Biodiversity and Conservation Science

Dirk Hartog Island National Park Ecological Restoration Project

Stage Two – Year Five

Translocation and Monitoring Report

June 2022 to June 2023

June 2023

GOVERNMENT OF WESTERN AUSTRALIA

Department of **Biodiversity, Conservation and Attractions**

Department of Biodiversity, Conservation and Attractions
Locked Bag 104
Bentley Delivery Centre WA 6983
Phone: (08) 9219 9000
Fax: (08) 9334 0498

www.dbca.wa.gov.au

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This report/document/publication was prepared by Saul Cowen, Leanne Van der Weyde, Michael Smith, Kelly Rayner, Aline Gibson Vega, Colleen Sims, and reviewed by Lesley Gibson.

Questions regarding the use of this material should be directed to:
Research Scientist – DHINPERP Fauna Reconstruction
Department of Biodiversity, Conservation and Attractions
Locked Bag 104
Bentley Delivery Centre WA 6983
Phone: 044 877 2684
Email: Mike.Smith@dbca.wa.gov.au

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Cover image by Aline Gibson Vega

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Acknowledgments

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Summary

Year five of the second stage of the Dirk Hartog Island National Park Ecological Restoration Project involved the first translocation of the Western grasswren (*Amytornis textilis*) and a supplementation of the dibbler (*Parantechinus apicalis*). Western grasswrens were translocated in October 2022 and were sourced from Hamelin Station Reserve and Peron Peninsula. Dibblers bred at Perth Zoo were released in two cohorts, one in October and the other in November 2022. The current number of individual animals across seven species translocated to Dirk Hartog Island is 787 and will increase further with the translocation of brush-tailed mulgara (*Dasycercus blythi*) planned for June 2023 and dibbler planned for October and November 2023. These translocations will be reported on in the Stage - Two Year 6 report.

Ongoing monitoring of translocated fauna continues to rely upon a range of different methods, including cage, Elliott, and camera trapping in addition to scat and track searches and the WildTrack passive RFID detection system. Translocations continue to be assessed against success criteria, prescribed in approved Translocation Proposals, with more progress made towards achieving these goals in 2022-23.

Here we present results for:

- the Western grasswren translocation,
- a supplementation translocation for dibbler,
- translocated species monitoring undertaken between July 2022 and May 2023, and
- the ongoing monitoring of extant mammals and reptiles on the island.

1 Background

The vision for the management of Dirk Hartog Island National Park (DHI) is to create a special place with well managed system processes supporting healthier vegetation and a suite of re-established (since the time of Dirk Hartog's landing in 1616) and newly established (for conservation outcomes) terrestrial animals. The island and its wildlife are highly valued by the Western Australian community and by people from further afield.

By June 2022, the project had achieved eradications of sheep (*Ovis aries*), goats (*Capra hircus*) and feral cats (*Felis catus*) — ameliorating issues relating to unsustainable predation and over grazing — followed by the reestablishment/establishment of six mammal species. A strategic framework for the program, prepared by Morris *et al.* (2017), outlined a further seven species to be translocated to the island: brush-tailed mulgara (*Dasycercus blythi*), Western grasswren (*Amytornis textilis*), heath mouse (*Pseudomys shortridgei*), desert mouse (*P. desertor*), woylie (*Bettongia penicillata*), boodie (*Bettongia lesueur*), and chuditch (*Dasyurus geoffroii*). Because of issues around trappable numbers, heath mice are unlikely to be established on the island.

1.1 Site description

Dirk Hartog Island is in the Shire of Shark Bay in Western Australia (WA) at approximately -26° S and 113° E, and forms part of the Shark Bay UNESCO World Heritage Area. It falls within the Department of Biodiversity, Conservation and Attractions (DBCA) Parks and Wildlife Service's Gascoyne District in the Midwest Region. The island is approximately 80 km long and up to 12 km wide with a total area of 63,300 ha, making it the largest island in WA. The island contains multiple terrestrial vegetation elements, including *Acacia*-dominated shrubland communities, *Triodia*-dominated grasslands, *Thryptomene dampieri* heath, large areas of *Spinifex longifolius* (typically associated with consolidated and mobile dune-systems) and chenopod communities associated with the many 'birrida' clay-pans (Beard 1976).

1.2 Rainfall

Dirk Hartog Island has a semi-arid climate, typically receiving most rain over the winter months but with occasional heavy falls in summer and autumn due to cyclonic events. Annual rainfall for the reporting period (1 July 2022 to 30 May 2023) was 125.2 mm, with the largest falls between August and mid-September 2022. This is about 100 mm short of the annual average, and less than half the annual totals observed the previous two years, most likely due to a lack of summer rainfall events.

1.3 Release areas

The translocated species have been released in several different areas since 2019 (Table 1 and Figure 1).

Table 1: Location (refer to Figure 2) and timing of release for each translocated species.

Species	Source and year	Area
Banded hare-wallabies	Bernier and Dorre Islands, 2017 and 2018	between Notch Point and Cape Ransonnet
Rufous hare-wallabies	Bernier and Dorre Islands, 2017, 2018 and 2019	between Notch Point and Cape Ransonnet and Herald Bay
Greater stick-nest rats	Salutation Island, 2021 and East and West Franklin Islands, 2022	between Garys beach and Quoin bluff
Dibbler	Jurien Bay Islands via Perth Zoo Native Species Breeding Program, 2019, 2020, 2021 and 2022	between the weather station and the Herald Bay barge landing
Shark Bay bandicoots	Bernier and Dorre Islands, 2019 and 2020	between Herald Bay and ten mile well
Shark Bay mice	Northwest Island, 2021 and Bernier Island, 2022	*Spinifex longifolius*-dominated dune systems between Tetradon Loop and Herald Heights
Western grasswren	Hamelin Station Reserve and Peron Peninsula, 2022	around the new airstrip and associated drainage lines in the greater Herald Bay area

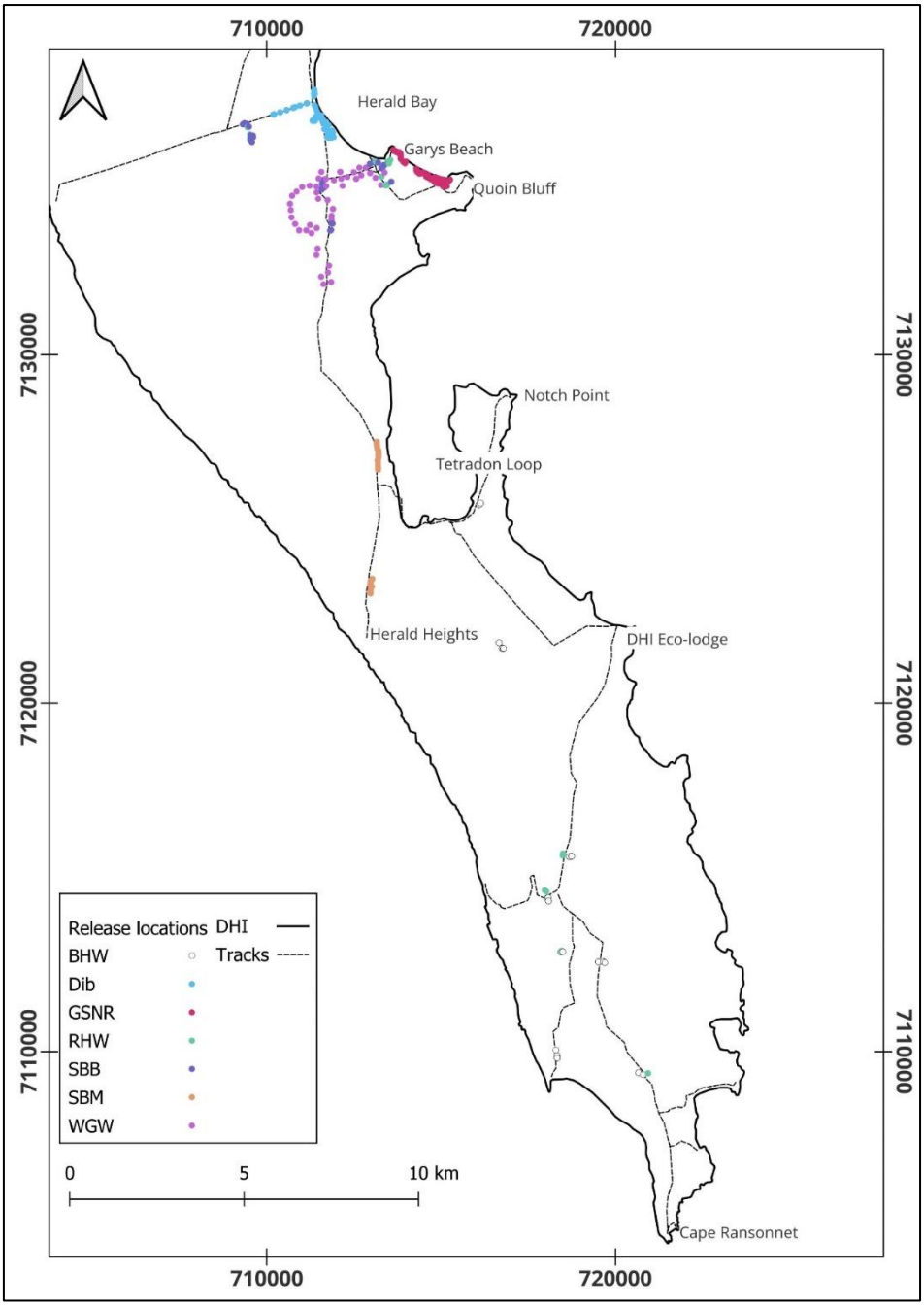

Figure 1: Release locations for each species. BHW = Lagostrophus fasciatus, Dib = Parantechinus apicalis, GSNR = Leporillus conditor, RHW = Lagorchestes hirsutus, SBB = Perameles bougainville, SBM = Pseudomys gouldii, WGW = Amytornis textilis.

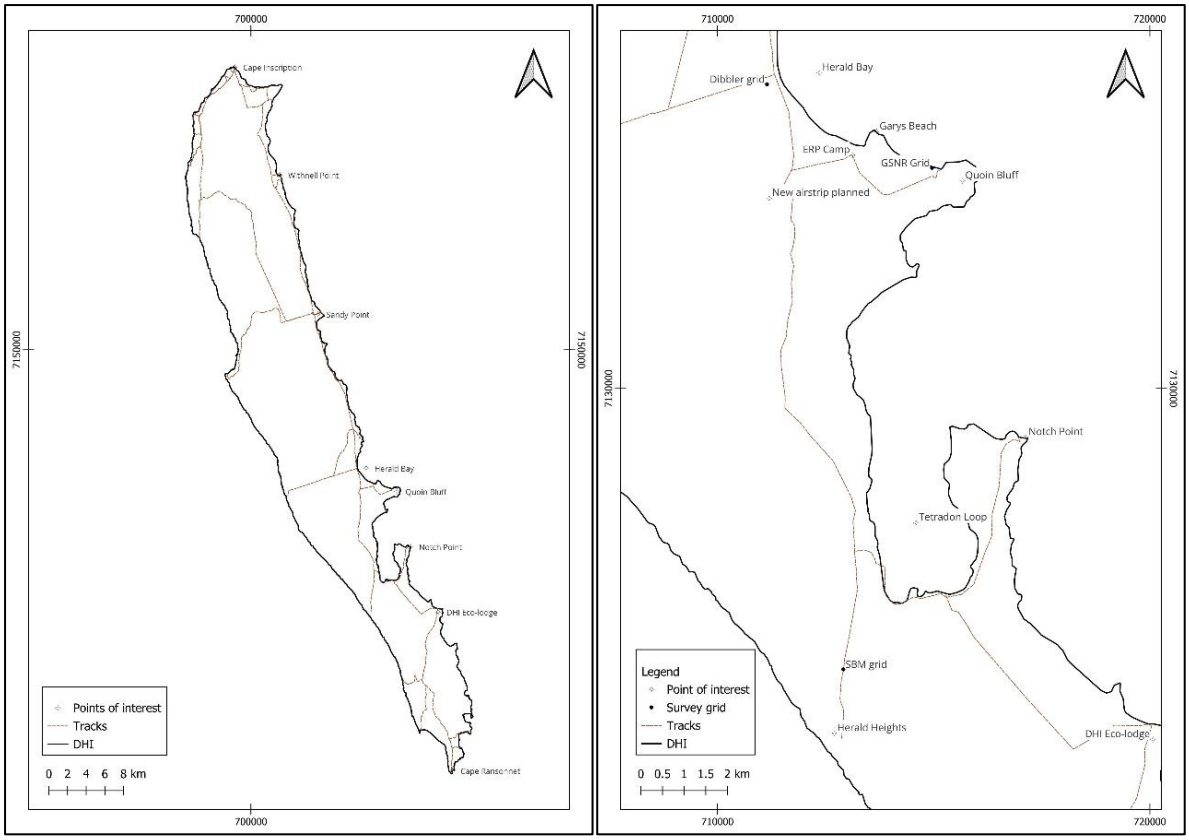

Figure 2: Map of DHI with major points of interest (left) and map of main areas of operation in 2022/2023 (right).

2 Individual species updates

2.1 Shark Bay mouse

2.1.1 Methods

2.1.1.1 Translocation

Shark Bay mice (SBM) were translocated to DHI for the first time in April 2021 (Table 1), with a total of 80 individuals released and a female-biased sex ratio of 3:2. A second release of SBM in 2022 totalled 50 individuals with a sex ratio of 27M:23F. Two release points were utilised as shown in Figure 1 and Figure 3.

2.1.1.2 Trapping

A new trapping grid was created to monitor the SBM released in 2022 at Herald Heights with trap sites separated by approximately 50m (Figure 3). The location of the trap sites was designed to cover habitat comprised of *Spinifex longifolia* in the dunes and low heath scrub to the west (Figure 3). The site also encompassed the SBM release locations (Figure 3). In September 2022 (12th to the 16th) and April

2023 (19th to the 22nd), this grid comprising four transects of 15 trap sites (each site with two Elliott traps baited with universal bait) were opened.

A preliminary multi-session SECR model was used to estimate site density for this area.

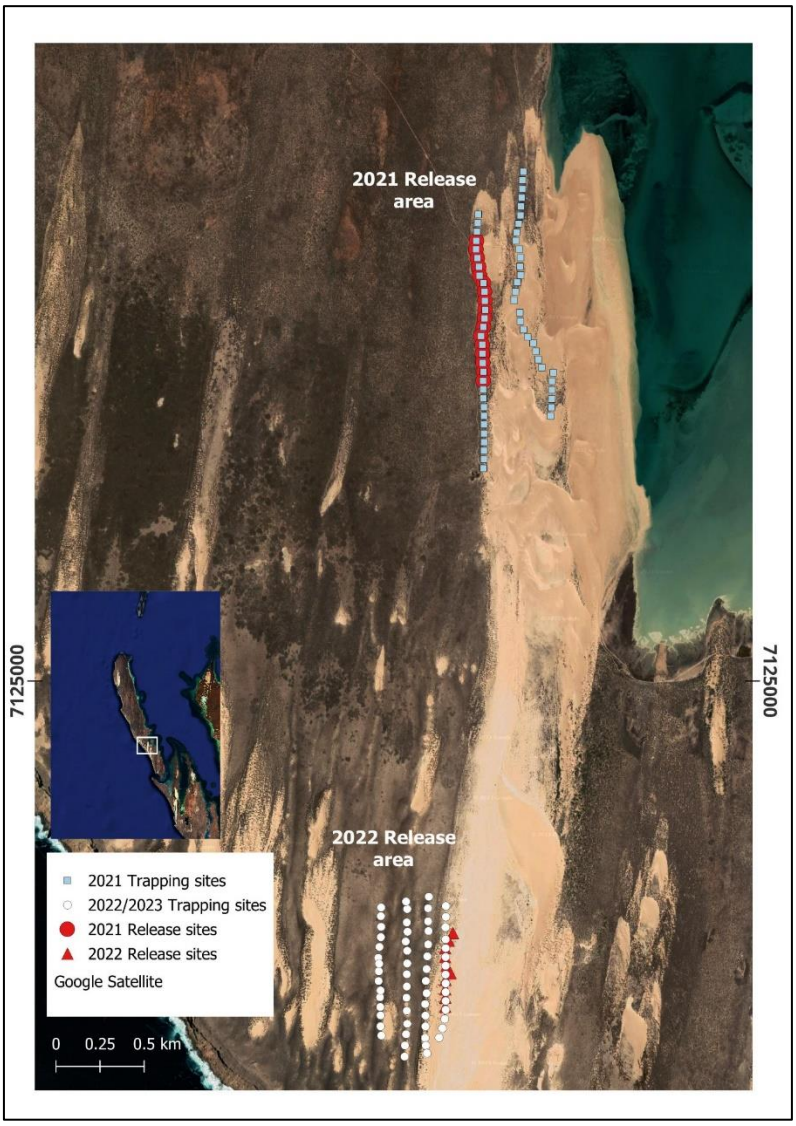

Figure 3: Location of the trapping grids used to monitor SBM released in 2021 and 2022.

2.1.1.3 Camera trap monitoring

Camera traps were used to monitor SBM at the 2021 and 2022 release areas (Figure 3), with a focus on the artificial refuge release sites. The 2021 cameras were removed in March 2022 and the 2022 cameras in April 2023.

