



Five Rivers Reserve and trawtha makuminya Tasmania

18-28 February 2014

Bush Blitz Species Discovery Program



Australian Government

Department of the Environment and Energy



bhpbilliton

Sustainable Communities



Australian
Biological
Resources
Study

What is Bush Blitz?

Bush Blitz is a multi-million dollar partnership between the Australian Government, BHP Billiton Sustainable Communities and Earthwatch Australia to document plants and animals in selected properties across Australia.

This innovative partnership harnesses the expertise of many of Australia's top scientists from museums, herbaria, universities, and other institutions and organisations across the country.

Abbreviations

ABRS

Australian Biological Resources Study

ALCT

Aboriginal Land Council of Tasmania

ANIC

Australian National Insect Collection

ASBAF

Alpine Sphagnum bogs and Associated Fens

CANBR

Centre for Australian National Biodiversity Research (Australian National Herbarium)

EPBC Act

Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)

ILC

Indigenous Land Corporation

NVA

Natural Values Atlas (Tasmania)

TAC

Tasmanian Aboriginal Centre

TFIC

Tasmanian Forest Insect Collection

TLC

Tasmanian Land Conservancy

TMAG

Tasmanian Museum and Art Gallery

TSCC

Tasmanian Seed Conservation Centre

TSP Act

Threatened Species Protection Act 1995 (Tasmania)

Summary

In February 2014, a Bush Blitz survey was conducted in Five Rivers Reserve and trawtha makuminya in the Tasmanian Central Highlands.

The vegetation in the reserves is dominated by eucalypt forest and woodland, and includes a diverse range of alpine and sub-alpine communities. Habitats of high conservation value include grasslands, wetlands and moorlands.

The reserves were previously subject to various intensities of commercial timber harvesting, but retain substantial areas of un-logged forest and now include regenerating forest.

The Bush Blitz survey recorded 873 species, of which 676 were new records for the reserves. Eighteen putative species new to science were collected: 8 true bugs, 4 spiders, 1 snail and 5 lichens. Five animal species (3 mammal and 2 bird) and 10 plant species listed as threatened under state or federal legislation were identified.

Seventeen high-quality seed collections were made for the Tasmanian Seed Conservation Centre (TSCC). Of note were the collections of Blue Matcurrent (*Coprosma moorei*) and Silver Banksia (*Banksia marginata*), which were the best achieved so far for these difficult-to-collect species.

Other highlights of the survey included the following:

- The first observations of the Long-nosed Potoroo (*Potorous tridactylus apicalis*) and the Swift Parrot (*Lathamus discolor*) in the reserves.
- Five active Tasmanian Wedge-tailed Eagle (*Aquila audax fleayi*) nests recorded.
- Discovery of widespread and breeding populations of Tasmanian Devil (*Sarcophilus harrisii*). They generally appeared healthy, with Devil Facial Tumour Disease detected at only five of 35 sites.
- Collection of the moth *Leptozeptis* sp. ANIC21 (Cosmopterigidae), which is most likely a new record for Tasmania.
- Discovery of a rare beetle, *Kaveinga abbreviata*, for which there are only a handful of Tasmanian records.



Cathy Byrne and Celeste Burns setting up an insect trap, photo Cassandra Nichols © copyright, Earthwatch Australia

Areas of particularly high plant biodiversity were the small alpine marshland at Mackenzie's Tier, small rainforest patches in Viormy, and the riparian corridor of the Nive River, also within Viormy. The discovery of a sassafras forest growing on what can be described as a liverwort meadow above Serpentine Rivulet appears to be a unique habitat and likely to support isolated invertebrate populations. The meadow itself has an extremely high diversity of liverworts.

Thirty exotic plant species were identified, of which only two are declared weeds— Slender Thistle (*Carduus pycnocephalus*) and Ragwort (*Senecio jacobaea*). The majority of recorded exotic species were restricted to areas that had previously been disturbed by grazing, forestry or other activities, particularly along roads and their immediate surrounds.

Good spatial information was obtained on the distribution and abundance of Cats (*Felis catus*). Camera traps documented Tasmanian Devils, Eastern Quoll (*Dasyurus viverrinus*) and Cats visiting the same lure over consecutive nights, which demonstrates the closeness and competitiveness of this association. More information on Cat populations will aid development of effective ways to reduce their numbers.



Some of the Bush Blitz team © copyright, Earthwatch Australia

Front row: Lynette Cave, Lea Holmes, Miguel de Salas, Brandon Pyke, Lily Smith, Jacqueline Karras

Back row: Celeste Burns, Jane Hutchinson, James Hattam, Cassandra Nichols, Andrew Tennant, Bruce Paton, Mim Jambrecina, James Wood, Chad Lizdenis, Matthew Taylor, Gerry Cassis, Ian Rollins, Emma Clifton, Kate Gillespie, Laura Powell

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Introduction

This is a report for the Bush Blitz program, which aims to improve our knowledge of Australia's biodiversity. Bush Blitz is an initiative of the Australian Government, through the Australian Biological Resources Study (ABRS), in partnership with BHP Billiton Sustainable Communities and Earthwatch Australia. Bush Blitz aims to:

- promote, publicise and demonstrate the importance of taxonomy through species discovery
- undertake a national species discovery program
- support the science of taxonomy in Australia through training of students and early career researchers, and by providing grants for species description and resolution of taxonomically problematic, nationally important groups
- promote partnerships between scientific institutions, government, industry and non-government organisations
- inform reserve managers and other stakeholders of the results of Bush Blitz projects.

Five Rivers Reserve and trawtha makuminya Bush Blitz

The acquisition of trawtha makuminya, previously known as Gowan Brae, in 2013 joined the central highland reserves into a single, more or less contiguous block. This provided an opportunity to expand Bush Blitz's cover of the region; Skullbone Plains, the most westerly section of Five Rivers Reserve, was surveyed in 2012.¹

The survey took place between 18 and 28 February 2014. Therefore, the results are representative of the late summer/early autumn activity in the area. Some species, insects and birds in particular, may be absent or impossible to detect at that time of the year.

An important feature of this Bush Blitz was the involvement of the Tasmanian Aboriginal community. A community camp hosted by the Tasmanian Aboriginal Centre (TAC) included field activities and a shared dinner at trawtha makuminya. This event was a highlight for the survey team. Clyde Mansell, Chief Executive Officer of the Aboriginal Land Council of Tasmania (ALCT), also visited the expedition and spent time with scientists at trawtha makuminya.

Eight BHP Billiton employees participated in this Bush Blitz as field assistants to the scientists. They were coordinated by Bruce Paton and Cassandra Nichols from Earthwatch Australia. This professional development opportunity is available to BHP Billiton employees twice a year, and their involvement is highly regarded by the Bush Blitz team.

¹ <http://bushblitz.org.au/skullbone-plains-tas-2012/>.

The ABRS provided the logistical coordination and overall leadership of the survey while experts from the following organisations conducted the field and laboratory work:

- Tasmanian Museum and Art Gallery (TMAG)
- Tasmanian Herbarium
- Tasmanian Land Conservancy (TLC)
- Australian National Botanic Gardens (ANBG)
- University of New South Wales (UNSW)
- University of Tasmania (UTAS)
- CANBR (Australian National Herbarium)
- Queensland Museum
- Royal Tasmanian Botanical Gardens.



Serpentine River from liverwort meadow, photo Bruce Paton © copyright, Earthwatch Australia

Acknowledgements

The Bush Blitz team were Mim Jambrecina and Kate Gillespie. They would like to thank the ALCT, TAC, TLC and the Indigenous Land Corporation (ILC) for facilitating access to the reserves and providing advice and assistance. They would also like to thank Bill and Rosslyn Humphries at the Bronte Park Village, and all other Bush Blitz participants.

Reserve overview²

Reserve names:

Five Rivers Reserve
trawtha makuminya

Area:

approximately 11,000 ha
approximately 6,750 ha

Land manager/owner:

Five Rivers Reserve: Tasmanian Land Conservancy (TLC)
trawtha makuminya: Aboriginal Land Council of Tasmania (ALCT)

Description

Five Rivers Reserve and trawtha makuminya between them cover approximately 18,000 ha of the south-eastern part of the Central Plateau, approximately 10 km east of Lake St Clair.

Five Rivers Reserve is so named because the Nive, Little Pine, Pine and Little Rivers and the Serpentine Rivulet flow through it. It was purchased by the TLC from Gunns Limited in 2011 as part of their New Leaf Project, to protect the area from further timber harvesting. The reserve is made up of five land parcels: Viormy, Pine Tier, Roscarborough, Serpentine and Skullbone Plains, the last being the subject of a Bush Blitz in 2012. The 2014 Bush Blitz concentrated on the four previously unsurveyed parcels, as well as trawtha makuminya, which lies between Skullbone Plains and the remainder of Five Rivers Reserve. In 2014, the TLC released a five-year management plan for Five Rivers Reserve, which has been informed by the preliminary results of this Bush Blitz.

² Information sourced from 'trawtha makuminya: cultural heart of the Central Highlands', Tasmanian Land Conservancy. 37 (Winter 2013), <http://tasland.org.au/content/uploads/2015/07/37-Winter-2013.pdf>, accessed 27 April 2016 and the Five Rivers Reserve Management Plan 2014–2019. Tasmanian Land Conservancy, Hobart, Tasmania, <http://www.tasland.org.au/content/uploads/2015/06/Five-Rivers-Reserve-Management-Plan-June-2015.pdf>, accessed 27 April 2016.

trawtha makuminya was secured for the Tasmanian Aboriginal community from a private owner by an innovative partnership between the Australian Government, ILC, TLC, ALCT and TAC. trawtha makuminya is managed as a permanent reserve by TAC, as delegated by ALCT. Under Tasmania's dual naming policy,³ the Aboriginal name 'trawtha makuminya' was proposed by TAC for an area that includes the survey sites. In the palawa kani language, this means 'tracks through big river country'.

Aboriginal people were the original inhabitants of the reserves. The first European settlers arrived at trawtha makuminya in the 1860s, using the land for sheep farming. The adjacent Five Rivers Reserve wasn't settled by Europeans until the beginning of the twentieth century.

In the past, Five Rivers Reserve was subject to various intensities of commercial timber harvesting but it retains substantial areas of un-logged forest, and has areas of regenerating forest. It also contains other priority forest types, and areas of grassland, wetlands and moorlands, in varying size and condition.

Over 93 per cent of trawtha makuminya is intact native vegetation. About 5 per cent of the southern part of the property was completely cleared in the past; vegetation in this area is slowly regenerating.

Conservation values

Five Rivers Reserve and trawtha makuminya provide high connectivity between the Tasmanian Wilderness World Heritage Area, Walls of Jerusalem National Park, the Central Plateau Conservation Area and state forest. Skullbone Plains, which is part of the Five Rivers Reserve, has world heritage area status. Elevation in the reserves ranges from 600 m to over 1,100 m. The annual rainfall averages 2,500 mm, and there are prolonged frosts and heavy snowfalls in winter.

The reserves contain a large network of natural and artificial freshwater systems. They fall within the upper catchments of the River Derwent, which is one of the primary sources of water for downstream agriculture, industry and domestic water supplies.

