Bush Blitz 2014 Five Rivers Reserve

Terrestrial Mammals and Birds

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Front Image: Black currawong caught on camera, Five Rivers Reserve © TLC

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Abstract

Surveys for terrestrial birds and mammals were undertaken on the Five Rivers Reserve as part of the 2014 National Bush Blitz program. Information on mammals was collected using motion sensor cameras installed at 46 sites on roads and tracks across the reserve. Bird lists were compiled from 20 minute counts undertaken in a 2 hectare search zone at a subset of 13 of the camera sites.

A total of 24 vertebrate species were identified by camera traps from 4,375 fauna images collected over 1,669 trap nights. Of these, 15 were terrestrial mammals of which 12 were native and 3 were exotic species. A total of 30 bird species were identified during bird counts, all were native species. The 2014 Bush Blitz surveys confirmed 5 new though previously suspected species on the Five Rivers Reserve: bringing the known diversity for the reserve to 22 mammal and 48 bird species. This number is expected to increase with future surveys.

The diversity and relative abundance of medium to large weight range mammals is typical of this locality in Tasmania. Future surveys should aim to improve detectability of smaller sized mammals especially bandicoot, rodents and bats.The presence of three co-occurring Dasyuridae, the Tasmanian devil, spotted-tailed quoll and eastern quoll, highlight the importance of this reserve for maintaining an intact guild of Australia's largest carnivorous marsupial fauna. The frequency by which Tasmanian devils were detected, the number of cohorts and the potential number of individuals identified, suggests this species remains relatively robust and widespread across the reserve despite the fatal devil facial tumour disease still being present. At least 14 individual feral cats were detected which highlights the need to obtain more intensive data on cat populations so a management plan can be developed and implemented.

A total of 48 bird species have now been recorded on the reserve which includes nine of Tasmania's endemic terrestrial species. As many of Tasmania's bird species had already departed the area, this number is likely to increase over time. Four threatened species have been confirmed with two additional species still suspected but not yet detected. This bird diversity is typical of Tasmania's highland wet forest, grassy woodlands and grasslands which survive in large ecologically intact patches relatively free from ongoing disturbance. The few exotic species means the area retains a naturally intact avian community utilising the structural old growth elements of forests and woodlands and riparian edges containing flowering groves of understorey shrubs. The abundance of water and fallen timber increases habitat richness and niche availability for these and many other native fauna species.

Acknowledgements

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1.0 Introduction

The Five Rivers Reserve in Tasmania's Central Highlands is located approximately 10 km east of Lake St Clair and 15 km northwest of Bronte Park, at latitude 42 02 28.21 S and longitude 146 20 23.79 E (Figure 1). The reserve is 11,113 ha in size and comprises five previously named parcels of land: Skullbone Plains, Viormy, Pine Tier, Roscarborough and Serpentine. The reserve is protected under a permanent conservation covenant and Skullbone Plains has world heritage status. Neighbouring land tenures include State and private conservation reserves, State and privately managed forests, pastoral land, private shacks, and hydro-electricity impoundments/lagoons.

The reserve is at elevations of 600 m to over 1,100 m, receives on average over 2,500 mm of rainfall per year, and is exposed to prolonged frost and heavy snowfalls in winter. It is predominantly eucalypt forest and woodland interspersed with a rich and diverse range of alpine and sub-alpine vegetation communities and habitats of high conservation value. The area embraces a network of natural and artificial freshwater systems and is the first location where water enters private land from Australia's only natural upland glacial lakes district. In the past the reserve has been subject to various intensities of commercial timber harvesting but retains substantial areas of un-logged and regenerating forest plus other priority forest types, grasslands, wetlands and non-forested areas such as moorland, all in varying size and condition. These large and structurally intact vegetation communities contain functioning ecosystems expressed at a landscape scale (Tasmanian Land Conservancy 2014).

The Bronte region including the Five Rivers Reserve supports populations of several conservation significant fauna species (Bryant & Jackson 1999). Prior to this work a total of 239 faunal species have been recorded on the reserve, which includes 15 species of mammal, 44 bird species, 8 reptile and 3 amphibian species. Skullbone Plains is key habitat for the nationally endangered Clarence galaxias *Galaxias johnstoni*, an endemic freshwater fish that occurs in the Clarence, Nive and Little River sub-catchments. The Bronte region is a long-term monitoring site for the nationally endangered Tasmanian devil *Sarcophilus harrisii* (Owen and Pemberton 2005), nationally vulnerable spotted-tail quoll *Dasyurus maculatus* and the eastern quoll *Dasyurus viverrinus.* The Tasmanian bettong *Bettongia gaimardia* has been identified on Skullbone Plains and historical records indicate that the nationally threatened eastern-barred bandicoot *Perameles gunnii* once occurred in the wider region but no recent sightings are available. The white-footed dunnart *Sminthopsis leucopus* is an IUCN Red List species that has been recorded nearby at Liaweenie and potentially occurs in the reserve. A number of bat species have been recorded on Skullbone Plains by Lisa Cawthen (pers. com) and possibly occur more widely across the reserve: Eastern falsistrelle *Falsistrellus tasmaniensis*, long-eared bat *Nycotohphilus sp*., Gould's wattled bat *Chalinolobus gouldii* and a forest bat *Vespadelus sp*.

