007- Predator (butcherbird) monitoring

Milestone description: *Monitor butcherbird with tracking tags.*

Introduction

Golden-shouldered Parrots are threatened by an increase in predation pressure, caused by woody thickening of their habitats. It is thought that predators are now more abundant and hunting more effectively because of the increased cover provided by the invasive trees.

The long-term goal of habitat management on Artemis Station is to reset parrot habitats back to an open state. This should drive down predation pressure and increase parrot survival rates (which is being measured using colour-band monitoring – see Milestone 005).

We are confident in the link between habitat thickening and increased predation pressure, we need to ensure that the specific habitat restoration actions and the speed and scale at which we are able to restore areas, is commensurate with a significant reduction in predation pressure. This means we need to monitor the response by predators to our habitat restoration work. During the Priority Species Grant period, we did this by mapping the spatial response of Black-backed and Pied Butcherbirds to restored areas. We wanted to understand how butcherbirds might change the way they use habitats. We collected information about location for both species, and behaviour (for Pied Butcherbirds) inferred from XYZ triaxial data. Results from Black-backed Butcherbirds are complete are presented below. As discussed below, we adopted a more robust experimental design for Pied Butcherbirds involving pre- and post-management data collection. The pre-management data are presented below, with the post-management data scheduled to be collected in October 2023.

Methods

Butcherbirds were trapped using either a balsawood butcherbird decoy or a live mouse (which was kept in a wire mesh cage and unharmed during the process; Animal Ethics Approval Number: SEES/517/19). Birds were ensnared in mist-nets or a bow-net.

We used two different GPS tags depending on which species we tracked. For the smaller Black-backed Butcherbird (mean weight = 77g), we used 1.29g PinPoint-10 tags that included a PicoPip Ag337 VHF beacon glued to its side (LOTEK, New Zealand). These were glued to trimmed dorsal feathers just above the birds' synsacrum using cyanoacrylate glue. The PinPoint-10 tags were programmed to take a GPS fix every 10 minutes in two x two-hour windows (0630-0830 and 1600-1800).

For the larger Pied Butcherbird (mean weight = 113g) we used ~3.0g PinPoint VHF50 tags, attached in the same manner as we used for the PinPoint-10s. The VHF 50s have three main advantages over the PinPoint-10 tags. First, they have a larger battery and therefore they can collect more position fixes during a longer operating life. Second, they can collect triaxial positional data about the tagged bird's movements, from which behaviour can be inferred. And third, data can be downloaded remotely via a VHF communication link, using a wireless PinPoint Commander module (LOTEK, New Zealand). This avoids the need to recapture the bird or find a dropped tag for collecting data.

The triaxial data points are movements in the X, Y & Z planes. These data were collected by the PinPoint VHF50 tags every second of a sampling period that was tied to a known GPS location. To interpret the raw XYZ data, it is necessary to take a sample of behavioural observations for calibration. We did this by watching a focal tagged bird through binoculars, and recorded (verbally

on a mobile phone) every behaviour the bird exhibited during the XYZ data collection period. We recorded behaviours in finer granularity than we eventually used. The audio transcripts were later digitised, and the behaviours grouped into the two categories shown in Table 1. These categories reduced the dimensionality of the original narrative. Relationships between XYZ data and behaviours was explored using generalized linear models, with logit link using the R function "glm".

Table 1. Behavioural classes for triaxial data

Primary behaviour	Sub-category	Explanation
flying	flying down	Flying, at any speed, in a downwards trajectory
	flying level	Flying, at any speed, in a horizontal trajectory
	flying up	Flying, at any speed, in a upwards trajectory
	steep dive	A steep dive downwards
non-flying motion	hop	hopping up or down branches
	ground	more or less stationary on the ground
	flapping stationary	flapping whilst perched, normally associated with collecting nesting material
perched	[none]	stationary perched position (includes bouts of preening)
lost	[none]	focal bird lost during observation period

Results

We tracked 4 black-backed butcherbirds using standard PinPoint-10 GPS tags. They were captured at locations that were immediately adjacent to areas that had already been restored. This generated 342 GPS points. We also captured tracking data from 8 pied butcherbirds (two tags failed). This generated 2,532 GPS points and 281,004 triaxial data points. Figure 1 provides a broad overview of the GPS tracking data for both species of butcherbirds. Table 2 shows metadata for the tagged birds.

