



Initial Observations in June and July 2017 on the Biological Value of the Natewa Peninsular

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INTRODUCTION

Fiji has no substantially sized National Parks, which makes it virtually unique in the world. In most other countries, National Parks provide the focus for much of the total tourism visits and spend. Indeed, were it not for National Parks countries like New Zealand, Costa Rica, South Africa etc, would have many fewer visitors than currently. The reason that no National Parks have been created in Fiji is that 90% of the land suitable for conservation protection is in the hands of thousands of mataqali*, (*pronounced "matangalee", which are family groups usually within a village that own or have traditional management rights to land) so the government has little scope for being able to create the same National Park facilities as in other countries, where they directly own the land.

In 2016, the Nambu Conservation Trust which was formed by one of the mataqali in Natewa village approached Operation Wallacea with the suggestion that their land on the steep slopes and plateau of the Natewa province and the adjacent Natewa Bay could be developed as a National Park to encourage visitors and homestays in the local communities. If a National Park was to be created anywhere in Fiji then the forests and reefs of the Natewa Peninsular would be one of the priorities. The forests had already been identified by BirdLife International as an Important Bird Area and still contain many of the Fiji endemic species such as Silktail, Barking Imperial Pigeon and Fiji Goshawk. Moreover, Natewa Bay from a scientific viewpoint was a virtually unexplored set of reefs with no published papers ever produced on this area.

The first visit in 2016 established that the Nambu Conservation Trust had a viable concept for the Park but that for it to work it would have to be a group of mataqali working together to establish an area large enough for effective conservation. The proposing mataqali then recruited a second mataqali to join the concept and proposed that survey work commenced with just these two mataqali at first who would gain financial benefits from the research and as a result encourage other mataqali to want to join in with the proposal. This was accepted by Operation Wallacea and investments started to develop the facilities for the research which was to commence in June 2017. The idea for the first year was to concentrate the research on the forests, whilst at the same time developing a marine research site and equipping it with dive equipment. The concept of 'research tourism' such as that operated by Operation Wallacea was new to the peninsular so a deal of effort in the first year was put into developing safety systems, operational procedures and training of key Fijian staff in how to support field research teams and provide a memorable experience for the participating students.

This report describes the results of the initial surveys performed by the Opwall science teams from the first forest camp to be established in the Natewa forests. Note the research is funded entirely from the payments made by the 173 students in school groups from around the world who made up the supporting teams for one week each over an 8 week period (early June to early August 2017). A series of objectives were set for the initial surveys and these were achieved or partially achieved as set out below:

1. To identify a network of trails through the land of the participating Mataqali that could be used by tourists:

A network of walking trails were identified centred on the Natewa camp, and surveyed with GPS. The network is presented on the map in this report.

2. To identify reliable sites for seeing some of the Fiji endemic birds and in particular those that can only be seen in Natewa or on Taveuni (a smaller island to the south east of Vanua Levu).

3. To prepare a short report with pictures of the bird life to be found in the proposed National Park.

See Bird appendix for details on both these objectives. The bird report with photographs taken by the survey team in 2017 will be prepared before the start of the 2018 season and printed up for distribution to the local mataqali.

4. To identify the main trees in the proposed National Park area and prepare short descriptions to be used for labelling of trees along tourist trails

This is part answered in the Botany appendix, but the text and locations for labelling of the trees still needs to be done and will be included in the 2018 objectives (see below).

5. To calculate how much carbon is being stored in the trees in the proposed National Park area which is important for carbon funding applications.

The carbon calculations are being produced by Richard Barker from Queens University Belfast and will be completed by early 2018 and included as a separate appendix.

6. To produce a short report with photos of the major species of invertebrates found in the proposed National Park area.

This season concentrated mainly on butterflies (Insects appendix). Moth traps were trialed but lack of time, facilities and taxonomy precluded the collection of results. Flight intercept traps for beetles were not deployed this year.

7. To produce a short report with photos of the major reptile and amphibians found in the proposed National Park area. The herpetological (amphibians and reptiles) community was found to be extremely depauperate, most likely badly damaged by the invasive mongoose which was very common over the whole of the Natewa peninsular. Future studies are unlikely to be worthwhile until a mongoose eradication programme can be established.

8. To prepare a plan for how the proposed protected conservation area could be managed. This would include costings for installing trails, invasive predator control, preparation of materials to both promote the proposed conservation area and also provide information for visitors. Preliminary discussions have begun with local mataqali, but a wider range of communities and villages on the Peninsular need to be contacted and included in future conservation and management plans.

9. To train a few local people from the Natewa Province to be able to guide visitors to the

native vegetation in years gone by, but was now surrounded by plantations of mahogany of various ages. The building on the site had been constructed for forestry use, and was converted by OpWall staff so that it contained a small lab, a medical room, and sleeping quarters for local staff. A kitchen area was constructed at the rear, with tents on wooden platforms at the front (Figure 4).



Figure 2. Gradient profile of topography from Natewa Bay (left) to the OpWall forest camp (right)



Figure 3. Google Earth generated track from Natewa Bay (top) to OpWall forest camp Figures 4 a & b. Forest camp main building and tents (photos Martin Speight)

RESULTS

The first field season of habitat and species monitoring and surveying at the Operation Wallacea forest camp was completed between 11 June and 1 August 2017. Monitoring plots, trails and transects were established to investigate various type of habitat (e.g mountain ridge, valley, primary forest, logged forest and plantations, and riparian strips). Teams of high school groups, led by scientists and local guides, visited these plots and transects on a regular basis, employing a wide variety of appropriate sampling and measuring techniques to assess the diversity of the Natewa forests and to establish species inventories to be compared between years at the same site.

The Appendices to this report contain detailed descriptions of the methods used and the records and photo guides of the animals and plants recorded in the forests of the Natewa Peninsular. This section summarises the major findings.

Amphibians, mammals and reptiles (Appendix 1, Greg Kerr)

Herpetofaunal species diversity and abundance across the survey sites were low. Only two frog species were recorded. The cane toad was the most abundant and widely distributed, being recorded at most sites. The Fijian ground frog was only recorded in a short section and no tree frogs were found. 5 skink and 3 gecko species were recorded. The skinks included two species previously not recorded on Vanua Levu, the Pacific blue-tailed skink *Emoia caeruleocauda* and the montane tree skink *Emoia campbelli*.

In terms of invasives, 3 rodent species including the Polynesian rat, *Rattus exulans* and the brown rat, *R. norvegicus*, were captured across the surveyed region. A very high density of the small Indian mongoose *Urva/Herepestes auropunctatus* was evident.

Birds (Appendices 2a & 2b, Joe England, Paul Hackett & Greg Kerr)

34 species of bird were observed in total. 17 of them were endemic to Fiji, of which 3 (Maroon Shining Parrot, Fiji Wattled Honeyeater and Orange Dove) to the Natewa Peninsular and Taveuni, Island and one, Natewa Silktail, confined to just the Natewa Peninsular. Mist netting was carried out each week, resulting in a total of 70 birds (including 11 recaptures) from 11 species being caught and released. Each individual was ringed before being released.

Insects (Appendix 3, Roy Wiles)

Sampling of insects in the forest season had particular emphasis on butterflies. Light trapping at night and flight intercept trapping were trialled but species records were not collected due to low catch numbers. 13 species of butterfly were identified, with another unknown swallowtail specimen photographed once. This species to date has not been identified despite extensive consultation with the Swallowtail and Birdwing Butterfly Trust and it is possible that it is a new species to science. This would be an amazing find since no

new swallowtail species has been described for over 50 years. Polymorphisms were observed in two species in particular, namely the blue moon butterfly, *Hypolimnas bolina*, and the common crow butterfly, *Euploea lewinii*.

Molluscs (Appendix 4, Gilianne Brodie)

Gastropod molluscs (snails) were not sampled routinely throughout the whole field season, but merely for two days towards the end of the period. Nevertheless, random searching in leaf litter found two empty land snail shells, both of which are endemic to Fiji. *Callistocharis fulguratus* is a relatively common species in the gastropod family of Placostylidae, found on the islands of Viti Levu, Vanua Levu, Ovalau and Beqa, while *Callistocharis elobatus* is considered endemic to the island of Vanua Levu and was last scientifically recorded by sighting of living specimens in 1972. It will be important to sample systematically next season to investigate the current status of this species in particular.

Plants (Appendix 5, Andrew Powling)

94 species of trees and shrubs were recorded during the OpWall season 2017, 29 were endemic to Fiji, another 45 indigenous to the region, and a further 18 species introduced (and in some cases, becoming naturalised via cultivation). Of the endemics, 2 species (*Balaka seemannii* and *Veitchia filifera*) have only been recorded from Vanua Levu and Taveuni, whilst 1 species (*Balaka macrocarpa*) is unique to Vanua Levu alone.

64 species of non-tree species were also recorded, including herbs, ferns, grasses and climbers.

Ant plants (Appendix 6, Roy Wiles & Will Earle)

This appendix describes the plant species (genus *Squamellaria*) that occur in the peninsular and which provide ready made next chambers for ant species.

Carbon calculations (Appendix 7, Richard Barker, Queens University Belfast)

To follow in early 2018.

CONCLUSIONS

It is clear from the initial surveys that the Natewa forests are of considerable conservation value for Fiji. They have already been identified as an Important Bird Area by BirdLife International and the surveys supported this with 17 Fiji endemic species found in the surveys. These included three species endemic to just the Natewa peninsular and the adjacent Taveuni Island (Fiji Wattled Honeyeater, Orange Dove, Maroon Shining Parrot) and

in good numbers and one found only on the Natewa Peninsular (Natewa Silktail). Whilst the herpetofauna records were severely impacted apparently due to mongoose predation, two species previously not recorded on Vanua Levu, the Pacific blue-tailed skink *Emoia caeruleocauda* and the montane tree skink *Emoia campbelli* were found in the forests. The shell of a Vanua Levu land snail species not recorded since 1972 was observed and it is probably that this species still exists in the Natewa forests. An unknown swallowtail butterfly was also photographed early in the season and investigations by the Swallowtail and Birdwing Trust specialists to date has not been able to identify this unknown butterfly. There remains the possibility that this may indeed be a previously undescribed species to science and if so this will be the most significant find of the surveys since no new butterfly species has been described for over 50 years.. In addition, 29 woody plant species endemic to Fiji, were recorded from these initial surveys of which two species (*Balaka seemannii* and *Veitchia filifera*) have only been recorded from Vanua Levu and Taveuni, and one (*Balaka macrocarpa*) is unique to Vanua Levu alone. Given that this was just an initial survey of one small part of the forests it suggests that if the area were to be protected it could be an attractive place for visitors to Fiji, to see some of the endemic fauna and flora of the islands.

However, the absence of snakes and the Fiji banded iguana, the failure to capture four skink species, four gecko species and the tree frog previously recorded on Vanua Levu, and the low abundance of those native species recorded, suggests that the ground dwelling herpetofauna on the Natewa Peninsula is under significant long-term predatory pressures.

The limited diversity and abundance of herpetofauna in the 30 year old secondary forest found across much of the study site reflects a pattern of decline observed across Fiji where ever introduced rats *Rattus* sp., cats *Felis catus*, dogs *Canis lupus familiaris* and the small Indian mongoose are abundant (Morley and Winder 2014, Brown and Daigneault 2015). One of the key agents for decline of native and endemic species on tropical oceanic islands are introduced predators (Case et al. 1992). Morley and Winder (2014) found that skink abundances on mongoose free islands in Fiji were approximately five times higher than when mongoose were present, irrespective of habitat type. These species were frequently observed either on the site, or in travel to and from the site, on the Natewa Peninsula.

If the diversity and abundance of herpetofauna on Natewa Peninsula is to be restored a program designed to eradicate or control the cats and the small Indian mongoose must be developed on the Peninsula. To address concerns of interest to practitioners and policymakers, Brown and Daigneault (2015) analysed survey data to document the impacts of the small Indian mongoose in Fiji and conducted a cost-benefit analysis of management approaches that are both culturally appropriate and readily implementable. They found that the monetised benefits of kill trapping exceed the benefits of live trapping and hunting. And that all of these management options are preferred to the status quo of no management.

Construction of a five-kilometre predator proof fence across the flat isthmus of the Natewa Peninsula would enable an effective long-term control/eradication program to be implemented across the Peninsula. Implementation of such a program would require extensive consultation with the local mataqali. But, should their support be obtained, there is sufficient knowledge of large scale control/eradication programs for this or similar species

in for example Amami-Oshima and Okinawa Islands, Japan (Yamada and Sugimura 2004), and New Zealand and Hawaii (Young et al. 2013) to suggest that control programs to significantly reduce the mongoose population may be plausible.

This report is the first of a series of reports on the biodiversity of the Natewa forests and Natewa Bay which will be prepared from the annual research programmes run by Operation Wallacea. For the 2018 season a second forest camp is proposed that will involve an additional mataqali in a different part of the peninsular and also allow a new part of the forest to be surveyed. At the original Natewa camp data will be collected as a part of an annual programme to monitor changes in the abundance and species richness of different taxa over time. In particular, the 2018 forest research programme will have the following objectives:

1. To complete a map of vegetation communities across the peninsular.
2. To complete additional quadrats of forest structure in the different habitats to progress the carbon calculations.
3. To gather additional data on land snails, butterflies, moths and beetles using appropriate trapping and sampling techniques.
4. To complete a similar bird report on birds as compiled in 2017 for the new forest camp.
5. To repeat the point count and mist netting surveys at the Natewa camp to assess changes in abundance of birds.
6. To complete Silktail surveys in a range of habitats to assess overall abundance across the peninsular.
7. To describe the bat community in the peninsular.
8. To complete trapping surveys for mongoose to assess the most effective trapping methods leading to an eradication programme.
9. To discuss the concept of a predator proof fence across the narrowest part of the western end of Natewa Peninsular, and a national park for the whole peninsular, with local mataqali to assess the degree of support.

In addition to the 2018 forest objectives research will also begin in Natewa Bay with the following objectives for 2018:

1. To produce a species list and photographic guide to the fish species in the Bay
2. To produce a species list and photographic guide to the mollusc species in the Bay
3. To produce a species list and photographic guide to the coral and sponge species in the Bay
4. To establish a series of transects that can be surveyed annually to assess changes in reef fish communities and coral cover
5. To introduce stereo video surveys to quantify the reef fish communities
6. To utilise video coral intercept transect data to quantify coral cover

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Operation Wallacea in Fiji

Herpetofauna Survey – 2017

Vanua Levu, Natewa Peninsula – Fiji Forest Site

13 June 2017 – 26 July 2017



Gregory D. Kerr

Appendix

Introduction

In 2013 the Nambu Conservation Trust created the first Fiji National Park on their mataqali land. The neighbouring mataqali also agreed to put their land into the newly formed Natewa National Park so that the park area encompassed over 2000 ha of rainforest. There has been considerable interest from neighbouring mataqali to extend this national park onto the rest of the high conservation value forests in the Natewa tribal district. This would result in a national park that covers most quality conservation land on the Natewa peninsula. To demonstrate to the remaining mataqali that the creation of a national park can lead to income for those communities, in 2017, Operation Wallacea initiated an eight-week program of tourist visits and biodiversity research at the Fiji Forest Site on the Natewa Peninsula.

The objectives of the program in the first year were to:

- determine the avian, major invertebrate and reptile and amphibian species in the national park;
- identify the main trees in the national park and prepare short descriptions to be used for labelling of trees along tourist trails;
- identify reliable sites for seeing some of the Fiji endemic birds and Natewa or Taveuni endemics;
- calculate carbon stored in the trees;
- identify a network of trails through the proposed national park area that could be used by tourists; and
- prepare a plan for how the national park could be managed.

This report documents the outcome of the herpetofauna survey undertaken at seven sites within a two-kilometre radius of the Forest Campsite (16° 38' 7.66" S 179° 45' 16.42" E) on the Navonu-Natewa Road approximately six kilometres south of Natewa Village on the Natewa Peninsula, Vanua Levu, Fiji.

Prior to this survey the herpetofauna of Natewa Peninsula presented a significant gap in natural history knowledge, being one of the largest and the most significant areas on Vanua Levu yet to be surveyed (Morrison 2005).

Background

The known terrestrial fauna of Fiji consists of 30 species: three frogs, two iguanas, three snakes, ten geckos and 12 skinks (Morrison 2003, 2005). Forty percent (12 out of 30) of these species are endemic to Fiji while a further 40% are considered native species. The remaining six species (20%) are human-mediated colonizers (Morrison 2003). Roughly 75% are recorded from rainforest habitats (Morrison and Naikatini 2008). Of the 30 terrestrial species recorded for Fiji, 19 species [three frog (**Rhinella marina*, *Platymantis vitiensis*, *P. vitianus*) one iguana (*Brachylophus fasciatus*), one snake (*Candoia bibroni*), seven geckos (*Gehyra oceanica*, *G.*



vorax, *Hemidactylus frenatus*, *H. typus*, *Lepidodactylus lugubris*, *Lipinia noctua*, *Nactus pelagicus*) and seven skinks (*Cryptoblepharus eximius*, *Emoia concolor*, *E. cyanura*, *E. impar*, *E. mokosariniveikau*, *E. nigra*, *E. trossula*]) have been recorded on Vanua Levu (Morrison 2005).

