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Mammal Survey Lutregala Marsh Reserve, Bruny Island

2015 - 2016

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Cite as: Bryant, S.L. (2017). Mammal survey Lutregala Marsh Reserve, Bruny Island 2015-2016. Tasmanian Land Conservancy, Lower Sandy Bay, Tasmania 7005.

Front Image: Feral cat on Lutrgeala Marsh Reserve 2016 – TLCs monitoring camera.

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Contents

Summary

In 2015 the Tasmanian Land Conservancy initiated a mammal survey on Lutregala Marsh Reserve, Bruny Island as part of its long term ecological monitoring program and to assist the Bruny Island Cat Management Project. Five motion sensor cameras were installed in May 2015 with repeat sampling in August 2016 including an additional three monitoring sites. A total of 12 terrestrial mammal species were identified from 1064 fauna images collected over 485 trap nights. Of the 12 mammal species, 7 were native, 4 non-native and one rodent species was undetermined. Mean mammal diversity decreased from 6.2 species in 2015 to 4.1 species in 2016 which may have been due to seasonal and life history stages of species between sampling periods. The most noteable detections were potoroo, eastern quoll, ringtail possum, echidna and invasive fallow deer with 19 detections and a 63% occupancy in 2016. Removal of fallow deer from the Reserve and the entire island should be a government conservation priority, given the partly protected status of this species.

A relatively high number of cat detections were obtained on the Reserve and the range of body sizes from adults to kittens confirmed that cats are breeding there. Four to 6 individual cats were identified in 2015 and 4 to 6 different cats in 2016 with 7 to 10 different cats detected on the Reserve over the two survey periods. Two population clusters were suspected; one associated with the Simpsons Bay Road end of the Reserve, and the second closer to The Neck Road, physically separated by waterlogged marshland and Lutregala Creek. Future cat management will need to focus efforts on both physical sides of the Reserve and not just Simpsons Bay Road end.

Acknowledgements

The Tasmanian Land Conservancy gratefully acknowledges the support of the Save The Tasmanian Devil Appeal through the UTAS Foundation that enabled the purchase of motion sensor cameras and the volunteers who help score fauna images. This work is part of the Bruny Island Cat Management Project administered by the Kingborough Council in partnership with the Tasmanian and Commonwealth governments and a range of other stakeholders. In particular Kaylene Allan (project manager) and Menna Jones (UTAS) have been instrumental in encouraging monitoring and research on Bruny Island to underpin this project. This work also provides essential baseline data for the TLC's ecological monitoring program of Lutregala Marsh Reserve and a number of TLC staff have been involved with its operation, namely Matthew Taylor, Denna Kingdom, Dan Sprod and Phil Roach. Sincere thanks to everyone.

1.0 Introduction

1.1 Lutregala Marsh Reserve

Lutregala Marsh is a 41.9 hectare saltmarsh and coastal forest reserve at the mouth of Simpsons Creek of Isthmus Bay – the narrow connection joining south and north Bruny Island (Fig 1). It is typically part of a larger low lying saline marsh system supplied by freshwater originating in the South Bruny Range as Lutregala Creek then becoming Simpsons Creek as it flows into Simpsons Bay. On its eastern boundary the Reserve adjoins the Bruny Island Neck Game Reserve and to the south and west adjoins private properties used for grazing and domestic purposes (Fig 2).

Lutregala Marsh Reserve was listed on the register of the National Estate in 1997 as an intermediate marsh [vegetation above and below the waterline]. This saltmarsh ecosystem plays an important role in nutrient cycling in Simpsons Bay and coastal areas and contains threatened sea lavender *Limonium austral*, 15 species of terrestrial amphipods, crustaceans and mollusca and a rich diversity of raptors, waterfowl, seabirds, resident and migratory shorebirds. The Reserve's swamp gum *Eucalyptus ovata* forest provides important habitat for the endangered swift parrot *Lathamus discolor* and its scattered white gum E. *viminalis* provides foraging and breeding habitat for endangered forty-spotted pardalote *Pardalotus quadragintus,* both bird species occur on the reserve.