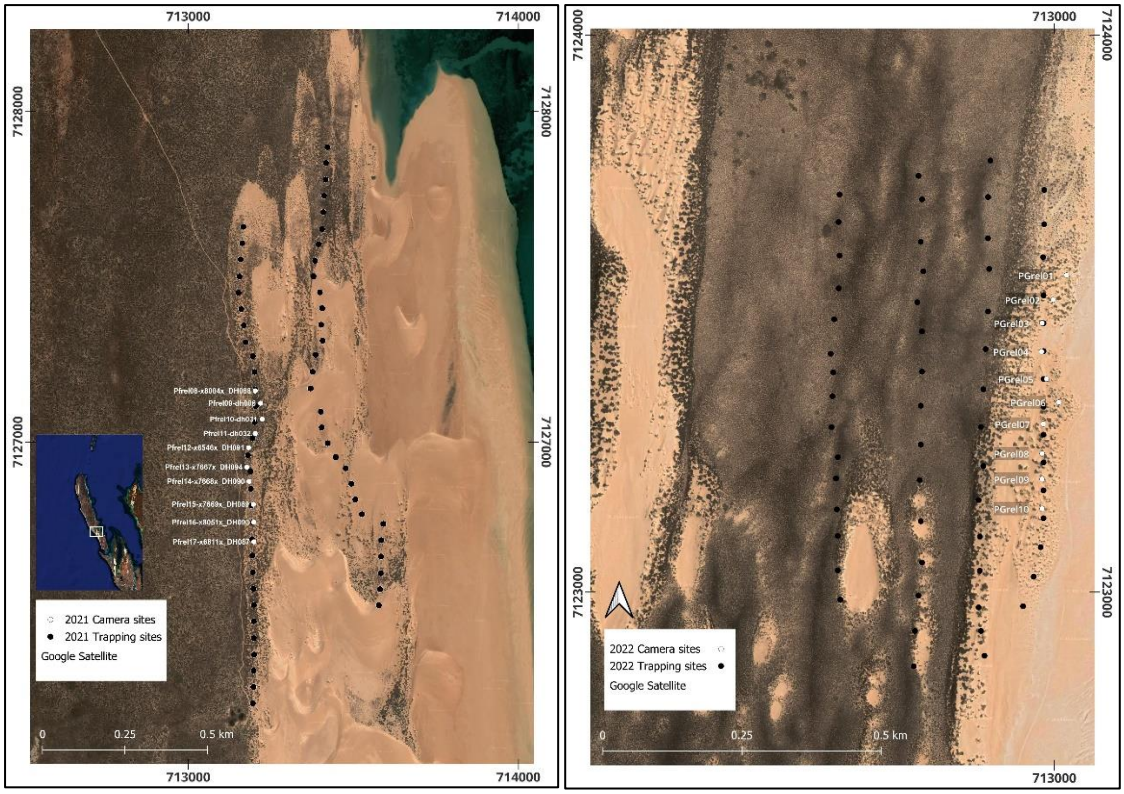

Figure 4: Location of camera traps used to monitor SBM activity at the 2021 release area (left) and the 2022 release area (right).

2.1.2 Results

2.1.2.1 Trapping

In September 2022, there were 65 SBM captures (noting one individual escaped before being processed). From those identified, 39 were new individuals. There was only one confirmed recapture of a female individual from the 2022 release. Of the 39 new individuals, three were considered too small to microchip and only had DNA tissue taken. The sex ratio across all individuals was 23F:17M.

In April 2023, there were 149 SBM captures. Of these captures, 80 were new individuals and 22 were recaptures of previously marked individuals. The sex ratio across all individuals was 8F:9M.

Utilising data from all four trapping events (from both the 2021 and 2022 release sites) to improve precision in detection probabilities and sigma estimates (range parameter), density at both release sites increased from first to second trapping events, noting that the trapping success at the 2022 release site was comparatively high in April 2023 (Figure 5).

In general, at the 2022 release site, trap success was highest on the two eastern transect lines which ran primarily through the *Spinifiex longifolia* dune habitat, noting there was high trap success in the dune area around the release sites (refer to Figure 2).

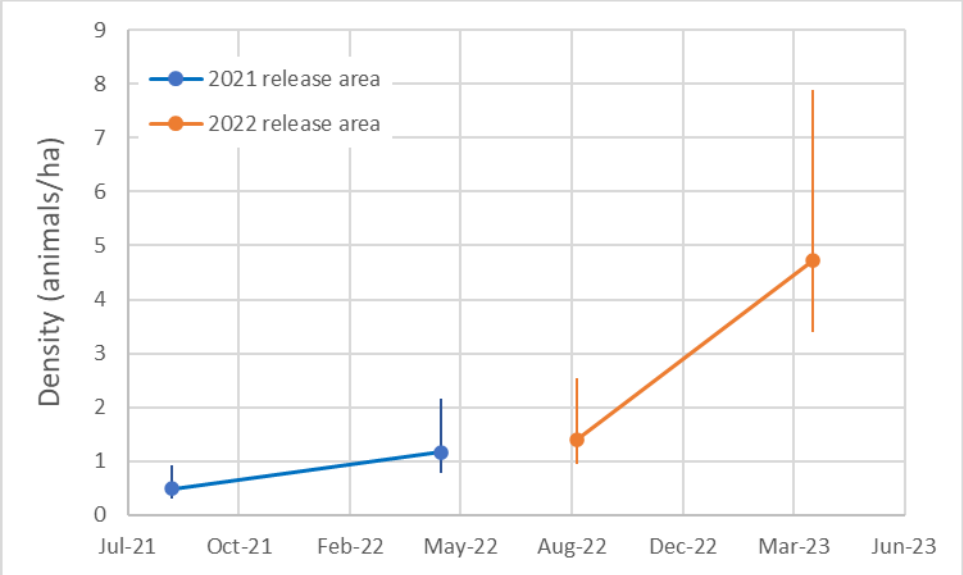

Figure 5: Shark Bay mouse density estimates (plus 95% Confidence Intervals) from trapping at the first and second release sites.

Individuals recaptured after translocation tended to initially lose weight (Figure 6), but those individuals recaptured over longer periods (i.e., more than 150 days later) tended to show a recovery with their individual weights generally increasing again so that total weight loss was reduced. For example, the mean weight loss of individuals captured after more than 150 days post release was -2.1 g (± 8.1 SD; n=12) compared to the mean weight loss after 30 days or less post translocation of -8.4 g (± 7.0 SD; n=21).

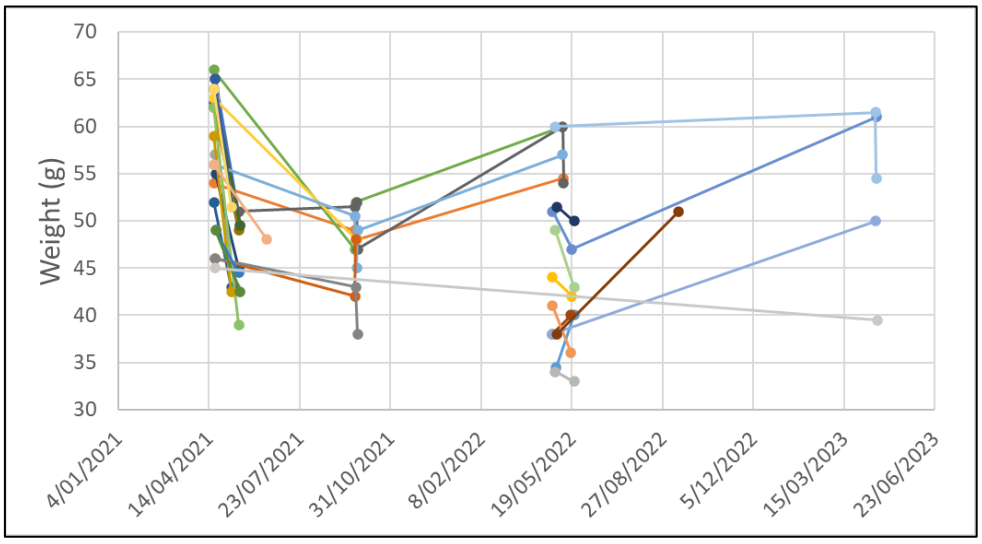

Figure 6: Estimated weight change for 32 translocated SBM that were recaptured on one or more occasions. Note, an individual captured in April 2023 decreased in weight significantly in the space of two days, highlighting the inaccuracy issues that can be associated with measuring animal weights.

2.1.2.2 Cameras and incidentals

Camera traps deployed in the 2021 release area (Figure 4; deployed from the 20th of April 2021 to the 20th of March 2022) provided a total of 558 independent detections (i.e., > 60 mins since first detection; Figure 7). Camera traps deployed in the 2022 release area (Figure 4; deployed from the 29th of April 2022 to the 21st of April 2023) provided a total of 1257 independent detections (Figure 7).

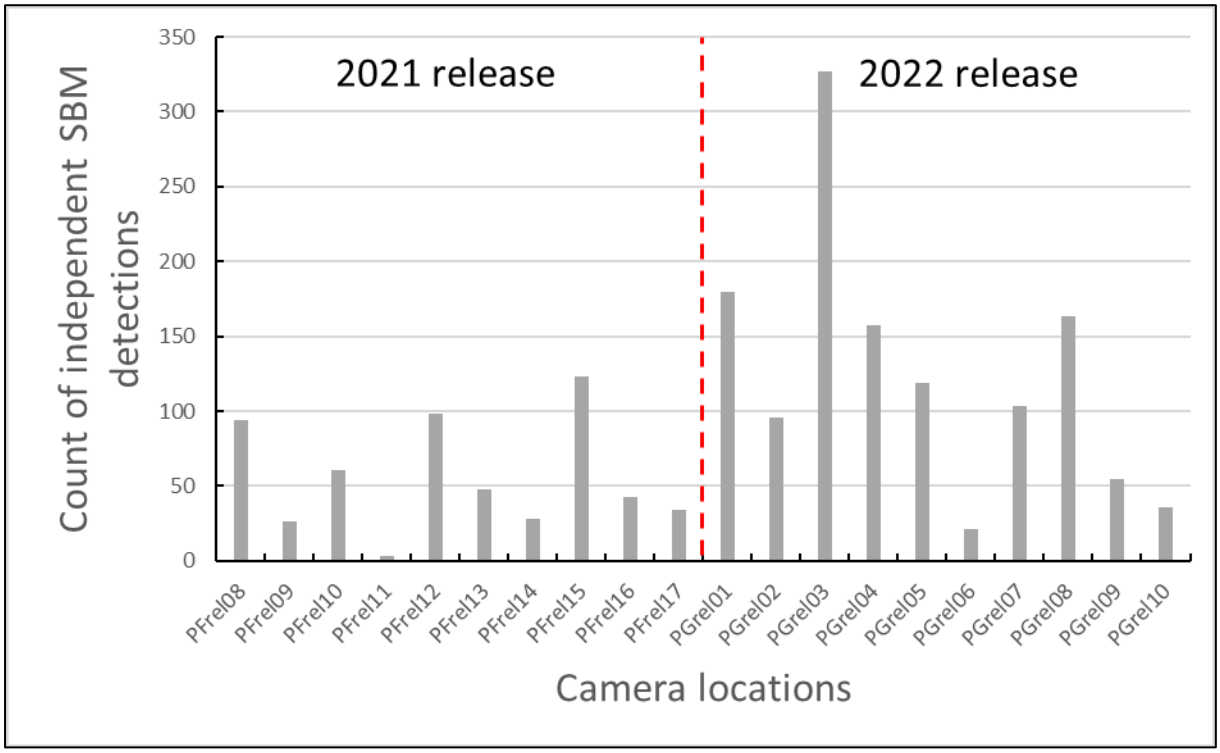

Figure 7: Independent detections of SBM from ten cameras placed at each of the 2021 and 2022 release areas. Individuals captured within 60 mins of the first capture were deemed not independent.

Shark Bay mice have been observed as far north as the Herald Bay camp with confirmed individual sightings and a burrow detected. Possible tracks have also been observed in the Cape Ransonnet area.

2.1.3 Discussion

The density of SBM on DHI increased at the two surveyed areas, exceeding estimated densities for Bernier Island (0.68/ha) but were still much lower than Northwest Island (10.86/ha). All but one of the short- and medium-term success criteria for this species have been met (Appendix 1). One exception is the weight of the translocated animals. The mean weight of recaptured translocated animals has decreased over time, noting however that animals are typically in good condition. Average body weight of animals from Northwest Island are significantly greater than

the average body weights of the Bernier Island populations and it is likely that animal weights on DHI are stabilising around some average population weight suitable for the island which will undoubtedly vary over time with resource availability and may well be different to either of the source populations.

The large number of new individuals captured during the last two trapping events indicates that the species is successfully reproducing and establishing itself on the island. Incidental observations of individuals have been observed around the Herald Bay camp which is a significant dispersal distance for this species. Similarly, possible tracks have been observed as far south as Cape Ransonnet. However, to fully assess the long-term success criteria for the species (Appendix 1), future monitoring on DHI will need to expand to other areas away from the release sites. This will also assist with assessing the growth and distribution of the population.

Finally, camera trapping at artificial refuges has proved a very successful tool in monitoring this species, particularly for the second release (however, we recognise that animals detected in the 2022 release area may also include individuals dispersing from the 2021 release area). Individuals show regular activity around the refuges which has enhanced detection rates for long-term monitoring.

2.2 Greater stick-nest rat

2.2.1 Methods

2.2.1.1 Translocation

Greater stick-nest rats (GSNR) were translocated to DHI from Salutation Island for the first time in May 2021, when 58 individuals were released into ‘protonests’ (Figure 8) with a sex ratio of approximately 2M:3F. Initial monitoring was conducted in this area (Figure 8). Four additional animals (2M:2F), an adult female from Salutation Island, who had been held in captivity for collar trials, along with three young, were also released in the same area in June 2021.

A supplementation translocation of GSNR occurred in May 2022, with a total of 30 individuals translocated from each of East and West Franklin Islands. The sex ratio was 3M:2F. These animals were released in an area adjacent (Figure 9) to the 2021 release area (Figure 8).

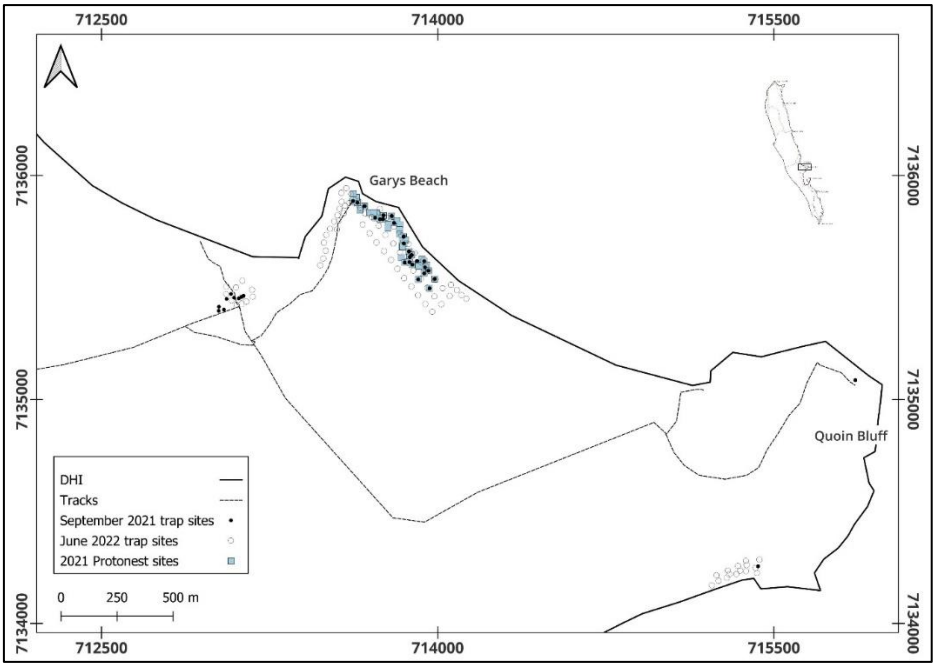

Figure 8: 2021 release site and initial trap sites targeting greater stick-nest rats.

2.2.1.2 Trapping

A single trap trapping grid was used to monitor GSNR in September 2022 and April 2023 (Figure 9). The survey area was across the 2022 release area between Gary's Beach and Quoin Bluff (Figure 9). Fifty cage traps baited with sweet potato, corn and sunflower seeds were set for four nights from the 16th to the 20th of September in 2022 and from the 24th to the 27th of April 2023.

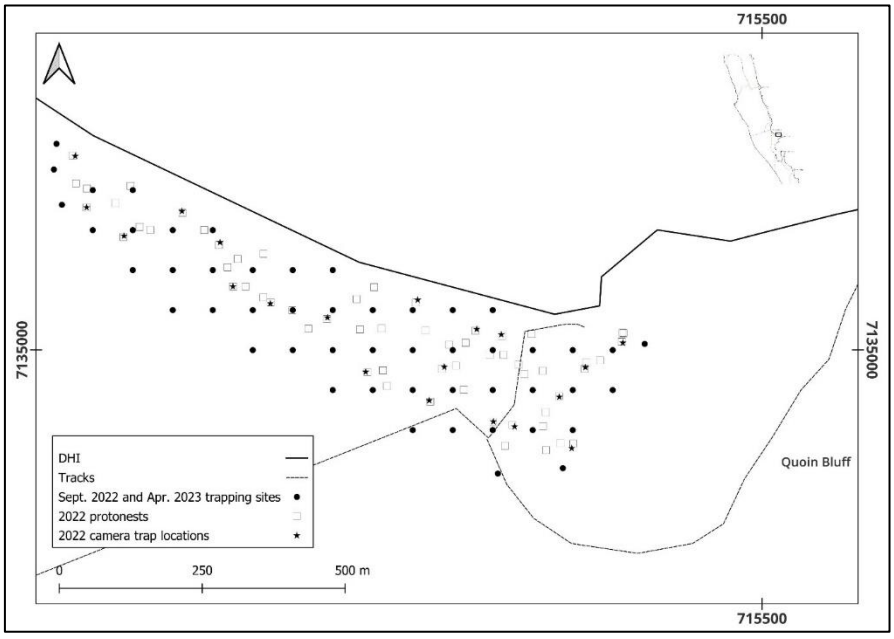

Figure 9: 2022 release sites and cage and camera trapping information for greater stick-nest rats.