Methods

Traplines were installed at each of the seven survey sites (Table 1) following the methods of the Biological Survey of South Australia (Owens 2000). Trap lines were installed from 13 June onwards and removed between 21 and 26 July. Total trapping effort was 615 trap nights.

Table 1: Herpetofauna survey site locations, associated habitat, traps and trapping data.

Site Alias	*Easting	*Northing	Altitude (m ASL)	Locality Description	Habitat Description	Date installed	Date Closed	Length (m)	Pitfalls	Funnels	Trap Nights
Trans - A1	2106705	2162096	352	1.63 km NNW of Basecamp on verge of main Navonu-Nayewa Road	In grassy road verge between two sections of secondary forest	13/06/17	21/07/17	60	3 X 10 L Bucket 3 X 15 cm wide X 60 cm deep tube	4	120
Trans - A2	2106494	2162413	413	2.4 km north of Basecamp on track 150 m west of the main Navonu-Nayewa Road	Secondary forest with nearby sections of primary forest	14/06/17	21/07/17	60	3 X 10 L Bucket 3 X 15 cm wide X 60 cm deep tube	4	120
Trans - B	2106375	2161125	273	Up the spur approx 500 m along transect B to first gully W of spur	Secondary forest with nearby sections of primary forest	14/06/17	22/07/17	60	3 X 10 L Bucket 3 X 15 cm wide X 60 cm deep tube	4	110
Trans - C1	2106488	2160612	235	50 m in from main Navonu-Nayewa Road on transect C	Rank dense grassy verge and cleared area to north of track	06/07/17	26/07/17	30	2 X 10 L Bucket 1 X 15 cm wide X 60 cm deep tube	2	25
Trans - C2	2106091	2160402	288	500 m in on transect C on flatter section just 10 m south of track	Secondary forest - regrowth 30+ years	15/06/17	26/07/17	30	2 X 10 L Bucket 1 X 15 cm wide X 60 cm deep tube	4	26
Trans - D	2106348	2160038	240	1.2 km in along track on Transect D. S of transect D, on and then immediately west of	Secondary forest	21/06/17	26/07/17	60	3 X 10 L Bucket 3 X 15 cm wide X 60 cm deep tube	4	94



				track heading south from D.							
Trans - E	2107164	2160047	290	1.4 km in along transect E. 50 m in from track edge	Secondary forest, amidst a section of primary forest remnant	20/06/17	26/07/17	60	3 X 10 L Bucket 3 X 15 cm wide X 60 cm deep tube	4	120
										Total	615

*Trans Mercator Proj. Origin 17° 00' S 178° 45' E False Coord 2000000 m E & 4000000 m S

Five trap-lines consisted each of six pitfalls, 10 m apart connected by a 25-cm high, 60 m long flywire fence (Figure 1). This design leaves 5 m of flywire as wings at the end of each pitfall line. Two types of pitfall trap were alternated along the fence. 10 L buckets were interspersed with 15 cm wide X 60 cm deep PVC pipe tube. The PVC piping was closed at the bottom with flywire held in place by 10-gauge fencing wire. In addition, at both ends of the fence after the last pitfall a funnel trap was placed either side of the flywire fence.

Due to difficulties in obtaining flywire in Fiji it was only possible to construct half of the pitfall line in Transect C (30 m of fencing with three pitfalls – one 10 L bucket and two 60 cm deep PVC pipes) at the start of the survey. The pitfall line in Transect D could not be constructed at this time. When flywire was obtained, the 60-m pitfall line on Transect D was installed. But, because of low herpetofauna activity at site C (Trans – C2) and evidence of higher abundance in association with grass verges along the track at the start of transect C, instead of completing the existing line on Transect C, a 30-m pitfall line (two outer 10 L buckets and a central 60 cm deep PVC pipe) was installed at the start of transect C (Trans – C1). This left a 30-m pitfall line (Trans – C2) at the initial site on Transect C.

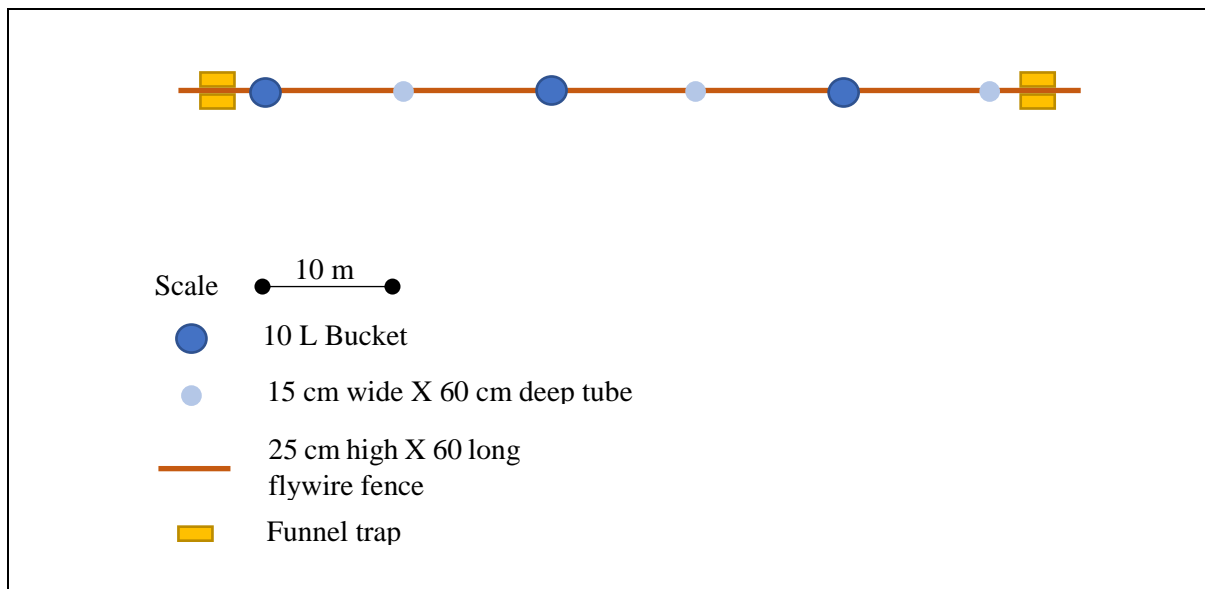


Figure 1: Layout of 60 m pitfall/funnel trap line

The incorporation of funnel traps into the pit-trapping line has been shown to markedly increase the capture rate of medium and large snakes, legless lizards, and more widely foraging fast moving skinks, which either do not enter, or climb out of, pitfall traps (Thompson and Thompson 2007).

All pitfall traps and funnel traps were checked in the morning and afternoon on each day they were opened. After installation pitfall lines were typically closed each Saturday morning at the completion of the monitoring week, prior to the departure of the monitoring team. Traps were reopened on the subsequent Tuesday with the arrival of the next team. On days when high rainfall totals occurred and water started flowing across the ground, traps were closed to prevent animals drowning in flooded pitfalls. A full overview of trapping effort at each site is provided in Appendix 2.



Given the requirement to visit traps twice daily and the significant distances and difficulty of movement along transects, it was not possible to have all traps lines open at once. Consequently, approximately half of the traplines were opened in each four-night monitoring period.

In addition to the pitfall surveys, physical searches both during the day and at night with spotlights, were carried out throughout the program. While walking to and along all transects during daylight, active searches were made for all herpetofauna. Also, between the 15/07 and 23/07 five active searches were carried out in the Wailutu Reserve along the Wailutu Creek south of the dam. Physical searches involved the lifting of rocks and logs, looking under bark on tree trunks and at the base of fern and palm fronds, and searching the ground. Where animals were observed and captured they were identified and released. On one or two nights a week, active searches were made using spotlights around the Forest Basecamp.

Herpetofauna were identified using a dichotomous key modified from Morrison (2003) (Appendix 1). Because of the trapping methods used terrestrial mammals in the area were also caught as bycatch.

Results

A detailed overview of animals captured in pitfall and funnel traps on each transect for each trap night is provided in Appendix 3, and a detailed overview of incidental observations and captures is provided in Appendix 4. Both herpetofaunal species diversity and abundance across the survey sites were low: Species (number of times trapped in pitfall line, number of incidental observations/captures):

- Amphibians: cane toad **Rhinella marina* (7, 11), Fiji ground frog *Platymantis vitianus* (0, 4).
- Skinks: Pacific blue-tailed skink *Emoia caeruleocauda* (0, 1), brown-tailed copper-stripped skink *Emoia cyanura* (3, 1), montane tree skink *Emoia campbelli* (0, 1), blue-tailed copper-stripped skink *Emoia impar* (0,2), Fijian copper-headed skink *Emoia parkeri* (0, 1).
- Geckos: Pacific slender-toed gecko *Nactus pelagicus* (3,1), mourning gecko *Lepidodactylus lugubris* (0, 16), oceanic gecko *Gehya oceanica* (0, 3).
- Mammals: Polynesian rat *Rattus exulans* (4, 0), house mouse **Mus musculus* (1, 0), small Indian mongoose **Urva auropunctatus* (0, 13), brown rat **Rattus norvegicus* (0, 1).

Only two frog species were recorded. The cane toad was the most abundant and widely distributed, being recorded at most sites. The Fijian ground frog was only recorded in a short section along the Wailutu creek. The Wailutu creek lies within the Wailutu Reserve and appears to be a truly remnant piece of primary rainforest. The ground frog was only found either in the creek line under rocks, in or on the creek edge, or in litter beside the creek. No Fijian tree frogs *Platymantis vitiensis* were detected.

Five skink species were recorded. This included two species previously not recorded on Vanua Levu; the Pacific blue-tailed skink *Emoia caeruleocauda* and the montane tree skink *Emoia*



campbelli. Both species were only recorded on one occasion each. *E. caeruleocauda* is a widespread species reaching southern Indonesia in distribution. *E. campbelli* has previously only been recorded on Viti Levu. *E. parkeri* is a Fijian endemic previously only recorded on four nearby islands. Both *E. cyanura* and *E. impar* are widely distributed throughout the Pacific, being the two most abundant skinks found within the Fiji Islands (Morley and Winder 2014).

Three gecko species were recorded. All three species are widely distributed. Both *N. pelagicus* and *L. lugubris* we found in the gut of a mongoose trapped near to the basecamp.

No snake species were recorded. Discussion with local Fijians suggests that the Boa *Candoia bibroni* has not been observed on the Natewa Peninsula for many years. The iguana *Brachylophus fasciatus* has also not been observed on the Peninsula.

Three rodent species (*R. exulans*, **R. norvegicus*, and **M. musculus*) were captured across the surveyed region. All three species are widely distributed throughout the Fijian island. A very high density of the small Indian mongoose **U. auropunctatus* (synonyms *Herpestes javanicus* and *Herpestes auropunctatus* (Patou et al. 2009)) was recorded across the study area, with observations of animals, scats or tracks being made on most days. As an example of the density of this species, five mongoose were caught in two hours in one snare near to be basecamp.

Discussion

The absence of both the boa and the Fiji banded iguana, the failure to capture four skink species, four gecko species and the tree frog previously recorded on Vanua Levu, and the low abundance of those native species recorded, suggests that the ground dwelling herpetofauna on the Natewa Peninsula is under significant long-term predatory pressures.

The limited diversity and abundance of herpetofauna in the 30 year old secondary forest found across much of the study site reflects a pattern of decline observed across Fiji where ever introduced rats *Rattus* sp., cats *Felis catus*, dogs *Canis lupus familiaris* and the small Indian mongoose are abundant (Morley and Winder 2014, Brown and Daigneault 2015). One of the key agents for decline of native and endemic species on tropical oceanic islands are introduced predators (Case et al. 1992). Morley and Winder (2014) found that skink abundances on mongoose free islands in Fiji were approximately five times higher than when mongoose were present, irrespective of habitat type. These species were frequently observed either on the site, or in travel to and from the site, on the Natewa Peninsula.

If the diversity and abundance of herpetofauna on Natewa Peninsula is to be restored a program designed to eradicate or control the cats and the small Indian mongoose must be developed on the Peninsula. To address concerns of interest to practitioners and policymakers, Brown and Daigneault (2015) analysed survey data to document the impacts of the small Indian mongoose in Fiji and conducted a cost-benefit analysis of management approaches that are both culturally appropriate and readily implementable. They found that the monetised benefits of kill trapping exceed the benefits of live trapping and hunting. And that all of these management options are preferred to the status quo of no management.



Construction of a five-kilometre predator proof fence across the flat isthmus of the Natewa Peninsula would enable an effective long-term control/eradication program to be implemented across the Peninsula. Implementation of such a program would require extensive consultation with the local mataqali. But, should their support be obtained, there is sufficient knowledge of large scale control/eradication programs for this or similar species in for example Amami-Ohshima and Okinawa Islands, Japan (Yamada and Sugimura 2004), and New Zealand and Hawaii (Young et al. 2013) to suggest that control programs to significantly reduce the mongoose population may be plausible.

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Appendix 1: Key to the herpetofauna of Fiji. Key modified from Morrison (2003).

LIZARD KEY

1a	Dorsal surface covered by large, overlapping, shiny scales	2	
1b	Dorsal surface covered by small, non-overlapping scales	13	
2a	Eyes with moveable lower eyelid	3	
2b	Eyes without moveable lower eyelid (each eye covered by clear scale); slender body with moderate short limbs; dorsal surface silvery gray with alternating black and white lateral stripes	4	
<i>Cryptoblepharus eximius</i> (p36)			
3a	Limbs long (tips of toes extend to or beyond axilla or armpit when adpressed); striped or unicolour green, olive, gray or black body background colour	4	
3b	Limbs short (tips of toes extend forward to midbody or slightly beyond when adpressed); brown body background colour	12	
4a	Three to five narrow longitudinal white dorsal and lateral stripes; dorsal stripes occasionally obscured or faded in adults; middorsal stripe on head to tip of snout always visible, tail blue-green	5	
4b	No narrow middorsal stripe; tail never blue or green	7	
5a	Typically a single middorsal stripe and pair of dorsolateral white stripes; > 55 lamellae under fourth toe	6	
5b	Usually a single middorsal, 2 dorsolateral and 2 lateral white stripes, usually still distinct in adults; < 55 lamellae under fourth toe; hindtoe length pattern 4>3=5>2>1; ventral surface usually ivory occasionally suffused with blue or gray	6	
<i>Emoia caeruleocauda</i> (p38)			
6a	Anterior loreal height < length; belly and underside of thighs white or copper tinted; tail in adults is brownish		
6b	Anterior loreal height > length; belly and underside of thighs dusky; tail in adults often still bluish		
<i>Emoia cyanura</i> (p44)			
<i>Emoia impar</i> (p46)			
7a	Adults > 55mm SVL	8	
7b	Adults < 52mm SVL; copper coloured head and greenish bronze back; iridescent green tail; ventral surface with copper ivory chin and throat and yellow green to emerald green belly; 31-41 lamellae beneath fourth toe	8	
<i>Emoia parkeri</i> (p52)			
8a	Body not uniform green or black in colour; > 40 lamellae under fourth toe	9	
8b	Adults > 80mm SVL; dark brown-black head and at least anterior half of body; ventral surface dusky to dull golden brown; 31-39 lamellae under fourth toe	9	
<i>Emoia nigra</i> (p50)			
9a	Adults > 60mm SVL; no turquoise bands on side of neck or trunk	10	
9b	Adults < 60mm SVL; copper brown dorsal background colour overlain by broad turquoise bands on side of neck and trunk; 48-49 lamellae under fourth toe	10	
<i>Emoia mokosariniveikau</i> (p48)			
10a	Adults slender; ventral surface not bluish white	11	
10b	Adults > 70m SVL; dorsal surface olive brown to gray typically with dark bars or broken bands and white spots on back; vent bluish white; 42-56 lamellae under fourth toe	11	
<i>Emoia trossula</i> (p54)			