Table 2. Butcherbird tracking metadata

Species	Tag number	Date range tracked	Triaxial data pts	Number GPS points
Black-backed	50334	20220509_20220514	na	64
Black-backed	50341	20220510_20220517	na	97
Black-backed	50340	20220510_20220517	na	94
Black-backed	50336	20220508_20220514	na	87
Pied	56408	20220917_20220925	114,015	1045
Pied	56402	20220922_20220927	25,196	185
Pied	56400	20221012_20221018	15,779	217
Pied	56401	20221013_20221019	25,206	217
Pied	56379	20221013_20221019	25,201	217
Pied	56406	20221012_20221018	25,200	217
Pied	56409	20221013_20221019	25,199	217
Pied	56401	20220921_20220927	25,208	217
Pied	56406	no data	no data	no data
Pied	56405	no data	no data	no data

For one pied butcherbird (tag number 56408) we collected 3743 seconds (>62 minutes) of behavioural data which was used to calibrate the triaxial data. These data were split into 244 seconds of flying, 261 of non-flying motion and 3238 seconds of perched time.

Preliminary generalized linear modelling showed strong relationships between movements recorded in the X, Y and Z planes with observed behaviours recorded simultaneously (Table 3; Figure 2). These results will be used to predict behaviours of tagged birds after the post-management data collection is complete (scheduled for October 2023).

Table 3. GLM results showing the relationship between XYZ data and observed behaviours

	Estimate	Std. Error	z value	Pr(>|z|)
Intercept	2.620077	0.211704	12.376	< 2e-16 ***
X	-0.033610	0.005221	-6.438	1.21e-10 ***
Y	0.020743	0.007372	2.814	0.00489 **
Z	-0.023044	0.005069	-4.546	5.47e-06 ***