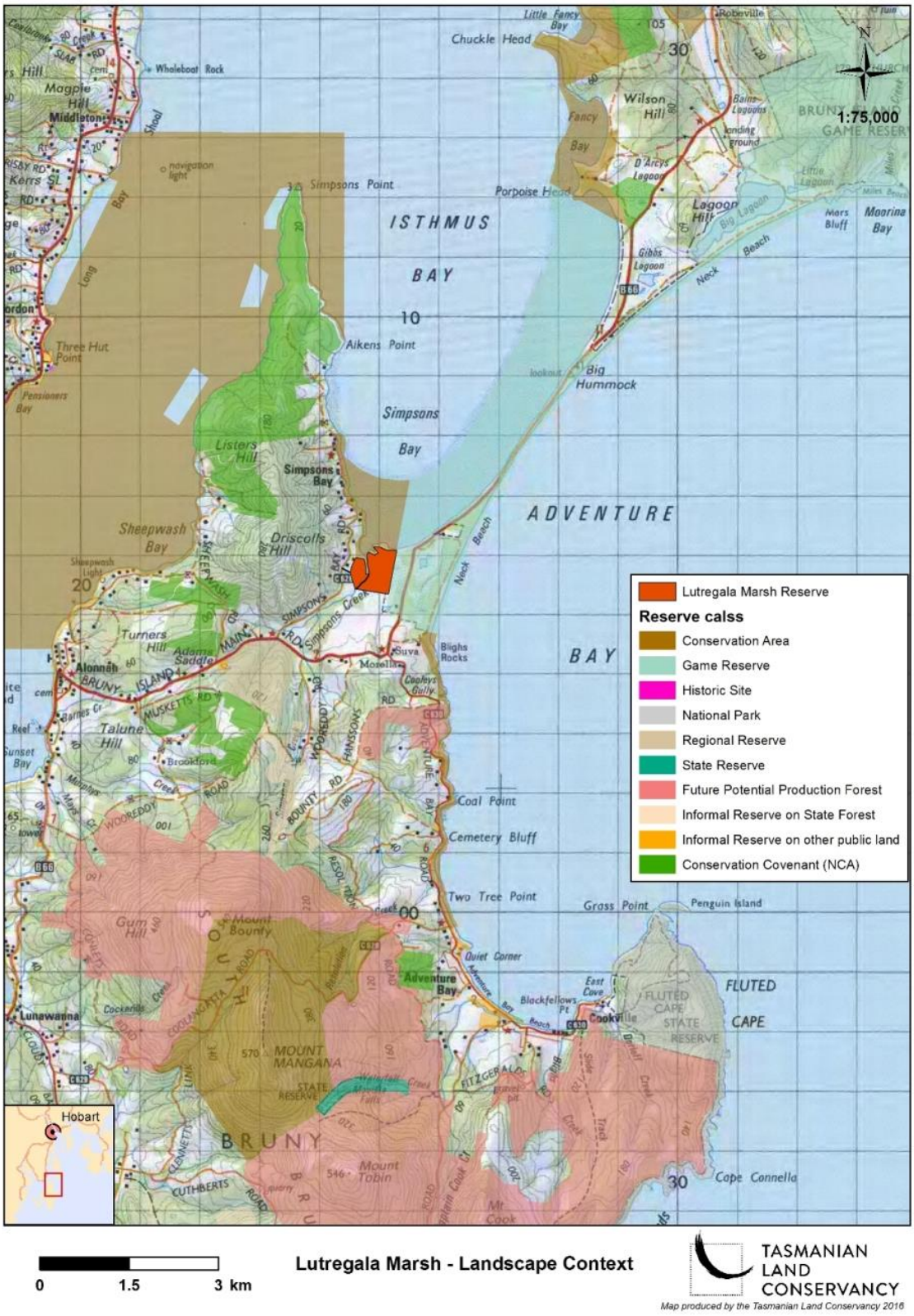

Fig 1 Location and landscape context of Lutregala Marsh Reserve, Bruny Island.

Fig. 2 Physical features of Lutregala Marsh Reserve Bruny Island (red line shows reserve boundary).

1.2 Lutregala Marsh Reserve Management Plan

This mammal survey is inn accord with the Lutregala Marsh Reserve Management Plan (Tasmanian Land Conservancy 2016) which contains the following key actions and targets.

Feral Animal Control

1. **Minimise the impact of cats on wildlife on the Reserve**
2. **Support eradication of fallow deer on Bruny Island**

A neighbour to the west of Lutregal Marsh Reserve has numerous cats whose movements are not controlled. One way to address this issue is within a broader cat management strategy that has been developed and is now being implemented across Bruny Island, in conjunction with Kingborough Council and other partners. This integrated community-based program brings considerable scope for effective control and even potential eradication of feral cats from the island in the future. The TLC is therefore partnering in this cooperative and comprehensive cat management strategy for Bruny Island and Lutregala Marsh Reserve has been identified as an important management site.