<p>11a Adults > 55mm SVL; head and body green-greenish tan, head usually dark green; ventral surface yellow-white to lime green; 43-65 lamellae under fourth toe</p>		
	<p><i>Emoia concolor</i> (p42)</p>	
<p>11b Adults > 65mm SVL; dorsal surface grayish-olive brown with diffuse dark bands; ventral surface bright sulphur yellow to greenish yellow; 48-54 lamellae under fourth toe</p>		
	<p><i>Emoia campbelli</i> (p40)</p>	
<p>12a Dorsal surface frequently with broad, light longitudinal stripe; bright spot on nape</p>		
	<p><i>Lipinia noctua</i> (p76)</p>	
<p>12b Dorsal surface typically unicolour or spotted; no light mark on nape of neck</p>		
	<p><i>Leiopisma alazon</i> (p68)</p>	
<p>13a Soft skin on body, easily torn; no middorsal crest of conical spines; eyes with clear immovable lower spectacle; iris elliptical</p>	<p>14</p>	
<p>13b Tough skin on body, not easily torn; middorsal crest of conical spines; eyes with moveable lower eyelid; iris circular</p>	<p>23</p>	
	<p>Not on Vanua Levu</p>	
<p>14a Four or five clawed digits with enlarged ventral pads</p>	<p>15</p>	
<p>14b All digits clawed and straight-sided without enlarged pads</p>		
	<p><i>Nactus pelagicus</i> (p78)</p>	
<p>15a Five distinct digits on each foot; adults > 36mm SVL</p>	<p>16</p>	
<p>15b First digit tiny and undeveloped; unregenerated tail length (TL) < SVL; adults < 45mm SVL; body and head covered by numerous small equal sized scales</p>		
	<p><i>Hemiphyllodactylus typus</i> (p66)</p>	
<p>16a All five digits with distinct claws; lamellae divided into 2 rows; digital pads oblong in shape</p>	<p>17</p>	
<p>16b Claws on first digit either tiny and visible only on toe ridge or entirely absent; lamellae single, notched or divided; digital pads rounded, obovate or oblong</p>	<p>18</p>	
	<p><i>Hemidactylus frenatus</i> (p62)</p>	
<p>17a Unregenerated TL < SVL; < 11 rows of lamellae beneath fourth toe; dorsal surface with scattered enlarged scales; tail with regular whorls of spine-like scales on dorsal and lateral surface</p>		
<p>17b Unregenerated TL 1.25-1.5 x SVL; > 12 rows of lamellae beneath fourth toe; no enlarged body scales; tail with spine-like scales along ventrolateral edge</p>		
	<p><i>Hemidactylus garnotti</i> (p64)</p>	
<p>18a Digital lamellae undivided or terminal and penultimate lamellae notched</p>	<p>19</p>	
<p>18b Digital lamellae divided into 2 rows; 8-9 rows of lamellae under fourth toe; unregenerated TL > SVL; digits strongly expanded into a round pad</p>		
	<p><i>Gehyra mutilata</i> (p56)</p>	
<p>19a Claw on first digit tiny; adults > 55mm SVL; digital pads elliptical or obovate; narrow rows of lamellae; no divided or notched lamellae at distal end of digit</p>	<p>20</p>	
<p>19b Claw on first digit absent; adults < 55mm SVL; elongated digital pads either obovate or oblong; lamellae moderate-wide to wide; may have divided or notched lamellae at distal end of digit</p>	<p>21</p>	
	<p><i>Hemidactylus frenatus</i> (p62)</p>	

20a Twelve to sixteen lamellae under fourth toe; large elliptical digital pads; tail scales uniform dorsally, ventrally row of enlarged smooth scales from vent to tail
Gehyra oceanica (p58)

20b More than 19 lamellae under fourth toe; obovate digital pads; tail encircled by alternate whorls of enlarged scales; adults large > 100mm SVL
Gehyra vorax (p60)

21a Terminal and penultimate lamellae divided and tail scales of uniform size
 22

21b Terminal and penultimate lamellae undivided but may be notched; tail with uniform whorls of moderate-scales
Lepidodactylus manni (p74)

22a Unregenerated TL 1.0-1.25 x SVL; adults < 44mm SVL; digital pads obovate; tongue and buccal cavity pink; dark brown orbital stripe; spine-like scales on ventrolateral edge of tail
Lepidodactylus lugubris (p72)

22b Unregenerated TL < SVL; adults > 48mm SVL; digital pads elongate and obovate; tongue and buccal cavity black; no spine-like scales on tail; endemic to Rotuma
Lepidodactylus gardineri (p70)

23a Light green body with 2-3 narrow white vertical bands outlined in black; ventral surface whitish with green mottling; middorsal crest of long conical spines
Brachylophus vitiensis (p34)

23b Dark green body with or without 2-3 broad white not outlined vertical bands; ventral surface yellowish green; middorsal crest of short conical spines
Brachylophus fasciatus (p32)

Brachylophus bulabula

Detailed view of scales on head of skink (from McCoy 1980)

(a) dorsal view

(b) lateral view

Labels: Rostral, Frontonasal, Prefrontal, Frontal, Supraocular, Frontoparietal, Interparietal, Parietal, Nuchal, Nasal, Mental, Infraorbital, Supraorbital, Temporals, Tympanum.

Detailed underside of gecko foot (From McCoy 1980)

Labels: terminal lamella, undivided lamellae, digital expansion, webbing, claw, divided lamellae.

(a) to midbody (b) to axilla

Lizards with adpressed limbs



Site Alias	*Easting	*Northing	Altitude (m ASL)	Date installed	Date Opened	Date Closed	Nights Open	Pitfalls	Funnels	Trap Nights	Date removed	Notes	Total trap nights per site
Trans -A1	2106705	2162096	352	13/06/17	13/06/17	16/06/17	3	3 X 10 L Bucket 3 X 15 cm wide X 60 cm deep tube	4	30	21/07/17		120
Trans -A1	2106705	2162096	352	13/06/17	27/06/17	01/07/17	4	3 X 10 L Bucket 3 X 15 cm wide X 60 cm deep tube	4	40	21/07/17		
Trans -A1	2106705	2162096	352	13/06/17	04/07/17	07/07/17	3	3 X 10 L Bucket 3 X 15 cm wide X 60 cm deep tube	4	30	21/07/17	Closed early due to rain in afternoon and overnight of 07/07	
Trans -A1	2106705	2162096	352	13/06/17	18/07/2017 20/07/2017	19/07/2017 21/07/2017	2	3 X 10 L Bucket 3 X 15 cm wide X 60 cm deep tube	4	20	21/07/17	Heavy rain overnight on 18/07. Closed traps AM 19/07. Rain all day 19/07	



Site Alias	*Easting	*Northing	Altitude (m ASL)	Date installed	Date Opened	Date Closed	Nights Open	Pitfalls	Funnels	Trap Nights	Date removed	Notes	Total trap nights per site
Trans -A2	2106494	2162413	413	14/06/17	14/06/17	16/06/17	3	3 X 10 L Bucket 3 X 15 cm wide X 60 cm deep tube	4	30	21/07/17		120
Trans -A2	2106494	2162413	413	14/06/17	23/06/17	25/06/17	2	3 X 10 L Bucket 3 X 15 cm wide X 60 cm deep tube	4	20	21/07/17		
Trans -A2	2106494	2162413	413	14/06/17	27/06/17	01/07/17	2	3 X 10 L Bucket 3 X 15 cm wide X 60 cm deep tube	4	20	21/07/17		
Trans -A2	2106494	2162413	413	14/06/17	04/07/17	07/07/17	3	3 X 10 L Bucket 3 X 15 cm wide X 60 cm deep tube	4	30	21/07/17	Closed early due to rain in afternoon and overnight of 07/07	
Trans -A2	2106494	2162413	413	14/06/17	18/07/2017 20/07/2017	19/07/2017 21/07/2017	2	3 X 10 L Bucket 3 X 15 cm wide X 60	4	20	21/07/17	Heavy rain overnight on 18/07. Closed traps	



Site Alias	*Easting	*Northing	Altitude (m ASL)	Date installed	Date Opened	Date Closed	Nights Open	Pitfalls	Funnels	Trap Nights	Date removed	Notes	Total trap nights per site
								cm deep tube				AM 19/07. Rain all day 19/07	
Trans -B	2106375	2161125	273	14/06/17	14/06/17	16/06/17	2	3 X 10 L Bucket 3 X 15 cm wide X 60 cm deep tube	4	20	22/07/17		110
Trans -B	2106375	2161125	273	14/06/17	21/06/17	22/06/17	2	3 X 10 L Bucket 3 X 15 cm wide X 60 cm deep tube	4	20	22/07/17	Traps closed in PM on 22nd June and overnight because of rain	
Trans -B	2106375	2161125	273	14/06/17	04/07/17	08/07/17	4	3 X 10 L Bucket 3 X 15 cm wide X 60 cm deep tube	4	40	22/07/17	Closed early AM 08/07	
Trans -B	2106375	2161125	273	14/06/17	18/07/2017 20/07/2017	19/07/2017 22/07/2017	3	3 X 10 L Bucket 3 X 15 cm wide X 60 cm deep tube	4	30	22/07/17	Heavy rain overnight on 18/07. Closed traps AM 19/07.	



Site Alias	*Easting	*Northing	Altitude (m ASL)	Date installed	Date Opened	Date Closed	Nights Open	Pitfalls	Funnels	Trap Nights	Date removed	Notes	Total trap nights per site
												Rain all day 19/07	
Trans -C1	2106488	2160612	235	06/07/17	06/07/17	08/07/17	2	2 X 10 L Bucket 1 X 15 cm wide X 60 cm deep tube	2	10	26/07/17	Closed early AM 08/07	25
Trans -C1	2106488	2160612	235	06/07/17	11/07/17	15/07/17	2	2 X 10 L Bucket 1 X 15 cm wide X 60 cm deep tube	2	10	26/07/17	Closed early AM 08/07	
Trans -C1	2106488	2160612	235	06/07/17	25/07/17	26/07/17	1	2 X 10 L Bucket 1 X 15 cm wide X 60 cm deep tube	2	5	26/07/17		
Trans -C2	2106091	2160402	288	30/06/17	11/06/17	15/06/17	1	2 X 10 L Bucket 1 X 15 cm wide X 60 cm deep tube	3	6	26/07/17		26
Trans -C2	2106091	2160402	288	15/06/17	15/06/17	16/06/17	1	2 X 10 L Bucket	4	7	26/07/17		



Site Alias	*Easting	*Northing	Altitude (m ASL)	Date installed	Date Opened	Date Closed	Nights Open	Pitfalls	Funnels	Trap Nights	Date removed	Notes	Total trap nights per site
								1 X 15 cm wide X 60 cm deep tube					94
Trans -C2	2106091	2160402	288	30/06/17	30/06/17	01/06/17	1	2 X 10 L Bucket 1 X 15 cm wide X 60 cm deep tube	4	7	26/07/17		
Trans -C2	2106091	2160402	288	30/06/17	25/07/17	26/07/17	1	2 X 10 L Bucket 1 X 15 cm wide X 60 cm deep tube	3	6	26/07/17		
Trans -D	2106348	2160038	240	21/06/17	21/06/17	22/06/17	2	1 X 10 L Bucket 2 X 15 cm wide X 60 cm deep tube	4	14	26/07/17	Traps closed in PM on 22nd June and overnight because of rain	94
Trans -D	2106348	2160038	240	27/06/17 Received next lot of flywire and	27/06/17	01/06/17	4	3 X 10 L Bucket 3 X 15 cm wide X 60	4	40	26/07/17		



Site Alias	*Easting	*Northing	Altitude (m ASL)	Date installed	Date Opened	Date Closed	Nights Open	Pitfalls	Funnels	Trap Nights	Date removed	Notes	Total trap nights per site
				installed 2nd 30 m				cm deep tube					
Trans -D	2106348	2160038	240	27/06/17	11/07/17	15/07/17	4	3 X 10 L Bucket 3 X 15 cm wide X 60 cm deep tube	2	32	26/07/17	Two funnel traps damaged by rats, night of 12/07/16 - removed for repair	
Trans -D	2106348	2160038	240	27/06/17	25/07/17	26/07/17	1	3 X 10 L Bucket 3 X 15 cm wide X 60 cm deep tube	2	8	26/07/17		
Trans -E	2107164	2160047	290	20/06/17	20/06/17	22/06/17	3	3 X 10 L Bucket 3 X 15 cm wide X 60 cm deep tube	4	30	26/07/17	Traps closed in PM on 22nd June and overnight because of rain	
Trans -E	2107164	2160047	290	20/06/17	27/06/17	01/07/17	4	3 X 10 L Bucket 3 X 15 cm wide X 60 cm deep tube	4	40	26/07/17		120



Site Alias	*Easting	*Northing	Altitude (m ASL)	Date installed	Date Opened	Date Closed	Nights Open	Pitfalls	Funnels	Trap Nights	Date removed	Notes	Total trap nights per site
Trans -E	2107164	2160047	290	20/06/17	11/07/17	15/07/17	4	3 X 10 L Bucket 3 X 15 cm wide X 60 cm deep tube	4	40	26/07/17		
Trans -E	2107164	2160047	290	20/06/17	25/07/17	26/07/17	1	3 X 10 L Bucket 3 X 15 cm wide X 60 cm deep tube	4	10	26/07/17		

*Trans Mercator Proj. Origin 17o 00' S 178o 45' E False Coord 2000000 m E &4000000 m S



Appendix 3: Overview of animals captured in pitfall and funnel traps on each transect for each trap night. Weather condition and light levels are also provided.

Date	Transect	Trap Night	Max Temp	Min Temp	Wind Speed	Wind Direction	Cloud Cover	Rain	Moon	Night Light	Observers	Method	Species	Number	Age	Sex
13/06/2017	Trans - A1	1	3	2	0		8	0	2	2	5	SPT	<i>Rattus exulans</i>	1	A	
13/06/2017	Trans - A1	1	3	2	0		8	0	2	2	5	SPT	<i>Rhinella marina</i>	1	J	
14/06/2017	Trans - A1	2	3	2	0		0	1	1	2	7		None			
14/06/2017	Trans - A2	1	3	2	0		8	1	2	2	5		None			
14/06/2017	Trans -B	1	3	2	0		8	1	2	2	6		None			
15/06/2017	Trans - A1	3	3	2	0		0	0	1	1	7	SPT	<i>Emoia cyanura</i>	1	J	
15/06/2017	Trans - A2	2	3	2	0		0	0	2	1	5		None			
15/06/2017	Trans -B	2	3	2	0		0	0	2	1	6		None			
15/06/2017	Trans - C2	1	3	2	0		0	0	2	1	6		None			
16/06/2017	Trans - A1	4	3	2	0		0	0	1	1	7	SPT	<i>Emoia cyanura</i>	1	J	
16/06/2017	Trans - A2	3	3	2	0		0	0	1	1	7		None			
16/06/2017	Trans -B	3	3	2	0		0	0	1	1	7		None			
16/06/2017	Trans - C2	2	3	2	0		0	0	1	1	7		None			
20/06/2017	Trans -E	1	3	2	0		1	0	1	1	8	SPT	<i>Rhinella marina</i>	2	J	
21/06/2017	Trans -B	4	3	2	0		4	2	1	1	7		None			



Date	Transect	Trap Night	Max Temp	Min Temp	Wind Speed	Wind Direction	Cloud Cover	Rain	Moon	Night Light	Observers	Method	Species	Number	Age	Sex
21/06/2017	Trans -D	1	3	2	0		4	2	1	1	7	SPT	<i>Rhinella marina</i>	1	J	
21/06/2017	Trans -E	2	3	2	0		6	2	1	1	7		None			
22/06/2017	Trans -B	5	2	2	2		8	2	1	1	7		None			
22/06/2017	Trans -D	2	2	2	2		8	2	1	1	7		None			
22/06/2017	Trans -E	3	2	2	2		8	2	1	1	7		None			
23/06/2017	Trans -D	3	2	2	0		8	2	1	1	7	SPT	<i>Rhinella marina</i>	1	J	
27/06/2017	Trans - A1	5	3	2	0		4	0	1	1	7	SPT	<i>Emoia cyanura</i>	1	J	
27/06/2017	Trans -D	4	3	2	0		4	0	1	1	7		None			
27/06/2017	Trans -E	4	3	2	0		4	0	1	1	7	SPT	<i>Nactus pelagicus</i>	1	A	
28/06/2017	Trans - A1	6	3	2	2		8	0	1	1	2		None			
28/06/2017	Trans -D	5	3	2	2		8	0	1	1	2		None			
28/06/2017	Trans -E	5	3	2	2		8	0	1	1	2		None			
29/06/2017	Trans - A1	7	3	2	1		3	3	2	1	7		None			
29/06/2017	Trans -D	6	3	2	1		3	4	1	1	7		None			
29/06/2017	Trans -E	6	3	2	1		3	4	1	1	7	SPT	<i>Rhinella marina</i>	1	J	
30/06/2017	Trans - A1	8	3	2	0		1	0	2	1	7		None			
30/06/2017	Trans -D	7	3	2	0		8	4	2	2	7		None			
30/06/2017	Trans -E	7	3	2	0		8	4	2	2	7		None			
4/07/2017	Trans - A1	9	3	2	0		6	2	3	2	4		None			
4/07/2017	Trans - A2	4	3	2	0		6	2	3	2	4		None			



Date	Transect	Trap Night	Max Temp	Min Temp	Wind Speed	Wind Direction	Cloud Cover	Rain	Moon	Night Light	Observers	Method	Species	Number	Age	Sex
4/07/2017	Trans -B	6	3	2	0		6	2	3	2	4		None			
5/07/2017	Trans - A1	10	3	2	0		8	4	3	2	4		None			
5/07/2017	Trans - A2	5	3	2	0		8	4	3	2	4		None			
5/07/2017	Trans -B	7	3	2	0		8	4	3	2	4		None			
6/07/2017	Trans - A1	11	3	2	0		0	0	3	2	4	SPT	<i>Mus musculus</i>	1	A	
6/07/2017	Trans - A2	6	3	2	0		0	0	3	2	4		None			
6/07/2017	Trans -B	8	3	2	0		0	0	3	2	4		None			
6/07/2017	Trans - C1	1	3	2	0		0	0	3	2	4		None			
7/07/2017	Trans - A1	12	3	2	0		0	2	3	2	4		None			
7/07/2017	Trans - A2	7	2	2	1		0	2	3	2	4		None			
7/07/2017	Trans -B	9	2	2	1		0	2	3	2	4		None			
7/07/2017	Trans - C1	2	2	2	1		0	2	3	2	4	SPT	<i>Rattus exulans</i>	2	A	
8/07/2017	Trans -B	10	2	2	1		8	2	3	2	4		None			
8/07/2017	Trans - C1	3	2	2	1		8	2	3	2	4	SFT	<i>Nactus pelagicus</i>	1	A	
11/07/2017	Trans - C1	4	3	2	0		8	1	4	3	7		None			
11/07/2017	Trans - C2	3	3	2	0		8	1	4	3	7		None			
11/07/2017	Trans -D	8	3	2	0		8	1	4	3	7		None			
11/07/2017	Trans -E	8	3	2	0		8	1	4	3	7		None			