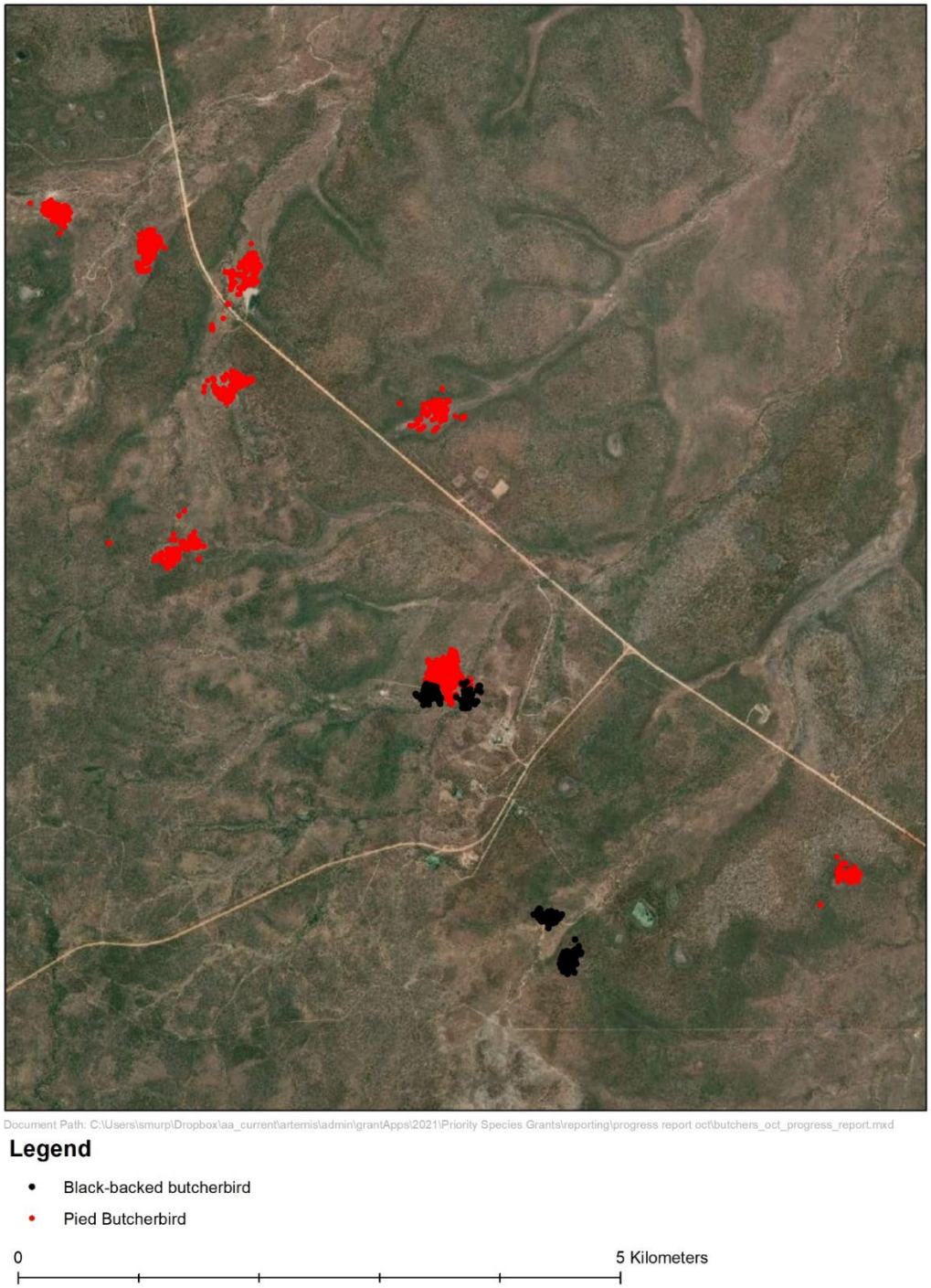

Figure 1 Raw GPS tracking data for Pied (red dots) and Black-backed Butcherbirds (black dots)

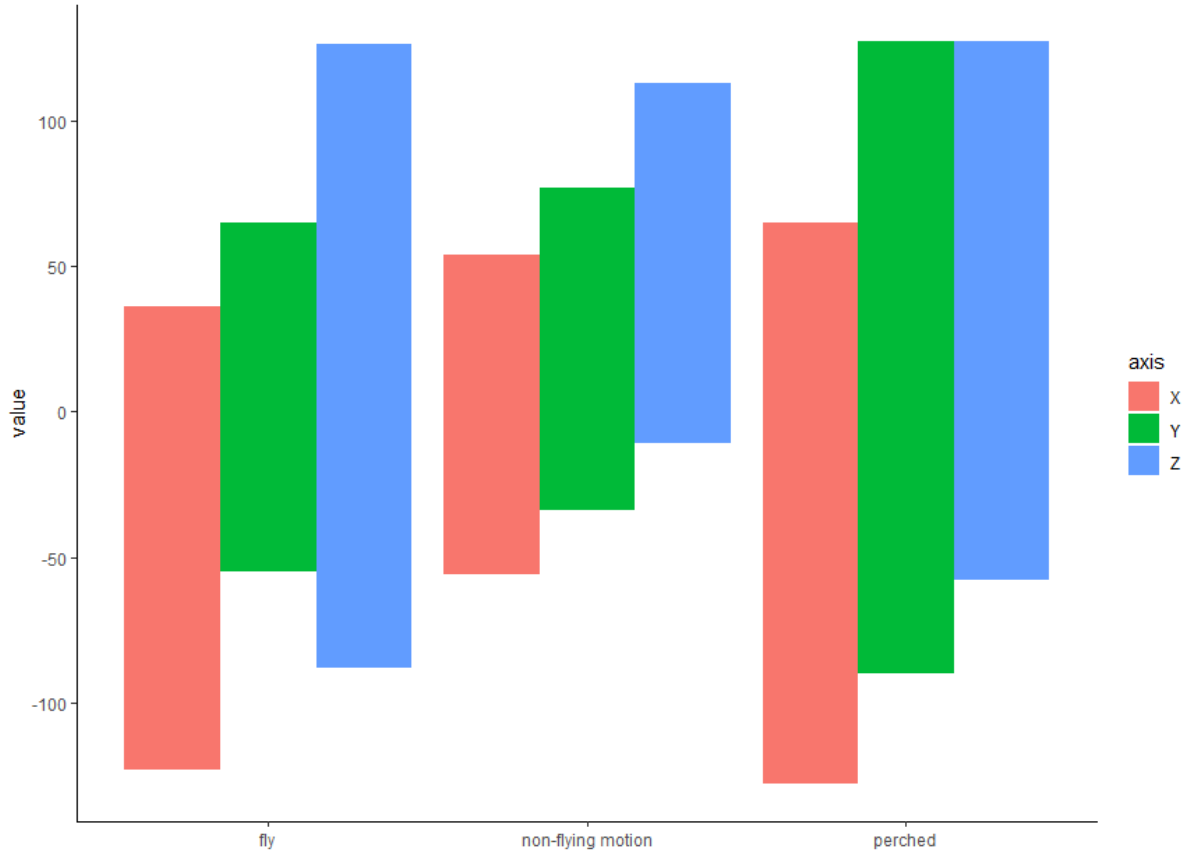

Figure 2 Plot showing XYZ values as functions of observed behaviours

Discussion

The key finding from this study was that none of the tagged black-backed butcherbirds entered into the areas that we had previously restored (using a cut-stump treatment which removed all stems). Figure 3 shows an example. This demonstrates that we are likely to be able to reduce predation pressure from Black-backed Butcherbirds using our habitat restoration methods.