2.2.1.3 Cameras

Greater stick-nest rats were monitored at one third (20) of the 2022 protonests using cameras. These cameras were taken down in May 2023.

2.2.1.4 Protonest activity

Protonests that were built as part of the release strategy for both the 2021 and 2022 translocations (Figure 8 and Figure 9) have been monitored regularly — approximately every three months (in alignment with camera servicing) to assess if the protonests continue to be used by stick-nest rats. In addition to camera images, an index of activity has been generated. Where there was evidence of tracks, clear "runways" to the protonest, signs of building activity, and/or presence of scat, a '1' was assigned for each indicator. Thus, for any given visit to a protonest, the maximum score a site could be given was '4'. The data collected at each protonest used in the 2022 release was collated from the 4th of July 2022 to the 25th of May 2023 and a simple index was calculated as the sum of indicator scores across each visit.

2.2.1.5 WildTrack modules

WildTrack modules (see Cowen *et al.*, 2022) remained deployed throughout the 2021 and 2022 release areas to monitor post-release survival of individuals as part of a Ph.D. project by Kelly Williams.

2.2.2 Results

2.2.2.1 Trapping

Trapping of GSNR in September 2022 at the 2nd release site was more successful than previous attempts, but no animals were trapped in April 2023. In 2023, the high capture rate of Shark Bay bandicoots likely contributed to precluding GSNR from entering the cage traps. During that survey, individuals were sighted, and signs of GSNR (fresh footprints and scats) were noted regularly throughout the trapping area.

In September 2022, eight individuals were caught over the four trap nights. Five individuals were from the 2022 release and the other three were new individuals. It is not possible to confirm whether the new individuals were progeny of the 2022 supplemental release or the 2021 release. Of the three new individuals, all of which were juvenile or subadult, two were male and one was female. For the recaptured individuals, four were female and one was male.

No 'within survey' recaptures of any individuals occurred during the trapping period, so no density estimate could be made. All individuals were healthy and one adult female was likely to be pregnant. The weight change in translocated individuals

captured after more than 100 days was on average, positive (mean = 6.3, SD = 37.9, n = 12; Figure 10).

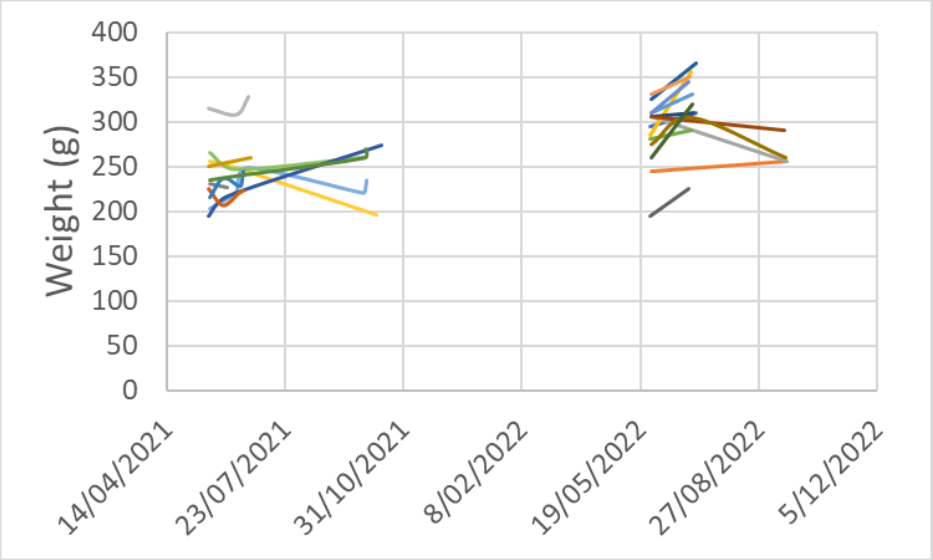

Figure 10: Weight change over time for recaptured translocated greater stick-nest rats.

2.2.2.2 Cameras

Camera activity was highest around protonest 51, but also comparatively high around 15, 18, 30, 33 and 54 (Figure 11). Attached young, juveniles and sub-adults have all been captured on remote cameras.

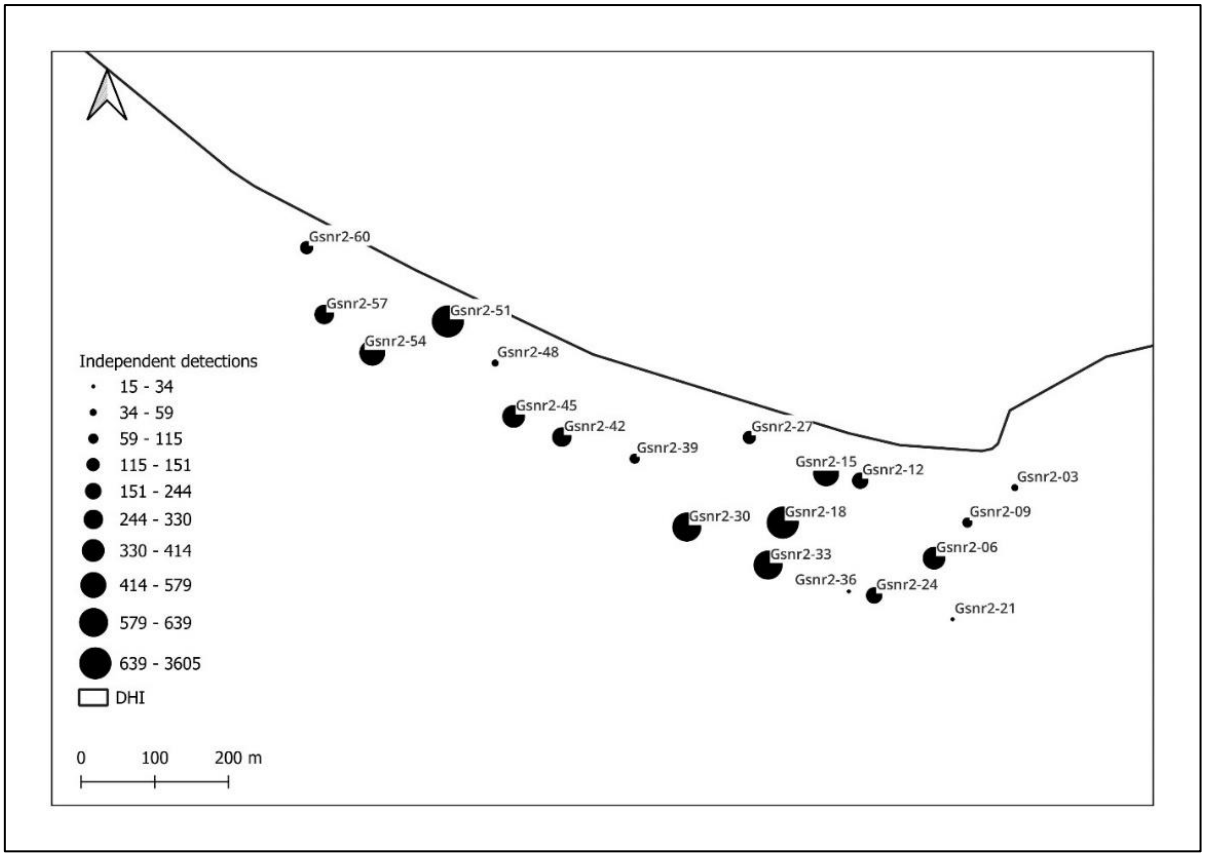

Figure 11: Independent (within 60 min.) camera activity from 14th June 2022 to 25th May 2023 at the monitored protonests.

2.2.2.3 Protonest activity

Across all surveys, protonest activity was highest at protonest 51, with high activity also around protonests such as 11, 15, 18, 35, 55 and 58 (Figure 12). In the most recent survey (May 2023), activity was still recorded at nests 9, 34, 35, 37, 45, 51, and 59, with nest 51 still recording the most activity (Figure 12).

2.2.2.1 WildTrack modules

Data from the WildTrack modules provided some additional information for individuals still occupying areas around both release sites. Of the 40 modules, 12 have detected GSNR, and 13 individuals have been recorded. All but one individual was from the second release (i.e., Franklin Island rats).

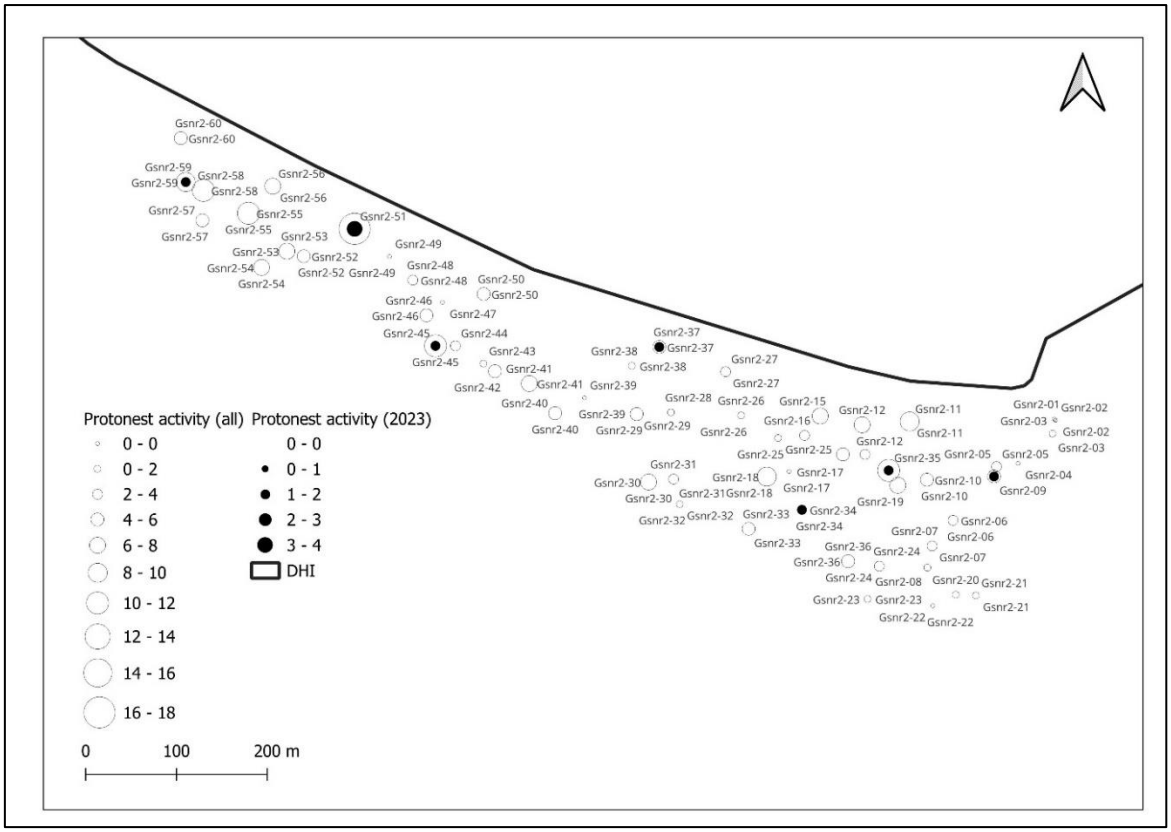

Figure 12: Activity scored at each protonest from 4th of July 2022 to the 25th of May 2023 (open circles) and in May 2023 (black circles).

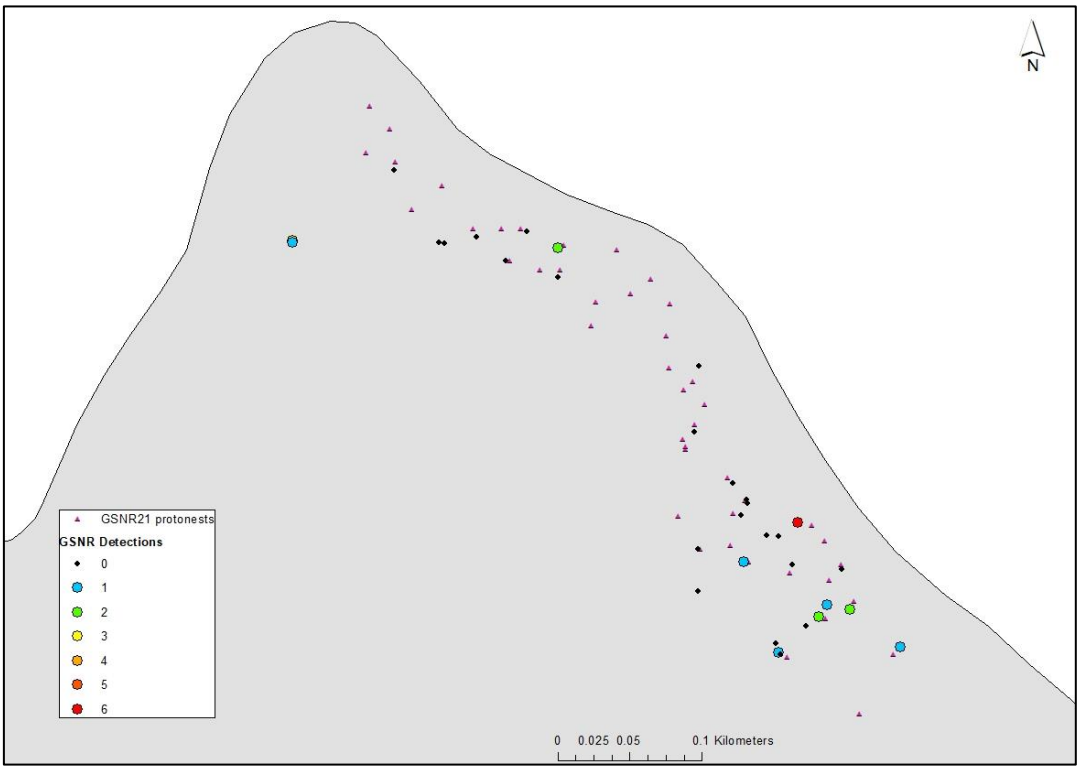

Figure 13: Detections of GSNR from the WildTrack modules in the 2021 release area.

2.2.2.2 Incidentals

Observations of GSNR occur in and around the Herald Bay camp, with tracks regularly seen between the camp and the Operations base. GSNR signs have also been recorded as far south as Surf Point (track and scats) and the eastern end of the management fence (tracks). These all indicate the continued presence and dispersal of this species.

2.2.3 Discussion

While there are some challenges in monitoring the GSNR in the release areas, there is evidence to show that they continue to survive and reproduce on DHI. Trapping capture rates at certain times of the year, along with detections through the WildTrack modules and cameras, and detection of scats and tracks, are indicative of a dispersing and presumably expanding (in occupancy) population.

Of note, given the result of animals being caught during both September trapping events, but no individuals being caught in the April/May trapping events, it is possible that GSNR are not as readily trappable in autumn which is consistent with observations on Salutation Island.

The short- and medium-term success criteria have largely been met (Appendix 1), leaving the long-term success criteria for assessment (Appendix 1). We do note that some of the success criteria are insoluble (see comments in Appendix 1). To assess the longer-term success criteria, the species will require monitoring to expand into areas away from the release sites.

2.3 Dibbler

2.3.1 Methods

2.3.1.1 Translocation

Dibblers were first translocated to DHI in October 2019 from a captive breeding program at Perth Zoo (Cowen *et al.*, 2020). Additional translocations of 31 dibblers (14M:17F) and 36 dibblers (17M:19F) from Perth Zoo, to reinforce the initial founder cohorts were undertaken in October 2020 and 2021, respectively. All these animals were released in the same general area (Table 1, Figure 1 and Figure 15).

Two translocations of dibblers were undertaken in 2022 from Perth Zoo: on the 15th of October and 1st of November. In October, dibblers were released into pens (n=17 across 9 pens, one individual escaped during the release process) or from nest boxes (n=10). The November cohort of dibblers were released via nest boxes only (n=16). Across both releases, 20 individuals were female and 24 were male (5:6 ratio).

2.3.1.2 Soft-release pens and nest boxes

The soft-release pens used in 2022 followed the same design and protocol as per the dibbler release in 2021 (see Cowen *et al.*, 2022) while the nest boxes were redesigned with PVC pipe to be more like those used at Perth Zoo. Following encouraging results from the 2021 release, these methods were employed again to promote release site fidelity across the full 2022 dibbler cohort. The nine soft-release pens were built immediately north of the Herald Bay barge landing and nest boxes (n=26) were placed to the south and east of the previous pen and nest box locations (Figure 15). Health and weight of dibblers in the release pens were monitored during the 10-day post-release period with animals being captured two or three times for assessment based on observed weight changes.

2.3.1.3 WildTrack modules

Thirty-eight modules were deployed in the release area of the dibblers in November 2022 to try and improve monitoring of this species. The modules were placed near nest boxes and pens from both the 2021 and 2022 release sites, as activity was being observed at these nest boxes as recently as September 2022.