There have also been fallow deer *Dama dama* recorded on the property. Deer were accidently introduced to the island from a restocking program on nearby Sattelite Island in 2012/3. Bruny Island is outside the range of this partly protected species in Tasmania and their complete removal should be considered an urgent priority for government and the community. Fauna monitoring will help collect trend data on this invasive species and contribute to any efforts by PWS or State Government to have them eradicated.

Key Activities

- Continue partnering in a cat management strategy for Bruny Island
- Undertake standard long term ecological vegetation and fauna monitoring
- Install and score baited camera traps for feral and native animals

2.0 Survey Methods

Five motion sensor cameras were deployed on 26th May 2015 until 15th July 2015 and the following year from 23 August 2016 to 22 Sept 2016 including the placement of an additional three camera sites (8 total). Locations are shown in Figure 3. Methodology for the camera deployments, use of attractant and data analysis follows the STDP *Remote camera survey techniques for wildlife: Standard Operating Procedures* and TLCs monitoring procedures manual.

2.1 Camera traps

Scout Guard SG560Z Zero Glow 8m cameras with an 8GB SD camera card were installed with a setting of mode-camera, photo size 5MP, 1 photo per 30 seconds, flash range 15m, and date and time stamp activated.

Camera traps were located at the sites typical of Fig 4 and Fig 5 with cameras mounted on a tree or post at a height of approximately 1.5 m above the ground and angled in the direction of a runway, track or clearing or habitat feature. Commercially prepared fish oil was used as a scent attractant and dispensed onto a rock or wood surface or directly onto cleared ground approximately 2 to 3 m away from the camera to attract animals to the desired site.

Fig 3 Camera locations on Lutregala Marsh Reserve (LUMA).

Fig. 4 Camera site LUMA6 facing marshland and LUMA4 in forest corridor.

2.2 Photo interpretation

Cameras were retrieved and images catalogued according to year and site number. Metadata on deployment and retrival, location, and other relevant information pertaining to the survey was recorded. Photos were processed and scored according to TLCs standard protocols (Appendix A).

A determination of the number of different individual feral cats was undertaken manually by studying every image and assessing its body markings, time sequences and other body characteristics at comparable focal lengths. Animals were assigned an 'unknown' status if body markings were indistinguishable or partly concealed making cross referencing difficult. This assessment process enables an approximation of the number of individuals per site to be determined but is difficult to validate.

3.0 Results

3.1 Mammal Diversity

Table 1, Table 2 and Appendix B contain a list of the total species diversity recorded on Lutregala Marsh Reserve during each session of trapping. Total species diversity, includes bird and mammal species, was 26 known species from 1477 fauna images. The most diverse sites were located along the *Eucalypt Amygdalina* dry coastal forest track at LUMA3, 4 and 5. There was a decrease in

mean species diversity and total mammal diversity between 2015 and 2016 which may have been caused by a number of factors including seasonal differences relating to food supply and breeding cycle.

Twelve species of mammal were recorded on the Reserve. The most abundant and commonly detected species were Bennett's wallaby *Macropus rufogriseus*, Tasmanian pademelon *Thylogale billardierii* and brush-tailed possum *Trichosurus vulpecula*, which are widespread on Bruny Island and all three were detected at the 8 sites over the two trapping periods. In 2015, multiple images of a rodent species were captured at one site and of House mouse *Mus musculus* at two sites, but neither rodent species were detected in 2016. The rat species could not be determined but is probably either the introduced black rat *Rattus rattus* or native long-tailed mouse *Pseudomys higginsii* but was not the desired body shape for native swamp rat *Rattus lutreolus*. Eastern quoll *Dasyurus viverrinus* were identified at three sites in 2015 but not captured during 2016. All images were of black morph animals and could well represent only a small number of individuals in total. Other notable findings were that of fallow deer *Dama dama* at 5 of the 8 sites in 2016 and one image of a ringtail possum *Pseudocheirus peregrinus* indicating this species very low detectability rate on the Reserve.

Table 1. Results from fauna cameras on Lutregala Marsh Reserve 2015 and 2016.