The extensive highland eucalypt forests support large hollow bearing trees which provide nesting habitat for threatened bird species such as the masked owl *Tyto novaehollandiae* and other hollow dependent bird and mammal species. Five nests of the nationally endangered wedge-tailed eagle *Aquila audax fleayi* are known on the reserve and the State threatened white-bellied sea-eagle *Haliaeetus leucogaster* regularly forages over water bodies a few kilometres to the south of the reserve and areas adjacent to Pine Tier Lagoon. Nesting habitat for the grey goshawk *Accipiter novaehollandiae* is abundant along rivers and riparian zones across the reserve and this species is occasionally seen foraging in the wetter forest margins near the reserve (Tasmanian Land Conservancy 2014).

1.1 Aim

The aim of the Bush Blitz 2014 survey was to expand knowledge on birds and terrestrial mammals gained during Bush Blitz 2012 (Commonwealth of Australia 2014), and to specifically map the distribution and relative abundance of carnivorous mammals across the Five Rivers Reserve. This work will form the basis of a longterm monitoring program for this carnivorous group on the reserve.

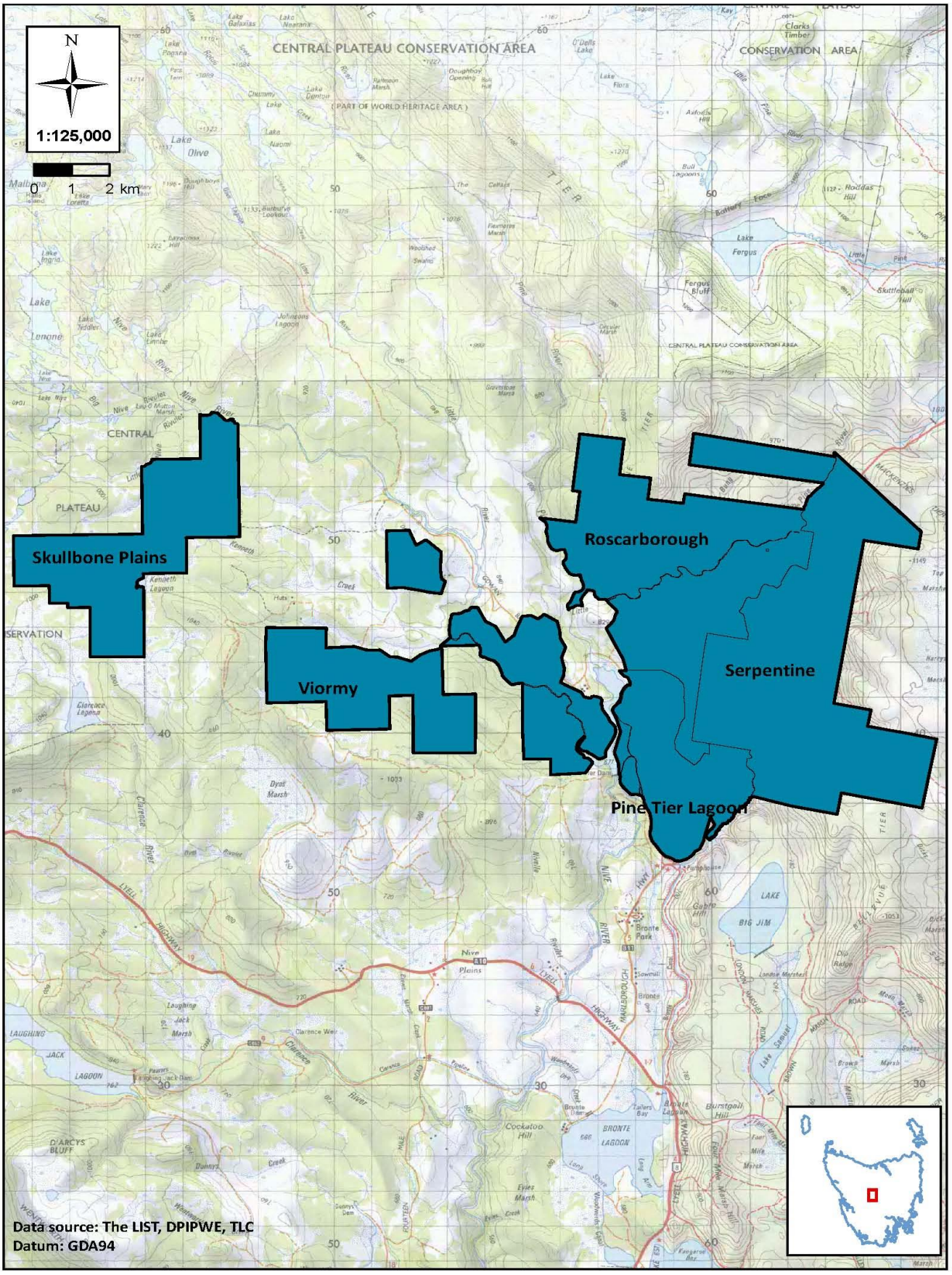

Fig 1. Location of the Five Rivers Reserve in Tasmania's Central Highlands and historic property names.

2.0 Survey Methods

2.1 Camera traps

Scout Guard SG560Z Zero Glow 8m cameras supplied by FORTEC® were used to survey terrestrial mammals. Cameras were programed with a setting of mode-camera, photo size 8MP, 1 photo per 30 seconds, flash range 15m, date and time stamp on and an 8GB SD camera card inserted.
Camera traps were installed at sites along roads and tracks across the Five Rivers Reserve (Fig 2). A site is defined as an area of homogeneous habitat corresponding to one of the three conservation targets for the reserve (highland forest and woodland, highland marshes, streams and wetlands). Cameras were position on a tree or steel pole at a height of 1 to 2 m above the ground, and an ultra minipod® was used to angle the camera in the direction of an animal runway, clearing or habitat feature (Fig 3). A lure consisting of a cupful of oats saturated in a mix of fish oil and canned fish contained within a plastic bait pod, was placed 2 to 3 m away and fixed at least 2m above the ground to attract animals to the desired site where a photo could be taken (Fig 4). Cameras were installed 19 to 22 Feb 2014 and collected 8 to 10 April 2014 and were operational for a maximum of 48 nights (Table 1).