The vegetation is predominantly eucalypt forest and woodland; there are also diverse alpine and sub-alpine vegetation communities, such as *Sphagnum* bogs, highland *Poa* grassland, highland grassy sedgeland, freshwater aquatic sedgeland and subalpine *Diplarrena latifolia* rushlands.

Collectively the reserves provide habitat for threatened wildlife, among them the Tasmanian Devil (*Sarcophilus harrisii*), Bindjulang or Spotted-tailed Quoll (*Dasyurus maculatus*), Tasmanian Wedge-tailed Eagle (*Aquila audax fleayi*) and Clarence Galaxias (*Galaxias johnstoni*).

³ Aboriginal and Dual Naming Policy, Tasmanian Government, Hobart, Tasmania, http://www.dpac.tas.gov.au/data/assets/pdf_file/0008/189314/Aboriginal_and_Dual_Naming_Policy.pdf, accessed 27 April 2016.

Methods

Taxonomic groups studied and personnel

A number of taxonomic groups were selected as targets for study. Table 1 lists the groups surveyed and the specialists who undertook the fieldwork.

Table 1 Taxonomic groups surveyed and personnel

Group	Common name	Expert	Affiliation
Mammalia	Mammals	Sally Bryant	TLC
Aves	Birds		
Lepidoptera	Butterflies	Abbey Throssell	TMAG/UTAS
Lepidoptera	Moths	Catherine Byrne	TMAG
Coleoptera	Beetles	Simon Grove David de Little	TMAG
Heteroptera	True bugs	Gerry Cassis Jacqueline Karras	UNSW
Odonata	Damselflies and dragonflies	Abbey Throssell	TMAG/UTAS
General invertebrates	General invertebrates	Kirrily Moore	TMAG
Araneae	Spiders	Robert Raven	Queensland Museum
Gastropoda	Snails and slugs	Kevin Bonham	Consultant to TMAG
Vascular plants (Tasmanian natives)	Vascular plants (Tasmanian natives)	Miguel de Salas	Tasmanian Herbarium
Vascular plants (exotics)	Vascular plants (exotics)	Matthew Baker	Tasmanian Herbarium
Vascular plants	Vascular plants	Matthew Taylor James Hattam	TLC
Bryophytes	Liverworts and mosses	Lynette Cave	Tasmanian Herbarium
Lichens	Lichens	Gintaras Kantvilas	Tasmanian Herbarium
Seeds	Seeds	James Wood Emma Clifton	Royal Tasmanian Botanical Gardens CANBR

Also attending from the TLC were Daniel Sprod (landscape values/GIS) and Dydee Mann (volunteer). The BHP Billiton participants were Lily Smith, Andrew Tennent, Chad Lizdenis, Celeste Burns, Brandon Pike, Ian Rollins, Laura Powell and Lea Holmes. Attending from the TAC were staff members Shaun Thirstens, Andry Sculthorpe and Tim Brown.

Site selection

Prior to the survey, the TLC identified a number of priority sites for collecting; these were visited where possible. Additional sites, chosen to give a full coverage of environmental diversity or to meet the habitat requirements of particular taxa, were limited by access; the reserves are largely roadless. Sites were marked with GPS and, if possible, photographed.

Survey techniques

A suite of standard survey techniques was used:

- **Mammals:** Camera traps were installed along roadsides and tracks across Five Rivers Reserve. A site was defined as an area of habitat corresponding to one of the three



A Fallow Deer (*Dama dama*) captured on a camera trap © copyright, TLC

conservation targets for the reserve (highland forest and woodland, highland marshes, streams and wetlands). Information was collected from 46 camera sites. Two cameras were set in trawtha makuminya. Cameras were positioned on a tree or steel pole at a height of 1 to 1.5 m and angled in the direction of an animal runway, clearing or habitat feature. The lure was a plastic bait pod filled with oats saturated in fish oil and canned fish. The pod was placed 2 to 3 m away from the camera and fixed at least 2 m above the ground to attract animals to the desired site. Cameras were installed 19 to 22 February 2014 and collected 8 to 10 of April 2014. They were operational for a maximum of 48 nights.

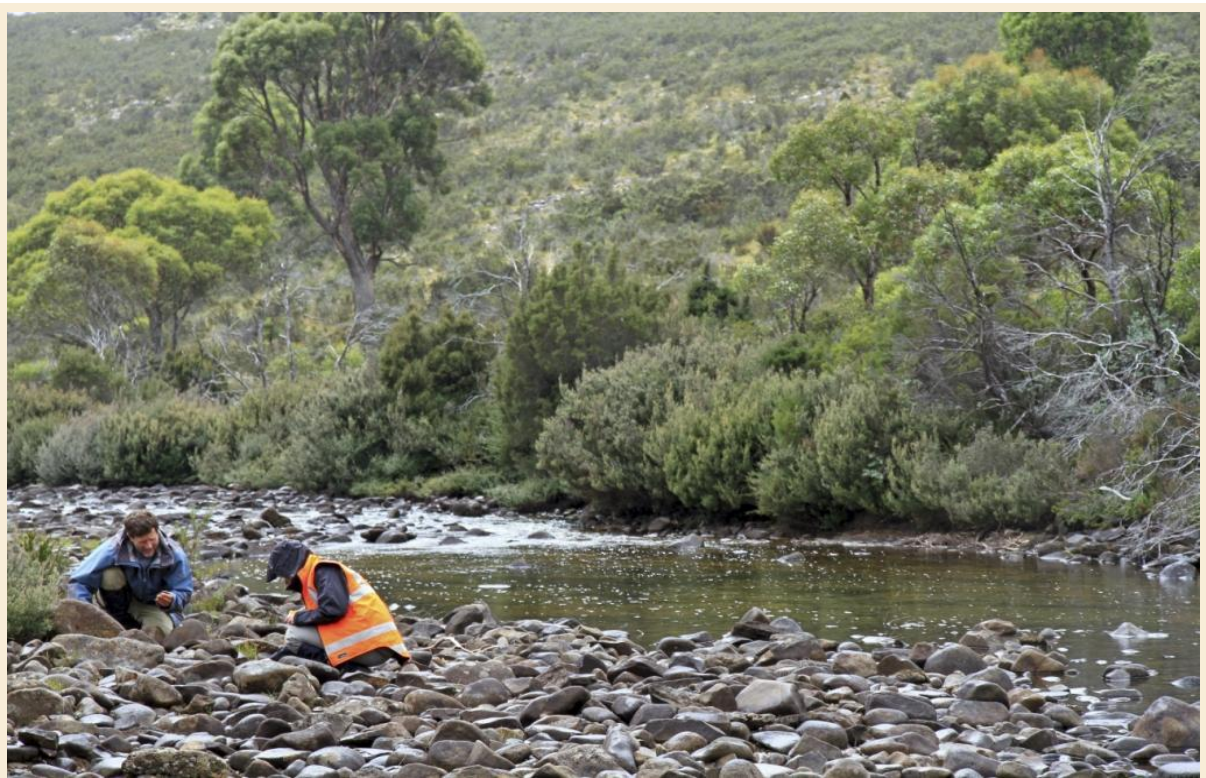
- **Birds:** Bird lists were compiled from counts undertaken in a search zone at a subset of 13 of the camera sites. General bird surveys followed the methodology used by BirdLife Australia for their Bird Atlas project (Birds Australia, 2010, www.birdlife.org.au). All bird species either seen (with 8 x 32 binoculars or similar) or heard, within a 2 ha search zone over a 20-minute survey period were recorded. Birds were only recorded from within the search zone, including birds flying overhead.
- **Butterflies:** Site selection focused on open ground and forest edges across a reasonable geographic range. Sites were selected to cover a range of habitats and were placed near priority sites where possible. Surveying was mainly conducted by opportunistic aerial netting of active adults, and was free-ranging over a small area around a central point (typically 50 m or so, up to 100 m). Search times varied from passing searches to around 90 minutes. Specimens were killed with ethyl acetate and pinned with wings set.

- **Moths:** Sites were selected to maximise representation of differing vegetation communities and land systems, but recently burnt or logged sites were avoided. Light traps were deployed at night to collect nocturnal adult moths. These traps consisted of a sheet, a portable bucket trap and a 160W mercury vapour lamp with a portable generator. Moth collection concentrated on the family Geometridae but other families were also collected. Portable bucket traps were distributed over as many different plant communities as possible. Day-flying moths were collected opportunistically using hand-held butterfly nets. Live specimens were placed in an ethyl acetate killing jar before being mounted on setting boards.
- **True bugs:** Sites were not pre-selected. Collections were based on food plant condition, particularly if plants were in flower. 21 sites and 26 host plants were surveyed over a six-day period. Specimens were collected by beating (where vegetation is beaten and specimens dislodged into an insect net and collected by aspirator) or sweeping vegetation, focusing particularly on flowers, fruits and seeds. Some species were collected from under the bark of eucalypts.
- **Damselflies and dragonflies:** Site selection focused on areas near water over a reasonable geographic range for each reserve, as well as the priority sites, where possible. Sites were chosen to cover a range of habitats, taking into account such factors as standing versus flowing water and the surrounding vegetation. Adult odonates were surveyed mainly by opportunistic aerial netting, with occasional sweeping of vegetation near water. Some aquatic netting for immature odonates was attempted at Serpentine Rivulet, but none were taken. Surveying at each site was free-ranging over a small area around a central point (typically 50 m or so, up to 100 m). Search times varied from passing searches to around 90 minutes. Specimens were killed with ethyl acetate and pinned with wings set; a few specimens were preserved by papering.
- **Beetles and other insects:** Four collecting traps designed to capture flying insects were set up in geographically separated locations for the duration of the Bush Blitz. The traps used were the Triangular Window Intercept-Trap (TWIT) and the Sea, Land and Air Malaise (SLAM) trap. The TWIT is best for those insects that drop when they hit a barrier, while the SLAM works best for those that respond to hitting a barrier by flying up. Both traps capture insects in a bottle of ethanol preservative. Active collecting focused on beetles, particularly the family Carabidae, but other insect groups were collected opportunistically. Most active collecting was around logs and stones, since this is where most carabid beetles can be found. A hand net was used opportunistically to sample flying and flower-visiting insects. Nocturnal insects were collected by spotlighting with a head torch. Specimens were collected from 33 sites.



A SLAM trap, designed to trap insects that fly up after hitting a barrier, photo Simon Grove © copyright, TMAG

- **Spiders:** For logistical reasons, sites were chosen based on moth collecting activities. Thirty sites were surveyed. The collection methods for Araneae are as many and varied as their preferred habitats and habits. For the three types of terrain studied (eucalypt forest, button grass and riverine habitats) the following collection methods were used where appropriate: log rolling, rock rolling, bark brushing, litter searching, night collecting, bank searching, bark stripping, pitfall trapping, soil brushing, moss pulling and curled bark searching.
- **Snails and slugs:** Sites were chosen to cover the geographic range of the reserve network, and all habitat types likely to support land snails. Emphasis was placed on rainforest, wet forest and high-altitude environments. Thirty-four sites were surveyed, 30 in Five Rivers Reserve and four in trawtha makuminya. Many sites of potential interest on trawtha makuminya were difficult to access. The main survey method was hand collecting, and a small leaf litter sample was taken at one site and later sorted at base camp. Surveying at each site was free-ranging over a small area around a central point (typically 50 m or so, up to 100 m). Search times varied from passing searches to up to 90 minutes, depending on the value of the site and logistics.