Site No	Easting	Northing	Habitat & TASVEG code	Trap Nights	Fauna Images	Tot Species Diversity*	Mammal Diversity
2015							
LUMA1	524673	5206917	Edge of small dam FRG / DOV	49	209	11	7
LUMA2	524668	5205845	Old pasture fenceline FRG / ARS	49	49	9	6
LUMA3	525399	5206253	Forest track 1 DAC	49	146	15	7
LUMA4	525302	5206229	Forest track 2 DAC	49	116	14	7
LUMA5	525072	5206022	Forest track 3 DAC	49	106	9	4
				245	**626**	**Mean 11.6**	**Mean 6.2**
2016							
LUMA1	524673	5206917	Edge of small dam FRG / DOV	30	72	7	6
LUMA2	524668	5205845	Old pasture fenceline FRG / ARS	30	32	6	3
LUMA3	525399	5206253	Forest track 1 DAC	30	6	2	2
LUMA4	525302	5206229	Forest track 2 DAC	30	34	5	4
LUMA5	525072	5206022	Forest track 3 DAC	30	31	6	5
LUMA6	524726	5205666	Pasture shelterbelt FRG / DOV	30	67	5	4
LUMA7	525093	5205615	Sedge and forest ARS / DOV	30	116	6	4
LUMA8	525184	5205611	Sedge and forest ARS / DOV	30	86	6	5
				240	**438**	**Mean 5.4**	**Mean 4.1**

*Includes mammals and birds, FRG cleared land, DAC *Eucalyptus amygdalina* dry coastal forest, DOV *Eucalyptus ovata* dry woodland and forest, ARS Saline sedgeland/rushland

Table 2 Distribution and abundance of mammals at Lutregala Marsh Reserve (no of detections).

No of Detections	Echidna	Bennetts Wallaby	Padem.	Brushtail Possum	Ringtail Possum	Potoroo	Eastern Quoll	Feral Cat	Rat sp	House Mouse	Fallow Deer	Cow
2015												
LUMA1	2	34	10	41	0	42	2	18	0	0	0	0
LUMA2	0	10	10	3	0	13	1	2	0	0	0	2
LUMA3	0	1	27	18	0	0	6	8	26	18	0	0
LUMA4	5	6	45	26	1	0	0	1	0	5	0	0
LUMA5	0	1	31	4	0	0	0	2	0	0	0	0
Detections % Occupancy	**7 40%**	**52 100%**	**123 100%**	**92 100%**	**1 20%**	**55 40%**	**9 60%**	**31 100%**	**26 20%**	**23 40%**	**0 0%**	**2 20%**
2016												
LUMA1	0	11	2	28	0	3	0	4	0	0	1	0
LUMA2	0	4	0	4	0	0	0	6	0	0	0	0
LUMA3	0	2	3	0	0	0	0	0	0	0	0	0
LUMA4	1	0	12	10	0	0	0	0	0	0	2	0
LUMA5	0	1	5	1	0	0	0	2	0	0	7	0
LUMA6	0	19	10	1	0	0	0	2	0	0	0	0
LUMA7	0	3	61	3	0	0	0	0	0	0	7	0
LUMA8	0	12	39	2	0	1	0	0	0	0	2	0
Detections % Occupancy	**1 13%**	**52 88%**	**132 88%**	**49 88%**	**0 0%**	**4 25%**	**0 0%**	**14 50%**	**0 0%**	**0 0%**	**19 63%**	**0 0%**

3.2 Cat Detections

A number of cats were identified on the Reserve in 2015 (31 detections) and in 2016 (14 detections) with the highest number of site detections arising near the Simpsons Bay Road end of the Reserve. An assessment of the images focusing on animal size and coat pattern enabled an estimate to be made of the number of known and unknown individual cats. The total number of images inspected and the determinations made is shown in Table 3, remembering that several images can be scored as 'one' detection.

The first finding was of a wide range of body sizes from adults to kittens which confirms that cats are breeding on the Reserve. The second finding was that the cats identified at sites LUMA 1, LUMA 2 and LUMA 6 at the Simpsons Bay Road end of the Reserve, were all different to those identified on the forest track at LUMA 3, LUMA 4 and LUMA 5 adjacent to the Neck Road. This finding suggests that two separate clusters of cats may be using the Reserve, one associated with the residences of Simpsons Bay which could comprise domestic cats and stray cats and the second cluster associated with The Neck Road further away from residences and more likely stray and feral cats.

