophidascaris as these have been identified in many potoroos previously. The definitive hosts of this parasite are snakes.

Figure 1


Gilbert's Potoroo
Middle Island Translocation Trial
Winter 2017
Legend
F 216 Radio Tracked Nest Locations
F395 Radio Tracked Nest Locations
F 395 G10-GPS Locations
M 332 Radio Tracked Nest Locations
M 332 G10-GPS Loactions
M 428 Radio Tracked Nest Locations
M 428 G10-GPS Locations
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1:18,500
0 187.5 375 750 1,125 1,500
Metres
Projection: Universal Transverse Mercator
MGA Zone 51. Datum: GDA94
Produced by the
Department of
Parks and Wildlife
Department of Parks and Wildlife

Figure 2

Middle I potoroo weight and diet

- M332 – released east side, moved to west side after 1 week with weight loss
- M428 – released west side, remained on east side of Flinders Peak granite
- F395 – released west side, found gully further west, moved to M428 site, settled there