Simon Grove and Lily Smith on the banks of the Nive River, photo Cassandra Nichols © copyright, Earthwatch Australia

- **Vascular plants, liverworts, mosses and lichens:** Sites were chosen to reflect altitudinal range, moisture availability/drainage and dominant vegetation. The survey concentrated largely on sites that had been undisturbed by logging operations in the past, and those that were relatively easy to access. Ten sites were surveyed. Vascular plants were either pressed in the field or collected and pressed at the end of each day. Bryophytes were placed into pre-folded packets when they were collected, with some additional sorting later using a microscope. Because of their small size and intermingled pattern of growth, lichens were collected as mixed samples and later sorted with the aid of a dissecting microscope. They were then stored for further study in the laboratory. All plant material was allowed to dry at room temperature before transfer to the laboratory where standard drying procedures were implemented.
- **Seeds:** Areas where Alpine Sphagnum bogs and associated fens listed in the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) were likely to occur were targeted. These sites were identified through the assessment of aerial/satellite images. Eleven sites were surveyed. On-site visual inspections were conducted to determine viable target populations. Fruit sampling determined whether seed collection was possible. Conservation seed collecting is constrained by the following rules:
 1. Fifty or more individuals must be sampled to capture the genetic diversity of the population.
 2. Only 10–15% of seed available on a given day to be collected so as not to impact natural recruitment.
 3. A collecting target of 10–20,000 seeds is aimed at for long-term conservation collections.
 4. Herbarium samples are collected to ensure full verification of the target taxon.
 5. Detailed field data must be recorded so as to permit long-term usage.

In addition to seed collection, opportunistic sampling of plants for the Australian National Herbarium and Tasmanian Herbarium was carried out, particularly for the groups Asteraceae and Orchidaceae.



Emma Clifton collecting seeds, photo Cassandra Nichols © copyright, Earthwatch Australia

Identification

- **Mammals:** Images from camera traps were identified by the collector, Sally Bryant.
- **Birds:** Bird sightings and calls were identified on site by Sally Bryant.
- **Butterflies:** Butterfly specimens were identified by Abbey Throssell. Most were identified in the field or at base, and then checked on return to the laboratory. Some butterfly identifications were later checked by Peter McQuillan (UTAS).



A mounted Shouldered Brown butterfly (*Heteronympha penelope*), photo Cassandra Nichols
© copyright, Earthwatch Australia

- **Moths:** Adult moths were identified either during or after the survey period by Catherine Byrne with reference to the following collections: TMAG insect collection, Department of Primary Industries Parks Water and the Environment insect collection and the Australian National Insect Collection (ANIC) (CSIRO, Canberra) as well as other reference material when necessary.
- **True bugs:** Specimens were identified by Gerry Cassis, using **literature** cited in the Australian Faunal Directory.
- **Damselflies and dragonflies:** All specimens were identified by Abbey Throssell. Most specimens were identified in the field or at base, and then checked on return to the laboratory.
- **Beetles and other insects:** All specimens were identified by the chief investigator, Simon Grove, with the exception of some of the paropsine chrysomelid (leaf) beetles, which were identified by David de Little. Collected material was compared to named specimens in the Tasmanian Forest Insect Collection (TFIC). About half of the species in the TFIC have formal scientific names, many of which have been determined through comparison with named material in ANIC in Canberra. The remainder bear unique code-names (e.g., *Cryptorhynchinae* TFIC sp. 56), signifying either that the taxon has not been described, or that it has not yet been matched to a described species. In this report, the above naming convention was adopted when referring to these species. Species which appear not to be represented in the TFIC, but which need not necessarily be new to science, have been coded as TMIC (Tasmanian Museum Insect Collection).
- **Spiders:** Apart from species identified by Dr Barbara Baehr (Research Fellow, Queensland Museum), identification was based on Queensland Museum data sources (images, keys, etc.) of Tasmanian spiders.
- **Snails and slugs:** All specimens were identified by Kevin Bonham. Most specimens were identified in the field or at base camp, with all identifications checked by microscope on return to the laboratory and compared against a reference collection, where necessary.

- **Vascular plants, liverworts, mosses and lichens:** Vascular plants were inspected under a dissecting microscope. Bryophytes were identified using high- and low-power microscopy, with some sectioning of leaves and stems as needed. Lichen identification involved low- and high-power microscopy, and thin-layer chromatography of selected specimens. Specimens were compared with reliably identified herbarium specimens from the Tasmanian Herbarium and the Australian National Herbarium, the Centre for Australian National Biodiversity Research (CANBR), and by consulting relevant literature. As there is no comprehensive flora list for lichens, and the majority of collections represent taxa that have not been treated in regional flora lists, a wide range of resources was employed for identifying this group. Plant identifications were carried out by the following staff from the Tasmanian Herbarium: Matthew Baker (vascular plants), Lynette Cave (bryophytes), Miguel de Salas (vascular plants) and Gintaras Kantvilas (lichens).
- **Seeds:** Plants were identified using dichotomous keys in the Flora of Australia and the Key to Tasmanian Vascular Plants. Specimens at CANBR were checked using the Australian National Herbarium. Individuals engaged to identify collections include Laurie Adams (CANBR), Matthew Baker (TMAG), Mark Clements (CANBR), David Mallinson (CANBR) and Miguel de Salas (TMAG).

All specimens were deposited in the permanent collection of the TMAG and the TMAG Herbarium.



trawtha makuminya, photo Matthew Newton © copyright, TLC

Results

Locational data for all collection and observation records are available to reserve managers. At least 676 species were new records for the reserves, including 18 species believed to be new to science. Five threatened and 12 exotic and pest animal species were observed, while 10 threatened and 30 exotic plant species were recorded. [Table 2](#) provides a summary of the flora and fauna identified during the survey.

Table 2 Summary of flora and fauna species identified

Group	Common name	Number of species identified	Species new to the reserve	Putative new species	Threatened species*	Exotic and pest species**
Mammalia	Mammals	15	1	0	3	3
Aves	Birds	29	4	0	2	0
Hymenoptera	Ants	3	3	0	0	0
Hymenoptera	Bees	1	1	0	0	1
Lepidoptera	Butterflies	7	6	0	0	1
Lepidoptera	Moths	123	123	0	0	0
Diptera	Flies	1	1	0	0	0
Coleoptera	Beetles	86	86	0	0	0
Neuroptera	Net-winged insects	1	1	0	0	0
Heteroptera	True bugs	46	46	8	0	1
Cicadomorpha	Cicadas and leafhoppers	2	2	0	0	0
Blattodea	Cockroaches	1	1	0	0	0
Orthoptera	Grasshoppers	2	2	0	0	0
Dermaptera	Earwigs	1	1	0	0	0
Odonata	Damselflies and dragonflies	12	12	0	0	0
Araneae	Spiders	86	86	4	0	3

Group	Common name	Number of species identified	Species new to the reserve	Putative new species	Threatened species*	Exotic and pest species**
Onychophora	Velvet worms	3	3	0	0	0
Gastropoda	Snails and slugs	26	15	1	0	3
Magnoliophyta	Flowering plants	248	104	0	10	30
Liverworts	Liverworts	21	20	0	0	0
Mosses	Mosses	47	46	0	0	0
Lichens	Lichens	112	112	5	0	0
Total		873	676	18	15	42

* Species listed under the Commonwealth EPBC Act and/or Tasmania's *Threatened Species Protection Act 1995* (TSP Act).

** Includes native species that are at times pests or are exotic to this region.



Simon Grove photographing insects, photo Cassandra Nichols© copyright, Earthwatch Australia

Species lists

Updated species lists for the reserves are provided in [Appendix A](#). Species lists were compiled using data from participating institutions.

Names in **brown bold text** are putative new species. Species marked with an asterisk (*) have not been previously recorded for these reserves. Those without an asterisk have been recorded previously and were confirmed by this survey. Species shown with **blue squares** were not recorded during this survey, but are known from previous studies.

Some specimens have been identified only to family or genus level. This is partly because identifying specimens is very time-consuming, with detailed microscopic examination needed in many cases. In addition, some groups are 'orphans': there are no experts currently working on them, and the taxonomic literature is out of date. Species-level identification is not possible for these groups. Unidentified Bush Blitz specimens are held in institutional collections where they can be subject to future study.

Nomenclature and taxonomic concepts used in this report are consistent with the Australian Faunal Directory and *A Census of the Vascular Plants of Tasmania, including Macquarie Island*⁴.



Red-necked Wallaby (*Macropus rufogriseus*) captured on a camera trap © copyright, TLC



Close-up of a cushion plant, photo Cassandra Nichols © copyright, Earthwatch Australia

⁴ de Salas, M. F. & Baker, M. L. 2015, *A Census of the Vascular Plants of Tasmania, Including Macquarie Island*, Tasmanian Herbarium, Tasmanian Museum and Art Gallery, Hobart, www.tmag.tas.gov.au.

Discussion

Putative new species

Here we use the term ‘putative species new to science’ in the sense of an unnamed species that, as far as can be ascertained, was collected for the first time during the survey. It is confirmed as a new species once it is named and its description published. Specimens collected during the Bush Blitz also include unnamed taxa that are already known from museum and herbarium collections: these are not counted as putative new species.

Fauna

Invertebrates

True bugs

Eight putative new species of true bug were recognised in the reserves: seven species of Miridae and one Tingidae. A ninth new species, from the family Acanthosomatidae, was identified from outside the survey area.



Spiders

Four putative new spider species were discovered: Desidae n. gen. n. sp. 03, Desidae n. gen. n. sp. 04, Eutichuridae n. gen. n. sp. and Miturgidae n. gen. n. sp. Desidae n. gen. n. sp. 03, Desidae n. gen. n. sp. 04 are two new species from a known but as yet unnamed genus. Miturgidae n. gen. n. sp. was found by local student, Robert Beeton. Thirteen-year-old Robert is a proud pakana from the North East Tribe of Tasmania. The species name of this spider will be paruwī, which is pakana for beetle: Beetles was the nickname of Robert's late father.

Also recorded on the survey were a number of previously discovered but undescribed species; descriptions of some of these are being prepared for publication. It would take years to classify all of the specimens collected, many of which belong to genera not previously known from Tasmania and including many new to science.



A new genus and species of racing stripe spider, Miturgidae n. gen. n. sp. © copyright, Robert Whyte



Robert Beeton with the spider that will be named for his father, photo Sue Vittori © copyright, Earthwatch Australia

Snails and slugs

Punctidae gen. "Snow" n. sp. "Mackenzies Tier" is a new species in a diverse genus of undescribed alpine endemics. Three specimens were found: one live and one dead on Mackenzies Tier (Serpentine), and one live specimen on Viormy. All specimens were found in leaf litter patches on top of dolerite boulders at altitudes above 950 m.

Species in the "Snow" group are distinguished from each other by a range of shell features, including shell size, strength of radial and spiral sculpture, and elevation of spire. The specimens collected did not closely match any of the seven species already known; since the survey a ninth member of the group has also been collected on The Boomerang, a mountain in far southern Tasmania, by Michael Driessen from the Department of Primary Industries, Parks, Water and Environment.

This group displays high local endemism with species often endemic to particular mountain ranges. In the Central Plateau area, the broad distribution of high-altitude habitat makes very localised endemism less likely, so this species may also occur outside the study area.