Table 3 Estimate of number of cats on Lutregala Marsh Reserve

2015 Site		Image no	Date	Time	Description	Cat Id No.	Unknown
LUMA1	cat	248	28/05/2015	20:11	grey tabby unknown		U1 tabby
LUMA1	cat	328-329	4/06/2015	23:03	ginger & white tabby	2	
LUMA1	cat	335	5/06/2015	15:04	no id light coat - possibly ginger 2		U2 ginger
LUMA1	cat	378	11/06/2015	4:04	no id light coat - possibly ginger 2		U2 ginger
LUMA1	cat	379	11/06/2015	4:06	no id light coat - possibly ginger 2		U2 ginger
LUMA1	cat	381-388	11/06/2015	18:45	ginger and white tabby	2	
LUMA1	cat	412	14/06/2015	3:31	no id light coat - possibly ginger		U2 ginger
LUMA1	cat	414	14/06/2015	3:33	no id light coat - possibly ginger		U2 ginger
LUMA1	cat	425-426	16/06/2015	17:36	grey bold tabby 1	1	
LUMA1	cat	429	16/06/2015	21:35	ginger and white tabby 1 (2 images)	2	
LUMA1	cat	440	18/06/2015	16:57	ginger and white tabby unknown		U2 ginger
LUMA1	cat	464-465	21/06/2015	2:22	no id light coat - possibly ginger		U2 ginger
LUMA1	cat	471	21/06/2015	7:22	no id - possibly grey tabby 1		U1 tabby
LUMA1	cat	506	25/06/2015	1:41	no id light coat - possibly ginger		U2 ginger
LUMA1	cat	514-515	25/06/2015	16:08	ginger and white tabby	2	
LUMA1	cat	521	26/06/2015	9:49	no id light coat looks the same as 465		U2 ginger
LUMA1	cat	525	27/06/2015	2:40	no id light coat looks the same as 465		U2 ginger
LUMA1	cat	536	28/06/2015	16:06	ginger and white tabby	2	
LUMA1	cat	641	10/07/2015	0:07	ginger and white tabby	2	
LUMA1	cat	642	10/07/2015	0:22	ginger and white tabby	2	
LUMA2	cat	79	2/06/2015	10:46	grey or tabby head only ?		U1 tabby
LUMA2	cat	97	7/06/2015	16:42	grey bold tabby 1	1	
LUMA3	Cat	66	8/06/2015	18:16	adult fine grey tabby	3	
LUMA3	cat	78	11/06/2015	21:17	adult fine grey tabby	3	
LUMA3	cat	186-189	24/06/2015	4:01	kitten fine grey tabby	4	
LUMA3	cat	229-230	3/07/2015	20:11	kitten fine grey tabby	4	
LUMA4	cat	159	21/06/2015	0:37	adult fine grey tabby	3	
LUMA5	cat	84-85	24/05/2015	2:15	kitten fine grey tabby	4	
LUMA5	cat	31-32	5/06/2015	18:54	adult fine grey tabby	3	
SITE 2016		**Image no**	**Date**	**Time**	**Description**	**Individual**	**Unknown**
LUMA1	cat	20	26/08/2016	18:15	adult, possibly grey tabby		U1 tabby
LUMA1	cat	56	7/09/2016	17:20	adult pure black	1	
LUMA1	cat	75	14/09/2016	18:56	adult strongly marked tabby	2	
LUMA1	cat	76	14/09/2016	22:21	adult dark possibly pure black		U2 black
LUMA2	cat	24	24/08/2016	20:59	adult - pale, possibly white to ginger	3	
LUMA2	cat	46	27/08/2016	22:17	adult fine tabby		U1 tabby
LUMA2	cat	212-213	3/09/2016	12:12	adult pure black	1	
LUMA2	cat	377	6/09/2016	16:49	adult pure black	1	
LUMA2	cat	790	20/09/2016	17:52	adult pure black	1	
LUMA5	cat	9	24/08/2016	7:22	dark unknown		U2 black
LUMA5	cat	10	24/08/2016	13:48	young black tabby white rear socks	4	
LUMA6	cat	48	3/09/2016	16:38	adult pure black	1	
LUMA6	cat	55	6/09/2016	17:04	adult pure black	1	

An assessment of the total number of individual cats on the Reserve by studying coat pattern and other attributes was estimated to be:

2015 - 4 individual cats + 2 unknowns = 4 to 6 cats

2016 - 4 individual cats + 2 unknowns = 4 to 6 cats

An analysis of all the images combined over the two year period found that one cat (ginger and white tabby) could have been present in both years but that all other cats were unique. Two grey strongly marked tabbys were different individual cats (Fig 6). This means there was a total of 7 different cats + 3 unknown cats (7 to 10 cats) captured on the Reserve during the two monitoring periods.

- grey bold tabby 1
- ginger & white tabby
- adult fine grey tabby
- kitten fine grey tabby
- adult pure black
- strongly marked tabby
- young tabby white rear socks

The seven individual cats are shown in (Appendix C).

2015 LUMA1 pic 426 – grey bold tabby 1	2016 LUMA1 pic 75 -adult strongly marked tabby
	

Fig 6 Hind markings on two grey tabby cats showing them as different individuals.