2.3.1.4 Cameras

The lured camera trapping grid that was used to monitor dibblers from mid-2019 continued until September 2022, after which it was removed due to the low detection rates for dibblers. The camera grid did however provide detections of a wide range of species and was useful for additional monitoring of previously translocated species.

Cameras that had been set at the pen sites and nest boxes (n=18) from the 2021 release site were also taken down in September 2022, as this provided about one year of monitoring at these locations.

Camera traps were set up in October for the 2022 dibbler release at nine release pens and at 16 of the 26 nest boxes to monitor dibbler activity. These cameras are expected to remain active for around 12 months.

2.3.1.5 Trapping

Trapping was undertaken in November 2022 and May 2023 at the dibbler grid (Figure 2). Two traps were set at 60 sites (120 traps) for four nights from the 2nd to the 6th of November 2022 and the 21st to the 24th of May 2023. The dibbler grid was used due to its proximity to the previous release sites and associated detections of dibblers on remote cameras.

2.3.2 Results

2.3.2.1 Soft-release pens and nest boxes

Dibblers were weighed before leaving Perth Zoo, on arrival at DHI and 2-3 times later if being held in the soft release pens. Dibblers released from nest boxes had all lost weight during travel (mean loss = 5.7% body weight; Table 2). Dibblers held in a pen following release also experienced a similar weight loss (mean loss = 5.6%) measured between five and nine days (Table 2). Nonetheless, initial weight loss of animals within the pens was deemed to be acceptable and all animals were held for the full nine days intended.

Table 2: Release information for dibblers translocated in 2022.

Pen dibblers				**Nest box dibblers**			
Dibbler ID	Sex	Loss %	Days	Dibbler ID	Sex	Loss %	Days
1304	F	-7.9	5	1232	F	-1.7	1
1305	F	-7.9	9	1222	M	-3.8	1
1296	M	0.0	8	1243	M	-5.6	1
1297	M	-3.8	8	1235	M	-5.3	1
1300	F	-5.1	8	1322	F	-4.3	1
1301*	F			1299	M	-3.9	1
1320	M	-10.4	8	1212	F	-3.1	1
1321	M	-4.3	8	1245	M	-4.8	1
1324	F	-4.9	9	1244	M	-4.5	1
1325	F	-1.4	9	1228	M	-3.9	1
1326	M	-3.3	9	1333	M	-4.9	1
1327	M	-6.7	9	1334	M	-7.7	1
1328	F	-4.4	9	1337	F	-5.4	1
1329	F	-13.5	9	1263	M	-5.3	1
1331	M	-4.3	9	1309	F	-7.1	1
1332	M	-2.2	9	1341	M	-8.3	1
1335	F	-5.9	5	1307	F	-9.5	1
1336	F	-8.6	8	1323	M	-6.3	1
				1246	F	-6.9	1
				1330	F	-7.9	1
				1306	F	-4.9	1
				1248	M	-6.3	1
				1340	M	-7.5	1
				1342	F	-7.1	1
				1298	M	-4.2	1
				1295	M	-7.5	1

* Female escaped prior to release in pen.

In terms of weight change for recaptured translocated individuals, one female has been recaptured in several trapping sessions in the 18 months following her release on DHI (Figure 14) and has gained weight in this time (Figure 14).

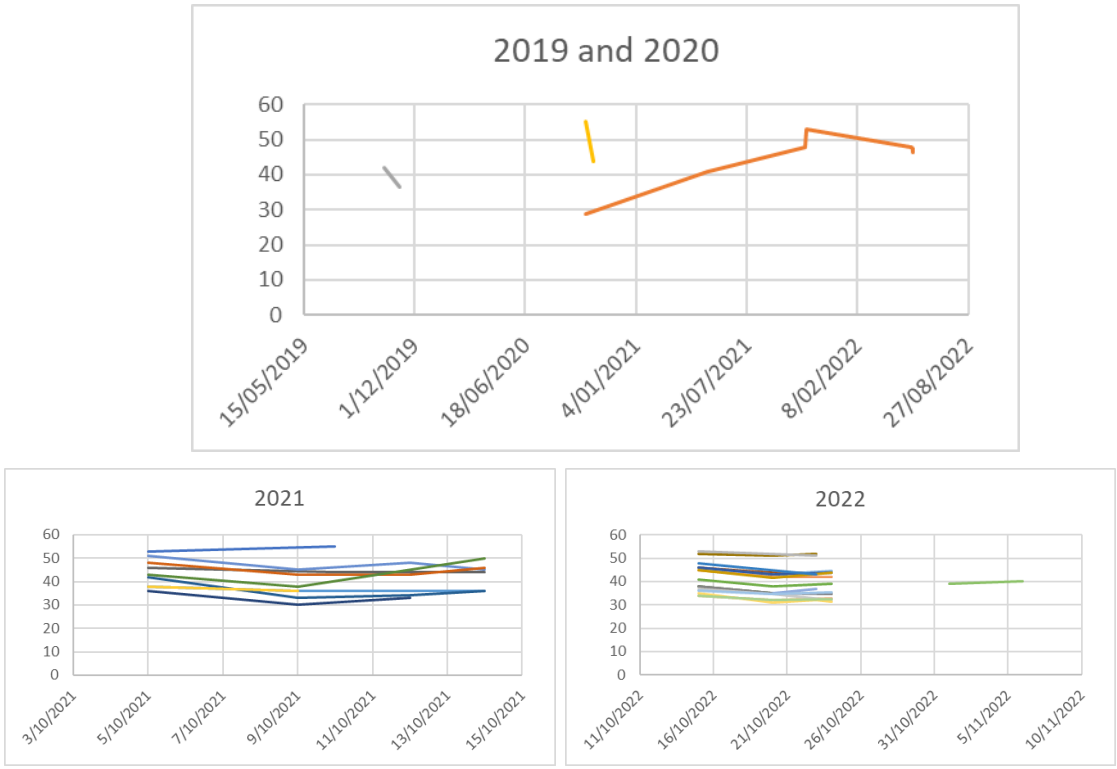

Figure 14: Weight change for recaptured translocated dibblers released prior to 2021 (top), in 2021 (bottom left), and in 2022 (bottom right).

2.3.2.2 WildTrack modules

The WildTrack modules have had limited success in detecting dibbler activity. Some of the issues may have related to a range of technical problems, but it is also probable that few dibblers stayed in the area captured by the WildTrack modules. At present only two dibblers have been detected on the WildTrack modules (one at a single location and one at three different locations).

2.3.2.3 Cameras

Lured camera grid

The lured grid had very low success in monitoring dibblers with only six detections in over 23,000 trap nights. Detections were found almost entirely in the eastern side of the grid, through the foredune vegetation (Figure 15). The preference for this area was used as a basis for selecting the pen and nest box release sites in 2022.

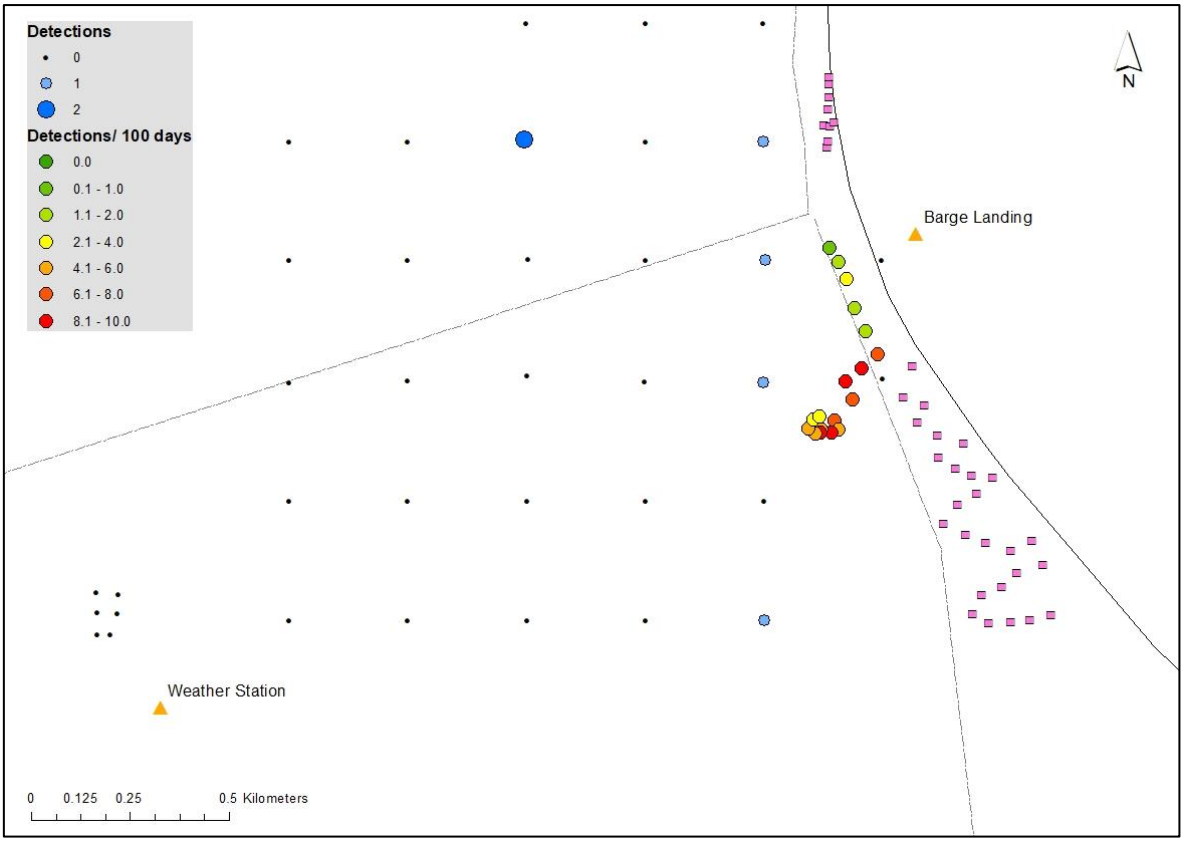

Figure 15: Detection of dibblers on camera traps from both the lured camera grid (total detections; blue circles) and pens and nest boxes (coloured circles) with increasing detection rates. Pink squares represent locations of 2022 pen and nest box release locations.

Cameras at 2021 release pens and nest boxes

Cameras set at the 2021 soft release pens produced a total of 135 independent detections (60 min) with a total camera effort of 3704 days (Figure 16). Whereas those set at the nest boxes produced a total of 262 independent detections over a total of 2935 camera trap nights (Figure 16).

Cameras set at the 2022 soft release pens produced a total of 550 independent detections with a total camera effort of 1492 days (Figure 17). Whereas those set at the nest boxes produced a total of 202 independent detections across a total of 2213 camera trap nights (Figure 17).

Activity was greatest around the independent nest boxes in 2021 (Figure 16), but the pens in 2022 (Figure 18).

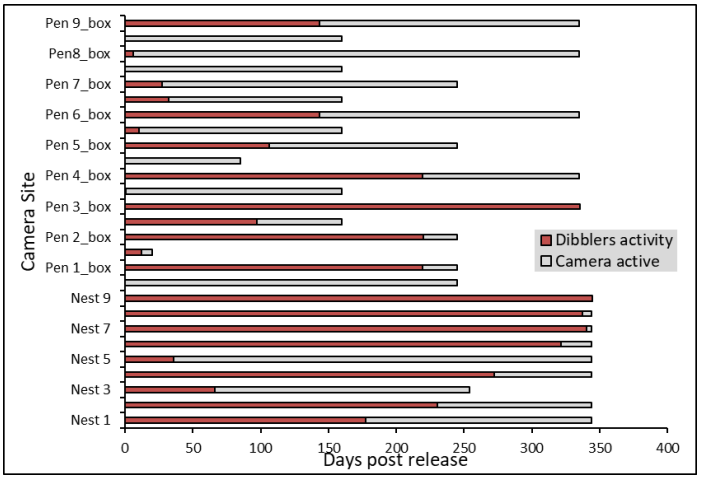

Figure 16: Dibbler activity detected on cameras set in 2021 outside pens and nest box locations.

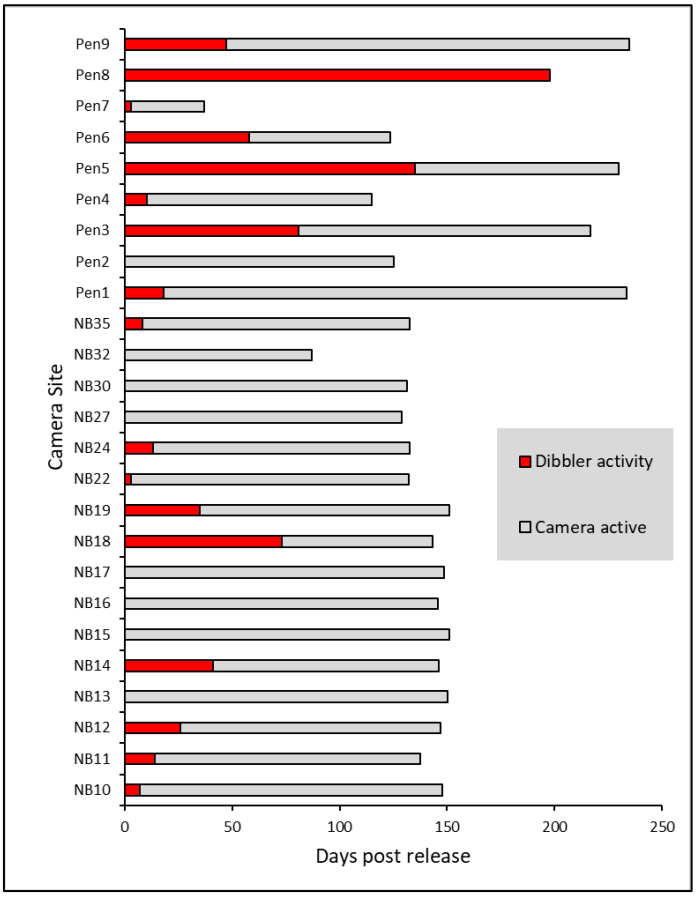

Figure 17: Dibbler activity detected on cameras set in 2022 outside pens and nest boxes.

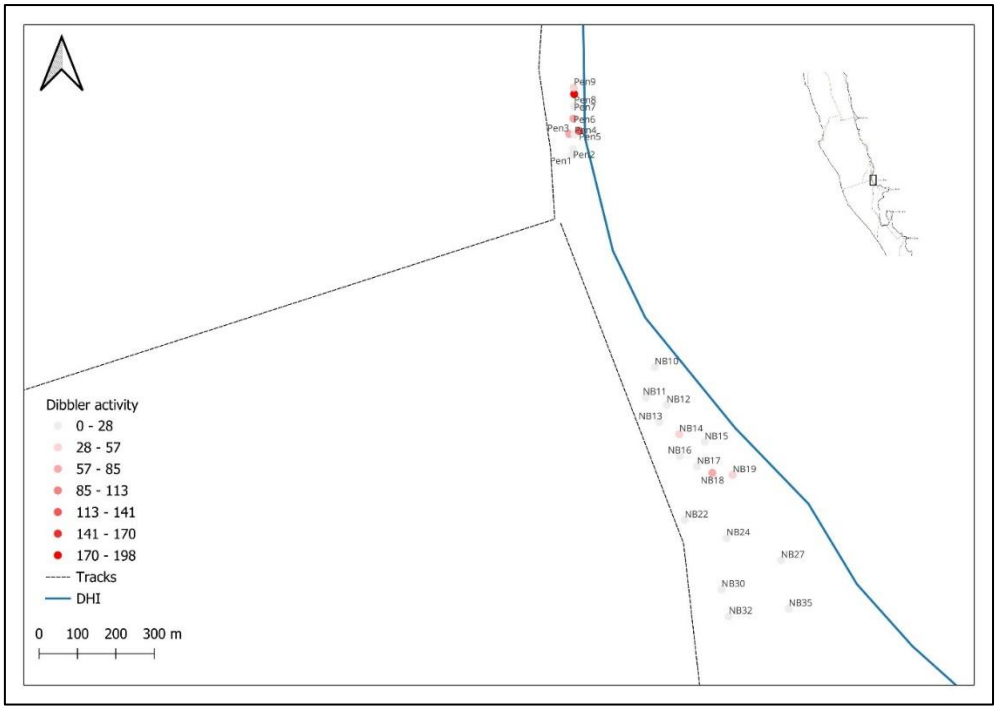

Figure 18: Location of 2022 dibbler camera sites and characterisation of site activity.

2.3.2.4 Trapping

Trapping in November 2022 had low success with only one dibbler caught, that had been released a few days earlier as part of the second dibbler release. One dibbler was also seen crossing the road while checking traps, but it was unknown if it was a newly released or older individual.

Trapping in 2023 resulted in the capture of one female dibbler (new individual) with 8 pouch young.

2.3.3 Discussion

Elliott traps have proved to be of limited use in terms of their capacity to capture dibblers (one individual trapped in each of two trapping efforts) in their current configuration. Camera monitoring, and to a much lesser degree WildTrack monitoring, associated with release area nest boxes and pens has provided the most information post release.

An approach that will allow ongoing monitoring across the distribution of the species is required to assess the longer-term success criteria. This will need to be the focus of ongoing research.

Dibblers are largely meeting the short- and medium-term success criteria (Appendix 1), but there are issues associated with the maintenance of weight and the potential to recapture F1 individuals (Appendix 1). A contributing factor to the observed weight loss is that the point of comparison or commencing weight of these animals could be

inflated due to factors associated with captivity (i.e., food being easily available, energy required for daily activities highly reduced compared to wild animals).