An additional finding, which supports previous tracking work, is that both species of butcherbirds occupy small home ranges in the project area (Pieds = 7.9ha ± 2.1; Black-backeds = 3.0ha ± 0.51, based on minimum convex polygons). Our field observations frequently involved more than a pair on any one territory. This points to a very high density of both species of butcherbirds inhabiting the project area.

While the tracking data collection from Black-backed Butcherbirds is complete and tells us they do seem to avoid restored areas, we have yet to complete data collection for Pieds. As noted above, a weakness of the Black-backed data is that we only tracked individuals after the habitat restoration work had been done. Even though each was caught on or very close to the edge of restored areas, and none of them entered into those places, it could be argued that those particular birds' territories never encompassed those areas in the first place. A more robust experimental design would be to collect pre-management baseline data and repeat that process after management had been completed, and this is what we are doing with Pieds.

We anticipate that Pied Butcherbirds will continue to use areas that we have restored because they are known to occupy very open habitats elsewhere in Australia. However, we believe that habitat restoration is likely to have a number of non-exclusive effects that reduces predation pressure on Golden-shouldered Parrots overall. First, restoration might reduce territory quality (e.g. less productive hunting etc.) and therefore we may see an increase in territory size, and therefore a decrease in the total Pied Butcherbird population size. Second, a reduction in territory quality may lead to smaller group sizes. Third, restoration may reduce hunting success. The GPS and triaxial data collected during the Priority Species grant period will provide critical baseline data for us to explore these issues in forthcoming work.

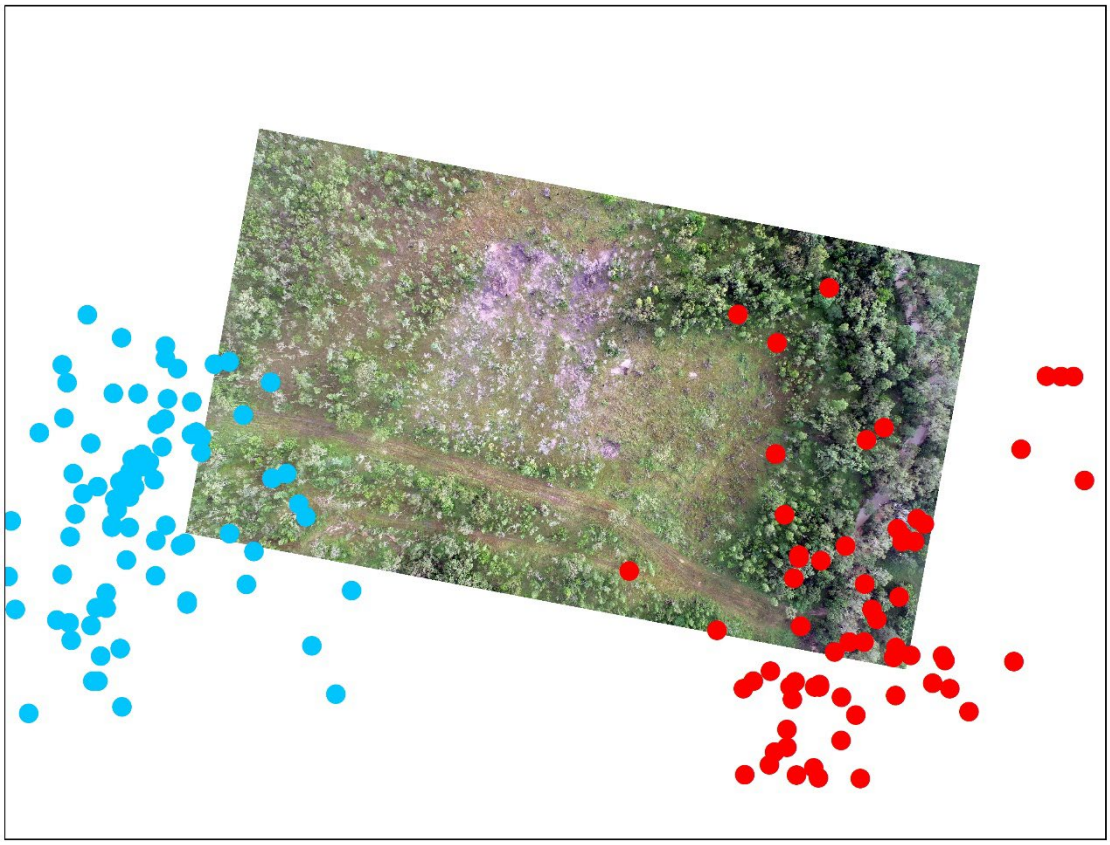

Figure 3. Example of black-backed butcherbird tracking data showing they did not enter the restored areas