4.0 Discussion

Technological advances in remote sensing camera traps offer less invasive and more ethical and economical ways of gathering information about species presence and distribution (Meek *et al.* 2014). The information collected during this survey has added to the growing body of knowledge on the vertebrate fauna of Bruny Island and has provided insight into the density and distribution of several mammal species on Lutregala Marsh Reserve, especially feral cats. A total of 12 mammals were recorded during this survey, all are known to occur on Bruny Island although fallow deer *Dama dama* are a more recent arrival to the island and not recorded in previous survey reports (Driessen *et al.* 2011; Natural and Cultural Heritage Division 2015). This mammal diversity is relatively low but not unsurprising given the small size of the Reserve and that waterlogged marshland is not a favoured habitat type of a large number of terrestrial mammals. However, the density is typical of a rural landscape on Bruny Island where mixed forest corridors, marshland and riparian habitats are interconnected by a network of roads and tracks which facilitate movement and dispersal of predator and prey species. Hence the small mosaic and structural diversity of habitats of Lutregala Marsh Reserve, affords habitat richness and niche availability for a select number of species though possibly limits the existence of others. The detection of potoroo *Potorous tridactylus*, echidna *Tachyglossus aculeatus*, ringtail possum *Pseudocheirus peregrinus*, eastern quoll *Dasyurus viverrinus* and potentially long-tailed mouse *Pseudomys higginsi* demonstrates the diversity in a mosaic of habitats. The finding of 19 detections and 63% occupancy of fallow deer *Dama dama* is a major concern to the TLC given the damage this species is known to cause to marshland including newly emergent vegetation and regeneration of wet forest species (Invasive Species Council 2010). Removal of this species from the Reserve and the entire island should be a conservation priority.

Remote sensing cameras are but one survey tools that should be used in combination with other methods to monitor vertebrate species (Meek *et al*. 2014). A total of 27 native terrestrial mammals have been recorded on Bruny Island (Natural and Cultural Heritage Division 2015) which includes all of Tasmania's 8 arboreal species of bat. This 2015 study demonstrated that some species may avoid detection either due to an alternate habitat preference, diet or life history traits and therefore more targeted surveys incorporating a variety of camera heights, settings and lure preferrences may potentially improve species detectability on TLCs reserve in the future. There remain some obvious gaps in knowledge for Bruny Island generally, particularly for the smaller to medium weight range terrestrial mammals such as: dusky antechinus *Antechinus swainsonii*, white-footed dunnart *Sminthopsis leucopus*, platypus *Ornithorhynchus anatinus*, Tasmanian bettong *Bettongia gaimardi*, eastern barred *Perameles gunnii* and brown bandicoot *Isoodon obesulus*.

On Lutregala Marsh Reserve in 2015 eastern quoll *Dasyurus viverrnus* were captured at 3 sites with 9 detections but this species was not recorded at the same or adjacent survey sites in 2016. The availability of pasture, grassland and forest for food and den resources would suggest this Reserve is an ideal location for eastern quoll and that any low or declining population levels could potentially be due to seasonal variation in food source or stage of breeding cycle and denned young

in 2016 compared to 2015. Parker's (2016) study on Bruny Island recorded a total of 1,054 eastern quoll detections with the majority (n=995) beong on the north Bruny Island in agricultural and dry forested habitats. Parker obtained 56 detections of quolls on south Bruny Island, 2 being on agricultural land, 10 being in dry forested habitat and 44 detections were in wet forest habitat. Three detections of quolls were recorded at 2 sites at the Neck (coastal scrub habitat).

Parker detected cats and eastern quolls on the same camera at 5 sites compared to this study where eastern quoll and cats were detected on the same camera at 3 sites; two sites were in agricultural land and one in forest habitat.

In 2016 Parker found for the entire island a total of 41 cat detections from 27 individual cats recorded over 2,079 trap nights. This finding compares to 14 cat detections from 4 to 6 individual cats (50% occupancy) recorded over 240 trap nights just on Lutregala Marsh in 2016. This is relatively high in comparison given the small size and physical nature of the reserve. In 2015 cat results were even hisgher of 4 to 6 cats from 31 detections. It is likely this higher cat rate is related to the residences on Simpsons Bay Road and demonstrates the level of impact strays and or domestic cats can have on cat densities where their movements are not controlled.