Information was collected from a total of 46 camera sites. Several additional sites had to be abandoned because cameras shifted on the minipod and did not collect images from the target area.

2.2 Photo interpretation

Cameras were downloaded and images were stored according to site number. The total number of fauna images and the total number of camera trap nights were calculated for each site. Photos were checked and any image that could not be reliably identified to species was assigned 'unknown'. A 'total occurrence' for each species per site was determined by counting the number of discrete times the animal was recorded at the site. For example, if the same animal was recorded in consecutive images (i.e. photo 1, 2, 3) then it scored 'one occurrence'. This reduces the bias caused by animals that spend a prolonged period of time in front of the camera and are obviously the same individual. 'Occupancy' can then be used as a surrogate measure to determine abundance.

2.3 Bird Surveys

General bird surveys followed the 2 ha search methodology used by BirdLife Australia for their Bird Atlas project (Birds Australia 2010, www.birdlife.org.au). This involved recording all bird species either by sight (with 8 x 32 binoculars or similar) or by call, within a 2 ha search zone over a 20 minute survey period. Birds are only recorded from within the search zone but this can include birds flying over. The recommended search shape is 100 m x 200 m (about 2 ha) and the center of any two 2 ha search areas should be at least 400 m apart. The sites where bird surveys were undertaken are shown in Table 1. By adopting the same bird methodology as that used for 'The Atlas of Australian Birds' this species information can contribute towards BirdLife Australia's efforts to document the distribution and relative abundance of birds across the Australian continent (Birds Australia 2010).

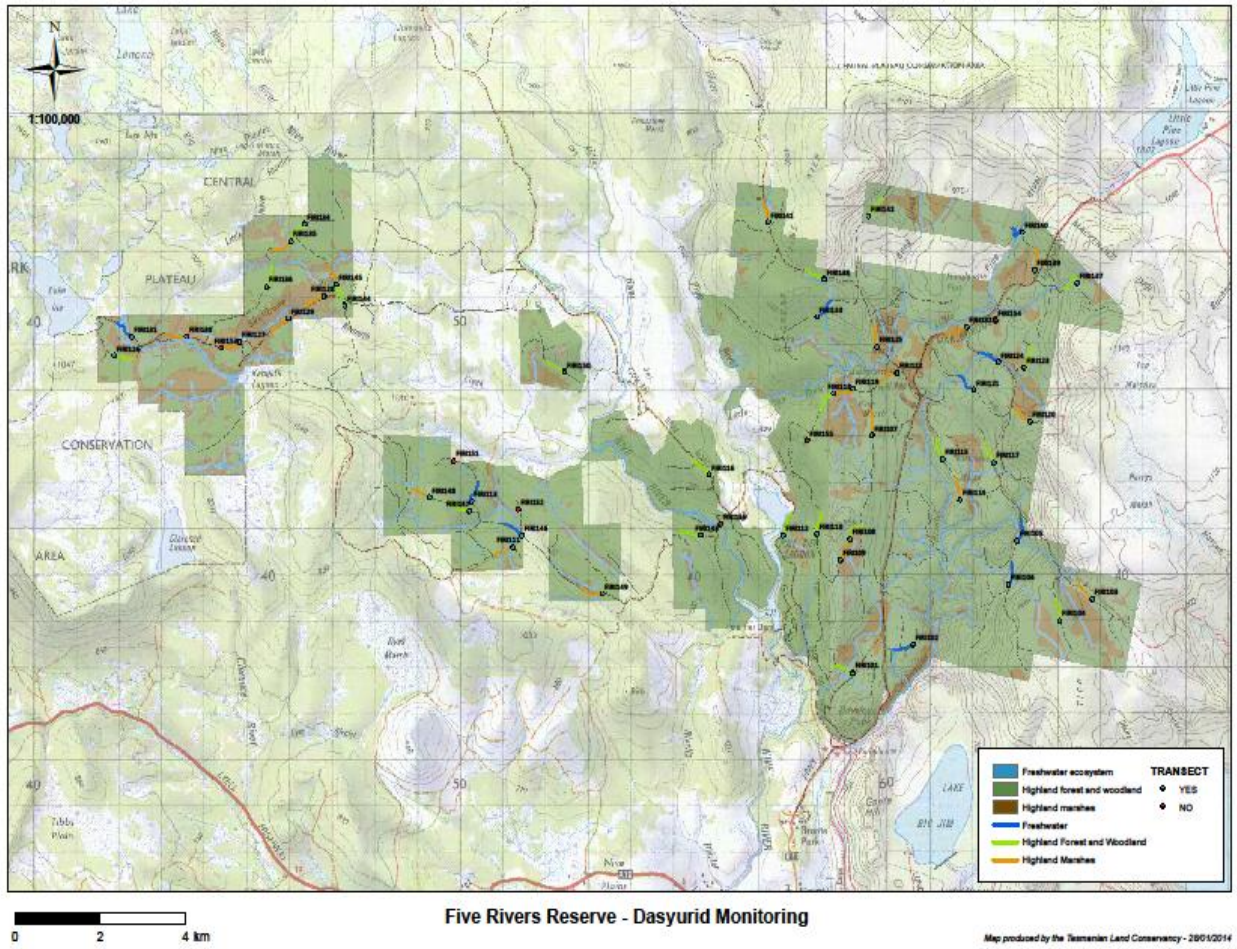

Fig 2. Location of the camera traps across the Five Rivers Reserve.