Table 3 Putative new invertebrate species

Family	Species
True bugs	
Acanthosomatidae	Acanthosomatidae n. sp. BBCHT14_Msp.027
Miridae	Cremnorrhini n. sp. BBCHT14_Msp.007
Miridae	Mirini n. sp. BBCHT14_Msp.029
Miridae	<i>Morobea</i> n. sp. BBCHT14_Msp.009
Miridae	<i>Orthotylus</i> n. sp. BBCHT14_Msp.010
Miridae	<i>Orthotylus</i> n. sp. BBCHT14_Msp.014
Miridae	<i>Wallabicoris</i> n. sp. BBCHT14_Msp.006
Miridae	Zanchiini n. sp. BBCHT14_Msp.011
Tingidae	<i>Tingis</i> n. sp. BBCHT14_Msp.004
Spiders	
Eutichuridae	Eutichuridae n. gen. n. sp.
Miturgidae	Miturgidae n. gen. n. sp. "Miturgopelma paruwi"
Snails and slugs	
Punctidae	Punctidae gen. "Snow" n. sp. "Mackenzies Tier"

Flora

Lichens

Identification of the five putative new species of lichen is ongoing. The generic placement of *Ramboldia* n. sp. requires further investigation, but it appears to be a new species. *Megalospora* n. sp. appears to be a new taxon, related to *M. occidentalis* from Western Australia. More specimens are needed before it can be formally described. The collection of *Pertusaria* n. sp. is sterile; without the reproductive characters needed for identification, its generic placement is uncertain. However, its chemical composition is unusual, suggesting it is a new species. Further collection and study of the most unusual lichen, *Rimularia* n. sp., is required, but it appears to represent yet another new species of that genus. It appears to be closely related to *R. hepaticicola* but contains squamatic acid. Further study of *Trapelia* n. sp. is also required, but it is likely that this collection represents a new species.

Table 4 Putative new lichen species

Family	Species
Lichens	
Lecanoraceae	<i>Ramboldia</i> n. sp.
Megalosporaceae	<i>Megalospora</i> n. sp.
Pertusariaceae	<i>Pertusaria</i> n. sp. (with bourgeanic, stictic and cryptostictic acids)
Trapeliaceae	<i>Rimularia</i> n. sp.
Trapeliaceae	<i>Trapelia</i> n. sp.

Threatened species

Australia is home to an estimated 570,000 species, most of which have not been described. Approximately 92% of Australian plants, 87% of mammals, 93% of reptiles and 45% of birds are endemic. Changes to the landscape resulting from human activity have put many of these unique species at risk. Over the last 200 years, many species have become extinct; many others are considered to be threatened, i.e. at risk of extinction.⁵

Fauna

Vertebrates

Vertebrates were surveyed only within Five Rivers Reserve.

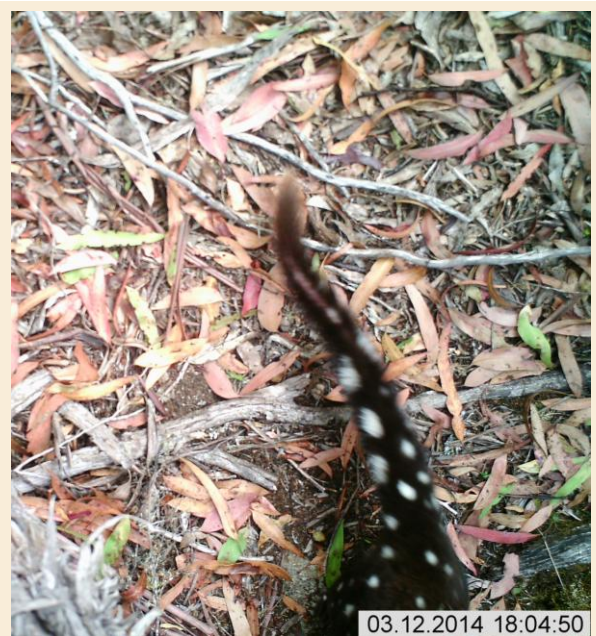
Mammals

Three threatened mammal species were detected during the survey. All had previously been recorded in Five Rivers Reserve.⁶ The Tasmanian Devil (*Sarcophilus harrisii*), listed as Endangered under the EPBC and TSP Acts, was widespread with a breeding population. It was photographed at 35 of the 46 camera sites. An assessment of coat pattern confirms a minimum of 12 individuals; this assessment is ongoing. The devils generally appeared healthy and robust with a range of body sizes observed. The Tasmanian Devil population appears to be relatively widespread across Five Rivers Reserve despite the persistence of the fatal devil facial tumour disease. Ongoing monitoring will help determine the population trends of this species in the area.

⁵ Chapman, A. D. 2009, *Numbers of Living Species in Australia and the World*, 2nd edn. Australian Biological Resources Study, Canberra.

⁶ Ref Bryant, S. L. 2014, *Carnivorous Mammal Monitoring 2014: Five Rivers Reserve, Bronte*. Tasmanian Land Conservancy, Sandy Bay, Tasmania.

Luaner or Eastern Quolls (*Dasyurus viverrinus*) were photographed at 13 sites, mostly near areas of highland marshes. The species is listed as Vulnerable under both Acts, but due to widespread declines it has recently been nominated for listing as Endangered under the TSP Act. Both the black and grey colour phases were seen; an assessment of the number of individuals has not been undertaken. Genetic diversity within the Tasmanian Eastern Quoll population shows significant regional differentiation, with the populations in central Tasmania being the most diverse. The Fish Rivers Reserve may well become a high priority for management and a source of animals for future conservation initiatives. Cameras targeting marshland and open grassland would potentially show the abundance of this species in its preferred habitat.



The Tasmanian Devil (*Sarcophilus harrisii*) population was generally healthy, with Devil Facial Tumour Disease detected at only five of 35 sites © copyright, TLC

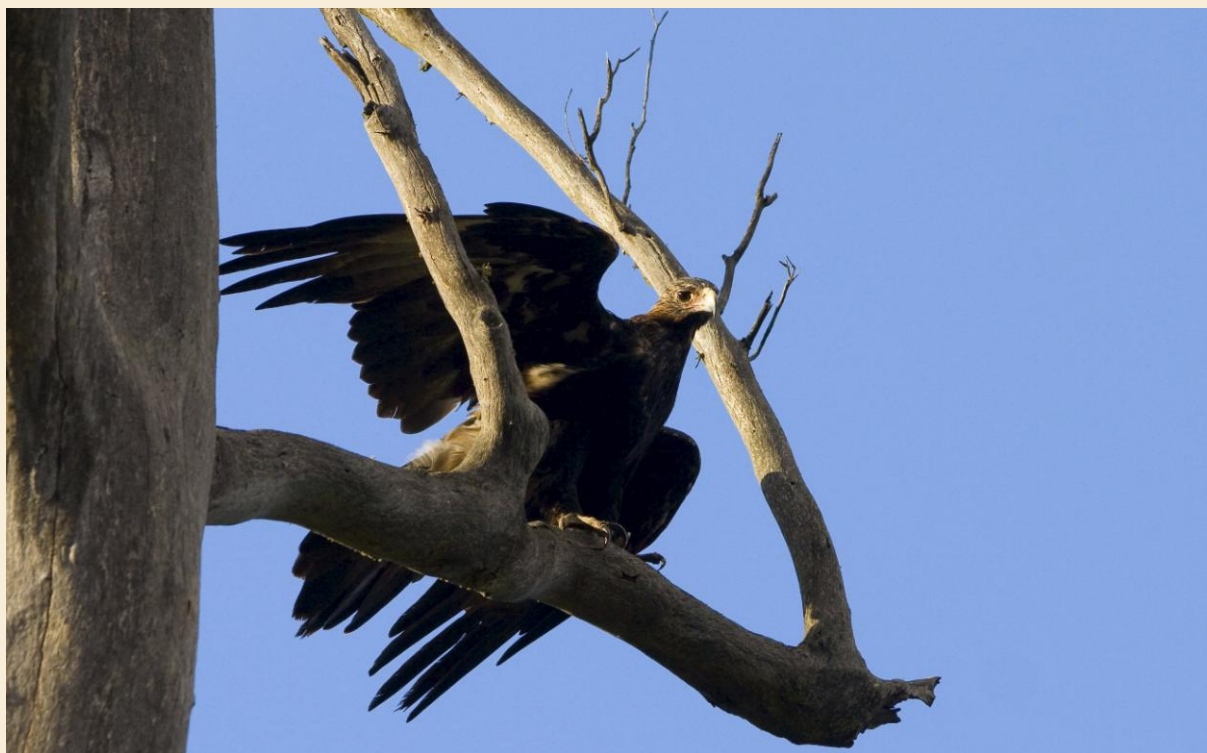
The spotted tail of a Bindjulang or Spotted-tailed Quoll (*Dasyurus maculatus*) © copyright, TLC

Bindjulang or Spotted-tailed Quolls (*Dasyurus maculatus maculatus*), also listed as Vulnerable under both Acts, were recorded from two sites, with two individual animals confirmed. The low detection rate may indicate that this wide-ranging territorial species is naturally rare in this area or that its arboreal nature precluded it from being photographed more frequently.

The recorded 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 bandicoots, rodents and bats. The presence of three co-occurring threatened Dasyuridae highlights the importance of this reserve for maintaining an intact guild of Australia's largest carnivorous marsupial fauna.

Birds

The Tasmanian Wedge-tailed Eagle (*Aquila audax fleayi*) and the Swift Parrot (*Lathamus discolor*) are listed as Endangered under both the EPBC and TSP Acts. This was the first time the Swift Parrot had been seen on the reserve. The sighting of several small flocks feeding on flowering Mountain White Gum (*Eucalyptus dalrympleana*) confirms the importance of the reserves to the species post-breeding and during its migration to the mainland. It could be that late-flowering eucalypts such as Gum-topped Stringybark (*Eucalyptus delegatensis*) and Mountain White Gum provide an important food source for this species when the more lowland Blue Gum (*Eucalyptus globulus*) and Swamp Gum (*Eucalyptus ovata*) have finished flowering.



Tasmanian Wedge-tailed Eagle (*Aquila audax fleayi*) in the Chauncy Vale Wildlife Sanctuary near Bagdad, Tasmania, photo Nick Rains © copyright, Department of the Environment

The Tasmanian Wedge-tailed Eagle was recorded at three of the 13 sites, and five active nests were found. Threatened species such as the Grey Goshawk (*Accipiter novaehollandiae*) and Tasmanian Masked Owl (*Tyto novaehollandiae castanops*) are also known to occur in the region, but were not recorded during this survey.

Fishes

Clarence Galaxias (*Galaxias johnstoni*), listed as Endangered under the EPBC and TSP Acts, has previously been identified at Five Rivers, but was not encountered during the survey. Fish were not a target taxon of this Bush Blitz.