Date	Transect	Trap Night	Max Temp	Min Temp	Wind Speed	Wind Direction	Cloud Cover	Rain	Moon	Night Light	Observers	Method	Species	Number	Age	Sex
12/07/2017	Trans - C1	4	3	2	0		8	0	4	3	7		None			
12/07/2017	Trans - C2	5	3	2	0		8	0	4	3	7		None			
12/07/2017	Trans -D	9	3	2	0		8	0	4	3	7		None			
12/07/2017	Trans -E	9	3	2	0		8	0	4	3	7	SPT	<i>Rhinella marina</i>	1	J	
13/07/2017	Trans - C1	5	3	2	0		6	3	4	4	7		None			
13/07/2017	Trans - C2	6	3	2	0		6	3	4	4	7		None			
13/07/2017	Trans -D	10	3	2	0		6	3	4	4	7	SPT	<i>Nactus pelagicus</i>	1	A	
13/07/2017	Trans -E	10	3	2	0		6	3	4	4	7		None			
14/07/2017	Trans - C1	6	3	2	0		8	2	3	3	7		None			
14/07/2017	Trans - C2	7	3	2	0		8	2	3	3	7		None			
14/07/2017	Trans -D	11	3	2	0		8	2	3	3	7		None			
14/07/2017	Trans -E	11	3	2	0		8	2	3	3	7		None			
18/07/2017	Trans - A1	13	3	2	2	E	8	1	2	1	6		None			
18/07/2017	Trans - A2	8	3	2	2	E	8	1	2	1	6		None			
18/07/2017	Trans -B	11	3	2	2	E	8	1	2	1	6		None			
20/07/2017	Trans - A1	14	3	2	2	E	8	1	2	1	6		None			
20/07/2017	Trans - A2	9	3	2	2	E	8	1	2	1	6		None			
20/07/2017	Trans -B	12	3	2	2	E	8	1	2	1	6		None			



Date	Transect	Trap Night	Max Temp	Min Temp	Wind Speed	Wind Direction	Cloud Cover	Rain	Moon	Night Light	Observers	Method	Species	Number	Age	Sex
21/07/2017	Trans -B	13	3	2	2	E	8	1	2	1	6		None			
25/07/2017	Trans - C1	7											None			
25/07/2017	Trans - C2	8											None			
25/07/2017	Trans -D	12										SPT	<i>Rattus exulans</i>	1	A	
25/07/2017	Trans -E	12											None			
													Total Captures	18		

Temperature: 1=0-10 °C, 2=10.1-20 °C 3=20.1-30 °C, 4=30.1-40 °C, 5=>40 °C.

Wind: 0=calm, 1=Light-leaves rustle, 2=Moderate-moves branches, 3=Strong-impedes progress.

Cloud: Eights.

Rain: 0=Nil, 1=drizzle or light rain, 2=Med-heavy rain, 3=light rain in past 24 hours, 4=no rain now but med-heavy rain in last 24 hours, 5=past 24 hours, 6=fog/mist, 7=isolated showers.

Moon: 0=no moon, 1=1/4 moon, 2=1/2 moon, 3=3/4 moon, 4=full moon, 5=moon present - use if unsure of phase

Nightlight: 1=very dark-no moon and cloud, 2=dark-1/4 moon, or moon and heavy cloud, 3=detail seen-moon and clear sky, 4=bright-1/2 moon and no cloud.

Methods: SPT=Pitfall Trap, SFT=Funnel Trap.

Age: A=Adult, J=Juvenile.



Date	Transect	*Easti ng	*Nort hing	heig ht (mASL)	Locality Description	Habitat	Reco rd Type	Effort	Meth od	Species	Numb er	Age	Sex	Micr o- habi tat	Comments
09/06/ 2017	Trans-A2	No	No		south of A2 on Navonu- Nayewa Road	road	CF			<i>Emoia caeruleoc auda</i>	1				Run over by car
08/06/ 2017	Forest Basecam p	21071 48	21605 42	243	Forest Basecamp	Buildings	CC			<i>Lepidodac tylus lugubris</i>	1	A			
09/06/ 2017	Forest Basecam p	21071 48	21605 42	243	Forest Basecamp	On car	CC			<i>Gehyra oceanica</i>	1	A			
10/06/ 2017	Forest Basecam p	21071 48	21605 42	243	Forest Basecamp	Buildings	CC			<i>Lepidodac tylus lugubris</i>	1	J			
11/06/ 2017	Forest Basecam p	21071 48	21605 42	243	Forest Basecamp	Buildings	CC			<i>Emoia impar</i>	1	A			
14/06/ 2017	Forest Basecam p	21071 48	21605 42	243	Forest Basecamp	Buildings	CC			<i>Rhinella marina</i>	1	J		GR	
14/06/ 2017	Trans-A2	21065 24	21624 13	413	adjacent to pitfall line		BU			<i>Urva auropunct atus</i>	3	A		GR	
16/06/ 2017	Trans-A2	21067 96	21619 54	352	south of A2 on Navonu- Nayewa Road	on road	CC	7 peopl e/ 50 min		<i>Emoia campbelli</i>	1	A			



Date	Transect	*Easti ng	*Nort hing	heig ht (m A SL)	Locality Description	Habitat	Reco rd Type	Effort	Meth od	Species	Numb er	Age	Sex	Mic ro- habi tat	Comments
16/06/ 2017	Forest Basecam p	21071 48	21605 42	243	Forest Basecamp	Buildings and cleared grassland	CC			<i>Rhinella marina</i>	2	J		GR	
27/06/ 2017	Forest Basecam p	21071 48	21605 42	243	Forest Basecamp	Buildings	CC			<i>Lepidodac tylus lugubris</i>	4			BG	
27/06/ 2017	Forest Basecam p	21071 48	21605 42	243	Forest Basecamp	Buildings and cleared grassland	CC			<i>Rhinella marina</i>	2	J		GR	
27/06/ 2017	Forest Basecam p	21070 80	21606 00	230	Niuwauvudi Creek S of bridge	creek edge	CC			<i>Rhinella marina</i>	1	A		EW	
28/06/ 2017	Forest Basecam p	21071 48	21605 42	243	Forest Basecamp	Buildings	CC			<i>Lepidodac tylus lugubris</i>	1			BG	
28/06/ 2017	Forest Basecam p	21071 48	21605 42	243	Forest Basecamp	Buildings	S			<i>Rattus norvegicus</i>	1	A		BG	
28/06/ 2017	Trans-D	21063 48	21600 38	240		road	CC		HD	<i>Emoia impar</i>	1	J		IG	
28/06/ 2017	Trans-D	21063 98	21600 51	235	On track between two areas of rank grassland	grassland	DS			<i>Urva auropunct atus</i>	3	A		GB	
29/06/ 2017	Trans-A2	21063 75	21623 89	433	Tree trunk overhanging cliff edge in ridgeline	Tree trunk	CC		HD	<i>Emoia parkeri</i>	1	A		TK	



Date	Transect	*Easti ng	*Nort hing	heig ht (mA SL)	Locality Description	Habitat	Reco rd Type	Effort	Meth od	Species	Numb er	Age	Sex	Micr o- habi tat	Comments
30/06/ 2017	Forest Basecam p	21071 48	21605 42	243	Forest Basecamp	rank grassland SW of house			SN	<i>Urva auropunct atus</i>	5	A		GR	
30/06/ 2017	Trans-D	21066 49	21601 43			On path between rank dense grassy verges	CC			<i>Emoia cyanura</i>	1	J			
5/07/2 017	Forest Basecam p	21071 48	21605 42	243	Forest Basecamp	Buildings	CC			<i>Lepidodac tylus lugubris</i>	4	A		BG	
5/07/2 017	Forest Basecam p	21071 48	21605 42	243	Forest Basecamp	Palm tree trunk	CC			<i>Gehya oceanica</i>	1	A		BG	
5/07/2 017	Trans- DAM	21063 53	21616 81	261	Wailutu Reserve - Wailutu Creek	Creekline in Primary Forest	CC	5 peopl e /50 min	HD	<i>Platymant is vitianus</i>	1	J		IL	immediatel y below dam
5/07/2 017	Trans- DAM	21063 53	21616 81	261	Wailutu Reserve - Wailutu Creek	Creekline in Primary Forest	CC	5 peopl e/ 50 min	HD	<i>Rhinella marina</i>	1	A		EW	immediatel y below dam
6/07/2 017	Trans- DAM	21064 90	21615 40	230	Wailutu Reserve - Wailutu Creek	Creekline in Primary Forest	S	7 peopl e/ 50 min	HD	<i>Platymant is vitianus</i>	1	J		EW	downstrea m of dam



Date	Transect	*Easti ng	*Nort hing	heig ht (mA SL)	Locality Description	Habitat	Reco rd Type	Effort	Meth od	Species	Numb er	Age	Sex	Micr o- habi tat	Comments
6/07/2017	Trans-DAM	2106552	2161490	230	Wailutu Reserve - Wailutu Creek	Creekline in Primary Forest	CC	7 people / 50 min	HD	<i>Platymantis vitianus</i>	1	J		UL	downstream of dam
13/07/2017	Forest Basecamp	2107148	2160542	243	Forest Basecamp	Buildings	CC			<i>Lepidodactylus lugubris</i>	4	A		BG	
13/07/2017	Forest Basecamp	2107148	2160542	243	Forest Basecamp	Buildings and cleared grassland	CC			<i>Rhinella marina</i>	2	J		GR	
13/07/2017	Trans-DAM	2106400	2161640	233	Wailutu Reserve - Wailutu Creek	Creekline in Primary Forest	S	7 people / 50 min	HD	<i>Platymantis vitianus</i>	1	J		IL	downstream of dam
18/07/2017	Forest Basecamp	2107148	2160542	243	Forest Basecamp	Buildings	CC			<i>Gehyra oceanica</i>	1	A	F	BG	gravid with two eggs
18/07/2017	Forest Basecamp	2107148	2160542	243	Forest Basecamp	Buildings and cleared grassland	CC			<i>Rhinella marina</i>	2	J		GR	
19/07/2017	Trans-DAM				Wailutu Reserve - Wailutu Creek	Creekline in Primary Forest		8 people / 50 min	HD	None	1	J		IL	downstream of dam
25/07/2017	Forest Basecamp	2107148	2160542	243	Forest Basecamp	rank grassland SW of house			SN	<i>Urva auropunctatus</i>	2	A		GR	



Date	Transect	*Easti ng	*Nort hing	heig ht (mA SL)	Locality Description	Habitat	Reco rd Type	Effort	Meth od	Species	Num ber	Ag e	Sex	Micr o- habi tat	Comments
25/07/ 2017	Forest Basecam p	21071 48	21605 42	243	Forest Basecamp	rank grassland SW of house				<i>Nactus pelagicus</i>	1			Gut	
25/07/ 2017	Forest Basecam p	21071 48	21605 42	243	Forest Basecamp	rank grassland SW of house				<i>Lepidodac tylus lugubris</i>	1			Gut	

Methods: SPT=Pitfall Trap, SFT=Funnel Trap, SN = snare.

Age: A=Adult, J=Juvenile.

Microhabitat: BU=Detected by presence of burrows, CC=Caught by hand, CF=found dead, DC=cast skin, DR=remains (eg skull, feathers), DS=Scat, DT=Track, H=heard, S=Seen, BG=On Building, Gut = in gut of captured *Urva auropunctatus*.

Appendix 2

Birds. Joe England and Paul Hackett

Summary

33 species were observed in total. 17 of them were endemic to Fiji, of which 3 (Maroon Shining Parrot, Fiji Wattled Honeyeater and Orange Dove) are confined to just Vanua Levu and Taveuni, and another (Natewa silktail) to the Natewa Peninsular of Vanua Levu alone. Details of species are presented below.

Methodology

Point Counts

Standardised point counts were carried out mainly at dawn with a few taking place in the afternoon. Morning sessions would start between 6.00am and 6.45am, whilst afternoon sessions started between 2.00pm and 2.45pm. Point counts were done over a one kilometre transect with ten points positioned 100m trail distance apart from each other. The transect and starting distance along the transect was written along with the weather conditions, temperature, wind speed and cloud cover. The date, start time and finish time were noted. After arrival at each point a one minute settling period allowed birds to come back into the area and start calling. Five minutes of counting then took place, noting everything seen and heard. Birds were identified to species level whilst an estimate of number and distance in bands of 0-25, 25-50, 50-100 and 100m+ was made. Flying birds were sampled but distance was omitted. Any calls which were not immediately recognised were recorded and listened back to in order to ensure identification.

Mist Netting

Netting was mainly carried out during the afternoon from 2.00pm until 5.00pm, some morning sessions were carried out from 6.30am until around 10.30am. Mist netting took place at selected sites along or close to transects with location, date, start time and finish time for each being recorded. Weather was considered, including temperature, wind speed and cloud cover and any obvious presence of fruiting or flowering plants was noted. Five 10x3m nets were set up at most sites in no standardised layout and checked roughly every 20-30 minutes. Birds caught were extracted and taken back to a ringing station at least 50m away from the nearest net where they were then processed. Metal rings were used in order to monitor population trends and individuals over a long time period. The species of bird was always determined and time of capture recorded. Sexing and ageing was carried out as much as possible, with any details giving insight into possible methods for the future being considered. Sexual dimorphism clearly defined genders of certain species and clear juvenile traits gave away very young birds but other than this there was very little information or data to use as a foundation. As part of this, wing and tail moults were measured using a 0-5 rating system (0 being old, 5 being new and S or V being a worn but newish feather or a newish looking old feather). Weight and simple morphological measurements were taken, including head-bill, wing, tarsus, body and tail length, additional notes were taken mainly focusing on body moult or any parasitic load. Playback was used fairly often with good results, as without the capture rate was very low. Appendix 2b contains the results of the mist net and point count surveys

Site Locations

(Map locations refer to the bigger map in Figure 1 above)

Site 1

Very close to camp with nets close to an old logging road in developing secondary slope forest dominated by casuarinas.

Site 2

A site with nets either side of an old logging trail, one side a mosaic of secondary open forest and good quality regrowth and the other purely good quality regrowth.

Site 3

Close to site 3 but away from the logging trail into good quality lowland regrowth with a dense understory but cleared areas.

Site 4

The site with the most pristine lowland forest running along a stream where the forest had never been logged, huge trees and a slightly sparser understory with deep gullies and ridges either side.

Site 5

Some of the nets were placed in the forest above the road in typical forest edge type understory but with many flowering trees and shrubs (especially Vuga), the remaining nets were placed further into the forest along the ridge which had good quality regrowth and at the highest elevation of any of the sites.



Appendix 2a - Species Accounts

Very common = seen everyday

Common = seen multiple times in a week

Uncommon = seen once a week

Scarce = seen multiple times in a month

Rare = seen once a month or less

1. *Egretta sacra*

Eastern Reef Heron

Rare visitor to the streams along the valley from the surrounding coastline where this species is very common. Disturbed from the bridge just north of base camp and seen flying over once (photo Glen Fergus).



2. *Anas superciliosa*

Pacific Black Duck

Scarce visitor to the pools of larger streams through the valley. Only seen flying in pairs fast and direct west or east along the main watercourse, mainly from the bridge in the early morning (photo Dick Daniels).



3. *Circus approximans*

Swamp Harrier

Rare raptor only seen twice in the field site over two months, supposedly more common in agricultural open country but still largely absent from those habitats. The sightings were within a few days of each other and both of a single bird gliding over the ridge about 2.3km north along the road from base camp (photo JJ Harrison).



4. *Accipiter rufitorques*

Fiji Goshawk

Fiji Endemic

Common and fairly obvious raptor heard and seen regularly, especially along the roadside by the pink house 300m north along the road from base camp where I suspect there was a breeding pair nesting. Very often mobbed, particularly by Fiji Woodswallow (photo Aviceda).



5. *Falco peregrinus*

Peregrine Falcon

Rare raptor only seen once from the main ridge north along the road, a fleeting glimpse of an adult zooming over the trees. Apparently a breeding pair use the cliffs behind the village of Vusaratu so it is likely that this was one of these birds venturing out to hunt (photo Mike Baird).



6. *Tyto alba*

Barn Owl

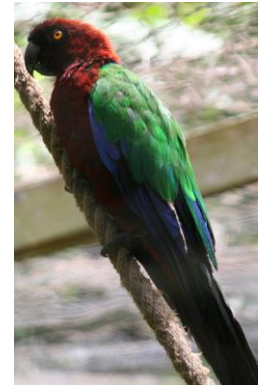
Rare and only nocturnal bird seen in or around the field site, one bird was seen flying over the road about 1km south of basecamp and another was heard once in Natewa village where it is an apparent inhabitant (photo Peter Trimming).