Fig. 3 Camera mounted on ultra minipod bracket.

Fig. 4 Camera with bait pod in the foreground.

Table 1. Location and results from fauna cameras and bird surveys across the Five Rivers Reserve, 2014.

FIRI Site No	Easting	Northing	Conservation Target & TASVEG code	Camera Nights	Fauna Images	Tot Species Identified	Mammal Species	Bird Sp in 2ha count
102	460730	5338673	Streams and Wetlands DDE	9	25	5	4	-
103	464934	5339657	Highland Marshes DDE	46	232	7	7	-
104	464174	5339179	Highland Forest and Woodland DDE*	15	266	7	6	-
105	463175	5340912	Streams and Wetlands DDE	45	60	4	3	7
106	462974	5339968	Streams and Wetlands DDE	46	56	8	6	4
107	459766	5343201	Highland Marshes DCO	47	285	9	7	-
111	451350	5340767	Highland Marshes DDE	45	80	6	5	6
113	450383	5341761	Streams and Wetlands DDP	46	104	7	6	5
115	461425	5342680	Highland Forest and Woodland DDE*	43	91	7	4	-
116	455946	5342350	Highland Forest and Woodland DDE*	44	84	6	6	-
117	462627	5342600	Highland Forest and Woodland DDE*	46	253	8	7	13
118	458872	5344112	Highland Forest and Woodland DDE#	15	102	6	6	-
119	459326	5344214	Highland Marshes DDE	47	81	5	4	-
120	463473	5343498	Highland Marshes DDE	43	23	6	5	-
121	462158	5344186	Streams and Wetlands DDE	34	8	3	3	11
122	460354	5344550	Highland Marshes DPD	45	117	9	7	-
123	463330	5344660	Highland Forest and Woodland DDE*	46	70	7	5	-
124	462733	5344787	Streams and Wetlands DPO	20	30	6	5	-
125	459887	5345113	Highland Marshes DPD	46	218	8	6	-
126	442005	5344928	Highland Forest and Woodland DDE#	46	93	7	6	15
127	444941	5345214	Highland Marshes DDE	45	17	3	3	18
129	446088	5345732	Highland Marshes DDE	28	22	6	3	-
130	443700	5345340	Highland Marshes DDE	8	20	5	4	-
131	442412	5345332	Streams and Wetlands DPO	13	40	6	4	5
132	461988	5345547	Highland Marshes DPD	46	30	5	4	-
133	458482	5345771	Streams and Wetlands DRO	46	30	4	4	-
135	446145	5347406	Highland Marshes DRO	48	32	6	5	-

136	445581	5346411	Highland Forest and Woodland DRO*	23	35	5	4	-
137	464583	5346499	Highland Forest and Woodland DPO#	46	45	4	3	-
138	458650	5346583	Highland Forest and Woodland DPO#	46	126	6	6	-
139	463585	5346782	Highland Marshes DPO	46	59	6	5	-
141	457336	5347819	Highland Marshes DDP	31	53	8	6	-
142	459688	5347951	Highland Forest and Woodland DPD#	29	5	3	3	-
143	455753	5341044	Highland Forest and Woodland DPD*	46	16	4	4	7
144	447411	5346011	Highland Forest and Woodland DDE#	41	46	7	5	-
145	447212	5346469	Highland Marshes DDE	48	129	9	8	-
146	451563	5341030	Streams and Wetlands DCO	46	29	8	7	-
147	450330	5341563	Highland Forest and Woodland DCO*	37	87	8	6	-
148	449400	5341859	Highland Marshes GPH	46	80	8	7	6
149	453448	5339773	Highland Marshes DDE	10	9	4	4	8
150	452563	5344567	Highland Forest and Woodland HHE*	15	17	5	4	20
151	449958	5342635	Highland Forest and Woodland HHE	46	178	9	7	-
152	451476	5341603	Highland Marshes GPH	27	190	7	6	-
153	444512	5345099	Highland Marshes GPH	46	696	8	6	-
154	462666	5345696	Highland Marshes DCO	8	53	5	4	-
155	458256	5343092	Highland Forest and Woodland DCO	24	53	4	4	-
46 sites			**Total**	**1669 trap nights**	**4375 fauna images**	**24 species identified**	**15 mammal species**	**30 bird species**

***unlogged, #logged**

3.0 Results

A full list of sites and species recorded on the Five Rivers Reserve during Bush Blitz 2014 is provided in Appendix A.

3.1 Mammals

Fifteen species of mammal were recorded during this 2014 survey including one new species – the long-nosed potoroo *Potorous tridactylus,* bringing the total known mammal fauna for the reserve to 18 species (Table 2). The most commonly recorded species across the 46 sites were the Bennetts wallaby (46 sites, 558 occurrences), and brush-tailed possum (42 sites, 364 occurrences) with Tasmanian devil and wombat being the next most commonly detected species.

Good spatial information was obtained on the distribution and abundance of Tasmanian devil, eastern quoll, spotted-tailed quoll and feral cats across the reserve. Of the 41 sites (of a total of 46) where these four predatory species were detected, 15 sites had two species co-occurring and 4 sites had three species co-occurring, the remaining 22 sites had a single predatory species recorded.