Table 5 Threatened vertebrate fauna species

Family	Species	Common name	Status
Mammals			
Dasyuridae	<i>Dasyurus maculatus maculatus</i>	Bindjulang, Spotted-tailed Quoll	Vulnerable EPBC & TSP Acts
Dasyuridae	<i>Dasyurus viverrinus</i>	Luaner, Eastern Quoll	Vulnerable EPBC & TSP Acts
Dasyuridae	<i>Sarcophilus harrisii</i>	Tasmanian Devil	Endangered EPBC & TSP Acts
Birds			
Accipitridae	<i>Accipiter novaehollandiae</i>	Grey Goshawk	Endangered TSP Act
Accipitridae	<i>Aquila audax fleayi</i>	Tasmanian Wedge-tailed Eagle	Endangered EPBC & TSP Acts
Psittacidae	<i>Lathamus discolor</i>	Swift Parrot	Endangered EPBC & TSP Acts
Tytonidae	<i>Tyto novaehollandiae castanops</i>	Tasmanian Masked Owl	Vulnerable EPBC Act & Endangered TSP Act
Fishes			
Galaxiidae	<i>Galaxias johnstoni</i>	Clarence Galaxias	Endangered EPBC & TSP Acts

Invertebrates

Butterflies

The Ptunarra Brown (*Oreixenica ptunarra*) is listed as Endangered under the EPBC Act and Vulnerable under the TSP Act. It has previously been identified on both reserves, but was not recorded during this survey.

Table 5 Threatened invertebrate fauna species

Family	Species	Common name	Status
Mammals			
Nymphalidae	<i>Oreixenica ptunarra</i>	Ptunarra Brown	Endangered EPBC Act & Vulnerable TSP Act

Flora

The seed collection team identified the EPBC Act listed Swamp Everlasting (*Xerochrysum palustre*), but seed was not available for collection. Ten species protected under the TSP Act were identified.

Table 6 Threatened flora species

Family	Species	Common name	Status	Indication of abundance
Flowering plants				
Asteraceae	<i>Argyrotegium poliochlorum</i>	Greygreen Cottonleaf	TSP Act–Rare	Common at one location
Asteraceae	<i>Xerochrysum palustre</i>	Swamp Everlasting	PBC Act–Vulnerable TSP Act–Vulnerable	Two clumps
Cyperaceae	<i>Carex capillacea</i>	Hair Sedge	TSP Act–Rare	Locally abundant
Cyperaceae	<i>Uncinia elegans</i>	Handsome Hooksedge	TSP Act–Rare	Common
Ericaceae	<i>Pentachondra ericifolia</i>	Fine Frillyheath	TSP Act–Rare	Occasional
Fabaceae	<i>Hovea montana</i>	Mountain Purplepea	TSP Act–Rare	Occasional at one location
Lamiaceae	<i>Westringia angustifolia</i>	Narrowleaf Westringia	TSP Act–Rare	Several along river side
Podocarpaceae	<i>Ptherosphaera hookeriana</i>	Drooping Pine	TSP Act–Vulnerable	Occasional on river side
Polygonaceae	<i>Muehlenbeckia axillaris</i>	Matted Lignum	TSP Act–Rare	Locally common at two locations
Polygonaceae	<i>Rumex bidens</i>	Mud Dock	TSP Act–Threatened	Occasional in running water

Exotic and pest species

Conservation reserves help protect Australia’s rare and threatened ecosystems and provide refuge for species at risk of extinction. Invasive species can have a major impact on already vulnerable species and ecosystems, as well as economic, environmental and social impacts. The inclusion of exotic and pest species records as part of this report is designed to provide land managers with baseline information to assist with future pest management programs.

Fauna

Twelve exotic or pest species were identified: 3 mammals, 1 bee, 1 butterfly, 1 true bug, 3 spiders and 3 gastropods.

Vertebrates

Mammals

Cats (*Felis catus*) are widespread throughout Australia and, by preying on small animals and competing with other predators, they have a major effect on the ecology of any system they enter. Cats were frequently recorded: 14 individuals were identified from 31 photos at 14 sites. A further 10 photos could not be assigned, so the number of individuals could be higher.

Camera traps allow researchers to gain insight into the distribution and abundance of Tasmania's three largest carnivorous marsupials and their relationship with Cats. Finding four sites where Tasmanian Devils, Eastern Quoll and Cats visited the same lure over consecutive nights demonstrates the closeness and competitiveness of this association. More information on Cat populations will help inform the most effective ways of reducing their numbers, as well as whether they are holding territories and thereby reducing the potential influx of new animals.

While the impact of Fallow Deer (*Dama dama*) in Tasmania is considered low, the population has huge potential for growth and therefore impact on the natural environment.⁷ The TLC consider Fallow Deer a serious pest species on the reserve.

Rabbits (*Oryctolagus cuniculus*) were seen only five times at two sites, however rabbit populations are widespread on the reserves and may be serious as their impacts can often go unnoticed.⁸



Camera traps are not the preferred method to detect these three vertebrate pests.

⁷ Potts, J. M., Beeton, N. J., Bowman, D. M. J. S., Williamson, G. J., Lefroy, E. C. and Johnson, C. N., 2015, Predicting the future range and abundance of fallow deer in Tasmania, Australia. *Wildlife Research* 41(8) 633-640. <http://www.publish.csiro.au/?paper=WR13206.htm>, accessed 3 May 2016.

⁸ <http://dpipwe.tas.gov.au/invasive-species/invasive-animals/invasive-mammals/european-rabbits>, accessed 3 May 2016.

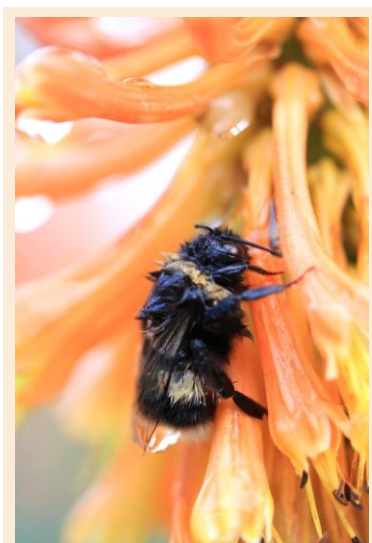
Table 7 Pest vertebrate fauna documented

Family	Species	Common name	Status
Mammals			
Cervidae	<i>Dama dama</i>	Fallow Deer	Occasional
Felidae	<i>Felis catus</i>	Cat	Common
Leporidae	<i>Oryctolagus cuniculus</i>	Rabbit	Common

Invertebrates

Bees

The Buff-tailed Bumblebee (*Bombus terrestris*) is now widespread across Tasmania. It was observed throughout the reserves. Its impacts are mostly unknown, but it may disrupt pollination of native plants, increase seed set of weeds, and compete with native bees and birds for food and habitat resources. Its introduction and spread is listed as a 'Key Threatening Process' under New South Wales legislation and a 'Potentially Threatening Process' under Victorian legislation; importation to the mainland is illegal. By law, bees on Bass Strait islands must be eradicated.⁹



Buff-tailed Bumblebee (*Bombus terrestris*), photo Cassandra Nichols
© copyright, Earthwatch Australia

Butterflies

The only introduced butterfly recorded in this survey was the Cabbage White (*Pieris rapae*), a very common and widespread pest of brassica crops. It was collected in Five Rivers Reserve.

True bugs

The Rutherglen Bug (*Nysius vinitor*) was collected at many sites, indicating it is abundant in the area. Rutherglen Bug can be a pest of many crops across Australia.

Spiders

Three introduced species of money spider (*Diplocephalus cristatus*, *Erigone* sp. and *Araeoncus* sp.) were found. These species are either known or likely to occur worldwide. They belong to very big genera and revisions are required to resolve their identities with certainty. These spiders can reach high numbers but are not listed on any national or state pest list.

⁹ Feral Animals of Tasmania, http://dpiwwe.tas.gov.au/Documents/Feral-Deck_Feral-Animals-of-Tasmania.pdf, accessed 27 April 2016.

Snails and slugs

Three exotic slug species were recorded; none is a listed pest. The Hedgehog Slug (*Arion intermedius*), a highly invasive species, was recorded at 11 sites across the survey area. It was generally recorded in low numbers, with the exception of one site in the Viormy enclave near trawtha makuminya, where it occurred in moderately high numbers near farmland. This species probably has little impact on native biodiversity. The Grey Field Slug (*Deroceras reticulatum*) was recorded at three sites and the Leopard Slug (*Limax maximus*) at two. Though neither species was found in significant numbers, they are considered agricultural and garden pests.

Table 8 Pest and exotic invertebrate fauna species

Family	Species	Common name	Status
Bees			
Apidae	<i>Bombus terrestris</i>	Buff-tailed Bumblebee	Common
Butterflies			
Pieridae	<i>Pieris rapae</i>	Cabbage White	Common
True bugs			
Lygaeidae	<i>Nysius vinitor</i>	Rutherglen Bug	Common
Spiders			
Linyphiidae	<i>Diplocephalus cristatus</i>	Common Money Spider	Common
Linyphiidae	<i>Erigone</i> sp.	Money Spider	Common
Linyphiidae	<i>Araeoncus</i> sp.	Money Spider	Common
Snails and slugs			
Agriolimacidae	<i>Deroceras reticulatum</i>	Grey Field Slug	Uncommon
Arionidae	<i>Arion intermedius</i>	Hedgehog Slug	Uncommon
Limacidae	<i>Limax maximus</i>	Leopard Slug	Uncommon

Flora

Thirty species of exotic plants, of which two are declared weeds,¹⁰ were identified. The two declared weeds, Slender Thistle (*Carduus pycnocephalus*)¹¹ and Ragwort (*Senecio jacobaea*)¹² are subject to Statutory Weed Management Plans. The majority of weeds were restricted to areas previously disturbed by grazing or forestry, and along roads and verges.

Table 9 Gazetted weeds documented

Family	Species	Common name	Status
Flowering plants			
Asteraceae	<i>Carduus pycnocephalus</i>	Slender Thistle	Confined to sites of former habitation, less than 20 plants
Asteraceae	<i>Senecio jacobaea</i>	Ragwort	Occasional at one locality, larger numbers further south. 10–100 plants, near roadsides. Presumably more widespread than records and observations suggest

The Scotch Thistle (*Cirsium vulgare*), was found as an occasional weed of open forest, and the small herb Procumbent Pearlwort (*Sagina procumbens*) was widespread in wet habitats.

Table 10 Non-gazetted weeds documented

Family	Species	Common name
Flowering plants		
Asteraceae	<i>Bellis perennis</i>	Common Daisy
Asteraceae	<i>Crepis capillaris</i>	Smooth Hawksbeard
Asteraceae	<i>Hypochaeris radicata</i>	Flat-weed, Cats-ear

¹⁰ *Tasmanian Weed Management Act 1999*, available from <http://dpiwwe.tas.gov.au/invasive-species/weeds/weed-legislation-and-management-plans/about-the-weed-management-act>, accessed 27 April 2016.

¹¹ <http://dpiwwe.tas.gov.au/invasive-species/weeds/weeds-index/weeds-index-declared-weeds/slender-thistle>, accessed 4 May 2016.

¹² <http://dpiwwe.tas.gov.au/invasive-species/weeds/weeds-index/weeds-index-declared-weeds/ragwort>, accessed 4 May 2016.