7. *Prosopiea tabuensis*

Maroon Shining Parrot

Fiji Endemic on Vanua Levu and Taveuni although introduced to Tonga. Very common and vocal bird of the forest, most commonly heard or seen flying from treetop to treetop where its distinctive flight pattern and body dimensions give it away. Far more difficult to see perched in tree despite its size and colours. Easily disturbed and will give raucous cackling call as flying away, a pair once didn't want to move too far away from our disturbance and kept alarm calling from a nearby tree, possibly breeding close by. Sometimes seen associating with other species in reasonable numbers especially around fruiting trees (photo Duncan Wright).



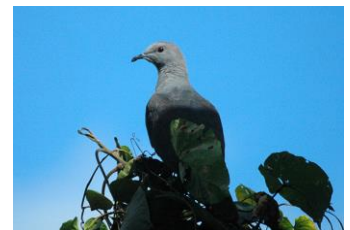
a

8. *Ducula latrans*

Barking Pigeon

Fiji Endemic

Very commonly heard and seen making up the background noise of the forest. Most frequently seen alone or in pairs perched conspicuously in a tall tree or flying across the canopy. Fruiting trees can often attract large congregations with birds flying in from all directions to feed, presumably in response to the booming calls of other individuals. Occasionally seen foraging lower down feeding on palm fruits (photo Tom Tarrant).



9. *Columba vitiensis*

Metallic Pigeon

An uncommon species heard and seen sporadically without much predictability as to where presumably due to their fairly nomadic movement in search of fruiting trees. The most reliable spots seemed to be the ridge at the top of transect E, the latter half of transect C and the slope beyond the main ridge north along the road. Only seen a handful of times and seemingly not as abundant as down in some of the more disturbed habitat. Females are fairly similar to Barking Pigeon and it is possible that some went under the radar when only seen in distant flight (photo Dick Daniels)



10. *Ptilinopus perousii*

Many-coloured Fruit-dove

An uncommon bird heard far more often than seen. Most sightings were of pairs or single bird in a 500m stretch of the road about 1.5km north on the main slope going up to the ridge but as with many other frugivorous species they are fairly nomadic (photo Aviceda).



11. *Chrysoenas victor*

Orange Dove

Vanua Levu & Taveuni Endemic

Very common distinctive and characteristic bird of the forest within the field site. The dripping tap call, although plaintive carries a significant distance and alerts observers to its presence, however despite the males almost neon colour they can be difficult to place in a tree. Females are far more cryptic, not only blending in with their green plumage but also seemingly lacking the dripping call. Unlike the other pigeons and doves, the areas they occupy are fairly predictable as they seem to be far more territorial. Over the two month period more and more individuals were seen feeding lower down in the forest strata on palm species and alike (photo Aviceda).



12. *Aerodramus spodiopygius*

White-rumped Swiftlet

Very common sight in the skies over the forest with loose flocks feeding quietly. Most abundant in large clearings and above the bridge (photo Ian Montgomery, birdway.com.au).



13. *Todirhamphus chloris*

White-collared Kingfisher

Uncommon species in the field site, far more often heard than seen. Generally keeping to the lush well vegetated clearings in the valleys but very abundant down at the coast where there was huge intraspecific variability with plumage and size, seems as though some work needs to be done to sort out confusion with the kingfisher species of the south pacific (photo JJ Harrison).



14. *Artamus mentalis*

Fiji Woodswallow

Fiji Endemic

Very common bird of the forest edge and canopy where it is regularly seen in pairs or small feeding flocks hawking out from a chosen perch to which they return and seem to habitually use from day to day. Very curious, twice coming close to the nets to



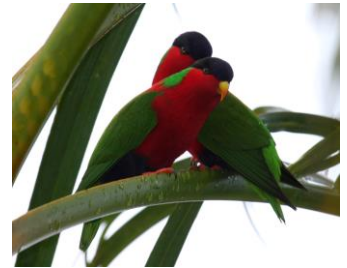
check on the disturbance caused by birds in the net and also the first species to mob any Fiji Goshawk (photo Aviceda).

15. *Phigys solitaries*

Collared Lory

Fiji Endemic

Common species that became increasingly common through the season as more and more flowers started to bloom. Initially seen flying in pairs or small groups quickly over the forest but latterly seen feeding and moving between trees especially in areas where there were Vuga and Mere flowers such as the main ridge (photo Aciceda).



16. *Cacomantis flabelliformis*

Fan-tailed Cuckoo

Uncommon but distinctive species when heard. They seem to occupy areas for brief periods of time regularly calling responding very well to playback but able to throw their voice so that it can be very difficult to see a stationary, perched bird. Three reliable spots for certain periods were 800m into transect C, the main ridge and about 600m north along the road (photo JJ Harrison).



17. *Turdus poliocephalus*

Island Thrush

Ringed: 2

Generally scarce but locally common on the slope of transect E and around the main ridge and transect A. A fairly cryptic bird being very difficult to see for any length of time, mainly heard singing or giving its alarm call and seen flying away low through the understory (photo markaharper1).



18. *Aplonis tabuensis*

Polynesian Starling

A scarce bird of the canopy, generally staying very quiet. Seen generally alone or in two's or three's on the slope about 1.5km north along the road, seen once along the dam transect with a Polynesian Triller (photo Duncan Wright).



19. *Acridotheres tristis*

Common Mynah

Ringed: 1

Locally very common introduced species resident at the base camp making the most of the kitchen scraps. Not seen outside the camp and so hopefully having minimal effect on the native birds (photo T G Santosh).



20. *Cettia ruficapilla*

Fiji Bush-warbler

Fiji Endemic

Ringed: 13

Very common bird of the forest understory, its melodic call being an iconic sound in the forest. Much more difficult to see than hear due to its skulking behaviour but caught fairly regularly in the mist nets. Commonly associates with other species in feeding flocks and responds well to Fiji Shrikebill playback so presumably forages successfully with this species (photo Paul Noakes).



21. *Lamprolia klinesmithi*

Natewa Silktail

Natewa Endemic

Ringed: 7

A common bird of the closed understory where it can be heard fairly frequently. Birds were seen generally in small groups, usually two birds but up to five birds were seen foraging together. Also a common member of mixed feeding flocks, responding well to the calls of Streaked Fantail and Fiji Shrikebill which it was seen associating with on multiple occasions. Territories were established by birds during the season and there were areas where you could reliably hear or see them. The first 150m of transect A was the best area along with the last 500m of the dam transect. Transect D had a pair about 350m in from the road in some relatively poor quality forest, transect C had a good spot about 850m in and 2km north along the road also had a bird frequently seen in the trees near the roadside. A very active forager and can be difficult to pin down in order to get a good view or a good photo (photo Aviceda).



22. *Rhipidura layardi*

Fiji Streaked Fantail

Fiji Endemic

Ringed: 8

Common bird of interior forest where it is seen usually in pairs or small groups generally with other species actively flushing insects with its tail and sallying to get them. Fairly inquisitive and will come close to inspect any disturbance or playback (photo Aviceda).



23. *Petroica pusilla*

Pacific Robin

A common species of the forest edge where it will perch and sally out into clearings to feed. Usually seen in pairs or in mixed flocks. A resident male was regularly heard calling below the camp in the morning with their distinctive 'stairfall' call (photo Ian Montgomery).



24. *Mayrornis lessoni*

Slaty Monarch

Fiji Endemic

Ringed: 3

Common member of mixed species flocks where it can easily go overlooked. Can be noisy with its harsh chattering call similar to that of the Streaked Fantail, but generally seen quietly foraging in the upper midstory (photo Aviceda).



25. *Myiagra vanikorensis*

Vanikoro Flycatcher

Fiji Endemic

A common bird noticeably doing well in areas of disturbance or forest edge. Its furtive call is generally the giveaway to its presence, most often seen in male and female pairs. A resident pair was very commonly seen in the large tree at the top of the drive up to the camp (photo Aviceda).



26. *Pachycephala vitiensis*

Fiji Whistler

Fiji Endemic

Ringed: 10

A very common bird, its abundance most evident during the dawn chorus when up to 20 could be heard from the camp. It becomes quieter during the day but can still be heard very regularly. Surprisingly shy, keeping well-hidden despite being evidently very close and colourful. Often seen as part of mixed species feeding flocks (photo Aviceda).



27. *Clytorhynchus vitiensis*

Fiji Shrikebill

Fiji Endemic

Ringed: 7

Very common in dense understory forest where its haunting call can be heard very often and can be called in using playback quite effectively. A noisy and active member of mixed flocks but can be found foraging in groups of three or four individuals. Can be fairly skulking and shy leading to brief views which along with the similar call and appearance of the female Black-faced Shrikebill led to frustrating and tantalising glimpses of possible Black-faced records but none guaranteed sightings. The lack of any males however suggests that these possible sightings may have just been hopeful thinking. If Black-faced Shrikebill is in the current field site then it is very low abundance or in an area that we did not get a chance to survey (photo Josep del Hoyo).



28. *Zosterops lateralis*

Silvereye

Ringed: 5

A common gregarious species frequently seen moving through the sub canopy of the forest generally in monospecific groups of up to 20 or so but occasionally seen associating with the Fiji White-eye. Constant contact calls between individuals make them very obvious as they forage actively (photo fir0002).



29. *Zosterops explorator*

Fiji White-eye

Fiji Endemic

Ringed: 1

An uncommon species, seemingly overshadowed by the Silvereye despite feeding together in mixed flocks. Both species seen feeding as part of larger mixed species feeding flocks, usually towards the back of the group as they move through the forest (photo Aviceda).



30. *Amandava amandava*

Red Avadavat

A locally common introduced species that was abundant in the roadside grasses at the bottom of the road where there was extensive surrounding open country. They did not extend up the road where the forest took over (photo Shantanu Kuveskar).

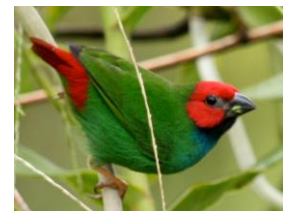


31. *Erythrura pealli*

Fiji Parrotfinch

Fiji Endemic

A scarce species in the field site where it was mainly heard briefly and seen flying away. A combination of being shy and mainly relying on the roadside habitat meant that this species possibly went overlooked to some extent. The best spot was 500m north along the road (photo Aviceda).



32. *Lalage maculosa*

Polynesian Triller

A very common canopy species, frequently heard trilling and seen flying in pairs to and from the tops of trees. In other habitats they were seen foraging very low but in the field site were definitely constrained to the canopy (photo Aviceda).



33. *Foulehaio taviunensis*

Fiji Wattled Honeyeater

Fiji endemic restricted to Vanua Levu and Taveuni

Locally common where there are flowering trees, but otherwise random sightings or absent from large areas of the forest. During the flowering of the Vuga trees on the main ridge there were large numbers of honeyeater all foraging (photo Duncan Wright) .

34. *Myzomela jugularis*

Sulphur-breasted Myzomela

Fiji Endemic

Ringed: 10

A very common species most frequently seen around clearings and forest edge where there are abundant flowering plants but can be seen in the forest interior. Large groups congregate around *Stachytarpheta cayennensis*, a North American introduced flowering plant but also found in huge numbers around the Vuga trees. Towards the end of the season a different four or five note raspy call was heard from this species, possibly coinciding with the start of their breeding as it was observed alongside males giving a nuptial flight in the canopy of tall trees (photo Aviceda).



Birds recorded on the Natewa Peninsular, July August 2017. Joe England, Paul Hackett & Greg Kerr

BIRDS SPECIES RECORDED IN FORESTS OF NATEWA PENINSULAR JULY/AUGUST 2017			
COMMON NAME	SCIENTIFIC NAME	FAMILY	DISTRIBUTION
Barn Owl	<i>Tyto alba</i>		
Barking Pigeon	<i>Ducula latrans</i>	Columbidae	Endemic to Fiji
Collared Tory	<i>Phigys solitarius</i>	Psittaculidae	Endemic to Fiji
Common Mynah	<i>Acridotheres tristis</i>	Sturnidae	Global
Eastern Reef Heron	<i>Egretta sacra</i>	Ardeidae	SE Asia
Fan-tailed Cuckoo	<i>Cacomantis labelliformis</i>	Cuculidae	Australasia
Fiji Bush Warbler	<i>Horornis fuscipilla</i>	Cettidae	Endemic to Fiji
Fiji Goshawk	<i>Accipiter fufitorques</i>	Accipitridae	Endemic to Fiji
Fiji Parrotfinch	<i>Erythrura palii</i>	Estrildidae	Endemic to Fiji
Fiji Shrike	<i>Clytorhynchus vitiensis</i>	Monarchidae	Fiji, Samoa & Tonga
Fiji White-eye	<i>Zosterops explorator</i>	Zosteropidae	Endemic to Fiji
Fiji Woodswallow	<i>Artamus mentalis</i>	Artamidae	Endemic to Fiji
Fiji Whistler	<i>Pachycephala vitiensis</i>	Pachycephalidae	Endemic to Fiji
Island Thrush	<i>Turdus poliocephalus</i>	Turdidae	SE Asia & SW Pacific
Many-coloured Fruit Dove	<i>Ptilinopus perousii</i>	Columbidae	SW Pacific
Maroon Shining Parrot	<i>Prosopelia tabuensis</i>	Psittaculidae	Endemic to Vanua Levu & Taveuni
Metallic Pigeon	<i>Columba vitiensis</i>	Columbidae	SE Asia & Australasia
Natewa Billtail	<i>Lamprolaima victoriae</i>	Rhipiduridae	Endemic to Natewa on Vanua Levu
Orange Fruit Dove	<i>Ptilinopus victor</i>	Columbidae	Endemic to Fiji
Pacific Black Duck	<i>Anas superciliosa</i>	Anatidae	Oceania
Peregrine Falcon	<i>Falco peregrinus</i>	Falconidae	Global
Polynesian Starling	<i>Aplonis tabuensis</i>	Sturnidae	Oceania
Polynesian Triller	<i>Lalage maculosa</i>	Campephagidae	SW Pacific
Red Avadavat	<i>Amandava amandava</i>	Estrildidae	Tropical Asia
Red-vented Bulbul	<i>Pycnonotus cafer</i>	Pycnonotidae	Global
Scarlet Robin	<i>Petroica multicolor</i>	Petroicidae	SW Pacific
Slaty Monarch	<i>Mayornis lessoni</i>	Monarchidae	Endemic to Fiji
Silvereye	<i>Zosterops lateralis</i>	Zosteropidae	SW Pacific
Slaty Robin	<i>Peneothello yanus</i>	Petroicidae	Indonesia & New Guinea not Fiji?
Streaked Fantail	<i>Rhipidura verreauxi</i>	Rhipiduridae	Fiji, Vanuatu & New Caledonia
Sulphur-breasted Myzomela	<i>Myzomela jugularis</i>	Meliphagidae	Endemic to Fiji
Swamp Harrier	<i>Circus approximans</i>	Accipitridae	Australasia
Vanikoro Flycatcher	<i>Myiagra vanikorensis</i>	Monarchidae	Fiji & Solomon Islands
Wattled Honeyeater	<i>Foulehaio flaviventer</i>	Meliphagidae	Endemic to Fiji
White-rumped Swiftlet	<i>Aerodramus podiopygius</i>	Apodidae	SW Pacific