Tasmanian devils were widely distributed across the reserve at 35 of the 46 sites. An assessment of coat pattern confirms a minimum of 41 individuals with 31 unknown animals. In the main devils appeared healthy and robust with a range of body sizes observed. However, devil facial tumour disease was detected in devils at six sites by the appearance of obviously large facial swellings beyond what would be considered normal facial scarring. Eastern quoll were captured at 13 sites mostly centred near areas of highland marshes. Both the black and grey colour phases were seen with 15 individuals identified and 7 of unknown identity. Spotted-tailed quoll were identified at two sites with two individual animals confirmed. Fourteen feral cats were positively identified from 31 occurrences at 14 separate sites. A further 12 images were unabled to be assigned, so the number of individual cats could potentially be even higher.

The potoroo was captured at only one site on one image and the Tasmanian bettong at one site on two images. This low detection rate could be due to either 'rarity' or that a meat based lure is not attractive to these species. Similary, the common ringtail possum was detected at only one site and the sugar glider and two species of pygmy possums were not detected at all which again suggests either rarity or more likely inappropriate camera placement for these predominantly arboreal species. Small carnivorous or omnivorous mammals such as bandicoots, antechinus, dunnart, and a range of native and introduced rodents should have been attracted to a meat-based lure but none of these were detected. More intensive survey effort including lower camera placement accompanied by hair-tube traps may improve the chances of detecting these species in their preferred habitat in the future.

3.2 Birds

A total of 30 bird species were identified during the 2014 bird surveys, all were native species. Several bird species were detected by camera traps but all had been previously recorded on the reserve. Confirmation of four new species on the reserve: the swift parrot, noisy miner, Australian magpie and grey butcherbird, was pleasing. The observation of several small flocks of nationally endangered swift parrot *Lathamus discolor* feeding on flowering *E. dalrympleana* confirms the importance of this region to this species post breeding and during its migration route back to the mainland. The noisy miner, Australian magpie and grey butcherbird were relatively confined and abundant on the 'Viormy island block' which differs from most other areas in the reserve due to the ongoing disturbance from illegal firewood removal. These three aggressive bird species favour disturbed areas especially open woodland and grassland where territories can be defended and resources more easily extracted.

Known diversity for the reserve is now 48 bird species (Table 3). This number is likely to increase over time as more spring bird surveys ie before species have departed the reserve for lower altitudes and or migration to the mainland (eg cuckoos, tree martin, etc) and nocturnal surveys are undertaken.

Table 2. Mammals recorded on the Five Rivers Reserve during Bush Blitz 2014 and previous surveys.

Mammal species (Endemic)	Previously recorded 2010 - 2014	Bushblitz 2014	Total no of occurrences	Total sites recorded n=46
Ornithorhynchus anatinus platypus	photo, seen	-	-	-
Tachyglossus aculeatus echidna	seen, prints, digging	photo	10	7
Sarcophilus harrisii Tasmanian devil (E)	Scats, prints, photos	photo, scats	157	35
Dasyurus maculatus Spotted-tailed quoll	photos	photo	2	2
Dasyurus viverrinus eastern quoll (E)	Photo, scats	photo	36	13
Vombatus ursinus common wombat	seen, scats, burrow	seen, photo, scats, burrow	128	35
Petaurus breviceps sugar glider	Tree scar, call	-	-	-
Pseudocheirus peregrinus common ringtail possum	call, scats, drey	photo	1	1
Trichosurus vulpecula fuliginosus common brushtail possum	call, scats, photo, hair, prints, smell	photo	364	42
Macropus rufogriseus Bennett's wallaby	Seen, photo, prints, scats, skull	photo, seen, scats	558	46
Thylogale billardieri Tasmanian pademelon (E)	Seen, photos, prints, scats, skull, caracass	photo, seen, scats	171	27
Bettongia gaimardi Tasmanian bettong	carcass	photo	2	1
Potorous tridactylus long nosed potoroo	-	photo	1	1
Pseudomys higginsi longtailed mouse (E)	photos	-	-	-
Rattus luttreolus swamp rat	photo, hair, smell	photo	3	3
Orytolagus cuniculus European rabbit	scats, seen, digging	photo, seen, diggings, scats	5	2
Dama dama fallow deer	seen, stripped saplings, hunted	photo prints, scats	7	3
Felis cattus cat	scats, seen, photo	photo, seen	31	14
Falsistrellus tasmaniensis Eastern falsistrelle	Lisa Cawthen PhD research	-	-	-
Nycotohphilus sp long-eared bat	Lisa Cawthen PhD research	-	-	-
Chalinolobus gouldii Gould's wattled bat	Lisa Cawthen PhD research	-	-	-
Vespadelus sp. forest bat	Lisa Cawthen PhD research	-	-	-

Table 3: Total bird species recorded on the Five Rivers Reserve.

Species (Endemic)	Previous	BBlitz 2012	FIRI 105	FIRI 106	FIRI 111	FIRI 113	FIRI 117	FIRI 121	FIRI 126	FIRI 127	FIRI 131	FIRI 143	FIRI 148	FIRI 149	FIRI 150
Phalacrocorax carbo great cormorant	seen														
Circus aeruginosus gouldi marsh harrier	seen														
Accipiter novaehollandiae grey goshawk	NVA														
Aquila audax fleayi Tasmanian wedge-tailed eagle	Seen, photo	seen					1 seen			1 seen			1 seen		
Falco berigora tasmanica brown falcon	seen	call													
Vanellus miles masked lapwing	call								2 seen						
Phaps chalcoptera common bronzewing	seen	seen							seen	seen					seen
Calyptorhynchus funereus yellow-tailed black cockatoo	seen	call													
Platycercus caledonicus green rosella (E)	seen	call					call		call	call		seen		call	call
Lathamus discolor swift parrot						6 birds								9 birds	
Neophema chrysostoma blue winged parrot	seen	call													
Cacomaantis pallidus pallid cuckoo	call														
Cacomaantis flabelliformis fantailed cuckoo	call														
Ninox leucopsis southern boobook	call														
Tyto novaehollandiae masked owl	NVA														
Aegotheles cristatus Australian owlet nightjar	call, camera														
Dacelo novaeguineae laughing kookaburra	call	call				call			call	call					call