Parker's detections occurred across 24 sites with wet forest habitat providing the greatest number of detections for any habitat type (cats were detected across 11 sites in wet forest). There were only three detections of cats in North Bruny with one of these confirmed as a domestic pet. Two detections occurred at the Neck and 19 detections occurred on the south of Bruny Island. The finding in this survey of 7 to 10 individual cats is relatively higher in comparison. All cat detection sites on Lutregala Marsh Reserve were within 2 km of a house site which suggests the cats can easily access refuge and food waste from neighbouring residences. However, an interesting observation was that two clusters of cats were established on the Reserve, one cluster focussed around Simpsons Bay Road and the second closer to the Neck and despite being close in distance the marshland channel of Lutregala Creek presents a physical barrier making crossing and intermixing more difficult. This suggests that any future cat management would need to focus its efforts on both physical sides of the Reserve and not just Simpsons Bay Road.

Lutregala Marsh Reserve contains abundant prey species for cats especially small to medium size mammals like a range of rodents, young pademelon, potoroo and eastern quoll and ground dwelling birds, in particular common bronzewing *Phaps chalcoptera* and painted button quail *Turnix varius*. The data obtained for these and other mammal species provides essential baseline information about the abundance and availability of potential prey species and how these may fluctuate in the future as cat management proceeds.

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Appendix A Instructions for analysing fauna images Tasmanian Land Conservancy March 2016

Each folder contains:

- These instructions
- An excel spreadsheet for recording data with several tabs
- Several folders, each containing images from a monitoring site

STEP ONE – RECORDING THE METADATA

1. Open the METADATA tab on the spreadsheet and record the following information for each site:
   - M_ID – the monitoring site ID as indicated on the folder of images
   - CAMERA_ID – the camera ID as indicated in brackets after the M_ID
   - DATE OUT – the date of the first image in the series
   - DATE RETREIVED – the date when the cameras were collected (skip this step if unsure)
   - DATE LAST IMAGE – the date recorded on the time stamp of the last image of the series
   - # TRAP NIGHTS – the total number of days the camera was operational (DATE OUT to DATE LAST IMAGE)
   - # IMAGES TOTAL – the total number of images recorded at that site
   - # IMAGES FAUNA – the total number of observations of fauna (count a sequence of photos as a single observation – see NOTE below). This can be done quickly be calculating the number of rows per site in the spreadsheet. Leave this step until after you have finished classifying all the images.
   - COMMENTS – details such as faulty camera, disabled/moved by animal, memory card filled before collection date, incorrect time stamp etc.

STEP TWO – RECORDING THE RAW DATA

1. Open the first image using Windows Photo Viewer
2. Open the RAW DATA tab of the spreadsheet. For each image of an animal record the following information:
   - M_ID – the monitoring site ID
   - SPECIES – the common name of the species (select from drop-down list)
     - If you don't know what the species is select 'unsure'. It is important not to guess.
   - PHOTO NUMBER – the photo number the animal appears in.
   - DATE – from the time stamp (beware they are recorded American style with the month first)
   - TIME – in 24hr format
   - NUMBER – the number of animals if there are more than one
   - COMMENTS – anything else you notice about the animal e.g. presence or absence of Devil Facial Tumour Disease
3. Delete all images that do not contain an animal *as you go*

NOTE: If the camera has recorded a sequence of photos of the same animal then just make a single entry in the data sheet, but record the range of photos that the animal occurs in (e.g. 075-082). The timestamp can help you work out whether it's the same animal. If there are two photos in a row of the same species, and the photos are less than 10 minutes apart then assume it's the same animal. If greater than 10 minutes then record it as a new observation

STEP THREE – SORTING THE IMAGES BY M_ID

1. Copy the raw data into the **sorted M_ID** tab of the spreadsheet
2. Select a cell in the data set
3. Right click, select **Sort**, then **Custom Sort**
4. Under **column** select M_ID, under **sort on** select Values, under **order** select A-Z
5. Select **Add Level**
6. For this level Under **column** select SPECIES, under **sort on** select Values, under **order** select A-Z

STEP FOUR – SORTING THE IMAGES BY DATE

1. Copy the raw data into the **sorted DATE** tab of the spreadsheet
2. Select a cell in the data set
3. Right click, select **Sort**, then **Custom Sort**
4. Under **column** select DATE, under **sort on** select Values, under **order** select Oldest to Newest
5. Select **Add Level**
6. For this level Under **column** select SPECIES, under **sort on** select Values, under **order** select A-Z