Date	Location	Start Time	Finish Time	Weather	Wind Speed	Temperature @	Cloud Cover	Point No.	Species	Number	Detection Method	Distance (m)	Notes
14/06/2017	E 100m	6.00	8.15	Overcast	None	20-25	6/8	1	Golden Whistler	1	H	25-50	
									Scarlet Robin	1	H	25-50	
									Barking Pigeon	2	H	50-100	
									Sulphur-breasted Myzomela	1	H	F	
								2	Orange Fruit Dove	1	H	25-50	
									Barking Pigeon	1	H	25-50	
									Golden Whistler	2	H	25-50	
									Maroon Shining Parrot	1	H	50-100	
									Fiji Bush Warbler	1	H	25-50	
								3	Golden Whistler	1	H	0-25	
									Many-coloured Fruit Dove	1	H	50-100	
									Collared Lory	2+	H	F	
									Barking Pigeon	5	H & S	3 x 50-100, 2 x 0-25	
									Wattled Honeyeater	1	H	25-50	
									Fiji Shrikebill	1	H	0-25	
									Orange Fruit Dove	1	H	25-50	
								4	Fiji Shrikebill	1	H & S	0-25	
									Golden Whistler	1	H	100+	
									Barking Pigeon	2	H	25-50	
									Orange Fruit Dove	1	H	25-50	
								5	Golden Whistler	2	H	25-50	
									Barking Pigeon	2	H	100+	
									Maroon Shining Parrot	1	H	50-100	
									Many-coloured Fruit Dove	1	H	50-100	
								6	Maroon Shining Parrot	1	H	100+	
									Barking Pigeon	2	H	50-100	
									Golden Whistler	2+	H	25-50	
									Orange Fruit Dove	1	H	25-50	
									Fiji Bush Warbler	1	H	50-100	
									Many-coloured Fruit Dove	1	H	50-100	
								7	Barking Pigeon	1	H	100+	
									Golden Whistler	1	H	50-100	
									Fiji Bush Warbler	1	H	25-50	
									Maroon Shining Parrot	1	H	50-100	
									Orange Fruit Dove	1	H	50-100	
								8	Barking Pigeon	2	H	50-100	
									Golden Whistler	2	H	50-100	
									Fiji Bush Warbler	1	H	100+	
									Maroon Shining Parrot	1	H	100+	
									Many-coloured Fruit Dove	1	H	50-100	
	Fiji Shrikebill	1	H	25-50									
9	Barking Pigeon	3	H	100+									
	Golden Whistler	2	H	50-100									
	Maroon Shining Parrot	1	H	100+									
10	Barking Pigeon	4+	H	100+									
	Golden Whistler	1	H	100+									
	Maroon Shining Parrot	1	H	100+									
15/06/2017	C 100m	6.40	8.30	Clear	None	15-20	0/8	1	Golden Whistler	1	H	25-50	
									Fiji Bush Warbler	1	H	0-25	
									Sulphur-breasted Myzomela	1	H	0-25	
									Barking Pigeon	2	H	100+	
								2	Maroon Shining Parrot	3	H	25-50	
									Barking Pigeon	3	H	100+	
									Fiji Bush Warbler	2	H	25-50	
									Vanikoro Flycatcher	1	H	0-25	
									Sulphur-breasted Myzomela	1	H	25-50	
								3	Barking Pigeon	3	H	50-100	
									Golden Whistler	1	H	50-100	
									Polynesian Triller	1	H	F	
								4	Barking Pigeon	4	H	100+	
									Polynesian Triller	3	H	0-25	
									Golden Whistler	1	H	50-100	
									Orange Fruit Dove	1	H	50-100	
								5	Golden Whistler	3	H	0-25	
									Sulphur-breasted Myzomela	1	S	0-25	
									Barking Pigeon	3	H	100+	
									Polynesian Triller	1	H	25-50	
									Fiji Bush Warbler	1	H	50-100	
									Orange Fruit Dove	1	H	25-50	
								6	Scarlet Robin	1	H	0-25	
									Barking Pigeon	3	H	100+	
									Maroon Shining Parrot	1	H	50-100	
									Sulphur-breasted Myzomela	2	H & S	0-25	
									Golden Whistler	1	H	0-25	
								7	Golden Whistler	2	H	0-25	
									Maroon Shining Parrot	1	H	0-25	
									Scarlet Robin	1	H	25-50	
									Polynesian Triller	1	H	0-25	
									Barking Pigeon	3	H	100+	
									Fiji Bush Warbler	1	H	50-100	
								8	Golden Whistler	2	H	25-50	
									Barking Pigeon	1	H	100+	
									Wattled Honeyeater	1	H	25-50	
									Fiji Shrikebill	1	H	25-50	
									Maroon Shining Parrot	2	H	0-25	
									Orange Fruit Dove	1	H	25-50	
									Polynesian Triller	1	S	0-25	
9	Barking Pigeon	3	H	50-100									
	Golden Whistler	2	H	100+									
	Polynesian Triller	1	H	0-25									
	Sulphur-breasted Myzomela	1	H	0-25									
	Wattled Honeyeater	1	H	25-50									
	Fiji Bush Warbler	1	H	50-100									
	Maroon Shining Parrot	1	H	25-50									
10	Orange Fruit Dove	1	H	25-50									
	Golden Whistler	1	H	0-25									
	Barking Pigeon	3	H & S	50-100									
	Maroon Shining Parrot	2	H	25-50									
	Fiji Bush Warbler	1	H	50-100									
16/06/2017	Road (350t	6.15	8.30	Partly Cloudy	None	15-20	4/8	1	Golden Whistler	5	H	1 x 50-100, 4 x 100+	
									Barking Pigeon	2	H	100+	
								2	Fiji Goshawk	1	S	0-25	Adult male
									Barking Pigeon	5	H	2 x 25-50, 3 x F	
									Golden Whistler	2	H	25-50	
									Pacific Black Duck	1	S	F	
									Polynesian Triller	1	H	25-50	
									Sulphur-breasted Myzomela	4	S	0-25	
								3	Fiji Bush Warbler	2	H	50-100	
									Barking Pigeon	4	H	100+	
									Maroon Shining Parrot	2	H	100+	
									Orange Fruit Dove	1	H	100+	
								4	Polynesian Triller	2	H & S	25-50	
									Barking Pigeon	3	H	100+	
									Fiji Bush Warbler	1	H	25-50	
									Sulphur-breasted Myzomela	3	H	1 x 25-50, 2 x F	
								5	Orange Fruit Dove	1	H	50-100	
									Polynesian Triller	1	S	0-25	
									Sulphur-breasted Myzomela	1	H	0-25	
									Fiji Woodswallow	1	S	F	
									Fiji Bush Warbler	1	H	0-25	
									Maroon Shining Parrot	1	H	100+	

								6	Fiji Bush Warbler	2	H	25-50	
									Barking Pigeon	3	H	1 x 0-25, 2 x 100+	
									Polynesian Triller	1	H	0-25	
									Golden Whistler	2	H	50-100	
								7	Fiji Bush Warbler	1	H	25-50	
									Barking Pigeon	2	H	100+	
									Golden Whistler	1	H	25-50	
									Maroon Shining Parrot	1	H	50-100	
								8	Golden Whistler	3	H	25-50	
									Fiji Bush Warbler	2	H	0-25	
									Barking Pigeon	3	H	1 x 0-25, 2 x 100+	
									Maroon Shining Parrot	1	H	50-100	
									Silvereye	1	H	25-50	
								9	Maroon Shining Parrot	1	H	50-100	
									Barking Pigeon	2	H	50-100	
									Golden Whistler	1	H	50-100	
									Polynesian Triller	1	H	50-100	
									Orange Fruit Dove	1	H	50-100	
									Fiji Bush Warbler	1	H	50-100	
								10	Barking Pigeon	2	H	100+	
									Sulphur-breasted Myzomela	1	H	25-50	
21/06/2017	Road (700r)	6.45	10.30	Overcast	None	20-25	4/8	1	Barking Pigeon	6	H & S	3 x 100+, 3 x 50-100	
									Golden Whistler	1	H	50-100	
									Polynesian Triller	1	H	100+	
								2	Fiji Bush Warbler	1	H	25-50	
									Maroon Shining Parrot	1	H	50-100	
									Polynesian Triller	3	H & S	0-25	
									Golden Whistler	2	H	50-100	
									Fiji Shrikebill	2	H & S	25-50	
									Barking Pigeon	3	H	100+	
									Sulphur-breasted Myzomela	1	S	25-50	
								3	Barking Pigeon	2	H	1 x 25-50, 1 x 100+	
									Golden Whistler	2	H	1 x 25-50, 1 x 50-100	
									Fiji Bush Warbler	1	H	100+	
									Polynesian Triller	1	H	50-100	
									Maroon Shining Parrot	1	H	50-100	
									Orange Fruit Dove	1	H	100+	
								4	Golden Whistler	1	H	0-25	
									Maroon Shining Parrot	2	H	50-100	
									Silvereye	7	S	0-25	
									Barking Pigeon	2	H	50-100	
									White-rumped Swiftlet	1	S	F	
								5	Barking Pigeon	1	H	100+	
									Maroon Shining Parrot	1	H	50-100	
									Fiji Bush Warbler	1	H	50-100	
									Fiji Shrikebill	1	H	50-100	
									Sulphur-breasted Myzomela	1	S	0-25	
								6	Golden Whistler	2	H	50-100	
									Maroon Shining Parrot	2	H	100+	
									Fiji Bush Warbler	1	H	25-50	
									Barking Pigeon	3	H	50-100	
								7	Barking Pigeon	3	H	100+	
									Polynesian Triller	1	H	100+	
									Maroon Shining Parrot	1	H	100+	
									Golden Whistler	1	H	50-100	
									Fiji Bush Warbler	1	H	50-100	
								8	Polynesian Triller	2	H	1 x 0-25, 1 x 100+	
									Barking Pigeon	2	H	100+	
									Maroon Shining Parrot	2	H	50-100	
									Sulphur-breasted Myzomela	1	S	0-25	
									Fiji Bush Warbler	1	H	25-50	
								9	Barking Pigeon	1	H	100+	
									Fiji Shrikebill	1	H	50-100	
								10	Golden Whistler	2	H	50-100	
									Barking Pigeon	1	H & S	50-100	
									Maroon Shining Parrot	1	H	50-100	
22/06/2017	B 100m	6.35	9.00	Rain	None	15-20	6/8	1	Golden Whistler	2	H	50-100	
									Fiji Bush Warbler	1	H	25-50	
									Barking Pigeon	2	H	100+	
									Polynesian Triller	1	H	50-100	
								2	Sulphur-breasted Myzomela	1	H	0-25	Flowers present
									Barking Pigeon	1	H	100+	
									Fiji Bush Warbler	2	H	25-50	
								3	Sulphur-breasted Myzomela	3	H & S	50-100	Flowers present
									Fiji Bush Warbler	1	H	25-50	
									Barking Pigeon	3	H	100+	
								4	Barking Pigeon	3	H	100+	
									Silvereye	1	S	F	
								5	Barking Pigeon	3	H	50-100	
								6	Barking Pigeon	2	H	50-100	
									Maroon Shining Parrot	1	H	50-100	
									Polynesian Triller	1	H	50-100	
								7	Barking Pigeon	1	H	50-100	
									Silttail	1	H	25-50	
									Polynesian Triller	1	H	50-100	
								8	Orange Fruit Dove	1	H	50-100	
									Barking Pigeon	1	H	100+	
								9	Barking Pigeon	1	H	100+	
									Polynesian Triller	1	H	50-100	
									Orange Fruit Dove	1	H	50-100	
								10	Slaty Monarch	1	H & S	0-25	
									Golden Whistler	1	H & S	0-25	
									Vanikoro Flycatcher	2	H & S	0-25	
									Streaked Fantail	2	H & S	0-25	
									Fiji White-eye	3+	H & S	0-25	
									Collared Lory	1	H	F	
23/06/2017	F 100m	6.30	9.30	Clear	None	20-25	2/8	1	Golden Whistler	7	H	25-50	
									Fiji Bush Warbler	1	H	0-25	
									Barking Pigeon	2	H	50-100	
									Maroon Shining Parrot	1	H	50-100	
									Silvereye	1	H	0-25	
								2	Barking Pigeon	3	H	1 x 25-50, 2 x 50-100	
									Golden Whistler	5	H	50-100	
									Polynesian Triller	1	H	50-100	
									Maroon Shining Parrot	2	H	25-50	
								3	Barking Pigeon	3	H	2 x 25-50, 1 x 100+	
									Maroon Shining Parrot	1	H	50-100	
									Golden Whistler	2	H	100+	
									Polynesian Triller	1	H	25-50	
								4	Maroon Shining Parrot	1	H	50-100	
									Barking Pigeon	2	H	50-100	
									Polynesian Triller	2	H	25-50	
									Slaty Monarch	1	H	25-50	
								5	Fiji Bush Warbler	2	H	25-50	
									Barking Pigeon	1	H	100+	
									Maroon Shining Parrot	1	H & S	0-25	
									Scarlet Robin	1	H	25-50	
									Wattled Honeyeater	1	H	0-25	
									Orange Fruit Dove	1	H	0-25	
								6	Orange Fruit Dove	1	H & S	0-25	
									Golden Whistler	2	H	25-50	
									Barking Pigeon	3	H	1 x 25-50, 2 x 100+	

Date	Time	Weather	Wind	Temp	Cloud	Species	Count	Sex	Age	Notes				
28/06/2017	C 200m	6.30	10.00	Clear	Low	20-25	3/8							
											Sulphur-breasted Myzomela	1	H & S	0-25
											7 Golden Whistler	3	H	50-100
											Barking Pigeon	4	H	100+
											Polynesian Triller	1	H	50-100
											Sulphur-breasted Myzomela	1	H	50-100
											Orange Fruit Dove	1	H	50-100
											8 Golden Whistler	3	H	2 x 50-100, 1 x 100+
											Barking Pigeon	3	H	100+
											Maroon Shining Parrot	1	H	100+
											Many-coloured Fruit Dove	1	H	100+
											9 Barking Pigeon	2	H	100+
											Many-coloured Fruit Dove	2	H	100+
											Golden Whistler	3	H	50-100
											Polynesian Triller	1	H	50-100
											Maroon Shining Parrot	1	H	100+
											10 Barking Pigeon	4	H	100+
											Golden Whistler	2	H	25-50
											Fiji Bush Warbler	1	H	100+
											Polynesian Triller	1	H	50-100
											Many-coloured Fruit Dove	2	H	100+
											Maroon Shining Parrot	1	H	50-100
											1 Golden Whistler	2	H	25-50
											Barking Pigeon	2	H	1 x 0-25, 1 x 100+
											Sulphur-breasted Myzomela	1	H	0-25
											Fiji Goshawk	1	H	25-50
											Maroon Shining Parrot	1	H	50-100
											2 Golden Whistler	1	H	50-100
											Barking Pigeon	3	H	1 x 0-25, 2 x 100+
											Polynesian Triller	1	H	0-25
											Fiji Bush Warbler	2	H	25-50
											Sulphur-breasted Myzomela	1	S	0-25
											3 Barking Pigeon	3	H	2x 25-50, 1 x 100+
											Golden Whistler	2	H	50-100
											Orange Fruit Dove	1	H	100+
											Maroon Shining Parrot	1	H	50-100
											Polynesian Triller	1	H	0-25
											Fiji Bush Warbler	1	H	50-100
											4 Fiji Bush Warbler	2	H	1 x 25-20, 1 x 100+
											Barking Pigeon	2	H	100+
											5 Golden Whistler	1	H	50-100
											Barking Pigeon	1	H	50-100
											Fiji Bush Warbler	1	H	25-50
											Maroon Shining Parrot	2	H	100+
											6 Barking Pigeon	1	H	100+
Fiji Bush Warbler	1	H	25-50											
Sulphur-breasted Myzomela	1	S	F											
Maroon Shining Parrot	1	H	100+											
Polynesian Triller	1	H	25-50											
Orange Fruit Dove	1	H	100+											
Metallic Pigeon	1	H	100+											
7 Barking Pigeon	4	H	25-50											
Maroon Shining Parrot	1	H	25-50											
Fiji Bush Warbler	1	H	25-50											
Golden Whistler	1	H	25-50											
Fan-tailed Cuckoo	1	H	25-50											
Polynesian Triller	2	H	F											
Fiji Shrikebill	1	H & S	25-50											
1 Golden Whistler	2	H	50-100											
Barking Pigeon	3	H	100+											
Polynesian Triller	1	H	50-100											
Fiji Bush Warbler	2	H	25-50											
Orange Fruit Dove	1	H	50-100											
2 Barking Pigeon	2	H	50-100											
Fiji Bush Warbler	3	H	0-25											
Scarlet Robin	1	S	0-25											
Silvereye	2	H & S	0-25											
Polynesian Triller	2	H	25-50											
3 Maroon Shining Parrot	1	H	50-100											
Barking Pigeon	2	H	100+											
Orange Fruit Dove	1	H	50-100											
Golden Whistler	1	H	50-100											
Polynesian Triller	1	H	50-100											
4 Fiji Bush Warbler	1	H	100+											
Barking Pigeon	1	H	100+											
Polynesian Triller	1	H & S	0-25											
White-rumped Swiftlet	1	S	F											
5 Polynesian Triller	1	H	25-50											
Barking Pigeon	1	H	100+											
Fiji Shrikebill	1	H	50-100											
6 Orange Fruit Dove	1	H	50-100											
Silktaill	1	S	0-25											
Sulphur-breasted Myzomela	1	H	0-25											
Barking Pigeon	1	H	100+											
7 Barking Pigeon	3	H	50-100											
Fiji Bush Warbler	1	H	50-100											
Polynesian Triller	1	H	50-100											
Maroon Shining Parrot	1	H	50-100											
Orange Fruit Dove	1	H	50-100											
Fiji Woodswallow	1	S	F											
8 Barking Pigeon	3	H	50-100											
Slaty Monarch	1	H	25-50											
Fiji Shrikebill	1	H	0-25											
Polynesian Triller	1	H	25-50											
Sulphur-breasted Myzomela	1	H	0-25											
9 Barking Pigeon	3	H	100+											
Slaty Monarch	1	H	50-100											
Fiji Bush Warbler	1	H	50-100											
Polynesian Triller	1	H	25-50											
Silktaill	1	H	25-50											
10 Fiji Bush Warbler	1	H	0-25											
Barking Pigeon	2	H	1 x 0-25, 1 x 100+											
Sulphur-breasted Myzomela	1	H	0-25											
Golden Whistler	1	H	25-50											
05/07/2017	E (End to S)	6.35	8.15	Clear	None	20-25	1/8							
1 Golden Whistler	2	H	25-50											
Barking Pigeon	2	H	50-100											
Fiji Bush Warbler	1	H	50-100											
Scarlet Robin	1	H	0-25											
Polynesian Triller	2	H	0-25											
2 Maroon Shining Parrot	2	H	50-100											
Barking Pigeon	2	H	50-100											
Vanikoro Flycatcher	1	H	50-100											
Fiji Bush Warbler	1	H	50-100											
3 Scarlet Robin	1	H	0-25											
Barking Pigeon	1	H	25-50											
Maroon Shining Parrot	1	H	100+											
4 Barking Pigeon	2	H	25-50											
Orange Fruit Dove	1	H	50-100											
Polynesian Triller	1	H	50-100											
Sulphur-breasted Myzomela	1	H	25-50											
5 Polynesian Triller	1	H	50-100											
Fiji Bush Warbler	1	H	50-100											
Barking Pigeon	3	H	50-100											