Family	Species	Common name
Asteraceae	<i>Leontodon saxatilis</i>	Hairy Hawkbit
Asteraceae	<i>Sonchus asper</i>	Prickly Sow-Thistle
Asteraceae	<i>Cirsium vulgare</i>	Scotch Thistle
Caryophyllaceae	<i>Cerastium vulgare</i>	Common Mouse-ear Chickweed
Caryophyllaceae	<i>Sagina procumbens</i>	Procumbent Pearlwort
Cyperaceae	<i>Isolepis setacea</i>	Bristle Club-rush, Bristleleaf Bulrush
Grossulariaceae	<i>Ribes uva-crispa</i>	Gooseberry
Juncaceae	<i>Juncus articulatus</i>	Jointed Rush
Lamiaceae	<i>Prunella vulgaris</i>	Self-heal
Onagraceae	<i>Epilobium ciliatum</i>	Glandular Willow-herb
Plantaginaceae	<i>Plantago lanceolata</i>	Ribgrass, Ribwort, Lamb's Tongues, Plantain
Poaceae	<i>Agrostis capillaris</i>	Common Bent, Browntop Bent
Poaceae	<i>Agrostis stolonifera</i>	Creeping Bent
Poaceae	<i>Aira caryophyllea</i>	Silvery Hairgrass
Poaceae	<i>Aira praecox</i>	Early Hairgrass
Poaceae	<i>Anthoxanthum odoratum</i>	Sweet Vernal Grass
Poaceae	<i>Cynosurus cristatus</i>	Crested Dog's Tail
Poaceae	<i>Holcus lanatus</i>	Yorkshire Fog
Poaceae	<i>Lolium perenne</i>	Perennial Ryegrass
Poaceae	<i>Vulpia bromoides</i>	Sild-Grass, Hair Grass, Squirrel-Tail Fescue
Polemoniaceae	<i>Navarretia squarrosa</i>	Californian Stinkweed
Polygonaceae	<i>Acetosella vulgaris</i>	Sheep Sorrel, Sorrel
Primulaceae	<i>Lysimachia arvensis</i>	Scarlet Pimpernel
Rosaceae	<i>Rosa rubiginosa</i>	Sweet Briar
Urticaceae	<i>Urtica incisa</i>	Stinging Nettle, Scrub Nettle

Range extensions

One specimen of the moth *Leptozeztis* sp. ANIC21 was collected from trawtha makuminya. Previous collections were from Mt Kosciuszko, NSW, and this is most likely a new record for Tasmania. The collection of the snail *Mulathena fordei* is the northernmost record for the species, representing a 30 km range extension. *Mulathena* has a mostly western distribution and the new records were well to the north-east of the known range.

Table 11 Range extensions documented

Family	Species	Nearest previous record	Native/introduced
Moths			
Cosmopterigidae	<i>Leptozeztis</i> sp. ANIC21	> 700 km north-east	Native
Snails and slugs			
Charopidae	<i>Mulathena fordei</i>	30 km south	Native



The collection of *Mulathena fordei* represented a 30 km range extension. This live specimen, with a shell only 5mm long, was taken in Mount Field National Park © copyright, Tim Rudman <https://www.flickr.com/photos/tindo2/>

Other points of interest

Fauna

Vertebrates

Mammals

Fifteen species of mammal were detected, including one species not previously known from the area— Long-nosed Potoroo (*Potorous tridactylus apicalis*)—bringing the total number of mammal species recorded in Five Rivers Reserve to 22. The most commonly recorded species across the 46 sites were Red-necked Wallaby (*Macropus rufogriseus*) 46 sites, 558 occurrences; Tasmanian Brushtail Possum (*Trichosurus vulpecula fuliginosus*) 42 sites, 364 occurrences; Tasmanian Devil (*Sarcophilus harrisii*) 35 sites, 158 occurrences; and Bare-nosed Wombat (*Vombatus ursinus*) 35 sites, 128 occurrences.



Bare-nosed Wombat (*Vombatus ursinus*) in tree hollow, above liverwort meadow, photo Bruce Paton © copyright, Earthwatch Australia

Good spatial information was obtained on the distribution and abundance of Tasmanian Devil, Eastern Quoll (*Dasyurus viverrinus*), Spotted-tailed Quoll (*Dasyurus maculatus*) and Cat (*Felis catus*) across the reserve. These four predatory species were detected at 41 of the 46 sites. Fifteen sites had two species co-occurring and four had three species co-occurring. Only a single predatory species was recorded at the remaining 22 sites.

The presence of the Long-nosed Potoroo and the Tasmanian Bettong reflects the size and diversity of habitats across this landscape, which enable Tasmania's two species of Potoroidae to coexist in close proximity. However, the Long-nosed Potoroo was captured in one image only, while the Tasmanian Bettong (*Bettongia gaimardi*) was recorded at one site on two images. This low detection rate could be due to either naturally low occurrence or because a meat-based lure is not attractive to these species.

The Common Ringtail Possum (*Pseudocheirus peregrinus*) was detected at only one site, while the Sugar Glider (*Petaurus breviceps*), Little Pygmy-possum (*Cercartetus lepidus*) and Eastern Pygmy-possum (*C. nanus*) were not detected at all. This again suggests either low numbers or, more likely, unsuitable camera placement for these predominantly arboreal species.

Small carnivorous or omnivorous mammals such as Southern Brown Bandicoot (*Isodon obesulus*), Eastern Barred Bandicoot (*Perameles gunnii*), Antechinus (*Antechinus* spp.) and Dunnart (*Sminthopsis* spp.), as well as a range of native and introduced rodents, should have been attracted to a meat-based lure, but none of these were detected. A 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.

Despite the abundant overgrown boulder fields that are ideal habitat for the Long-tailed Mouse (*Pseudomys higginsi*), the species was not detected. It has, however, been recorded during previous surveys. Similarly, the sphagnum bogs and featherbed habitats are ideal for Broad-toothed Rat (*Mastacomys fuscus*) and the Swamp Antechinus (*Antechinus minimus*), and the stringy bark forests may potentially contain both Tasmanian species of pygmy possums, but none of these species were detected. More work is needed to determine if these species are present in the area.

The species diversity in Five Rivers Reserve is expected in Tasmania's high country in areas where a mosaic of mixed forest types, marshland and riparian habitats are connected by a network of roads and tracks, which facilitate movement and dispersal. However, more information is needed about the presence and abundance of the medium to smaller weight range mammals and arboreal species.

Birds

Tasmania's avifauna is well known and comprises over 220 resident and migratory species across a wide range of habitats. Twenty-nine bird species were identified during this study. All are native species, and nine are endemic. The most notable finding was the confirmation of four species not previously identified on Five Rivers Reserve: Swift Parrot (*Lathamus discolor*), Noisy Miner (*Manorina melanocephala leachi*), Australian Magpie (*Cracticus tibicen hypoleuca*) and Grey Butcherbird (*Cracticus torquatus cinereus*).

The Noisy Miner, Australian Magpie and Grey Butcherbird were relatively confined but abundant on the Viormy island block, which differs from most other areas surveyed because of the ongoing disturbance from illegal firewood removal. These aggressive bird species favour disturbed areas, especially open woodland and grassland where territories can be defended and resources more easily obtained.

Forty-eight bird species have now been recorded in Five Rivers Reserve. This number is likely to increase as more surveys are undertaken at other times, such as 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, grass-birds and a range of waterfowl may occur in the marshland and wetland complexes that span the reserve. Spotted-quail Thrush (*Cinlosoma punctatum*), Painted Button-quail (*Turnix varius*) and Brown Quail (*Coturnix ypsilophora*) may also use the grassland and forest or woodland fringes.

Due to the timing of this work, many birds had already left the region for the lowlands of Tasmania or to migrate across Bass Strait. Some species (e.g. honeyeaters) undertake annual altitudinal migration, travelling down from the high country to spend the cooler months in coastal lowlands where food is more plentiful. During the winter months the Central Highlands experience heavy frosts and long periods of snow that severely limit the availability of resources, foraging niches and survivability for many bird species.

The bird diversity recorded is typical of areas of Tasmania with wet forests, grassy woodlands and grasslands that survive in large ecologically intact patches relatively free from ongoing disturbance. The lack of exotic species means the area retains a naturally intact avian community utilising the structural elements such as old growth forest and riparian edges where flowering groves of understorey species are seasonally abundant. The abundance of water and fallen timber has improved habitat richness and niche availability for birds and many other native fauna groups.

Tree hollows provide important breeding and shelter sites for a variety of fauna. Timber harvesting activities inevitably not only reduce the availability of hollows, but also increase disturbance within retained forest patches for many years after logging. Over time, the eucalypt forests and woodlands on Five Rivers Reserve will increase in ecological value for a range of hollow-nesting species. These include Tasmanian Masked Owl (*Tyto novaehollandiae castanops*), Southern Boobook (*Ninox novaeseelandiae leucopsis*), Green Rosella (*Platycercus caledonicus*), Blue-winged Parrot (*Neophema chrysostoma*), Yellow-tailed Black-cockatoo (*Calyptorhynchus funereus*), Australian Owlet-nightjar (*Aegotheles cristatus*), Striated Pardalote (*Pardalotus striatus*) and Tree Martin (*Petrochelidon nigricans*).

In addition to hollow-nesting birds, species such as the Strong-billed Honeyeater (*Melithreptus validirostris*) and Black-headed Honeyeater (*Melithreptus affinis*) are attracted to mature eucalypt forest for foraging under bark. The abundance of Cider Gum (*Eucalyptus gunnii*) along forest edges is also important in attracting nectar-feeding species such as the Yellow Wattlebird (*Anthochaera paradoxa*) to feed on its sap and the insects it attracts.

Invertebrates

Butterflies

Particularly good spots for butterflies were around Johnson's Lagoon in trawtha makuminya, and an area of highland grassy sedgeland in the south-east corner of Serpentine reserve: both of these were priority sites suggested by the TLC.

Seven species of butterfly, including one introduced species, were recorded. Silver Xenica (*Oreixenica lathoniella*) was abundant in grasslands and heathlands throughout both reserves. Mountain Blue (*Neolucia hobartensis*) and Australian Painted Lady (*Vanessa kershawi*) were also quite abundant in parts of trawtha makuminya. In contrast, a single specimen each of Orichora Brown (*Oreixenica orichora*) and Two-brand Grass-skipper (*Anisynta dominula*) were recorded.

Most butterflies were new records for the reserves. The only previously recorded species found during this survey was the Silver Xenica from Five Rivers Reserve. Two other butterflies that are known to be endemic to the area, the Ptunarra Brown (*Oreixenica ptunarra*) and the Common Brown (*Heteronympha merope*), were not recorded, possibly because the survey was conducted outside their main flight period.

All butterfly species recorded during the 2012 Skullbone Plains Bush Blitz were collected during the current survey. Two species found on this survey, the Two-brand Grass-skipper collected at trawtha makuminya, and the Orichora Brown collected at Five Rivers Reserve, were not collected at Skullbone Plains.

Since late February is toward the end of the flight period for butterflies, additional species that fly earlier in the year may also occur on the reserves.

Moths

There were 47 collection events for moths and 481 specimens were recorded. These specimens were from 18 different families, comprising about 120 species in 85 genera. Prior to this survey, no lists of moths were available for the reserves; all species collected are new records in the reserves.

The family with the highest species richness and abundance by far was the Geometridae with 247 specimens from 59 species in 34 genera. This represents about 20% of Tasmania's total fauna. Noctuidae were the second highest with 84 specimens from 20 species in 8 genera. The dominance of these two families is not surprising, as collecting was biased towards the Geometridae, the Geometridae are well represented in montane areas, and these two families numerically dominate the Australian macro-moths.