2.4 Western grasswren

2.4.1 Methods

2.4.1.1 Translocation

Eighty-five Western grasswrens (WGW) were translocated from Hamelin Station Reserve (38) and Peron Peninsula (47) to DHI in October 2022 (Table 3). Twenty-nine of these birds were fitted with VHF transmitters (Holohil BD-2X, 0.45g as per methods described in Louter, 2016; Farrell et al., 2018) prior to transport and all birds were fitted with a unique combination of three colour bands to allow for field identification in the future. Birds were caught using specially designed mist nets (two shelf, 1.1m high, Ecotone, Poland) in combination with call playback, to minimize bycatch and disturbance times. WGW that were deemed suitable for translocation (i.e., birds from groups with no dependent offspring) were held and translocated via helicopter in specially designed transport boxes (270 x 200 x 110mm; Westcare incorporated, Perth), then released on DHI on the same day as capture. Fifty-four WGW were deemed unsuitable for translocation (i.e., evidence of dependent young or could not be determined) and were released at the point of capture, as was bycatch (50). Translocated WGW were immediately released once arriving on DHI, to provide an opportunity for the animals to forage and find suitable shelter before dark. Birds were released at forty different locations in the greater release area, primarily around the birrida where the new airstrip is proposed and vegetation surrounding the associated drainage line (Figure 19).

Table 3: Source information relating to the Western grasswrens translocated to DHI.

Source	Capture date	Female	Male	Unsexed	Total
Hamelin Station Reserve	4/10/2022	1	1	1	3
	5/10/2022	3	8	0	11
	6/10/2022	3	7	0	10
	7/10/2022	4	5	0	9
	8/10/2022	2	3	0	5
Hamelin total		*13*	*24*	*1*	*38*
Peron Peninsula	9/10/2022	2	4	0	6
	10/10/2022	4	3	0	7
	11/10/2022	4	1	0	5
	12/10/2022	6	1	0	7
	13/10/2022	5	8	0	13
	14/10/2022	5	4	0	9
Peron total		*26*	*21*	*0*	*47*
Grand total		**39**	**45**	**1**	**85**

2.4.1.2 Radio-tracking and towers

Radio-tracking was used to detect birds fitted with transmitters and was conducted daily following the first day of release. Transmitters were too small to have a mortality sensor incorporated, so confirmation of the animal's status relied upon determining if the birds had moved between tracking attempts or observations of activity, however approaching birds was limited to avoid unnecessary disturbance, particularly in the first week following release. Only when signals did not change in strength or direction over several minutes were approaches made to see if transmitters had fallen off any birds.

In addition, nine passive VHF logger towers were erected that had previously proved to be successful in detecting other radio-tracked species such as SBM and GSNR (Cowen *et al.*, 2022). These towers were located around the Herald Bay area and along the fauna management fence.

One radio-tracking flight was also conducted on the 31st of October to locate 'missing' birds.

2.4.1.3 Audio recording units and remote cameras

Eighteen audio recording units (ARU) were deployed around the original release area and adjacent areas where birds were subsequently radio-tracked (Figure 20). ARUs were set to record in the early hours of the morning when birds are most likely to be active.

At the time of writing, no cameras targeting WGW have been serviced however, incidental detections have occurred on cameras currently deployed in the dibbler release area. One male WGW was captured on camera at two locations on four occasions as recently as February 2023. The colour combination of the leg bands was discernable in the imagery providing validation of this technique as a tool for monitoring WGW in the future.

2.4.2 Results

2.4.2.1 Radio-tracking

Of the 29 individuals fitted with VHF transmitters only 25 were radio-tracked following release as some transmitters fell off during transport. This issue was identified during the early stages of the translocation and was considered likely to be due to antennas getting caught in the foam used to pad the ceiling of the transport boxes. Once this issue had been identified, modification of the transport boxes was made, and no further incidents of this nature occurred. There were also some challenges with radio-tracking birds as transmitters showed frequency drift or had very limited range, most likely because of temperature effects on the batteries (as indicated by follow-up trials with shed transmitters), along with suspected damage to antennas (antennas had fallen off two transmitters in packaging, probably because the units were tiny

and therefore made of light materials). A radio-tracking flight to locate 'missing' birds, was no more successful than tracking completed on the ground during the same period, supporting the likelihood of transmitters failing for reasons above, rather than birds having moved outside the release (and tracking) area. Consequently, tracking varied from 2-27 days and only 16 birds were able to be tracked for at least 11 or more days (Table 4).

Table 4: Outcomes of transmitters attached to Western grasswrens translocated to Dirk Hartog Island in October 2022.

Release date	Animal ID	Sex	Outcome	Days elapsed	Distance from release point
4/10/2022	043-22550	M	Transmitter came off in transport box	0	n/a
4/10/2022	032-63522*	F	Transmitter failure	8	1600
6/10/2022	043-22545	M	Transmitter shed^	2	967
6/10/2022	043-22544*	M	Transmitter failure	9	0
7/10/2022	043-22541	F	Transmitter failure	13	206
7/10/2022	043-22562	M	Transmitter came off in transport box	0	n/a
7/10/2022	043-22543	F	Transmitter failure	13	263
7/10/2022	043-22563	F	Transmitter came off in transport box	0	n/a
7/10/2022	043-22562	M	Transmitter shed	7	92
8/10/2022	043-22564*	M	Transmitter failure	11	411
8/10/2022	043-22565	F	Transmitter failure	5	120
8/10/2022	043-22536	M	Transmitter failure	16	211
8/10/2022	043-22537	F	Transmitter shed	18	270
8/10/2022	043-22538	M	Transmitter came off in transport box	0	n/a
9/10/2022	043-22535	M	Transmitter shed	17	136
9/10/2022	043-22534	M	Transmitter shed	12	120
11/10/2022	043-21181	F	Transmitter shed	23	706
11/10/2022	043-21184	M	Transmitter failure	18	1230
11/10/2022	043-21183	F	Transmitter failure	19	229
11/10/2022	043-21185	F	Transmitter failure	27	170
12/10/2022	043-22572	F	Transmitter shed	8	681
12/10/2022	043-22526	F	Transmitter failure	9	167
13/10/2022	043-22525	F	Transmitter failure	13	464
14/10/2022	043-22524	M	Transmitter shed	9	305
13/20/2022	043-22523*	M	Transmitter failure	19	424
14/10/2022	043-22575	M	Transmitter shed	13	850
14/10/2022	043-22521*	M	Transmitter failure	16	699
14/10/2022	043-22576*	F	Transmitter failure	14	1800
14/10/2022	043-22574	F	Mortality	6	499

* Birds were heard singing or calling while being tracked, ^ Transmitter got caught on transport box during release.

Radio-tracking was conducted daily. Birds typically stayed in their immediate release area before beginning to disperse further afield (max. distance from release point was 2km). However, all tracked birds were still within the greater release area at completion of their tracking period. Birds were heard calling and singing while radio-tracking activities were being undertaken, an energetically demanding behaviour indicating that birds were finding the nutritional resources that they needed in their new home. One mortality event was recorded during the radio-tracking period, likely due to predation by an unknown predator.

2.4.2.2 Towers

For WGW, the towers proved to be ineffective. Some towers were erected beyond the dispersal range of the radio-tracked birds and, of the towers located near the release area (Figure 19), only 24 detections were made.

Figure 19: Locations of Western grasswren release sites (Bird symbol) and radiotracking records (blue dots) around the birrida where the new airstrip has been proposed. Several towers erected to assist with tracking (tower symbol) are shown as well as the ERP camp (yellow house symbol).

2.4.2.3 Audio recording units

WGW calls were recorded on 15 of the 18 ARUs (Figure 20). Thirteen of the 15 ARUs that recorded individuals also had ‘good’ call rates (Figure 20).

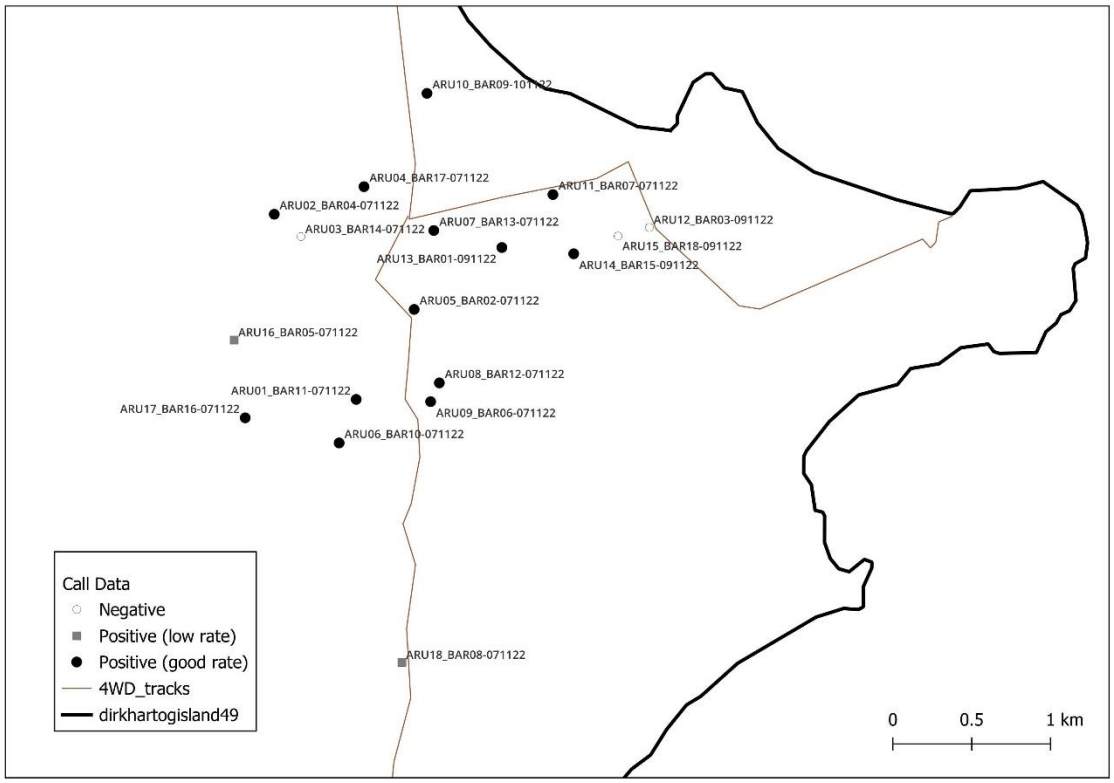

Figure 20: Location of ARUs with associated Western grasswren calling activity.

2.4.3 Discussion

After a successful release and post release tracking, WGW were effectively monitored using ARUs. This result provides a positive indication that most of the success criteria will be assessable, noting that the short-term criteria have been met (Appendix 1). In terms of assessing breeding, in addition to monitoring for the presence of unmarked individuals, cameras will be set up around the ARUs with wool dispensers to capture evidence that birds are collecting nesting material.

2.5 Shark Bay bandicoots

2.5.1 Methods

2.5.1.1 Translocations

Shark Bay bandicoots (SBB) were first translocated to DHI in September 2019 from Bernier and Dorre Islands (Cowen et al. 2020). A total of 70 animals were transferred directly from Bernier (n = 20) and Dorre (n = 50) Islands. The sex ratio for Dorre was exactly 1:1 but 13 females were translocated from Bernier compared to seven males. A further two males from Dorre Island which had been used for captive collar trials were released on DHI in October (with the dibbler release). An additional translocation to reinforce these initial founder cohorts was undertaken in September

2020. Twenty-seven SBB (11M:17F) were translocated from Bernier Island in 2020 bringing the total number of bandicoots translocated to DHI to 99.

2.5.1.2 Trapping

No targeted trapping of bandicoots was made during the past year, as opportunistic bandicoot captures were very high during surveys targeting other species. Density estimates could be derived from the second GSNR release area after trapping in September 2022 and April 2023. Shark Bay bandicoots were also captured during the 2023 dibbler trapping, but not in sufficient numbers to estimate density.

2.5.1.3 Cameras and incidental observations

In addition to cameras used for other targeted species' surveys on DHI, a small number of cameras were deployed across both the northern and southern areas of the island to provide further information on the occurrence of translocated species (Figure 21). A total of eight cameras have been deployed, five from the north of Herald Bay to Cape Inscription, and three from Tetradon Loop south toward Cape Ransonnet (Figure 21).

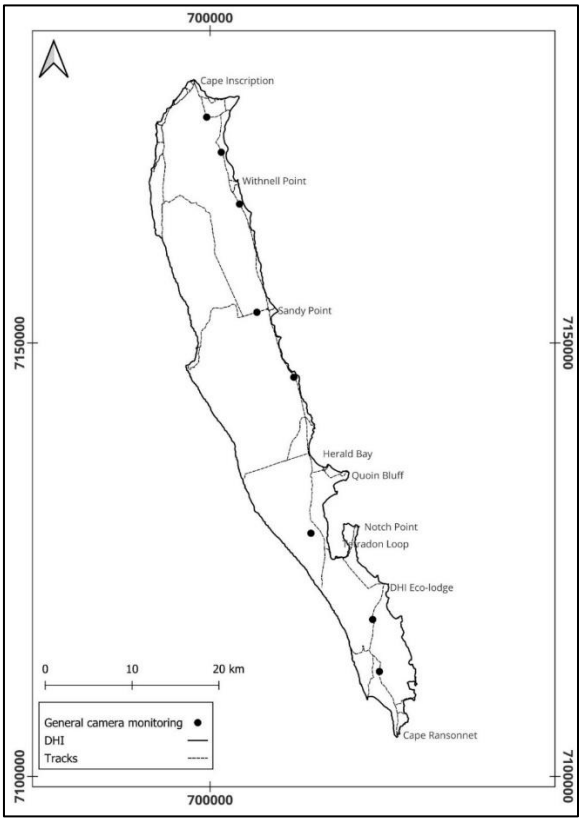

Figure 21: Location of general monitoring cameras.

2.5.2 Results

2.5.2.1 Trapping

During the GSNR survey in September 2022, 48 individual bandicoots were trapped. Of these, 44 were new individuals and three were recaptures (one individual escaped). Of note, 8 female captures had pouch young. Two of the recaptures were initially caught in June 2022 and the third one was first caught in September 2021. During the GSNR survey in April 2023, 49 individual SBB were trapped. Of these, 13 were new individuals.

A preliminary multi-session SECR analysis for these two trapping efforts estimated 0.81 (95% CI = 0.56 to 1.17) bandicoots per hectare in 2022 and 0.83 (95% CI = 0.57 to 1.19) bandicoots per hectare in 2023.

Twenty SBB were trapped during the small vertebrate surveys in 2022 at the two sites closest to Herald Bay. Of the 20 captures, 11 were new individuals. Nineteen SBB were also captured during the dibbler survey in November 2022, which included 17 new individuals. Twenty-two individual SBB were captured in the dibbler survey in May 2023, which included 20 new individuals.

2.5.2.2 Cameras

Cameras deployed around the island have confirmed SBB presence extending across most of DHI. In addition, SBB have been recorded at all camera survey sites targeted toward other species.

As an example, SBB were detected at the lured grid setup to monitor dibblers. Detections increased drastically in the year following the second release (Figure 22). Detections in this area were highest during spring in both 2021 and 2022.

Bandicoots have also been photographed on the SBM camera grids and GSNR grids. On the SBM grids, from April 2021 to March 2022, 24 independent detections of SBB were recorded at the 2021 release site and from April 2022 to November 2022, 22 detections have been made at the 2022 release site.

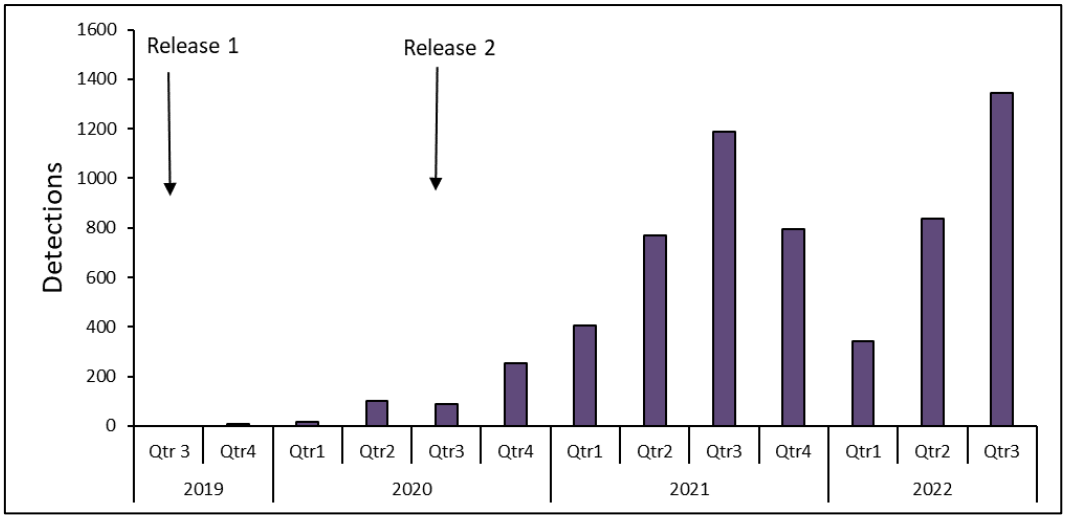

Figure 22: Detections of Shark Bay bandicoots from the lured camera grid used for monitoring dibblers. Detections are standardised at 25 cameras per quarter.