Species (Endemic)	Previous	BBlitz 2012	FIRI 105	FIRI 106	FIRI 111	FIRI 113	FIRI 117	FIRI 121	FIRI 126	FIRI 127	FIRI 131	FIRI 143	FIRI 148	FIRI 149	FIRI 150
Malurus cyaneus superb fairywren	seen	seen	seen	call			call	seen	call				call	call	
Pardalotus punctatus spotted pardalote	call	call	call			call	call	call	call	call				call	call
Pardalotus striatus striated pardalote	call	call													
Sericornis humilus Tasmanian scrubwren (E)	call	call			call		call	seen		call					call
Calamanthus fuliginosus striated fieldwren		seen													
Acanthiza pusilla brown thornbill	seen	seen	seen	seen			call	seen		seen				call	
Acanthiza ewingii Tasmanian thornbill (E)	seen	seen	seen		call	seen		seen	call	call		call	call		call
Manorina leachi noisy miner															call
Anthochaera paradoxa yellow wattlebird (E)	call	call						call	call	seen		seen			call
Lichenostomus flavicollus yellow-throated honeyeater (E)	call	call	call	call	call			call	call	call	call	call		call	call
Melithreptus validirostris strong-billed honeyeater (E)	seen														
Melithreptus affinis black-headed honeyeater (E)	seen						seen			call					call
Phylidonyris pyrrhoptera inordata crescent honeyeater	call	call							call	call					call
Phylidonyris nov.canescens New Holland honeyeater	call						call	seen		seen			call	seen	call
Acanthorhynchus tenuirostris eastern spinebill	call	call		call				call	call	call		call	call		call
Epthianura albifrons white-fronted chat	seen														
Petroica boodang scarlet robin	seen	call							Seen	Seen	Seen				call
Petroica phoenicea flame robin	seen														

Species (Endemic)	**Previous**	**BBlitz 2012**	**FIRI 105**	**FIRI 106**	**FIRI 111**	**FIRI 113**	**FIRI 117**	**FIRI 121**	**FIRI 126**	**FIRI 127**	**FIRI 131**	**FIRI 143**	**FIRI 148**	**FIRI 149**	**FIRI 150**
Melanodryas vittata dusky robin (E)	seen	call							call	Seen					call
Colluricincla harmonica grey shrikethrush	call	call	call		call		call								
Myiagra cyanoleuca satin flycatcher	call														
Rhipidura albiscarpa grey fantail	call	call	call				call	seen							
Coracina novaehollandiae black-faced cuckooshrike	call	call													call
Cracticus cinereus grey butcherbird							call								call
Cracticus hypoleuca Australian magpie															call
Strepera fuliginosa black currawong (E)	seen	call			call	call	call	call	call	call	call	seen			call
Corvus tasmanicus forest raven	seen	seen			call				call	call	call	call	call	call	call
Anthus novaeseelandiae Richard's pipit	seen										seen				
Hirundo neoxena welcome swallow	seen														
Hirundo nigricans tree martin	seen	seen													
Zosterops lateralis lateralis silvereye	call						call								
Species Recorded Total= 48	**43**	**26**	**7/30**	**4/30**	**6/30**	**5/30**	**13/30**	**11/30**	**15/30**	**18/30**	**5/30**	**7/30**	**6/30**	**8/30**	**20/30**

3.3 Named taxa newly recorded for the reserve

Table 4 contains a list of the five vertebrate species newly recorded on the Five Rivers Reserve during Bush Blitz 2014.

Table 4. Named vertebrate taxa newly recorded from Five Rivers Reserve

Taxon	Comment
Potorous tridactylus (long-nosed potoroo)	native marsupial
Lathamus discolor (swift parrot)	Native bird, breeding endemic, nationally endangered
Cracticus cinereus (grey butcherbird)	native bird
Cracticus hypoleuca (Australian magpie)	native bird
Manorina leachi (noisy miner)	native bird

3.4 Threatened fauna species recorded

A number of threatened fauna species are known to occur on the Five Rivers Reserve, and this survey identified one additional listed species, the swift parrot. Threatened species such as the grey goshawk and masked owl are known in the region, but have yet to be confirmed on the reserve. Table 5 contains a list of threatened vertebrate fauna species known to be on the Five Rivers Reserve.

Table 5. Threatened vertebrates confirmed on the Five Rivers Reserve

Species	Status (EBPC, TSPA)	2014 location sighted/observed	Indication of abundance
Sarcophilus harrisii Tasmanian devil	Endangered (EPBC, TSPA)	35 of 46 camera sites	Widespread, breeding population
Aquila audax fleayi Tasmanian wedge-tailed eagle	Endangered (EPBC, TSPA)	3 of 13 survey sites	Five active nests across the reserves
Lathamus discolor swift parrot	Endangered (EPBC, TSPA)	2 of 13 survey sites	Seasonal post breeding, localised
Dasyurus maculatus spotted-tailed quoll	Vulnerable (EPBC, TSPA)	2 of 46 camera sites	Localised, low density
Galaxias johnstoni Clarence galaxias	Endangered (EPBC, TSPA	Not in this surey	Skullbone Plains IFS monitoring site

4.0 Discussion

The information collected during Bush Blitz 2014 has added to the growing body of knowledge on the vertebrate fauna of the Five Rivers Reserve. A total of 15 mammals and 30 bird species were recorded during the survey including 5 new species for the reserve. This brings the total known on the reserve to 22 mammals and 48 bird species of which 5 are nationally threatened vertebrate species. This species diversity is typical of what is to be expected in Tasmania's high country in areas where a mosaic of mixed forest types, marshland and riparian habitats are interconnected by a network of roads and tracks which facilitate movement and dispersal. However, there remain some obvious gaps in knowledge particularly for the medium to smaller weight range mammals and arboreal species.