The geometrid moth *Amelora oritropha* is widespread in south-eastern New South Wales, Victoria and Tasmania, yet its food plant remains unknown, photo Cathy Byrne © copyright, TMAG

The most abundant moth was the widespread geometrid *Amelora oritropha*. This species occurs in the highlands of south-eastern New South Wales, Victoria and Tasmania and ranges over large areas of montane heathlands and open woodlands at altitudes of 600–1240 m. Its food plant/s is unknown.

The next most abundant species was a rare undescribed lichen moth in the genus *Scoliacma*. This species, although very widespread across the areas surveyed, has rarely been collected in Tasmania. It probably feeds on lichens.

Five major subfamilies of the Geometridae were represented in this survey: Ennominae, Geometrinae, Larentiinae, Oenochrominae and Sterrhinae. The other major subfamily, Archiarinae, was absent—probably due to the absence of their food plants (sub-alpine conifers) or because it was too late in the year for most adults to be flying.

The most species-rich geometrid subfamily was the Ennominae with 20 species in 15 genera recorded. In terms of generic diversity of the Ennominae, the Nacophorini was richest, with 12 species in eight genera. This is not surprising as the Australian Nacophorini are well represented in montane fauna and the tribe's greatest area of development is southern Australia.

This species richness was rivalled by the larentiine tribe Xanthorhoini, with 16 species in four genera. Globally, the Larentiinae is the most species-rich subfamily and is abundant at high altitudes and in cool, temperate areas. The genus *Chrysolarentia*, with 11 species, contributed most to the xanthorhoin diversity here. This large genus of 64 Australian species is an outstanding example of adaptive radiation and local evolution in a montane environment, with around 20 species occupying the highlands of Tasmania. These colourful, day-flying moths are a conspicuous feature of the Central Highlands.

Approximately the same number of geometrid specimens were collected in the 2012 Skullbone Plains Bush Blitz (286 compared to 247 in the current survey), but with a lower species richness of 47 species compared to 58 in the current survey in the same number of genera. The diversity of the two surveys is probably comparable after compensating for the larger geographical area of the current survey.

In contrast, the species and generic diversity in the Ennominae and the Nacophorini, the most diverse geometrid taxa in both surveys, were lower in the current survey. This was mainly due to the apparent absence of ten nacophorines: *Androchela newmannaria*, *Androchela smithi*, *Archephanes zalosema*, *Fisera eribola*, *Fisera perplexata*, *Furcatrox australis*, *Mnesampela heliochrysa*, *Paralaea tasmanica*, *Plesanemma altafucata* and *Smyriodes aplectaria*. Most of these, and other nacophorines, were likely not collected because their peak flying season is not normally until later in the year—in early to mid-autumn. Emergence of adults of these species

is cued by soaking rain and the lowering of soil temperatures in autumn, which had not occurred substantially in the season preceding the survey.



This rare undescribed lichen moth in the genus *Scoliacma* was the second most abundant species, but has previously rarely been collected in Tasmania. It probably feeds on lichens, photo Cathy Byrne © copyright, TMAG

Species records in these 2012 and 2014 Bush Blitz surveys are representative of only the late summer to early autumn fauna. Many of the insect groups, particularly in montane environments, are univoltine (producing one brood in a season) and seasonal, with the adult stage emerging in peak numbers only in spring or autumn.

Sixteen undescribed species of moths were collected, 15 in Five Rivers, four in trawtha makuminya; three of the species were found in both. The endemic arctiid *Scoliacma* sp. was the second most commonly collected species in the survey and was widely distributed throughout the reserves. This species has rarely been collected: only three Tasmanian specimens, collected in

1943, 1978 and 1983, are held in ANIC. Another undescribed endemic species of the Geometridae, *Chrysolarentia* sp. ANIC 02, is also uncommon, with only a few specimens held in ANIC. The endemic undescribed tortricid, *Cnephasia* ANIC sp. 01 is also uncommon. *Leptozeptis* sp. ANIC21 (Cosmopterigidae) was represented by one specimen collected from trawtha makuminya. This is most likely a new record for Tasmania.

Other highlights of the survey included the collection of *Drymoptila temenitis*, a rarely seen nacophorine geometrid. Two specimens of this species were collected from Roscarborough in eucalypt and acacia woodland. Very little is known of the biology of this species. Similarly, two specimens of the geometrid *Poecilasthena urarcha* were collected. This species is uncommon and restricted to the south-eastern highlands in Tasmania.

One specimen of the geometrid *Chrysolarentia insulsata* (Larentiinae) was collected in the Serpentine Conservation Area. This species, although widespread in south-eastern Australia, is uncommon in Tasmania.

Several specimens of four other endemic and uncommon species, the geometrids *Aponotoreas cheimatobiata* and *Chrysolarentia pericalles*, the pyralid *Mimaglossa crypserythra* and the tortricid, *Merophyas tenuifascia*, were also collected from several sites.

The mega-diverse Oecophoridae are generally not well-represented in montane habitats. They are generally small, weak fliers and less likely to be attracted to light; this may explain the lower number collected (ten species in eight genera).

Beetles

This Bush Blitz was conducted several weeks past the peak summer activity of most insects in this high-altitude part of Tasmania. The period included some very warm days and nights that were good for sampling insects, but also the first frosts of autumn. The reserves have not been systematically surveyed for beetles in the past, so most if not all of the species identified are likely to be new records for the reserves.

The areas of greatest species richness surveyed, by far, were the small patches of rainforest (e.g. in the west of the Viormy block). Elsewhere, wetter forests tended to be richer than drier forests. This may be an artefact of the relative ease with which habitats such as logs can be sampled in such forests, that sampling took place late in the season, and that dry forest was often too dry for widespread insect activity.

In total, 86 beetle species (including 13 species of carabids) were collected and identified. This is a low number compared to what is likely earlier in the summer, and mostly comprises species that are widespread in the Central Highlands or across Tasmania. Some 27 unnamed beetle taxa were recorded. All but six of these are already represented in the TFIC.

It was hoped that river-shingle specialist carabid beetle species would be found along the Nive and Pine Rivers, but the only species found through overturning pebbles in these areas were widespread open-country or generalist species: *Notagonum marginellum*, *Pseudoceneus sollicitus* and *Promecoderus brunnicornis*.

The Miena Jewel Beetle (*Castiarina insculpta*) is considered threatened because of its narrow range and great scarcity of records. Although not yet recorded for the reserves, it occurs widely in the upland heathlands west of Great Lake, just a few kilometres east of these properties. Previous observations indicate that adults are generally associated with flowers of the Kerosene Bush (*Ozothamnus hookeri*), and a female has been observed laying eggs in fissures in the woody stem of this plant. As small areas of similar habitat occur in this survey area, for instance near the eastern border of trawtha makuminya alongside the Nive River, it was hoped that this beetle would be located. However, extensive searching, as well as trapping, failed to produce any evidence of it. If it occurs here at all, the population would be small, relatively isolated, and therefore vulnerable. Its conservation management might require careful regeneration of currently ageing stands of its food plant using a small-scale mosaic of prescribed burning, as well as controlled grazing and browsing post-fire.

The beetle species of most note was *Kaveinga abbreviata* (Caraboidea:Rhysodidae), a single specimen of which was found in a large eucalypt log in the Viormy property. Whereas most carabid beetles are predators, rhysodines represent an ancient lineage whose extant members probably feed only on slime moulds deep within rotting wood. This species has a wide distribution in eastern Australia, but is rare in Tasmania, only appearing in a handful of records, although these cover a very wide range of altitudes and forest types.

The same log also produced a specimen of another enigmatic and undescribed beetle, the weevil *Dryophthorus* ECZ sp. 02.

Interestingly, both the above species seem to live their entire lives embedded in ‘mudguts’, the reddish-brown rot often found at the heart of old eucalypt logs. Presumably, they must occasionally emerge to disperse to find new logs, but mostly they seem to stay put, apparently motionless.



Rhysodine carabid beetles, like this *Kaveinga abbreviata*, represent an ancient lineage whose extant members probably feed only on slime moulds in rotting wood, photo Simon Grove © copyright, TMAG

This same eucalypt log also allowed confirmation of the habitat association of an undescribed species of leioidid beetle, *Neopelatops* TFIC sp. 01. This much livelier beetle is commonly caught in intercept traps in Tasmania’s wet forests, for instance at the Warra Long-term Ecological Research site, but its habitat associations were previously unknown.

The other carabid beetle of interest was *Promecoderus viridiaeneus*, a species that is probably widespread in the wetter forests of the Central Highlands but absent from the lowlands.



The carabid beetle *Promecoderus viridiaeneus*, found in a rotting log, photo Simon Grove © copyright, TMAG

Whereas most *Promecoderus* species are black and inhabit leaf litter, this species is metallic greenish and seems to prefer to live in or under logs. During the survey, it was found at a number of rainforest sites but not in drier forest.

A further log-dwelling carabid—one of Tasmania’s largest, *Percosoma carenoides*—was found at one rainforest site in Viormy, along with *Chylnus ater*, a carabid that is less commonly associated with logs. Both species are normally associated with mature forest.

Darkling beetles (Tenebrionidae) were numerous during the survey. All eight species identified are considered widespread inhabitants of forest or woodland, where their larvae develop in rotting logs.

Two species of moss beetle (Byrrhidae) were found among forest floor mosses in rainforest areas. Neither *Notolioon griffithi* nor *N. dives* is commonly encountered—indeed, the latter species is not represented in the TFC—but this could be because of their small size, their specialised microhabitat and their camouflaged appearance, the latter species being moss green.

The two reserves together provide an excellent array of upland habitats, which in turn support a range of characteristic species. The rainforest patches proved particularly rich in highly localised species. Rotting logs are another rich habitat for beetles and other invertebrates, in both rainforest and eucalypt woodland. In drier areas they additionally serve as refuges from desiccation. In terms of conservation, the main recommendation is to ensure that dead wood is not extensively harvested for firewood; rainforest fragments should also be protected, as much as is feasible, from wildfire.

True bugs

The reserves had not previously been surveyed for Heteroptera, therefore all Heteroptera collected were new records. As expected, the number of species was not particularly high. It is likely that the Heteroptera have been impacted by the high levels of habitat disturbance in the reserves.

Forty-six species of true bugs were collected from 26 host plant species. As has been found elsewhere during the Bush Blitz program, the number of species, including new species, was greatest for the plant bug family Miridae. In addition, the Acanthosomatidae were well represented in the reserves, with seven species found, including one that is considered new to science. The most interesting of the Miridae belongs to an undescribed genus and species of Orthotylinae, *Morobea* n. sp. BBCHT14_Msp.009, which belongs to a group that is mostly tropical in distribution.

Two ant-mimicking bugs were recorded. Most organisms actively avoid ants, as they are distasteful and aggressive, so it is an advantage to look like an ant to deceive potential predators. In Australia there are likely to be 150–200 ant-mimicking bugs. Australia is rich in ants and this seems to correlate with there being many ant-mimicking bugs. It is estimated that Tasmania has 20–30 species, but this needs confirmation.