Survey cut short due to student illness

Female

Wind speed now medium and cloud cover 6/8

						Orange Fruit Dove	1	H	50-100	
						Maroon Shining Parrot	2	H	100+	
						Golden Whistler	2	H	25-50	
						Sulphur-breasted Myzomela	1	H	F	
					6	Maroon Shining Parrot	3	H	0-25	
						Golden Whistler	1	H	50-100	
						Barking Pigeon	2	H	25-50	
						Sulphur-breasted Myzomela	1	H	F	
						Island Thrush	1	H	0-25	
					7	Barking Pigeon	4	H	50-100	
						Maroon Shining Parrot	1	H	50-100	
						Sulphur-breasted Myzomela	1	H	F	
						Orange Fruit Dove	1	H	25-50	
					8	Orange Fruit Dove	1	H	50-100	
						Barking Pigeon	3	H	100+	
						Vanikoro Flycatcher	1	H	50-100	
						Fiji Bush Warbler	1	H	50-100	
						Polynesian Triller	1	H	50-100	
						Maroon Shining Parrot	1	H	100+	
						Sulphur-breasted Myzomela	1	H	0-25	
					9	Fiji Shrikebill	1	S	0-25	
						Streaked Fantail	3	S	0-25	
						Golden Whistler	2	S	0-25	1 male
						Barking Pigeon	3	S	0-25	
						Orange Fruit Dove	1	H	25-50	
						Sulphur-breasted Myzomela	1	S	0-25	
					10	Sulphur-breasted Myzomela	1	H	25-50	
						Barking Pigeon	3	H	0-25	
						Maroon Shining Parrot	2	H	0-25	
						Vanikoro Flycatcher	1	H	50-100	
06/07/2017	Road (650r	6.25	10.00	Partly cloudy	Low	20-25	5/8			
						1	Golden Whistler	4	H	25-50
							Maroon Shining Parrot	4	H	25-50
							Barking Pigeon	3	H	2 x 50-100, 1 x 100+
							White-rumped Swiftlet	2	S	F
							Polynesian Triller	2	S	0-25
							Sulphur-breasted Myzomela	2	S	0-25
						2	Golden Whistler	2	H	25-50
							Barking Pigeon	4	H	1 x 25-50, 3 x 100+
							Fiji Bush Warbler	3	H	25-50
							Maroon Shining Parrot	1	H	100+
						3	Maroon Shining Parrot	2	H	0-25
							Orange Fruit Dove	1	H	25-50
							Barking Pigeon	4	H	100+
							Streaked Fantail	1	S	0-25
							Fiji Bush Warbler	1	H	50-100
							Golden Whistler	1	H	50-100
						4	Collared Lory	1	H	0-25
							Barking Pigeon	4	H	25-50
							Fiji Bush Warbler	2	H	1 x 25-50, 1 x 50-100
							Maroon Shining Parrot	2	H	25-50
							Sulphur-breasted Myzomela	2	S	F
							Scarlet Robin	1	H	100+
							Polynesian Triller	1	H	50-100
						5	Barking Pigeon	4	H & S	1 x 50-100, 3 x 100+
							Sulphur-breasted Myzomela	1	S	F
							Fiji Bush Warbler	2	H	25-50
							Golden Whistler	1	H	50-100
						6	Barking Pigeon	3	H	100+
							Orange Fruit Dove	1	H	50-100
							Fiji Bush Warbler	1	H	50-100
							Silvereye	2	S	0-25
							Polynesian Triller	1	H	25-50
							Fan-tailed Cuckoo	1	H	50-100
							Wattled Honeyeater	1	H	50-100
							Vanikoro Flycatcher	1	S	100+
							Sulphur-breasted Myzomela	1	S	25-50
						7	Polynesian Triller	1	H	25-50
							Maroon Shining Parrot	1	H	25-50
							Barking Pigeon	1	H	50-100
							Fiji Bush Warbler	1	H	25-50
							Slaty Monarch	1	H	25-50
						8	Fiji Shrikebill	2	H	25-50
							Vanikoro Flycatcher	1	H	25-50
							Silvereye	3+	H	25-50
							Fiji Bush Warbler	1	H	25-50
							Barking Pigeon	2	H	50-100
							Collared Kingfisher	1	H	50-100
							Slaty Monarch	1	H	50-100
							Maroon Shining Parrot	1	H	50-100
						9	Barking Pigeon	1	H	50-100
							Sulphur-breasted Myzomela	1	S	F
							Fiji Bush Warbler	1	H	25-50
							Maroon Shining Parrot	1	H	50-100
						10	Fiji Bush Warbler	1	H	25-50
							Polynesian Triller	1	H	25-50
07/07/2017	Dam 0m	6.15	9.30	Partly Cloudy	None	20-25	4/8			
						1	Fiji Bush Warbler	2	H	50-100
							Golden Whistler	5	H	50-100
							Barking Pigeon	2	H	100+
							Fiji Parrotfinch	1	S	F
							Pacific Black Duck	2	S	F
						2	Barking Pigeon	2	H	100+
							Fiji Bush Warbler	1	H	25-50
						3	Maroon Shining Parrot	1	H	100+
							Golden Whistler	1	H	25-50
							Barking Pigeon	2	H	100+
							Maroon Shining Parrot	1	H	50-100
						4	Barking Pigeon	2	H	100+
							Sulphur-breasted Myzomela	1	H	0-25
							Maroon Shining Parrot	2	H	100+
							Vanikoro Flycatcher	1	H	25-50
							Polynesian Triller	1	H	25-50
						5	White-rumped Swiftlet	1	S	25-50
							Maroon Shining Parrot	1	H	100+
							Orange Fruit Dove	1	H	100+
							Golden Whistler	1	H	50-100
							Barking Pigeon	1	H	50-100
						6	White-rumped Swiftlet	3	S	F
							Barking Pigeon	1	H	50-100
							Golden Whistler	1	H	25-50
						7	Barking Pigeon	2	H	50-100
						8	Golden Whistler	1	H	25-50
							Silktailed	1	H	25-50
						9	Streaked Fantail	1	S	0-25
							Barking Pigeon	2	H	50-100
							Golden Whistler	1	S	0-25
						10	Fiji Goshawk	2	S	F
							Barking Pigeon	2	H	1 x 50-100, 1 x 100+
							White-rumped Swiftlet	2	S	F
							Fiji Bush Warbler	1	H	25-50
							Polynesian Triller	1	H	0-25
12/07/2017	F 0m	6.15	9.15	Overcast	None	15-20	7/8			
						1	Golden Whistler	5	H	50-100
							Maroon Shining Parrot	2	H	50-100

						Polynesian Triller	1	H & S	0-25			
						Barking Pigeon	3	H	50-100			
						Sulphur-breasted Myzomela	1	H	0-25			
						2 Golden Whistler	4	H	50-100			
						Barking Pigeon	2	S	0-25			
						Orange Fruit Dove	1	H	50-100			
						Scarlet Robin	1	H	25-50			
						Silvereye	4	S	50-100			
						Sulphur-breasted Myzomela	1	H	50-100			
						3 Golden Whistler	1	H	0-25			
						Barking Pigeon	4	H	1 x 50-100, 3 x 100+			
						Sulphur-breasted Myzomela	1	H	25-50			
						4 Golden Whistler	1	H	100+			
						Barking Pigeon	3	H	100+			
						Fiji Bush Warbler	1	H	25-50			
						Maroon Shining Parrot	1	H	50-100			
						5 Barking Pigeon	2	H	100+			
						Maroon Shining Parrot	1	H	100+			
						Golden Whistler	3	H & S	2 x 0-25, 1 x 50-	One male and one female seen		
						Scarlet Robin	2	S	0-25	One male and one female seen		
						Sulphur-breasted Myzomela	2	S	0-25	Both males		
						Polynesian Triller	2	S	0-25			
						6 Golden Whistler	3	H	50-100			
						Fiji Bush Warbler	2	H	50-100			
						Polynesian Triller	1	S	25-50			
						Barking Pigeon	3	H & S	1 x 25-50, 1 x 50-100			
						Metallic Pigeon	1	H	50-100			
						Maroon Shining Parrot	1	H	100+			
						Scarlet Robin	1	H	25-50			
						7 Barking Pigeon	2	H	50-100			
						Maroon Shining Parrot	1	H	50-100			
						Vanikoro Flycatcher	2	H	25-50			
						Sulphur-breasted Myzomela	1	H	25-50			
						Golden Whistler	1	H	100+			
						8 Barking Pigeon	2	H	50-100			
						Polynesian Triller	1	H	25-50			
						Golden Whistler	2	H	25-50			
						Maroon Shining Parrot	1	H	100+			
						Scarlet Robin	1	H	0-25			
						9 Maroon Shining Parrot	1	H	100+			
						Golden Whistler	1	H	50-100			
						Sulphur-breasted Myzomela	1	H	50-100			
						Barking Pigeon	3	H	1 x 25-50, 2 x 100+			
						Polynesian Triller	1	H	50-100			
						10 Golden Whistler	2	H	25-50			
						Maroon Shining Parrot	2	H	50-100			
						Barking Pigeon	2	H	100+			
						Sulphur-breasted Myzomela	2	H	50-100			
13/07/2017	Road (700r	6.35	10.00	Cloudy	None	20-25	6/8	Polynesian Triller	1	H	25-50	
						1 Golden Whistler	5	H	0-25			
						Barking Pigeon	8	H	1 x 25-50, 7 x 100+			
						Maroon Shining Parrot	1	H	100+			
						Sulphur-breasted Myzomela	1	H	0-25			
						Fiji Bush Warbler	1	H	0-25			
						2 Barking Pigeon	6	H	100+			
						Golden Whistler	2	H	50-100			
						Silvereye	1	H	0-25			
						Fiji Bush Warbler	2	H	25-50			
						Orange Fruit Dove	1	H	100+			
						Sulphur-breasted Myzomela	3	H	0-25			
						3 Orange Fruit Dove	1	H	25-50			
						Golden Whistler	3	H	50-100			
						Fiji Woodswallow	2	H	100+			
						Fiji Shrikebill	1	H	50-100			
						Barking Pigeon	6	H	100+			
						Scarlet Robin	1	H	25-50			
						Metallic Pigeon	1	H	100+			
						Fiji Bush Warbler	1	H	25-50			
						Fan-tailed Cuckoo	2	H	50-100			
						4 Barking Pigeon	7	H	100+			
						Fiji Bush Warbler	1	H	25-50			
						Orange Fruit Dove	1	H	25-50			
						Golden Whistler	5	H	25-50			
						Maroon Shining Parrot	1	H	25-50			
						Polynesian Triller	1	H	25-50			
						Fiji Shrikebill	1	H	50-100			
						Metallic Pigeon	1	H	100+			
						Sulphur-breasted Myzomela	2	H & S	0-25			
						5 Fiji Bush Warbler	1	H	25-50			
						Sulphur-breasted Myzomela	8	H & S	0-25			
						Polynesian Triller	2	H	25-50			
						Barking Pigeon	4	H	100+			
						Golden Whistler	2	H	100+			
						Silvereye	1	H	25-50			
						6 Streaked Fantail	1	S	0-25			
						Golden Whistler	2	H	0-25			
						Fiji Shrikebill	1	H	50-100			
						Barking Pigeon	5	H	100+			
						Sulphur-breasted Myzomela	1	H	25-50			
						7 Wattled Honeyeater	2	H & S	0-25	Vunga flowers present		
						Sulphur-breasted Myzomela	6	H & S	0-25	Vunga flowers present		
						Orange Fruit Dove	2	H & S	0-25	Male and juvenile transitional male		
						Barking Pigeon	7	H	2 x 50-100, 5 x 100+			
						Silvereye	1	S	0-25			
						Maroon Shining Parrot	1	H	0-25			
						Collared Lory	2	H & S	F			
						8 Fiji Shrikebill	1	H	50-100			
						Sulphur-breasted Myzomela	2	H	50-100			
						White-rumped Swiftlet	1	S	F			
						Barking Pigeon	2	H	100+			
						Orange Fruit Dove	1	S	F			
						9 Golden Whistler	3	H	50-100			
						Barking Pigeon	4	H	100+			
						Fiji Bush Warbler	3	H	25-50			
						Sulphur-breasted Myzomela	1	H	0-25			
						Fiji Shrikebill	1	H	50-100			
						Maroon Shining Parrot	1	H	25-50			
						10 Fiji Bush Warbler	2	H	50-100			
						Golden Whistler	1	H	50-100			
						Barking Pigeon	4	H	100+			
						Sulphur-breasted Myzomela	1	H	50-100			
						Maroon Shining Parrot	1	H	100+			
14/07/2017	C 0m	6.30	9.45	Overcast	None	20-25	7/8	1 Barking Pigeon	2	H	100+	
						Golden Whistler	2	H	100+			
						Fiji Bush Warbler	1	H	50-100			
						Sulphur-breasted Myzomela	1	H	0-25			
						2 Polynesian Triller	1	H	50-100			
						Golden Whistler	3	H	50-100			
						Fiji Bush Warbler	2	H	50-100			
						Metallic Pigeon	1	H	100+			
						Barking Pigeon	4	H	100+			
						3 Fiji Bush Warbler	1	H	50-100			

							Maroon Shining Parrot	1	H	100+	
							Barking Pigeon	4	H	100+	
							Polynesian Triller	1	H	50-100	
							Golden Whistler	1	H	100+	
						4	Barking Pigeon	4	H	100+	
							Maroon Shining Parrot	1	H	100+	
							Polynesian Triller	1	H	100+	
							Scarlet Robin	1	H	50-100	
						5	Fan-tailed Cuckoo	1	H	100+	
							Silvereye	2	H & S	0-25	
							Barking Pigeon	2	H	100+	
							Fiji Shrikebill	1	H	100+	
							Fiji Bush Warbler	1	H	50-100	
							Orange Fruit Dove	1	H & S	100+	
							White-rumped Swiftlet	1	S	F	
						6	Barking Pigeon	3	H	100+	
							Fiji Shrikebill	1	H	50-100	
							Maroon Shining Parrot	2	H & S	50-100	
							Sulphur-breasted Myzomela	1	H	0-25	
							Golden Whistler	1	H	25-50	
							Fiji Bush Warbler	1	H	0-25	
							Fan-tailed Cuckoo	1	H	25-50	
						7	Fiji Bush Warbler	1	H	100+	
							Barking Pigeon	2	H	100+	
							Golden Whistler	1	H	50-100	
							Metallic Pigeon	1	H	100+	
						8	Barking Pigeon	2	H	100+	
							Maroon Shining Parrot	2	H	100+	
							Polynesian Triller	1	H	25-50	
							Metallic Pigeon	2	H	100+	
							Golden Whistler	1	H	100+	
							Fiji Bush Warbler	3	H & S	50-100	
						9	Fiji Bush Warbler	2	H & S	50-100	
							Barking Pigeon	2	H	50-100	
							Sulphur-breasted Myzomela	1	H	0-25	
							Metallic Pigeon	1	H	100+	
							Maroon Shining Parrot	1	H	25-50	
							Polynesian Triller	1	H	50-100	
						10	Barking Pigeon	5	H	100+	
							Fiji Bush Warbler	3	H	25-50	
							Sulphur-breasted Myzomela	1	H	25-50	
							Golden Whistler	1	H	50-100	
							Maroon Shining Parrot	1	H	25-50	
							Silvereye	2	H	25-50	
							Orange Fruit Dove	2	H	50-100	
21/07/2017	Road (400r	6.30	9.45 Rain	None	20-25	7/8	1	No birds			
							2	Barking Pigeon	3	S	1 x 0-25, 2 x 100+
							Golden Whistler	3	H	0-25	
							Scarlet Robin	1	H	25-50	
							Polynesian Triller	2	S	F	
							Maroon Shining Parrot	1	H	100+	
							Sulphur-breasted Myzomela	2	S	0-25	
						3	Sulphur-breasted Myzomela	1	H	0-25	
							Maroon Shining Parrot	1	H	100+	
							Barking Pigeon	1	H	100+	
							Fiji Bush Warbler	2	H	0-25	
							Orange Fruit Dove	1	S	0-25	
							Golden Whistler	2	H	25-50	
							Polynesian Triller	1	H	25-50	
							White-rumped Swiftlet	1	S	F	
						4	Maroon Shining Parrot	1	S	0-25	
							Golden Whistler	2	H	50-100	
							Barking Pigeon	3	H	100+	
							Fiji Bush Warbler	2	H	50-100	
							Silvereye	2	H	0-25	
							Fiji Shrikebill	1	S	25-50	
							Sulphur-breasted Myzomela	1	H	25-50	
						5	Barking Pigeon	3	H	100+	
							Orange Fruit Dove	1	H	0-25	
							Fiji White-eye	1	H	0-25	
							Polynesian Triller	1	H	0-25	
							Streaked Fantail	2	S	F	
							Golden Whistler	1	H	25-50	
							Fiji Bush Warbler	1	H	25-50	
						6	Barking Pigeon	4	H	50-100	
							Fiji Bush Warbler	2	H	50-100	
							Polynesian Triller	1	H	0-25	
						7	Sulphur-breasted Myzomela	2	H	0-25	
							Barking Pigeon	5	H	100+	
							Maroon Shining Parrot	1	H	100+	
							Golden Whistler	3	H	25-50	
							Polynesian Triller	1	H	25-50	
						8	Golden Whistler	1	H	50-100	
							Sulphur-breasted Myzomela	3	H	2 x 0-25, 1 x 50-100	
							Barking Pigeon	3	H	100+	
							Polynesian Triller	2	H	50-100	
							Maroon Shining Parrot	1	H	100+	
							Fiji Bush Warbler	1	H	50-100	
						9	Barking Pigeon	2	H & S	100+	
							Sulphur-breasted Myzomela	2	H & S	0-25	
							Fiji Bush Warbler	1	H	50-100	
							Silvereye	4	S	50-100	
						10	Barking Pigeon	5	H & S	100+	
							Sulphur-breasted Myzomela	3	H	25-50	
							Golden Whistler	2	H	50-100	
							Polynesian Triller	1	H	F	
							Common Myna	4	H	25-50	
							Maroon Shining Parrot	2	H	100+	
26/07/2017	Dam 0m	6.30	10.00 Overcast	None	15-20	7/8	1	Fiji Bush Warbler	2	H	0-25
							Barking Pigeon	4	H	100+	
							Maroon Shining Parrot	3	H & S	25-50	
							Golden Whistler	5	H	50-100	
							Sulphur-breasted Myzomela	1	H	F	
							Fiji Shrikebill	1	H	50-100	
						2	Sulphur-breasted Myzomela	1	H	0-25	
							Metallic Pigeon	1	H	100+	
							Barking Pigeon	2	H	100+	
							Golden Whistler	1	H	50-100	
							Fiji Bush Warbler	1	H	25-50	
						3	Barking Pigeon	3	H	100+	
							Metallic Pigeon	1	H	100+	
							Orange Fruit Dove	1	H	100+	
							Sulphur-breasted Myzomela	1	H	50-100	
							Collared Lory	2	H	25-50	
							Golden Whistler	1	H	50-100	
							Fiji Bush Warbler	1	H	0-25	
							White-rumped Swiftlet	1	S	F	
							Maroon Shining Parrot	1	H	25-50	
						4	Fiji Bush Warbler	2	H	0-25	
							Barking Pigeon	1	H	100+	
							Sulphur-breasted Myzomela	2	H	50-100	
							Fiji Shrikebill	1	H	50-100	