Recent technological advances in wildlife research using 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 use of camera traps has enabled us to gain insight into the distribution and abundance of Tasmania's three largest carnivorous marsupials and their potential relationship with feral cats. The finding of four sites where Tasmanian devils *Sarcophilus harrisii*, eastern quoll *Dasyurus viverrinus* and feral cats *Felis catus* consistently visited the same lure over several nights demonstrates the closeness and competitiveness of this association. The Tasmanian devil population appears to be relatively widespread across the reserve despite the persistence of the fatal Devil Facial Tumour Disease (Hamede *et al.* 2013); however ongoing monitoring will enable us to determine the population trends of this species into the future. Eastern quoll were detected at 13 sites which is significant as this species has recently been nominated for listing as endangered on Tasmania's threatened species legislation due to widespread declines (Fancourt *et al.* 2013). As the genetic diversity within eastern quoll shows significant regional differentiation, with the populations in central Tasmania being the most diverse, this reserve may well become a high priority for management and source of animals for future conservation initiatives (Cardoso *et al*. 2014). Future targetting of cameras around marshland and open grassland would potentially increase the level of occurrence of this species in its more preferred habitat type. The low detection rate of spotted-tail quoll may reflect this wide ranging territorial species being naturally rare in this area or that its aboreal nature precluded it being captured more frequently on camera. More information on feral cat populations will help inform management decisions about the most effective ways of reducing cat numbers and whether resident cats are holding territories and thereby reducing the potential influx of new animals.

Remote sensing cameras are but one of several survey tools that should be used in combination to monitor a range of vertebrate species (Meek *et al*. 2014). This 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 improve species detectability in the future. The presence of the long-nosed potoroo *Potorous tridactylus apicalis* (new record), and the Tasmanian bettong *Bettongia gaimardi* reflects the size and diversity of habitats across this landscape enabling Tasmania's two species of Potoroidae to coexist in relative close proximity. Their low detection rate could be due to unattractive lure, inappropriate camera placement or naturally low occurrence of these species due to limited resources, competition or threats. A rapid decline in Tasmanian bettong numbers has been detected within four months of local incursions of feral cats (Fancourt 2014) which could also be a contributing factor to their low level of occurrence on this reserve.

No evidence was obtained on either of Tasmania's two species of bandicoot *Isoodon obesulus* or *Perameles gunnii* despite both species being omnivorous and potentially attracted to the meat based lure. The abundance of overgrown boulder fields provides ideal habitat for longtailed mouse *Pseudomys higginsi* but this species was not detected. Similarly, the sphagnum bogs and featherbed habitats are ideal for broadtoothed rat *Mastacomys fuscus* and/or swamp antechinus *Antechinus minimus*, and the stringy bark forests may potentially contain both species of pygmy possums *Cercartetus lepidus* and *C nanus,* but none of these species were detected. More work is needed.

Tasmania's avifauna is well known and comprises over 220 resident and migratory bird species across a wide range of habitats (Watts 2002). Surveys undertaken previously and during Bush Blitz 2012 and

Bush Blitz 2014 have found a total of 48 bird species using the reserve on a permanent or seasonal basis. The confirmation of the nationally vulnerable swift parrot *Lathamus discolor* further supports the importance of this reserve to highly mobile threatened species and the imperative to maintain these forest systems free of ongoing disturbance. It could be that late flowering eucalypts such as *Eucalyptus dalrympliana* and *E. delegatensis* are an important food resource for this species during or post its breeding season when the more lowland *E. globulus* and *E. ovata* have finished flowering.

The bird diversity on the reserve is likely to increase as more surveys are undertaken during the spring period when many migratory species have returned, or after dusk to detect owls and other night birds. More cryptic species such as rail, snipe, little grass birds and a range of waterfowl may well be found in the marshland and wetland complexes that span the reserve. Button quail and brown quail may also use the grassland and forest woodland fringes. Due to the late timing of this work, many of Tasmania's bird species had already left the Bronte region for the lowlands of Tasmania or to migrate across Bass Straight. Some e.g. honeyeaters, undertake annual seasonal altitudinal migration, travelling down from the high country in late spring and autumn to spend the cooler winter months in coastal lowlands where food is more plentiful (Thomas 1986, 1987). During the winter months the reserve experiences heavy frosts and long periods of snow which severely limits the availability of resources, foraging niches and survivability for many bird species.

The bird diversity on Five Rivers is typical of Tasmania's wet forest, grassy woodlands and grasslands containing structural elements such as old growth forest and riparian edges where flowering groves of understory species are seasonally abundant (MacDonald 2001; Hingston & Grove 2010). The accessibility of water and fallen timber has improved habitat richness and niche availability for these and many other native fauna species. Interestingly, the identification of key aggressor species like the noisy miner *Manorina leachi*, Australian magpie and grey butcherbird *Cracticus cinereus* on the 'Viormy island block' demonstrates the preference of these species for disturbed areas where they can more easily establish and maintain their territories and protect resources.