2.5.2.3 Incidentals

Shark bay bandicoot visual sightings are common around the Herald Bay camp and track observations extend greatly to the north and south of the island. Anecdotally, the instance of roadkill SBB appears to have increased over time, however, there has been no standardised monitoring program in place to provide an accurate measure of this change.

2.5.3 Discussion

The distribution of SBB has expanded in both a northerly and southerly direction from the original release areas. The increasing distribution is in line with the increasing density estimates that have been observed in areas around and adjacent to the release sites, as well as observations of bandicoots on cameras spread over different parts of the island and in a variety of habitats.

The short- and medium-term success criteria for this species have been met (Appendix 1).

2.6 Hare-wallabies

2.6.1 Methods

2.6.1.1 Translocations

Rufous and banded hare-wallabies (RHW and BHW) were released in 2017 and 2018, between Notch Point and Cape Ransonnet (Figure 1). Additionally, a third release of RHW took place in 2019 around Herald Bay (Figure 1).

2.6.1.2 Cameras and incidental observations

As shown in Figure 21, eight cameras have been deployed to assess the occurrence of hare-wallabies and other species across the island.

2.6.1.3 BHW scat survey

Three transects were walked between 2019 and 2020 in areas known as Blowholes and Notch Point (Figure 23). A total of 214 BHW scat samples were collected. Further details around the sampling process have previously been described (Cowen *et al.*, 2021, 2020). The scats were processed to extract DNA and were sequenced using a custom 48 loci single nucleotide polymorphism (SNP) panel array developed for hare-wallabies. The SNP panel array included 5 loci which contained island-specific markers where specific alleles are fixed to the respective source populations (Dorre Island and Bernier Island).

SNP data was first filtered by setting data missing thresholds to 0.3 across samples and 0.3 across loci (% missing data which was deemed acceptable). The resulting SNP data for each scat sample which passed quality control were then used within the R package ScatMatch for individual discrimination (n = 114; Table 5).

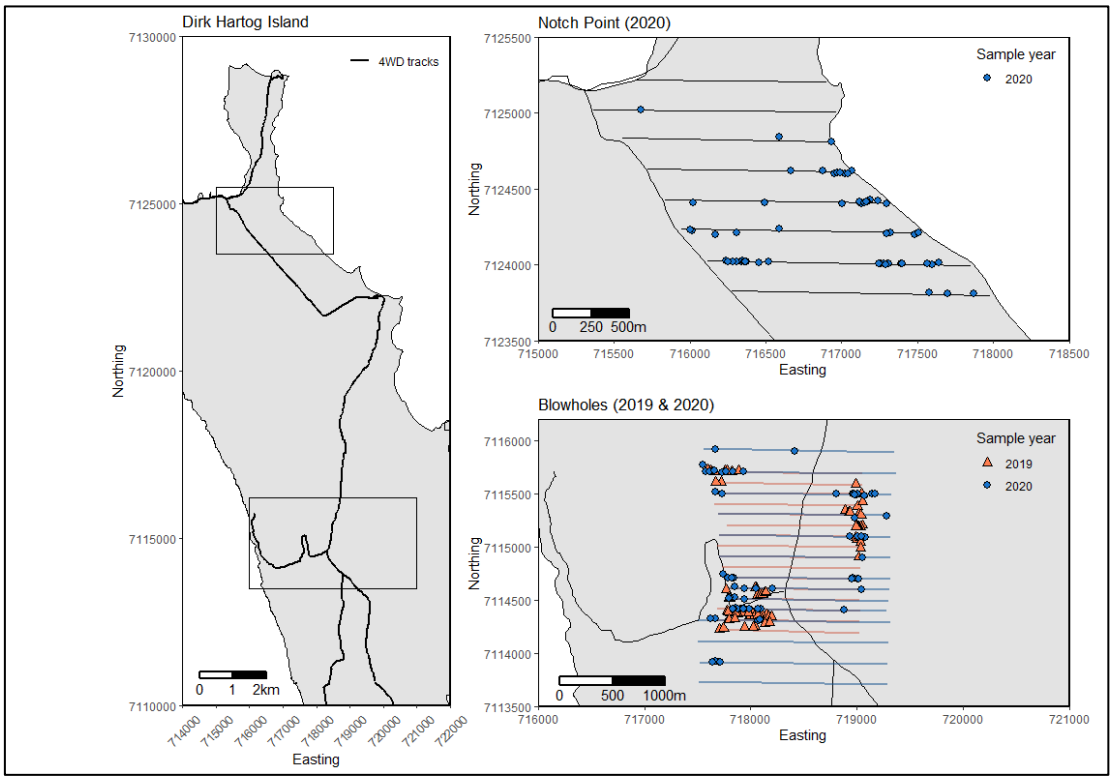

Figure 23: Location of transects on Dirk Hartog Island. Blowholes transects were conducted in 2019 (214 ha) and 2020 (368 ha), with slightly different transect lines walked between years. The survey at Notch Point was only conducted in 2020 (213 ha).

Table 5: ScatMatch detections of individuals for each transect sampling session, with sample sizes in parenthesis.

Transect (year)	ScatMatch
Blowholes (2019)	15 (41)
Blowholes (2020)	23 (47)
Notch Point (2020)	19 (26)

Individual detections were modelled in a preliminary spatially explicit capture recapture (SECR) model to estimate density. Scat detections were first snapped onto the closest point to the transect line of the given sampling session.

2.6.2 Results

2.6.2.1 Cameras and incidental observations

From the camera survey, RHW were observed at the furthest camera in the north (camera location shown in Figure 21). This is consistent with observations of tracks and live sightings also recorded in the area. Tracks and roadkill have been recorded less than a kilometer from Cape Ransonnet at the southern end of DHI. These records indicate that this species has spread north and south of the early release sites.

RHW were also recorded on the SBM, GSNR, and dibbler camera survey grids. At the SBM grids, one RHW was detected at the 2021 release site. At the 2022 release site at Herald Heights, 117 independent detections were recorded from 10 camera sites from the 21st of June to the 31st of December 2022 and 20 from the 1st of January to the 10th of April 2023. Additionally, visual observations are made regularly of RHW, around Herald Bay camp and by visitors near the homestead.

BHW continue to remain elusive, partly because it is not possible to visually differentiate between the two hare-wallaby species by their tracks and scats, and the BHW is not as easily detected by cameras and is rarely sighted as it tends to remain within denser habitat. One individual was visually sighted on the dibbler monitoring grid in May 2023.

2.6.2.2 BHW scat survey

After individual discrimination through ScatMatch, admixture estimates were derived by calculating the percentage of 10 alleles (from 5 loci) assigned to either Bernier or Dorre Islands (Figure 24). Although the sample size is small, there is evidence of first generation (50% allele origin to either source population) and second generation

(75% allele origin to one source population) hybridisation (Figure 24). In addition, the ScatMatch individual discrimination indicated that 10 individuals sampled in the 2019 Blowholes transect were resampled in the 2020 Blowholes transect. The maximum movement between scat collection points between years was 520m.

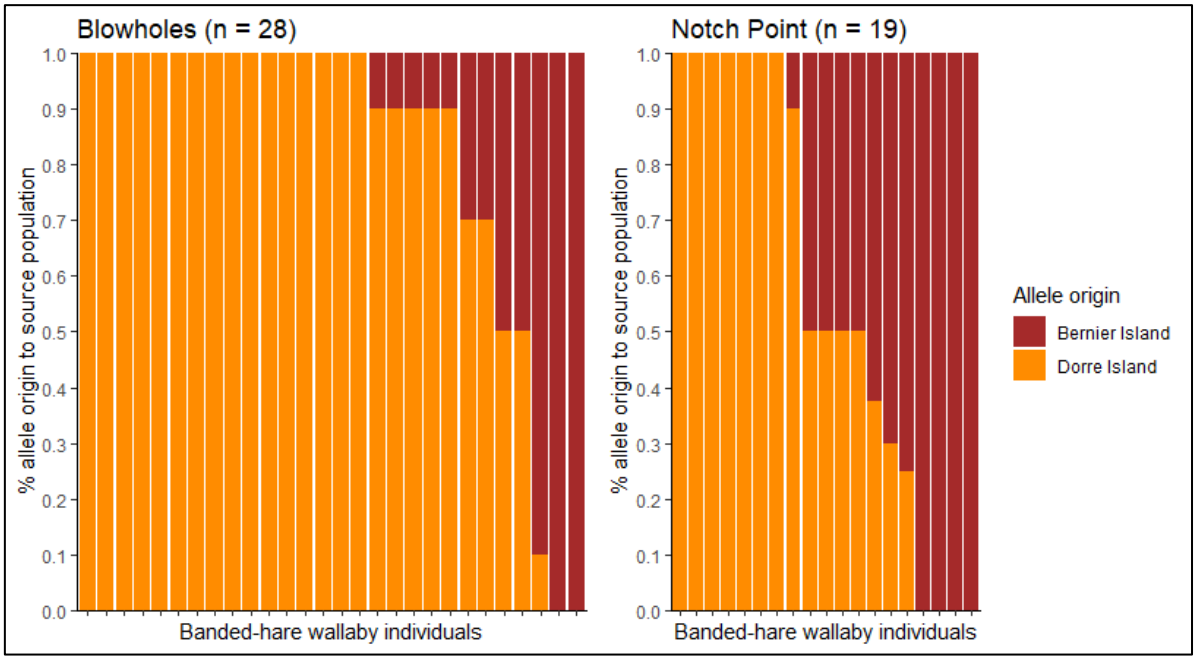

Figure 24: Admixture estimates of individual banded-hare wallaby to either Bernier or Dorree Island source populations

The best SECR model was model 2, in that animal home range may vary between years of sampling and between different transects at different spatial and temporal locations (Table 6). Within this model, density of banded hare-wallaby (animals/ha) for Blowholes in 2019, 2020 and Notch Point 2020 was estimated to be 0.043 (95% CI: 0.026 – 0.074), 0.071 (95% CI: 0.045 – 0.110) and 0.094 (95% CI: 0.058 – 0.154), respectively. As such, population density differences between transect years and sites were nonsignificant (overlapping confidence intervals), suggesting that population density has not increased between 2019 and 2020 at the Blowholes site and that density does not differ between localities (Blowholes and Notch point). These results suggest that since the last release in 2018 in the area, the Blowholes area may have reached its optimal population density, or more likely, animals were still able to emigrate to other parts of the largely uninhabited island.

Table 6: Models tested to estimate population density, where density, detectability (g0) or animal home range (sigma) could be influenced by session.

Model	Density	g0	Sigma
Null	D~1	g0~1	sigma~1
1	D~session	g0~1	sigma~1
2	D~session	g0~1	sigma~session
3	D~session	g0~session	sigma~1

2.6.3 Discussion

The RHW continues to do well on DHI with an increasing area of occupancy. Camera data has confirmed reported sightings of the RHW as far north as Cape Inscription and evidence of sightings, scat and tracks is also widespread (including roadkill almost to the southern tip at Cape Ransonnet). Unfortunately, there is much less information regarding the BHW. There are recent confirmations on cameras and one individual was sighted at the dibbler monitoring grid in May 2023. Scats that were collected in 2019 and 2020 have confirmed the persistence of this species in the survey area and have afforded a preliminary estimate of density. A scat survey is planned for spring 2023 with a view to providing more information on species abundance and distribution.

Both hare-wallaby programs have largely met the sensible short- and medium-term success criteria, noting some of the criteria are insoluble (Appendix 1). For example, it will be difficult to obtain sufficient information on animal weights given they are largely untrappable.

2.7 Extant vertebrate fauna

The extant fauna on DHI continues to be monitored regularly in Spring each year and aims to look at the long-term trends across a range of taxa following the eradication of introduced species, the restoration of previously extinct species and the introduction of new species. Baseline data prior to both programs has been collected and provides an assessment of the potential impact of the eradication and restoration programs.

2.7.1 Methods

2.7.1.1 Trapping

As per previous years, trapping involved the use of Elliott, pitfall, and funnel traps at eight sites. In a few cases, traps were closed due to the high presence of ants.

2.7.1.2 Incidental and camera observations

Cameras are in place across the island and are used for general and targeted surveys. These provide additional information on incidental sightings of extant species along with visual observations recorded during fieldwork periods.

2.7.2 Results

2.7.2.1 Trapping

From 1780 trap nights, 927 unique individuals (from 1054 captures) were recorded during the seven-day survey period in October 2022. Four mammal species and 28 reptile species were identified, including one new species, the bull skink (*Liopholis multiscutata*), recorded on DHI for the first time. Previous surveys captured 29, 29, 29, 28, and 29 reptile species, respectively. Skinks represented the highest proportion (7.6%) of reptile species caught, followed by geckos (5.3%). Individual counts of the different reptiles each year has varied considerably over time (e.g., Figure 25), suggesting that there are a range of factors differentially driving reptile abundance and distribution.

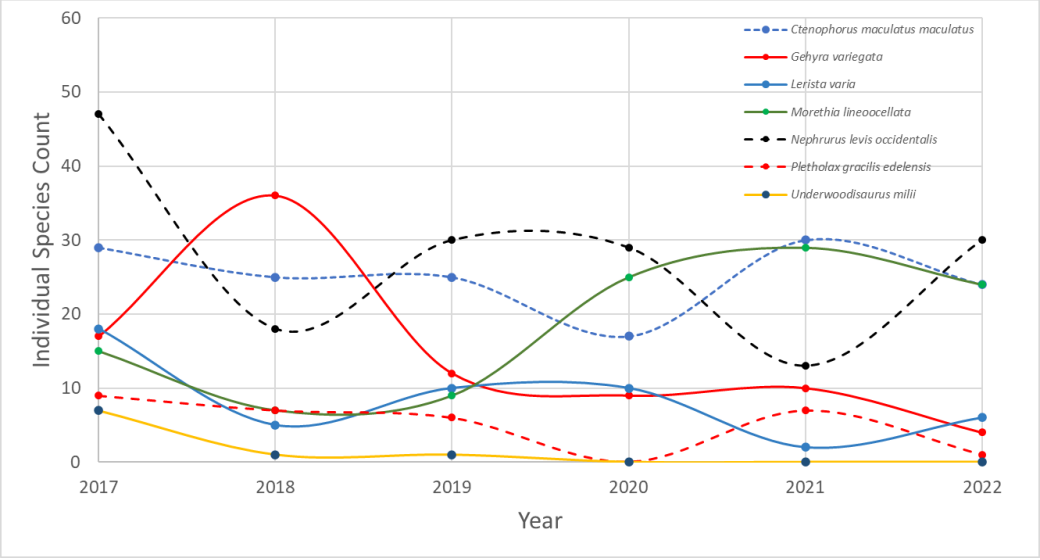

Figure 25: Examples of change in individual count data for six reptile species captured during the 6 years of surveying.

The largest percentage of total captures (across all species) was made up of ash-grey mice (*Pseudomys albocinereus albocinereus*; 34.6%) followed by the sandy inland mouse (*P. hermannsburgensis*; 26.3%). House mice were much lower than the other rodent species (8.2%). The little long-tailed dunnart (*Sminthopsis dolichura*) reached the highest capture numbers to date and both *P. a. albocinereus* and *P.*

hermannsburgensis have increased in capture number since the inception of the survey (Figure 26). Shark Bay bandicoots were caught for the first time (Figure 26).

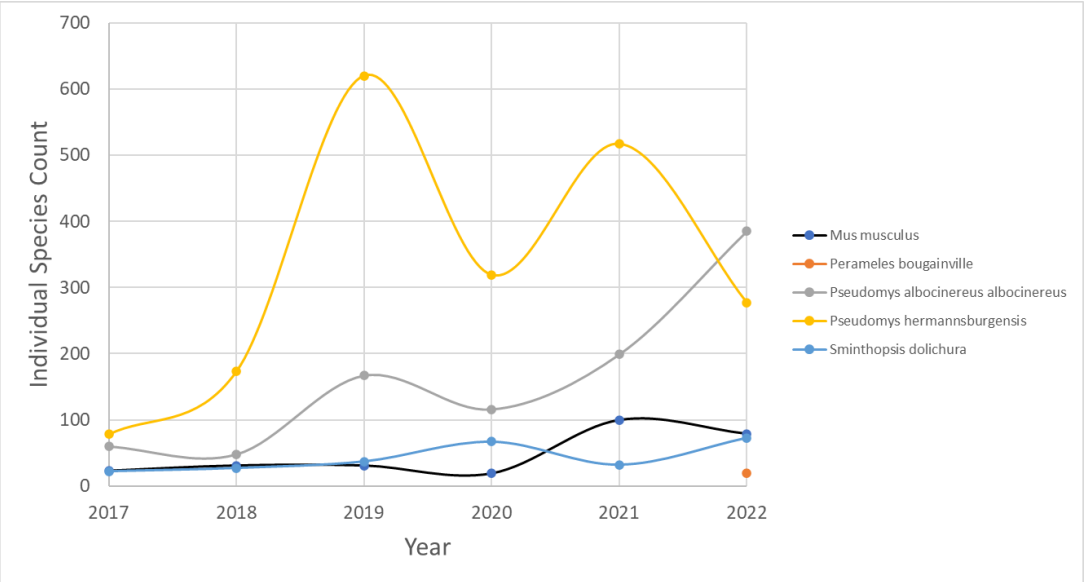

Figure 26: Total count of mammal species caught during the pit-survey each year.

2.7.2.2 Incidental and camera observations

Across all cameras, trapping and observational methods, 119 species were recorded during the past year (Appendix 2).