STEP FIVE – SUMMARISING THE DATA BY M_ID

1. Look at the **sorted M_ID** tab.
2. For each monitoring site (M_ID):
    I. record the tally for each species in the **summary M_ID tab,**
    II. make a single row for each species under the SPECIES column
    III. make a new column for each monitoring site and record the tally for each species
    IV. Leave a blank space (rather than a zero) if a species is not recorded at that site

STEP SIX – SUMMARISING THE DATA BY M_ID

1. Look at the data in the **sorted DATE** tab
2. For each date:
    I. record the tally for each species in the **summary DATE** tab
    II. make a single row for each species under the SPECIES column
    III. make a new column for each date and record the tally for each species
    IV. Leave a blanks space (rather than a zero) if a species is not recorded on that day

STEP SEVEN – CALCULATING SOME BASIC STATISTICS (ONLY IF YOU ARE REALLY KEEN)

Once you have finished tallying the data for M_ID and DATE you are ready for the fun bit - calculating occupancy, richness and abundance! You can do this for summary data for both site and date.

Abundance per species

1. Create a new column to the right of your data called ABUNDANCE SP
2. In the top row enter the following formula (=SUM(B2:BX)) where X is the value of the last column of data
3. 'Drag' the formula down so that it is repeated for each row of data – you do this by placing the mouse over the bottom right corner of the cell that you entered the above formula, holding down the left mouse button and moving the mouse down to select the rest of the column that has corresponding rows of data

Occupancy per species (don't worry about this step for the **summary DATE** tab)

1. Create a new column to the right of your data called OCCUPANCY
2. In the top row enter the following formula (=COUNT(B2:BX)) where X is the value of the last column of data
3. 'Drag' the formula down so that it is repeated for each row of data – you do this by placing the mouse over the bottom right corner of the cell that you entered the above formula, holding down the left mouse button and moving the mouse down to select the rest of the column that has corresponding rows of data

Abundance per site (or date)

1. Create a new row at the bottom of your data called ABUNDANCE M_ID (or ABUNDANCE DATE)
2. In the left column enter the following formula (=SUM(B2:X2)) where X is the value of the last row of data
3. 'Drag' the formula across so that it is repeated for each column of data – you do this by placing the mouse over the bottom right corner of the cell that you entered the above formula, holding down the left mouse button and moving the mouse right to select the rest of the row that has corresponding columns of data

Richness per site (or date)

1. Create a new row at the bottom of your data called RICHNESS (RICHNESS DATE)

2. In the left column enter the following formula (=COUNT(B2:X2)) where X is the value of the last row of data
3. 'Drag' the formula across so that it is repeated for each column of data – you do this by placing the mouse over the bottom right corner of the cell that you entered the above formula, holding down the left mouse button and moving the mouse right to select the rest of the row that has corresponding columns of data

Appendix B List of species captured on camera and number of detections.

2015 Species	LUMA 1	LUMA 2	LUMA 3	LUMA 4	LUMA 5	LUMA 6	LUMA 7	LUMA 8	Total Detections
Bassian Thrush			7		1				8
Bennett's Wallaby	34	10	1	6	1				52
Blackbird			3	1	13				17
C. Bronzewing Pigeon			24	3	46				73
Brushtail Possum	41	3	18	26	4				92
Painted Buttonquail			6						6
Cat	18	2	4	1	2				27
Cow		2							2
Eastern Quoll	2	1	6						9
Echidna	2			5					7
Fairy Wren		4	2	2					8
Green Rosella	6			1					7
Grey Fantail			1						1
House Mouse			18	5					23
Native Hen	5	1							6
No id	15	5	2	4	1				27
Olive Whistler				3					3
Pademelon	10	10	27	45	31				123
Potoroo	42	13							55
Purple Swamp hen	34								34
Rat sp			26						26
Ringtail Possum				1					1
Tas.Scrubwren			1	13	7				21
2016									
Bennett's Wallaby	11	4	2		1	19	3	12	52
Blackbird							1		1
Brown Falcon		1							1
Brushtail Possum	28	4		10	1	1	3	2	49
Cat	4	5			1	2			12
Currawong sp		2							2
Echidna				1					1
Fallow Deer	1			2	7		7	2	19
No id	4	2		3	2	7	1	5	24
Pademelon	4		3	12	5	10	61	39	134
Potoroo	1							1	2
Wood Duck							2		2

Total species diversity = 26 species + unknowns, 2015 = 1033 images, 2016 = 444 fauna images (total fauna images = 1477)

Appendix C Individual cats on Lutregala Marsh Reserve 2015–2016.

Ginger and white tabby

Grey bold tabby 1

Adult fine grey tabby

Pure black

Adult strongly marked tabby

Young tabby white rear socks