Of the bird species recorded, nine species are endemic and two species are listed on State and Commonwealth threatened species legislation: wedge-tailed eagle, swift parrot (Bryant & Jackson 1999), with a further three threatened species white-bellied sea eagle, grey goshawk and masked owl, requiring confirmation. Two wedge-tailed eagle nests were active in the 2014 breeding season, and one adult bird was regularly seen over the survey areas.

Tree hollows provide important breeding and shelter sites for a variety of fauna. Timber harvesting activities inevitably not only reduce the availability of hollows by removing hollow-bearing trees, but also increase disturbance within retained forest patches, many years after logging (Gibbons & Lindenmayer 2002; Koch *et al.* 2009). Over time, the eucalypt forests and woodlands on the Five Rivers Reserve will increase in value for a range of hollow nesting species such as masked owl, southern boobook, green rosella, blue-winged parrot, yellow-tailed black cockatoo, owlet nightjar, striated pardalote and tree martin. They may also provide breeding habitat for the nationally endangered swift parrot. In addition to hollow nesting species, those such as the strong-billed honeyeater and black-headed honeyeater are attracted to the mature eucalypt stems for foraging under bark. The abundance of cider gum *Eucalyptus gunnii* along forest edges is also important in attracting nectar-feeding species such as yellow wattlebird to feed on its sap and the insects it attracts.

The information collected during Bush Blitz 2014 has added to our knowledge of the vertebrate fauna of the Five Rivers Reserve and highlighted the importance of integrating a variety of survey techniques in order to detect a wide range of specialist species. More survey work is needed before we can complete the picture.

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Appendix A. Vertebrate species recorded on camera traps across the Five Rivers Reserve. Number refers to number of occurrences.

SPECIES SITE *bird survey site	brushtail possum	ringtail possum	bennetts wallaby	padem'n	wombat	devil	eastern quoll	sp-tailed quoll	cat	black c'wong	potoroo	bettong	skink	tiger snake	Unknown	owlet nightjar	deer	rabbit	echidna	raven	swamp rat	green rosella	wedge-t eagle	com b-wing	grey shrike-thrus	total no of occurrences	total species	Total Trap Nights
FIRI102	7		2		2	1				2																14	5	9
FIRI103	29		11	5	6	10	1		2						2											66	7	46
FIRI104	15		16	1	2	11	7			1					1											54	7	15
FIRI105*	4		22			1				1																28	4	45
FIRI106*	8		4	5	1	1	3			5						1										28	8	46
FIRI107	14		59	14	12	5				3					4		1			1						113	8	47
FIRI111*	3		11	17	1	9				3					2											46	6	45
FIRI113*	24		18	3	1	10			8	6					11											81	7	46
FIRI115	4		4		3				1	3			16	1	1											33	7	43
FIRI116	2		9	12	3	1													2							29	6	44
FIRI117*	12		42	34	25	7	1			6					5		5									137	8	46
FIRI118	17		7	2	1	6									1						1					35	6	15
FIRI119			32		4				1	10					1		1									49	5	47
FIRI120	3		6			1			1	1	1				1											14	6	43
FIRI121*	3		1		1																					5	3	34
FIRI122	7		25	5	1	1	2		2	18					3							1				65	9	45
FIRI123	14	1	14		2	1				6										4						42	7	46
FIRI124	1		5	4	1			1							2										2	16	6	20

FIRI125	12		31	5	4	6	7			11					6									1		83	8	46
FIRI126*	13		21	2		12			5	2		2			4											61	7	46
FIRI127*	2		3		1																					6	3	45
FIRI129			3		3	4				1					2					1			3			17	6	28
FIRI130	4		1		2	1														1						9	5	8
FIRI131*	13		4	1	1					1										1						21	6	13
FIRI132	9		2	2						3					1				1							18	5	46
FIRI133			7		3	4	1																			15	4	46
FIRI135	5		4		3	1				5									1							19	6	48
FIRI136	4		5	1		3							3													16	5	23
FIRI137	6		13			2				1																22	4	46
FIRI138	16		7		1	6	1		2						1											34	6	46
FIRI139	3		13	5	2				2	3					2											30	6	46
FIRI141	3		8		2		2			2			4						1		1					23	8	31
FIRI142	2		1						1																	4	3	29
FIRI143*	1		5			2																				8	3	46
FIRI144	12		8	2	1	2				3									2							30	7	41
FIRI145	2		22	12	4	6	7						27		4			1			1					86	9	48
FIRI146			4	3	1	7	1			1									1							18	7	46
FIRI147	5		4	7	1	12				9					1										1	40	7	37
FIRI148*	5		13	2	4	5			1	9					1				2							42	8	46
FIRI149*	4		1	1		2																				8	4	10
FIRI150*	4		1			1			1	4																11	5	15
FIRI151	30		23	14	10	9	1		3	9			3		1											103	9	46
FIRI152	18		15	4	9	3		1		1					2											53	7	27
FIRI153	16		40	1		1	2			10								4		33						107	8	46

FIRI154	1		1	7	7					2					1											19	5	8
FIRI155	7		10		3	4																				24	4	24
Total occurrence per species	364	1	558	171	128	158	36	2	31	142	1	2	53	1	60	1	7	5	10	41	3	1	3	1	3	1782		1669
Total Sites recorded n=46	42	1	46	27	35	35	13	2	14	31	1	1	5	1	24	1	3	2	7	6	3	1	1	1	2			