2.7.3 Discussion

Overall, the number of reptile and mammal species trapped has remained reasonably constant over time, but there have been clear changes in the number of individuals captured for each species from one year to the next. As shown in the examples provided in Figure 26, species counts typically oscillate over time, but overall, some species counts have remained reasonably constant, while others have increased or decreased. These results highlight the need for any analytical analysis of this data to account for species detectability and to incorporate meaningful covariates on the modelling of both detection and occupancy probabilities. It is also worth noting that arid and semi-arid processes can occur over long timeframes and as such, a longer-term data set (i.e., over 20+ years) may be required to understand any changes more fully in wildlife densities and distributions that have occurred in response to management as opposed to more ‘natural’ drivers of change.

3 General discussion and conclusions

Overall, the results for the 2022 to 2023 period were positive. There is good evidence that all translocated species are establishing, breeding, and beginning to disperse from their release areas. There were no indications of any animal health and welfare issues and an additional species, the Western grasswren was re-established on the island. Achievable success criteria are being met (Appendix 1) indicating overall program success.

Several species present monitoring challenges that will be the focus of research over the next few years. For example, the use of scat DNA sampling for GSNR is going to be investigated. A scat and track guide has been proposed, and an assessment of interest in and feasibility of a scat/track species recognition phone App (that harnesses AI technologies) will be investigated. If desired, feasible and effective, the App would open the monitoring of species up to citizen involvement. An initial assessment will also be made of the feasibility of using e-DNA (possibly collected from flies such as midges, mosquitos, water, or sand) to detect mammal species on the island.

4 Planning for 2023-2024

4.1 Translocations

- Brush-tailed mulgara (BTM) translocation from Mutawa in June 2023.
- Dibbler releases from Perth Zoo in October and November 2023.
- Investigate feasibility/effectiveness of additional BTM translocations from Pilbara source sites.
- Investigate feasibility of desert mouse translocations for 2024.

4.2 Monitoring

- Radio-tracking translocated BTM.
- Hare-wallaby scat search in Spring 2023.
- Monitor Western grasswrens in Spring 2023.
- Develop and enact monitoring for SBM, SBB, dibbler, GSNR and hare-wallabies away from release areas to facilitate assessment of long-term success criteria.

4.3 Genetic analyses

- Assess genetic variability (allelic richness and heterozygosity maintained at >90% of released individuals) of hare-wallabies as per long-term success criteria.
- Assess genetic variability (allelic richness and heterozygosity maintained at >85% of released individuals) of SBBs as per long-term success criteria.

- Assess the feasibility of using GSNR and SBB scats to monitor population size.

4.4 Future monitoring

- Begin to assess the feasibility of using e-DNA (whether collected from water, sand, insects, or some other substrate) to monitor for presence/absence of translocated species across the island.
- Develop scat and track guide for translocated fauna and begin to assess the feasibility of developing an App with AI capabilities to harness citizen captured data.

Appendices

Appendix 1 Success criteria

Brush-tailed Mulgara

Criteria	Assessment	Evidence
Short-term (< 6 months)		
>67% survival of individuals fitted with VHF transmitters with known outcomes at one month after release (or when the transmitter is removed).	Successful	
Likely causes of mortality have been identified and/or ameliorated during first two months of monitoring.	Successful	Only 1 confirmed mortality of collared individual – most likely predation by reptile, but this can rarely be confirmed as animals may have scavenged an already dead animal.
Monitoring methods provide evidence of continued persistence of populations up to 6 months post-release. At least 25% cameras show continued presence within 3km of the release site (or other nearby suitable habitat) and/or trapping of at least 20% of founders.		
Medium-term (6 to 24 months)		
Population settled in an area of suitable habitat as evidenced by monitoring methods (e.g., cameras, traps, or tracks) within 24 months post-release.		
Evidence of reproduction and successful recruitment of F1 and possibly F2 individuals into the populations within 24 months post-release.		
Average body weight and condition of captured individuals is maintained within range (within +/- 5%) of that observed in founder group at release (dependent on comparable rainfall and breeding season) within 24 months.		
Evidence of dispersal of new recruits beyond initial release area by two years post-translocation.		
Long-term (> 24 months)		
Area of occupancy increased or dispersal of recruits > 5 km from release area as confirmed through monitoring methods like camera surveys, track and scat surveys, trapping or PIT-tag readers at 4- and 7-years post release.		
Population size (consistent in either occupancy, abundance, density or activity rates) has increased from original founder population size after 5		

years (in absence of drought conditions).		
Evidence of F2 or later generations (as defined by new individuals) or reproductive activity after 5 years post release.		
Genetic diversity remains high (>90% allelic richness and >95% heterozygosity of founder group) with analysis confirmed by 7 years post-release.		

Shark Bay mouse

Criteria	Assessment	Evidence
Short-term (< 6 months)		
No more than 30% known mortality of ratio-tagged animals at the end of radio-tag life.	Successful	April 2021 release: • 12 animals collared. • By end of tag lives, 33% mortality. April-May 2022 release: • 12 animals collared. • By end of tag lives, 0.08% mortality. Overall mortality = 0.17%
Monitoring as measured by trap, track or camera surveys indicates continued survivorship of founder cohort for first 3 to 6 months and founders settle within an area indicating suitable habitat is being occupied.	Successful	Trapping at the 1st release area in September 2021 resulted in the capture of seven founders. Trapping at the 1st release area in May 2022 resulted in the capture of four founders. Trapping at the 2nd release area in September 2022 resulted in the capture of one founder.
No cause(s) of mortality which are unidentified or unable to be ameliorated.	Successful	Cause of mortality for individuals likely to have been killed were: • In 2021, 3 individuals were believed to have been killed by snakes and one by a bird of prey. • In 2022, one individual was thought to have been killed by a bird. Note, this criterion is largely insoluble. It is typically impossible to determine exactly how an animal has died if a collar is found. Finding a collar with teeth marks (for example) may be indicative of predation by a particular species, but the predator may have also scavenged from a carcass. Further, it would be impossible to completely ameliorate predation by snakes or birds without eradicating those species.
Recaptured founders have maintained or increased bodyweight (after initial weight loss expected during translocation process).	Successful	2021 • weight loss of collared animals: -24% • uncollared individuals: -12%. 2022 • mean weight gain (across 7 individuals) 20 days post translocation was 3.9%.
Medium-term (6 to 24 months)		
Founder population has established in release area (as indicated by ongoing presence through trap, track, or camera surveys) and numbers of individuals known to be alive is maintained or increased.	Successful	In terms of founder survival, trapping at the 1st release area in September 2021 (≈ 5 months after 1st translocation) resulted in the capture of 7 founders. Trapping at the 1st release area in May 2022 (≈ 1 year after 1st translocation) resulted in the capture of four founders. Trapping at the 2nd release area in September 2022 (≈ 5 months after 2nd translocation) resulted in the capture of one founder. At the first and second release sites population density increased over the twelve months following the release of animals (Figure 5).
Evidence of reproduction and successful recruitment of new F1 individuals into population.	Successful	25 new individuals were captured in the September 2021 survey. 38 new individuals were captured in May 2022. 39 new individuals were captured in September 2022. 80 new individuals were captured in April 2023.
Dispersal of new recruits and increasing activity (as measured by trap, track or camera surveys).	Successful	Shark Bay mice have been recorded at the Herald Bay camp (Figure 2). Possible tracks observed Cape Ransonnet (Figure 2).

Body weight and condition is maintained at levels like the source populations (as appropriate to prevailing seasonality and variable rainfall).	Unsuccessful	The weight of recaptured individuals continued to decrease over time after the initial translocation, noting that even though there was, on average, weight loss after longer periods (i.e., 150 days after release), the extent of weight loss decreased (Figure 6). Body condition was typically good for captured individuals.
Long-term (> 24 months)		
Population has continued to expand area of occupancy to at least twice that initially occupied by the founder group (as confirmed through increased number of sites with positive detections obtained through trap, track or camera surveys) and monitoring indicates increase in population size (as inferred through relative activity indices or relative abundance)	TBD	
F2 (and longer) generation present and reproducing (adults recorded five years or more post release will likely be at least F2)	TBD	
Genetic variability (allelic richness and heterozygosity) maintained at >90% of released individuals at 5- and 10-years post-release (alternative criteria may be developed based upon deviations of genetic diversity from a mean value).	TBD	
Population persists and recovers their area of occupancy and relative activity or relative abundance after a first drought cycle.	TBD	

Greater stick-nest rat

Criteria	Assessment	Evidence
Short-term (< 6 months)		
At least 70% of founder animals KTBA one to two months after release and monitoring indicates continued survivorship of animals for the next three to six months.	Successful	• After approximately one month post release, 67% of individuals collared during the 2021 release were alive when their collar was removed, two individuals (13%) were known to have died. The remaining 20% of collared individuals had various collar issues but were likely alive for the first month post translocation. Thus, around 87% of collared individuals were known to be alive within 1 to 2 months post release. • Nine camera detections were made at protonest sites around one month post the 2021 translocation. • 77% of radio-tracked individuals from the May 2022 release were alive after four to five weeks post release. • Trapping in September 2021 (≈ five months post release) resulted in the capture of six individual greater stick-nest rats (3M:3F), of which five were founders. • Trapping in September 2022 at the second release site (≈ five months post release) resulted in the capture of eight individual greater stick-nest rats, of which five were from the 2022 release.
No significant causes of mortality which are unidentifiable and unable to be ameliorated	Successful	The known mortalities of collared individuals (14% of all collared individuals across both releases) was explainable as predation by birds and reptiles. Whether 14% is 'significant' (or not) is insoluble and as such we treat it as not significant.
Founders have maintained or increased bodyweight (after initial weight loss (<15%) expected during translocation process)	Successful	2021 post release: The average weight change of the 11 individuals whose collars were removed was -1.4%, noting that 55% of individuals increased in weight. 2022 post release: The average weight change of the 10 individuals whose collars were removed was 9.1%. Total average across all collared individuals was 3.6% weight gain. Five founders trapped in September 2021 had an average weight gain of 6.8% with 60% of individuals increasing in weight.
Founders settle within an area and use daytime refuges/shelter, which may	Successful	As described in Figure 11 and Figure 12, stick-nest rats have maintained activity around the protonests used at their release

include constructed stick nests by females, use of hollows, rock caves and crevices, burrows and dead wood piles indicating suitable habitat is being occupied		sites, indicating they have 'settled in' and are using substrates in the immediate area.
Medium-term (6 to 24 months)		
Continued survivorship of founders (and progeny) over the first summer (≥50% of those KTBA at 6 months still KTBA at 12 months)	Unsuccessful	No translocated individuals known-to-be-alive after around 3 months have been recaptured. One 2021 release animal was detected up to July 2022 on the WildTrack system (14 months post release) and animals from the 2022 release were most recently detected in September 2022 (four months post release)
Population has established and maintained or expanded habitat used, including construction of stick nests.	Successful	Based upon Figure 12, stick-nest rats appear to be established at the 2022 protonests and are presumably using habitat. Maintaining or using habitat is a nonsensical success criterion. If the animals are in a place and alive over time, they are presumably using habitat, otherwise they would not be there.
Evidence of reproduction and successful recruitment of new F1 individuals into the population	Successful	In September 2021, one trapped individual was a new subadult female. In September 2022, three new individuals were trapped. Attached young, juvenile and subadult animals have been captured on remote camera within release area.
Dispersal of new recruits and increasing activity	Successful	Stick-nest rat tracks have been confirmed at Surf Point in April 2023, approximately 25 km from the release points. However, it is not known whether these are new recruits. 'increasing' activity is a nonsensical criterion.
Expansion of the area of occupancy of initial founder group	Successful	The initial area of occupancy of the founder group was meant to be the general area where the species was released and as such this criterion can be assessed as the area of occupancy of the species in general is increasing over time beyond the original release area. The confirmed presence of greater stick-nest rats near surf point is indicative of success.
Long-term (> 24 months)		
Population has increased and continued to expand area of occupancy to at least twice that initially occupied by the founder group	TBD	
F2 (and longer) generation present and reproducing	TBD	
Body weight and condition is maintained at levels similar to source populations, > 50% females breeding (as appropriate to prevailing seasonality and variable rainfall)	TBD	
Population persists and recovers their area of occupancy and density after a first drought cycle	TBD	
Genetic variability (allelic richness and heterozygosity) maintained at ≥90% of released individuals at five to 10 years post-release (alternative criteria may be developed based upon deviations of genetic diversity from a mean value).	TBD	

Dibbler

Criteria	Target	Measure of success (Triggers for action and/or review)	Success	Evidence
Short-term: 0-12 months post-release				
Survivorship of founders	Dibblers continue to be detected at least 12 months post-release	Dibblers recorded at ≥50% of soft-release/nest-box camera sites ≥10 days post-release.	Successful	78% of cameras located at pens and nest box in 2021 recorded dibbler activity for more than 10 days post release.

		Dibblers recorded at ≥25% of soft-release/nest-box camera sites ≥60 days post-release.	Successful	56% of cameras located at pens and nest box in 2021 recorded dibbler activity for more than 60 days post release.
		Dibblers recorded at lured and soft-release/nest-box camera sites at least 12 months after release.	Successful	19% of cameras located at pens and nest box in 2021 recorded dibbler activity for more than 330 days post release.
Health of founders	Founder animals maintain health and condition	Maintenance or increase in body weight and condition at 7 and 12 months compared to initial release.	Successful	Female trapped in May 2021 (≈ 8 months post release) increased in weight by 63% (noting she was carrying pouch young).
		Stabilisation or increasing body weight of animals released into 'soft release' pens, prior to opening of pens (~10-14 days).	Successful	In October 2021, all but one pen released dibbler lost weight over a 9-day period. In October/November 2022, pen released dibblers experienced an average weight loss of 5.57% over an average of 8 days. However, animal weight 'stabilised', thus meeting the criteria
Genetic diversity of founders	Sufficient numbers of animals are released to maximise genetic diversity on DHI (as determined by PVA)	>95% allelic diversity has been conserved during captive breeding	TBD	
Reproduction by founders	Some evidence of successful breeding	≥50% of trapped founder females produce pouch young 7 months after initial release.	Successful	Only female capture in May 2021 trapping was a founder with 8 pouch young and was caught again in 2022 with 6 pouch young. Only female captured in May 2023 trapping was a non-founder adult carrying 8 pouch young.
		Juveniles trapped or recorded by camera traps within 12 months of initial release.	TBD	No juveniles have been trapped or recorded on camera, but pouch young have been trapped twice. Also of note, juveniles were released, making it impossible to differentiate new juveniles from released ones without trapping them. There is also a possibility that juvenile dibblers may be caught on camera prior to the 2023 release.
Medium-term: 13 - 36 months post- release				
Survivorship of founders	Animals persist on island 36 months since first release	Founder individuals captured up to 24 months post-release	TBD	
		Naïve occupancy at lured camera and soft-release/nest-box sites increases.	TBD	
Health of founders	Founder animals maintain health and condition	Body weight and condition maintained within variation observed in initial release data and taking climatic variation into account.	TBD	
Reproduction of founders	Successful reproduction and	≥50% of trapped females with pouch young at 19 months	TBD	

	population recruitment	and 31 months after first release.		
		Island-born juveniles (F1) trapped by 36 months	TBD	
Behaviour/movements	Population expansion	Extent of occurrence increases between 12 and 36 months based on trapping/camera trap data.	TBD	
Long-term: 3 – 10 years post-release				
Population survivorship	Population persists on Dirk Hartog Island	Population size at 3 years maintained or increased at 10 years.	TBD	
Health of population	Population maintains heath and condition	Body weight and condition maintained within variation observed in initial release data and taking climatic variation into account.	TBD	
Reproduction	Successful reproduction and population recruitment	Evidence of young/juveniles in trappable population at 10 years. At least 50% of females breeding (depending on climatic conditions).	TBD	
Behaviour/movements	Animals establish in suitable habitat	Area of occupancy increased between 3 and 10 years based on trapping or camera trap data.	TBD	
Genetic vigour (after 10 years/120 months)	Population maintains genetic diversity of founder group and commensurate with island source population	>90% allelic diversity and >95% heterozygosity of founder group is maintained at 10 years.	TBD	
Genetic representation	Genetic admixture is maintained and not biased to one island source population	Frequency of island-specific alleles ('private alleles') does not diverge significantly from founder group.	TBD	

Western grasswren

Criteria	Assessment	Evidence
Short-term (< 6 months)		
≥80% survival (or ≤20% mortality) of radio-tagged individuals (with known outcomes) (30 days post-release).	Successful	No individuals were tracked for 30 days, but of the 25 animals tracked (average of 13 days ± 6 days SD) there was only one confirmed mortality.
≥50% radio-tagged individuals settle within areas of suitable habitat in proximity to release area (30 days post-release).	Successful	All tracked birds were still within the greater release area at completion of their tracking period (<1.6km)
Founders continue to be seen or heard calling/singing AND/OR interacting socially with other conspecifics (2 months post-release).	Successful	ARU information indicated birds were singing as recently as March 2023; five months post release (most recent data analysis)
No significant causes of mortality which are unidentifiable and unable to be ameliorated (6 months post-release).	Successful	Only one known cause of mortality of a tracked bird which appeared to be predation, but predator unknown.
Medium-term success criteria		
Evidence of reproductive behaviour (e.g., nest-building activity) (10 months post-release).	TBD	