Cicadas

The Tasmanian Hairy Cicada (*Tettigarcta tomentosa*) was quite common in the reserves at night. This is a widespread species in upland Tasmania, but it belongs to a lineage of just two species thought to be closely related to the ancestral cicada; they are nocturnal, emerge in the cooler months, and cannot sing, though they drum their feet on the vegetation, like some other plant bugs.

Damselflies and dragonflies

The reserves host a range of good habitats for damselflies and dragonflies (Odonata) and were found to support a reasonable diversity of species. Odonata were most diverse around Johnson's Lagoon, along Serpentine Rivulet and in an area of highland grassy sedgeland in the south-east corner of Serpentine.

Twelve species were recorded: five damselflies and seven dragonflies. These included two Tasmanian endemics: the Tasmanian Darner (*Austroaeschna tasmanica*) and Tasmanian Swamp Tigertail (*Synthemis tasmanica*).

Two odonate species collected during the Skullbone Plains Bush Blitz, the Red and Blue Damsel (*Xanthagrion erythroneurum*) and the Unicorn Darner (*Austroaeschna unicornis*), were not recorded on this survey. Two odonates not collected at Skullbone Plains that were recorded at both Five Rivers Reserve and trawtha makuminya were the Yellow-striped Hunter (*Austrogomphus guerini*) and Eastern Pygmyfly (*Nannophya dalei*).

Spiders

Over 200 specimens were collected during the survey. The exact number of species is hard to determine, as some specimens were juveniles and could not be identified to species level.

A number of spiders were collected that use some degree of ant mimicry. Ant-mimicking spiders release chemicals that make them smell like ants. They also behave like ants and have slender bodies with banding to make them appear like ants. Ant-mimicking spiders were collected in rolled-up bark and moth traps. Diversity was high in bark, where ant-mimicking bugs were found with the ant-mimicking spiders.



The ant-mimicking spider *Poecilopta zbigniewi*
© copyright, Robert Whyte

Velvet worms

Rotting logs comprise prime habitat for velvet worms (Onychophora). Although these were not a focus of collecting, three individuals, all members of the egg-laying genus *Ooperipatellus*, were found. The genus is poorly understood, and may comprise scores of species in Tasmania alone. Each of the three specimens has a distinct colour pattern and came from separate, isolated patches of wet forest or rainforest, so it is possible that they represent three separate species.



Three *Ooperipatellus* velvet-worms found in separate patches of wet forest or rainforest, photo Simon Grove
© copyright, TMAG

Snails and slugs

With 26 species recorded, the species diversity in the reserves was impressive. The properties include a wide range of habitats suitable for land snails and the combination of wet forest and high altitude habitats contributed to a few unexpected and biogeographically significant records.

The highest site diversity was nine species; this was recorded at four sites (two open rocky eucalypt woodlands, one wet eucalypt/teatree forest and one rainforest). There was no single dominant species and the most abundant, *Stenacapha hamiltoni*, was recorded at slightly less than half the sites and accounted for only about 12% of the specimen total.

The specimens of *Cystopelta* (native slug) collected represent an apparently undescribed species, which has been named *Cystopelta* sp. "River Dee". It was also recorded during the Skullbone Plains survey (as *C. bicolor*) and from at least one previous collection at River Dee. This is quite significant, as only two widespread species in the genus are known from the Tasmanian mainland. The identity of the slug as a distinct species was established from its dung coil, which differs from that of *C. bicolor*. The upper body of this slug is mainly blackish, whereas *C. bicolor* is usually dark brown.

There was a very isolated record (30 km range infill) of *Trocholaoma* cf. *spiceri* in a small sassafras gully above Serpentine Rivulet. This species is a specialist of very wet forest areas, and finding it in the sassafras forest growing on a liverwort meadow suggests this is a remnant of formerly larger rainforest patches. The species was not found, and would not be expected to occur in, the surrounding drier forest.

The sassafras gully habitat appears to be unique and the presence of an isolated land snail suggests it could support other isolated invertebrate populations. Management of the reserve should aim to avoid fire risks to this habitat, which is likely to be very sensitive.

Caryodes dufresnii was reasonably common but 22 of the 25 specimens recorded were dead juveniles. Two dead adults (one a fragment) and one live juvenile were also recorded.

Pernagera tasmaniae and *Paralaoma* cf. *hobarti* are eastern Tasmanian species that appear to have range boundaries within the survey area. Slight range extensions were recorded for both, and the presence of *P. tasmaniae* at the trawtha makuminya camp was interesting, given it was not found during the Skullbone Plains trip.

One live *Helicarion cuvieri* collected at a wet forest site on Viormy was a very different colour to all the other live specimens seen—it was predominantly pale orange, while all others were mainly black.



Sassafras remnant above Serpentine Rivulet
© copyright, Kevin Bonham

A minor range infill was recorded for *Tasmaphena sinclairi*. The species was not recorded at Skullbone Plains but is common on Viormy.

The Natural Values Atlas¹³ indicates that Coarse-ribbed Carnivorous Snail (*Tasmaphena ruga*) was previously recorded in the area. The species recorded was most likely *Stenacapha hamiltoni*—*T. ruga* does not occur in the area, with the nearest reliable record about 50 km away.

The species recorded during the Skullbone Plains Bush Blitz as *Paralaoma cf. caputspinulae* was the species here listed as *Paralaoma cf. hobarti*. An upcoming book by Staniscic et al. is expected to exclude *P. caputspinulae* from the Tasmanian fauna.

Flora

Vascular plants

The previous Bush Blitz at the adjacent Skullbone Plains—a property of fairly uniform elevation, rainfall and geology—gave the expectation of similar results. However, Five Rivers Reserve and trawtha makuminya encompassed greater variation in geology (and thus, indirectly, drainage conditions), elevation (affecting temperature), aspect and rainfall. This has resulted in a higher level of vascular plant biodiversity.

The vegetation was largely consistent with expectations given the altitude, geology and rainfall of the area. However, the high level of biodiversity in some locations was surprising when compared to the results of the 2012 Skullbone Plains Bush Blitz. Particularly biodiverse areas included the small area of alpine marshland at Mackenzie's Tier (Serpentine), small rainforest patches in Viormy, and the riparian corridor of the Nive River, also within Viormy.

Some species listed as previously recorded in the area in the Natural Values Atlas (NVA) are regarded by the survey team as taxonomically suspect and largely incorrect for the following reasons:

- The NVA does not differentiate between anecdotal observations from people with varying degrees of taxonomic expertise and vouchered herbarium collections.
- The majority of observations date from the 1980s and 1990s, in the time before GPS, and therefore have a high level of geographic uncertainty (estimated to be between 10 and 100 km).
- In the time since the original observations were made, the taxonomy of many groups has changed, with many species having been split into several new taxa. As no vouchers were collected for the listings, their current identities are therefore impossible to establish.

In some groups as many as 25–40% of the records have identification or geographical errors.

¹³ <https://www.naturalvaluesatlas.tas.gov.au/>.

The Tasmanian Herbarium does not hold any specimens that could be unambiguously shown to have originated from inside the reserves. Other Australian herbaria may possess specimens taken from the Central Highlands reserves, although this is unlikely given that the areas are relatively inaccessible. Such records would be accessible through the Australian Virtual Herbarium.¹⁴

Seeds

This was the first time the TSCC collected seed on Central Highland properties bordering the Marlborough Highway. This was also the first time the Tasmanian and Canberra seedbank programs have collaborated on a field trip. Despite difficulties locating fruiting populations for many of the target species, the trip was successful and secured good, high-quality seed collections for conservation and research purposes.

Despite collecting in a seasonal lull, 17 high-quality seed collections were secured. These collections are of a size adequate for long-term conservation and will be stored for (hundreds, potentially thousands, of years) in the TSCC and Australian National Botanic Gardens (ANBG) seed banks. These seed collections will also facilitate research about the longevity, dormancy and germination of seeds from a nationally listed, threatened community.

Eight of these collections were of taxa occurring within EBPC Act listed Alpine Sphagnum Bogs and Associated Fens (ASBAF). These fenland collections will feed into a research program currently underway at the ANBG, investigating longevity, dormancy and germination behaviour of species from these threatened communities.

The collections may also become foundation material in a developing national program, the Australian Seed Bank Partnership's Plants on the Precipice project. For three of the taxa, Fen Sedge (*Carex gaudichaudiana*), Fan Tuft-rush (*Oreobolus distichus*) and Veined Sun Orchid (*Thelymitra cyanea*), these collections represent a likely increase in the genetic diversity represented in *ex situ* conservation, in addition to recent collections from populations in the Australian Capital Territory, New South Wales and other areas of Tasmania.

The Blue Matcurren (*Coprosma moorei*) collection represents a new species to the TSCC. The large population found on trawtha makuminya presented the first opportunity to make a conservation-sized collection of this species, and the eight thousand seeds harvested are an impressive achievement as matcurren species are generally very difficult to collect.

The Silver Banksia (*Banksia marginata*) collection from the Little River is also significant to the Tasmanian seedbank. Although this species is common and widespread, opportunities to make conservation-sized collections seldom present themselves, because it has a tendency to drop its seeds quickly. The trawtha makuminya collection is still being processed but it seems likely that it will be the best attempt made so far to secure the genetic diversity of this important understory species and will easily achieve the numbers and quality set for conservation collections.

¹⁴ <http://avh.chah.org.au/>.

Liverworts, mosses and lichens

In contrast to the vascular plants, the lichen and bryophyte lists are comparatively short. This is due to the relatively small amount of time dedicated to collecting these groups, compared to the vascular plants. Specifically, nine person-days were spent collecting vascular plants, compared to three each for the lichens and bryophytes. Extra collecting time would most certainly have produced more extensive lists for both of these groups.



The liverwort *Marchantia berteroana*, photo Miguel de Salas
© copyright, Tasmanian Herbarium

One small rainforest patch in Viormy, for which the transition from neighbouring woodland to rainforest was sudden, contained incredibly diverse bryophyte flora. This highlights the importance of these tiny patches and the value of conserving them. Another interesting find was what could be described as a ‘liverwort meadow’ on Serpentine, tightly packed with possibly over 60 species of liverworts.

Glossary

ANIC: Australian National Insect Collection.

Bourgeanic, cryptostictic, squamatic and stictic acids: the presence or absence of these acids is used in the identification of lichens.

Cryptic species (cryptospecies): species that are physically similar but reproductively isolated from each other.

Devil Facial Tumour Disease: an aggressive, non-viral, transmissible parasitic cancer among Tasmanian devils.

Extant: still in existence; not extinct.

Putative new species: a species that has been recognised by an expert as never having been named or described in the scientific literature.

Species range: the geographical area within which a particular species can be found.

Taxon (plural taxa): a member of any particular taxonomic group (e.g. a species, genus, family).

Taxonomy: the science of discovering, naming, describing and classifying life on earth.

Undescribed taxon: a taxon (often a species) that has not yet been formally described or named.

Univoltine: producing one brood in a season.

Vouchers (voucher specimens): any specimen that serves as a basis of study and is retained as a reference.

Notes

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FRONT COVER Bracken fern frond above liverwort meadow, photo Bruce Paton © copyright, Earthwatch Australia

BACK COVER Abbey Throssell sweeping for damselflies and dragonflies, photo Cassandra Nichols © copyright, Earthwatch Australia



**Five Rivers Reserve
and
trawtha makuminya
Tasmania
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