Continued survivorship of founders with grasswrens detected (via sighting (including call broadcast surveys) or recording) at ≥50% of 'territories' established during initial post-release period (12 months post-release).	TBD	
Evidence of successful reproduction (e.g. observations of juveniles or unbanded birds) (13 months post-release).	TBD	
Extent of occurrence of grasswrens continued to expand beyond initial release area (24 months post-release).	TBD	
Long-term success criteria		
Population has increased and continued to expand extent of occurrence to at least twice that initially occupied by the founder group (4 years post-release).	TBD	
F1 generation birds confirmed to be alive and successfully reproducing (4 years post-release).	TBD	
Population persists and recovers their area of occupancy and density after a first 'drought' cycle (~10 years post-release).	TBD	
Genetic variability (allelic richness and heterozygosity) maintained at ≥90% of released individuals at five- and 10-years post-release (alternative criteria may be developed based on deviations of genetic diversity from a mean value) (5- and 10-years post-release).	TBD	
Genetic analysis indicates successful interbreeding between founders from Peron and Hamelin subpopulations (5- and 10-years post-release).	TBD	

Shark Bay bandicoot

Criteria	Assessment	Evidence
Short-term (0 - 6 months)		
At least 60% of founder animals known to be alive (KTBA) one-two months after release (based on radio-tracking and/or live-capture) and monitoring indicates continued survivorship of animals for the next four to seven months	Successful	100% survival of radio-tracked individuals released in 2019 and 2020 survived for 1 to 2 months post release.
No cause(s) of mortality which are unidentified and unable to be ameliorated	Successful	No mortality of radio-tracked individuals from 2019 and 2020 releases
Founders have maintained or increased bodyweight (after initial weight loss (<15%) expected during translocation process)	Successful	Average weight gain of recaptured founders after 6 months or more post release was 50.9 g (54.0 SD)
Founders settle within an area and use daytime refuges/shelter, indicating suitable habitat is being occupied	Successful	The species has survived, reproduced, colonized the release areas and has dispersed both north and south.
No evidence of significant founder survival compromised by expression of BPCV1	Successful	To date, no cases of BPCV1 have been detected
Medium-term (6 - 24 months)		
Continued survivorship of founders (< 20% identified mortality of founders and > 50% of those alive at 7 months still known to be alive (KTBA) at 12 months)	Successful	Of the 14 animals known to be alive after 7 months, 11 (or around 79%), were recaptured after the 12-month mark post release.
Founder population has established and expanded habitat used	Successful	The founder population has clearly dispersed and established in new areas of the island. Not possible to determine if this is expanding habitat use, that part of the criteria is nonsensical.
Evidence of reproduction (presence of pouch young) and successful recruitment of new F1 individuals into population	Successful	The species is clearly reproducing, recruiting and F1 if not F2 and F3 individuals are in the population.
Dispersal of new recruits and increasing activity (as measured by trap, track, spotlight or camera surveys)	Successful	The founder population has clearly dispersed and reproduced, as have island born individuals.
Expansion of the area of occupancy of initial founder group	Successful	The species has clearly expanded its area of occupancy from the initial release area.
Long-term (24 - 120 months)		
Population has increased and continued to expand area of occupancy to at least twice that initially occupied by the founder group and up to 25% of suitable habitat south of the management fence	TBD	
F2 (and longer) generation present and reproducing	TBD	
Body weight and condition is maintained at levels similar to source populations, >50% females breeding (as appropriate to prevailing seasonality and variable rainfall)	TBD	
Genetic variability (allelic richness and heterozygosity) maintained at >85% of released individuals at five- and 10-years post-release (alternative criteria may be developed based on deviations of genetic diversity from a mean value)	TBD	
Population persists and recovers their area of occupancy and density after a first ‘drought’ cycle	TBD	

Rufous hare-wallaby

Criteria	Assessment	Evidence
Short-term (0 - 9 months)		
At least 50% of the radio-collared, released hare-wallabies survive for the first four months after release.	Successful	In the 2017 trial release, 75% of collared individuals were known to be alive after 4 months post release. In the 2018 release, 83% of collared individuals were known to be alive after 4 months post release.
Any causes of mortality are understood and ameliorated.	Successful	In the 2017 trial release, one individual collared was known to have died, probably from myopathy. An individual was killed by a car in 2019. A second individual released in 2019 was found dead >6 months post release but the cause of the mortality identified could not be identified due to the level of decomposition. It was concluded that the mortality was not related to the actual translocation. Actions (reduced transport time through changed transport method) were taken in 2019 & 2020 to reduce risks associated with capture myopathy observed in 2017.
Founders have maintained or increased bodyweight, condition maintained.	Unsuccessful	In the 2017 and 2018 trial release, the weights of recaptured rufous hare-wallabies had increased from time of collaring, although few had reached their original capture weight. This is a flawed criterion as the species is not readily trappable.
Some evidence of successful recruitment of those that may have been larger pouch young when translocated.	Successful	The number of animals on the island is now greater than the released population, indicating recruitment. Also, wallabies with young-at-heal have been observed and captured on camera.
Medium-term (10 - 36 months)		
Population has established and expanded habitat is used.	Successful	Individuals are now being recorded across the island.
Body weight and condition are maintained.	Unsuccessful	This is criterion cannot be assessed properly for this species using current monitoring techniques.
Further evidence of successful reproduction; presence of pouch young, or F1 generation (from females with large pouch young when translocated).	Successful	Individuals with enlarged pouches and young-at-heal have been seen and captured on camera.
Hare-wallabies are recorded during spotlight and/or trapping monitoring sessions.	Successful	Scat DNA sampling being employed to monitor this species. Targeted spotlight and trapping sessions have not been used to monitor this species; however, animals are recorded anecdotally in weekly incidentals tallies during fieldwork periods and are regularly captured on remote camera.
Long-term (3 - 10 years)		
Population size improved from initial release and area of occupancy expanded.	TBD	
Health and condition maintained providing non-drought conditions experienced.	TBD	
Evidence of F2 (and longer) generations, at least 50% of females breeding (depending on climatic conditions).	TBD	
Population recovers area of occupancy and density after first drought cycle	TBD	

Genetic variability maintained at ≥90% of allelic diversity and heterozygosity of released individuals.	TBD	

Banded hare-wallaby

Criteria	Assessment	Evidence
Short-term (0 - 9 months)		
At least 50% of the radio-collared, released hare-wallabies survive for the first four months after release.	Successful	In the 2017 trial release, 83% of collared individuals were known to be alive after 4 months post release. In the 2018 release, 83% of collared individuals were known to be alive after 4 months post release.
Any causes of mortality are understood and ameliorated.	Successful	No known mortalities
Founders have maintained or increased bodyweight, condition maintained.	Successful	In the 2017 trial release, the weights of recaptured hare-wallabies decreased. In the 2018 release, recaptured wallabies (after around 12 weeks) regained lost weight. This is a flawed criterion – may be natural weight loss over summer months aligning with the monitoring period.
Some evidence of successful recruitment of those that may have been larger pouch young when translocated.	Successful	Some recaptured wallabies had pouch young and young-at-foot have been recorded
Founders settle within an area and use daytime refuges/shelter		Radio-collared animals settled within individual areas during the initial radio-tracking period (< 3 months), remaining in those areas until collars were retrieved (~ 9 months post release). Based on survivorship and attempts to recapture collared animals, available shelter and refuges were being utilised to great affect by BHW.
Medium-term (10 - 36 months)		
Continued survivorship of founders, >50% of those alive at 9 months still alive at 15 months	NA	Cannot be measured
Population has established and expanded habitat is used.	Successful	Individuals have been recorded and scat monitoring indicates establishment. The expanded habitat cannot be confirmed however, the area of occupancy has increased with animals observed and captured on camera as far north as Herald Bay in 2022-2023.
Body weight and condition are maintained (within release data variation and taking into account climatic conditions)	NA	Cannot be measured
Further evidence of successful reproduction; presence of pouch young, or F1 generation (from females with large pouch young when translocated), >50% of surviving founder females produce PY within 24 months, Young at heal/independent young recorded.	Successful	Animals with enlarged pouches have been captured on cameras.
Hare-wallabies are recorded during spotlight and/or trapping monitoring sessions.	Successful	Scat DNA sampling is being employed to monitor this species. Targeted spotlight and trapping sessions have not been used to monitor this species; however animals

		are captured sporadically on remote camera.
Long-term (37 – 120 months)		
Population has increased and expanded area of occupancy.	TBD	
Body weight and condition maintained, >50% females breeding.	TBD	
Evidence of F2 (and longer) generations.	TBD	
Population recovers area of occupancy and density after first drought cycle	TBD	
Genetic variability maintained at ≥90% of allelic diversity and heterozygosity of released individuals 5 to 10 years post release.	TBD	

Appendix 2 Species list for June 2022 to June 2023

Common name	Scientific name	Observation	Live capture	Remote camera
Sandhill Frog	*Arenophryne rotunda*	X		
Loggerhead Turtle	*Caretta caretta*	X		
Dwarf Bearded Dragon	*Pogona minor*	X		X
Shark Bay Heath Dragon	*Ctenophorus butlerorum*		X	
Spotted Military Dragon	*Ctenophorus maculatus*	X	X	
Western Netted Dragon	*Ctenophorus reticulatus*	X		
Smooth Knob-tailed Gecko	*Nephrurus levis*	X	X	
Barking Gecko	*Underwoodisaurus milii*	X		
South-western Clawless Gecko	*Strophurus spinigerus*	X	X	
Ornate Gecko	*Diplodactylus ornatus*	X	X	
Variegated Gehyra	*Gehyra variegata*	X	X	
Bynoe's Gecko	*Heteronotia binoei*	X	X	
Shark Bay Worm-lizard	*Aprasia haroldi*		X	
Spinifex Delma	*Delma butleri*	X	X	
Burton's Legless lizard	*Lialis burtonis*		X	
Shark Bay Keeled Legless Lizard	*Pletholax edelensis*		X	
Peron's Snake-eyed Skink	*Cryptoblepharus plagiocephalus*	X		
Western Limestone Ctenotus	*Ctenotus australis*		X	
West Coast Laterite Ctenotus	*Ctenotus fallens*	X	X	
Western Slender Blue-tongue	*Cyclodomorphus celatus*	X	X	
Elegant Slider	*Lerista elegans*		X	
Line-spotted Robust Slider	*Lerista lineopunctulata*		X	
Keeled Slider	*Lerista planiventralis*		X	
West Coast Worm-slider	*Lerista praepedita*		X	
Variable-striped Robust Slider	*Lerista varia*		X	
Bull Skink	*Liopholis multiscutata*		X	
Common Dwarf Skink	*Menetia greyii*		X	
West Coast Morethia Skink	*Morethia lineoocellata*	X	X	
Shark Bay Bobtail	*Tiliqua rugosa palarra*	X		X
Spiny-tailed skink	*Egernia stokesii*			X
Gould's Monitor	*Varanus gouldii*	X	X	X
Narrow-banded Shovel-nosed Snake	*Brachyurophis fasciolatus*		X	
Yellow-faced Whipsnake	*Demansia psammophis*		X	
Mulga Snake	*Pseudechis australis*	X	X	X
Gwardar	*Pseudonaja mengdeni*	X		
West Coast Banded Snake	*Simoselaps littoralis*	X	X	
Children's python	*Antaresia childreni*	X		
Southern Blind Snake	*Anilios australis*		X	
Brown quail	*Coturnix ypsilophora*	X		X
Stubble Quail	*Coturnix pectoralis*	X		
Australian Shelduck	*Tadorna tadornoides*	X		
Wedge-tailed Shearwater	*Puffinus pacificus*	X		
Australasian Gannet	*Sula serrator*	X		
Little Pied Cormorant	*Phalacrocorax melanoleucos*	X		

Common name	Scientific name	Observation	Live capture	Remote camera
Pied Cormorant	*Phalacrocorax varius*	X		
Australian Pelican	*Pelecanus conspicillatus*	X		
White-faced Heron	*Ardea novaehollandiae*	X		
Nankeen night heron	*Nycticorax caledonicus*	X		
Great Egret	*Ardea alba*	X		
Eastern Reef Egret	*Ardea sacra*	X		
Black-shouldered Kite	*Elanus caeruleus*	X		
Osprey	*Pandion haliaetus*	X		
Wedge-tailed Eagle	*Aquila audax*	X		X
White-bellied sea-eagle	*Haliaeetus leucogaster*	X		X
Swamp harrier	*Circus approximans*	X		
Spotted harrier	*Circus assimilis*	X		
Brown Falcon	*Falco berigora*	X		
Australian Kestrel	*Falco cenchroides*	X		X
Australian Hobby	*Falco longipennis*	X		
Australian Boobook	*Ninox boobook*	X		
Australian Bustard	*Ardeotis australis*	X		X
Little Button-quail	*Turnix velox*	X		
Painted Button-quail	*Turnix varia*	X		X
Whimbrel	*Numenius phaeopus*	X		
Common Sandpiper	*Actitis hypoleucos*	X		
Red-necked Stint	*Calidris ruficollis*	X		
Grey-tailed Tattler	*Tringa brevipes*	X		
Ruddy Turnstone	*Arenaria interpres*	X		
Pied Oystercatcher	*Haematopus longirostris*	X		
Sooty Oystercatcher	*Haematopus fuliginosus*	X		
Black-winged Stilt	*Himantopus himantopus*	X		
Red-necked Avocet	*Recurvirostra novaehollandiae*	X		
Greater Sand Plover	*Charadrius leschenaultii*	X		
Red-capped Plover	*Charadrius ruficapillus*	X		
Banded Lapwing	*Vanellus tricolor*	X		X
Silver Gull	*Larus novaehollandiae*	X		
Pacific Gull	*Larus pacificus*	X		
Lesser Crested Tern	*Sterna bengalensis*	X		
Crested tern	*Sterna bergii*	X		
Caspian tern	*Sterna caspia*	X		
Common Tern	*Sterna hirundo*	X		
Fairy Tern	*Sterna nereis*	X		
Australian Gull-billed Tern	*Sterna nilotica*	X		
Laughing Turtle-Dove	*Streptopelia senegalensis*	X		X
Brush Bronzewing	*Phaps elegans*	X		
Horsfield's Bronze Cuckoo	*Chrysococcyx basalis*	X		
Shark Bay Purple-backed fairywren	*Malurus assimilis bernieri*	X		X
Dirk Hartog Island Black and White Fairy-wren	*Malurus leucopterus leucopterus*	X		
Dirk Hartog Island Emu-wren	*Stipiturus malachurus hartogi*	X		

Common name	Scientific name	Observation	Live capture	Remote camera
Western grasswren	*Amytornis textilis*	X		X
Dirk Hartog Island Rufous fieldwren	*Calamanthus campestris hartogi*	X		X
Spotted scrubwren	*Sericornis maculatus*	X		X
Singing Honeyeater	*Gavicalis virescens*	X		X
Spiny-cheeked Honeyeater	*Acanthagenys rufogularis*	X		
White-fronted Chat	*Epthianura albifrons*	X		
Crested Bellbird	*Oreoica gutturalis*	X		X
Willie Wagtail	*Rhipidura leucophrys*	X		
Little Woodswallow	*Artamus minor*	X		
Black-faced Woodswallow	*Artamus cinereus*	X		X
Grey Butcherbird	*Cracticus torquatus*	X		X
Little crow	*Corvus bennetti*	X		X
Australian Pipit	*Anthus australis*	X		X
Welcome Swallow	*Hirundo neoxena*	X		X
Tree Martin	*Hirundo nigricans*	X		
Brown Songlark	*Cincloramphus cruralis*	X		
Silverye	*Zosterops lateralis*	X		
Rufous hare wallaby	*Lagorchestes hirsutus*	X		X
Banded hare wallaby	*Lagostrophus fasciatus*			X
Shark Bay bandicoot	*Perameles bougainville*	X	X	X
Little long-tailed Dunnart	*Sminthopsis dolichura*		X	X
Dibbler	*Parantechinus apicalis*	X	X	X
Greater stick-nest rat	*Leporillus conditor*	X	X	X
Ash-grey mouse	*Pseudomys albocinereus*	X	X	
Shark Bay mouse	*Pseudomys gouldi*	X	X	X
Sandy inland mouse	*Pseudomys hermannsburgensis*	X	X	
House mouse	*Mus musculus*	X	X	
Dugong	*Dugong dugon*	X		
Indo-Pacific Bottlenose Dolphin	*Tursiops aduncus*	X		
Humpback Whale	*Megaptera novaeangliae*	X		

References

Cowen, S., Rayner, K., Sims, C., 2021. Dirk Hartog Island National Park Ecological Restoration Project: Stage Two - Year Three Translocation and Monitoring Report. Department of Biodiversity, Conservation and Attractions, Perth, WA.

Cowen, S., Rayner, K., Sims, C., Friend, T., Knox, F., Ottewell, K., Gibson, L., 2020. Dirk Hartog Island National Park Ecological Restoration Project: Stage Two - Year Two Translocation and Monitoring Report. Department of Biodiversity, Conservation and Attractions, Perth, WA.

Cowen, S., Rayner, K., Sims, C., Van der Weyde, L.K., 2022. Dirk Hartog Island National Park Ecological Restoration Project: Stage Two - Year Four Translocation and Monitoring Report. Department of Biodiversity, Conservation and Attractions, Perth, WA.

Farrell, J., Hardy, J., Jacobs, Rudy, Jacobs, Rebecca, Kyi, G., McKay, D., Muns, S.J., 2018. Radio-tracking Grey Grasswrens *Amytornis barbatus barbatus* in north-western New South Wales: a pilot study. Corella 42 72 77.

Louter, M., 2016. The behavioral ecology of the thick-billed grasswren (Ph. D Thesis). Australian National University, Canberra, ACT.