	Golden Whistler	3	H	1 x 50-100, 2 x 100+
	Silktail	1	H	25-50
5	Maroon Shining Parrot	2	H	25-50
	Sulphur-breasted Myzomela	2	H	0-25
	Barking Pigeon	3	H	100+
	Golden Whistler	2	H	50-100
	Silvereye	5+	H	25-50
6	Sulphur-breasted Myzomela	2	H	0-25
	Golden Whistler	3	H	25-50
	Barking Pigeon	1	H	25-50
	Orange Fruit Dove	2	H	0-25
	Fiji Bush Warbler	1	H	0-25
	Maroon Shining Parrot	2	H	0-25
7	Barking Pigeon	2	H	1 x 50-100, 1 x 100+
	Vanikoro Flycatcher	1	H	25-50
	Sulphur-breasted Myzomela	1	H	
	Fiji Bush Warbler	1	H	
	Streaked Fantail	1	S	
8	Barking Pigeon	3	H	
	Fiji Bush Warbler	1	H	
	Golden Whistler	3	H	
	Silktail	1	H	
	Maroon Shining Parrot	1	H	
9	Silktail	2	S	
	Barking Pigeon	2	H	
	Silvereye	4+	H & S	
10	Golden Whistler	2	H	
	Fiji Bush Warbler	1	H	
	Barking Pigeon	3	H	100+
	Sulphur-breasted Myzomela	1	H	25-50

Insects. Will Earle and Roy Wiles

Methods

Two general types of techniques are employed to sample insects, one which relies on the activity of entomologists, and the other which employs the activity of insects. The latter techniques depend on insects moving through their habitats, and thus being caught or trapped by static devices such as pitfall traps, flight intercept traps (FITs and malaise traps), and light traps. In this the first OpWall season in Fiji, pitfalls and FITs were not used, and though light traps were investigated, this was only to establish practical limitations and technologies. Species records were not compiled. Teams of school students with an entomologist accompanied by local guides went out every day from the forest camp to catch insects on the wing using hand held nets (mainly Lepidoptera). The same forest transects used by the floral and bird surveys were visited, though habitat data relating to insect species richness and abundance were not collected this year. A small reference collection of insects (mainly butterflies) was begun by training students to pin and mount adult insects and to curate them in entomological store boxes. Photographic records were created wherever possible.

Observations on the variations in wing patterns of the Common Crow butterfly *Euploea lewinii* (C & R Felder 1865) on Vanua Levu . Roy Wiles; *Operation Wallacea June 21 - July 16 2017*.

The most common butterfly encountered in our provisional insect survey was the Common Crow. The wing patterns seemed highly variable and so photographic and physical collections were made to investigate this. However, the story of the Common Crow is complex and unfinished. Below is a report on what we have found so far.

Introduction.

The Common Crow Milkweed butterfly is a highly polymorphic species in the Crows and Tigers subfamily [Danainae](#) ([Danaini](#) tribe), genus *Euploea*. It is an extremely difficult genus (Vane-Wright 1984) because milkweed butterflies are wide ranging, with island forms that each have at some time been named as separate species, given subspecific status or variously lumped together to form large polymorphic species. In general terms, the early taxonomists e.g. Moore (1883) described populations on different islands as a different species and subspecies. Later workers considered many of these island taxa to be subspecies of a wide ranging polytypic species. Thus, *Euploea* is a large genus historically with some 1046 species and 999 subspecies reported in 21 subgenera, now reduced to more than 60, often widespread species. It would seem that “no two workers agree to a species level classification of ... Danainae” (Ackery and Vane-Wright 1984), which is still true today. Five species are considered present in Fiji of which the Common Crow is the most common on Vanua Levu. Other Crows (paraspecies) reported from Fiji are:

- *Euploea boisduvalii boisduvalii* Lucas, 1853 = *Euploea proserpina* Butler, 1866
- **Long Branded Blue Crow** *Euploea algea* (Godart 1859) = *Euploea helcita escholtzii* Felder & Felder, 1865: 345
- *Euploea treischkei* (Boisduval 1832) = *Euploea jessica* Butler, 1869
- **Purple Crow** *Euploea tulliolus* (Fabricius 1793) = *Euploea westwoodii* (C&R Felder) = *Euploea leucostictos macleayii* Felder & Felder, 1865_ Small Brown Crow, Eastern Brown Crow, Dwarf Crow,
- **Common Crow** *Euploea lewinii* Felder & Felder, 1865 = *Euploea lewinii eschscholtzii*, = *Euploea intermedia* (Moore, 1883).

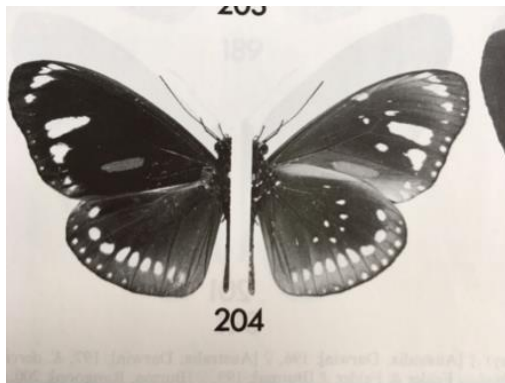
Synonymy of *E. lewinii*

Euploea (Nipara) unicolor (Druce, 1890)
Euploea (Nipara) walkeri (Druce, 1890)
Euploea bourkei (Poulton, 1924)
Euploea brunnescens (Carpenter, 1953)
Euploea distincta (Butler, 1874)
Euploea eschscholtzii (Felder & Felder, 1865)
Euploea indistincta (Moore, 1883)
Euploea intermedia (Moore, 1883)
Euploea lauensis (Carpenter, 1942)
Euploea lilybaea (Fruhstorfer, 1911)
Euploea mathewi (Poulton, 1924)
Euploea matilica (Fruhstorfer, 1911)
Euploea montrouzieri (Felder & Felder, 1865)
Euploea perryi (Butler, 1874)
Euploea unicolor (Druce, 1890)
Euploea walkeri (Druce, 1890)
Nipara indistincta (Moore, 1883)
Nipara intermedia (Moore, 1883)
Nipara unicolor (Druce, 1890)
Nipara walkeri (Druce, 1890)

The colloquial name “Common Crow” is given to 2 species of *Euploea*, *E. core* and *E. lewinii*. *E. core* with 15 subspecies is found from India to Australia excluding the South Pacific islands. *Euploea lewinii* is found in the south pacific islands including Fiji but excluding New Guinea, Australia and New Zealand. It has approximately 20 synonyms (see below) and is considered to be one polymorphic species with at least 8-9 named subspecies of which 6 are said to occur in the south pacific region. (Patrick and Patrick 2012).

Ackery and Vane-Wright (1984) discuss the taxonomic problems of *E. core* pointing out that often “populations have no more in common than the lack of certain morphological characters defining other species and non-coexistence.” In a cladistic analysis they recognised *E. core* as a paraspecies as opposed to cladospecies that have autapomorphies (monotypic) or synapomorphies (polytypic).

Fig 1 *E. boisduvalii* and *E. lewinii* from Ackery & Vane Wright (1984) Milkweed butterflies showing similarities in patterns (left wing =dorsal, right wing = ventral)



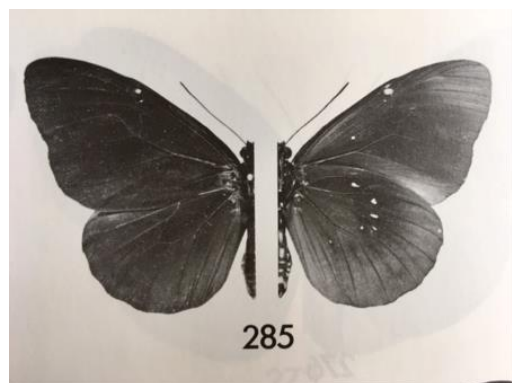
204 *E. boisduvalii boisduvalii* (Lucas) Fiji.



205 *E. boisduvalii brenchleyi* Butler, Solomon Isles.



284 *E. lewinii montrouzieri* Felfer & Felder Fiji, Taviuni. 285 *E. lewinii perryi* Butler f. *unicolor* Druce Cook Isles.



Ackery P. R. and Vane Wright R. I. (1984) treated the genus *Euploea* to a cladistic analysis and recognised the clade containing *E. boisduvalii*, (a clade including 11 other species including *E. core*), as different to the clade with *E. lewinii*, (also a clade including 11 other species), based on the shape of the male genitalia. The wing patterns are however, variable and can have very few spots as in 285 above. They can be very similar adding to the difficulties in identification. Our initial aims were to survey for butterflies to see which species were present and to make observations and ecological notes.

Methods

Surveys were carried out along trails and roads by simply walking with butterfly nets and cameras. Butterflies that could be identified at a distance were noted as having the potential for monitoring ecological change. Other species were caught in nets and identified in the hand then released. Some were collected and taken back to camp for identification. Photographic collections were made but these proved difficult for work on wing pattern analyses as they seldom recorded both front and hind wings, dorsal and ventral, of each specimen. Also there was no way of determining whether the same specimens were repeatedly photographed. However, photography did provide evidence of species present in the area.

For the work on variations in wing pattern of the Common Crow butterfly, a very common species in the area, a small collection was made and left with the local people for future reference.

Observations. On the Crow butterflies

The Common Crows we collected and identified as *E. lewinii* were based on Patrick and Patrick (2012). Physical and photographic collections of wings were made to investigate wing pattern variations. Our initial observations indicated a considerable variation both in patterns and sizes from specimens with few spots to specimens with many conspicuous spots and blotches. The wing patterns seem to encompass both *E. lewinii* and *E. boisduvalii* making identification based on wing pattern difficult.

Male wings



Fig 3 Dorsal and ventral wing patterns of male *E. lewinii*

Sex Brands /alar organs

Sex brands are located on the forewings of males which are covered by the hind wing when at rest. However, when the wings are opened the brand can be seen (Fig 4). There is a single sex brand on *E. lewinii*, which can sometimes be hard to see but is usually obvious when the wing is at an angle to the observer.



Fig 4 Male wings (underside) ventral and dorsal view. Sex brands indicated by arrows were removed and mounted in Hoyer's mountant on glass slides for microscopical examination.
Paper squares are 5mm²

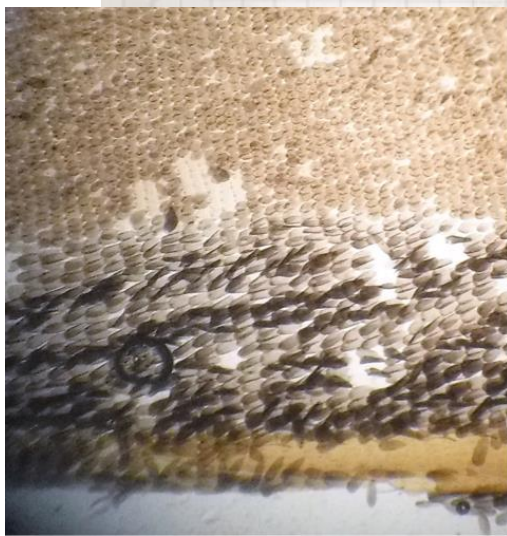
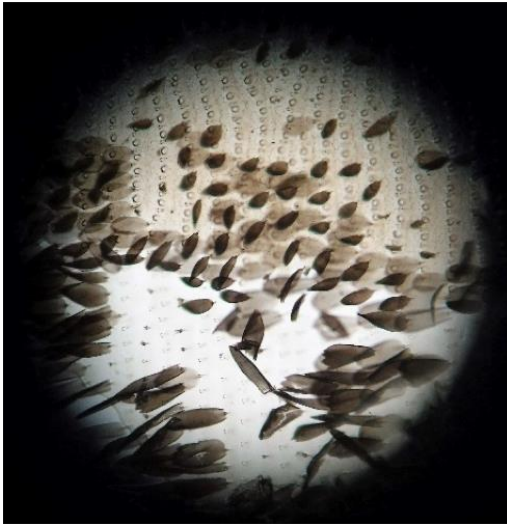


Fig 5 Dorsal and ventral wings of 3 males Note the size difference between the example above and those in Fig 4. Males have a curved (convex) posterior edge to the front wings (in females it is straight). Also, males have a pheromone storage area called a "sex brand" and indicated with an arrow (Fig 4) and seen under a microscope Figs 6a and 6b below.



Female Wings

Female wings: note the differences in spot sizes on both the underside and top of the hindwing. The female depicted in the bottom photo had the biggest spot patterns. It may be a different "species".



Discussion

Clearly, there is a fundamental taxonomic problem with the definition of species in *Euploea* and there is need of another comprehensive revision of the genus based on modern genetics.

The Purple Crow, a less common milkweed species and similar to the Common Crow (see below), was found at the same localities. It was easily identified based on wing pattern and may also have polymorphic wing patterns but this was not examined. It was in a different clade to both *E. lewinii* and *E. boisduvalii* in the cladistic analysis of Ackery and Vane Wright (1984) and is clearly a separate species.

E. lewinii are typical milkweed butterflies and are distasteful to predators (apostomatic). Therefore, other species mimic their patterns which further confuses the field identification of Fijian butterflies.

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Purple Crow left and Common Crow right

Insect species recorded on Natewa Peninsular, June to August, 2017, Roy Wiles

ORDER	FAMILY/SUBFAMILY	SCIENTIFIC NAME	COMMON NAME
Lepidoptera (butterflies)	Hesperiidae	<i>Oriens augustula</i>	Fijian Skipper
	Lycaenidae	<i>Jamides andrena</i>	Fijian Blue
	Lycaenidae	<i>Zizina otis</i>	Common Blue
	Nymphalidae/Danainae	<i>Danaus plexippus</i>	Monarch
	Nymphalidae/Danainae	<i>Euploea lewinii</i>	Common Crow
	Nymphalidae/Danainae	<i>Euploea tulliolus</i>	Purple Crow
	Nymphalidae/Danainae	<i>Tirumala namata neptunica</i>	Blue Tiger
	Nymphalidae/Nymphalinae	<i>Hypolimnas bolina</i>	Blue Moon
	Nymphalidae/Nymphalinae	<i>Jumonjia willida</i>	Meadow Argus
	Nymphalidae/Satyrinae	<i>Melanitis leda</i>	Evening Brown
	Nymphalidae/Satyrinae	<i>Xoisesesara</i>	Fijian Common Ringlet
	Papilionidae	<i>Papilio schmeltzi</i>	Fijian Swallowtail
	Pieridae	<i>Eurema hecabe sulphurata</i>	Common Sulphur
Lepidoptera (moths)	Geometridae	<i>Bulonga phillipsi</i>	Pale Green Carpet
	Noctuidae	<i>Chalcyope alcyona</i>	
	Uraniidae	<i>Urapteroides (Micronia) astheniata</i>	
Coleoptera (beetles)	Cerambycidae	<i>Olethius tyrannus</i>	Mango Longhorn Beetle
	Cicindellidae	<i>Cicindela vitiensis</i>	Fiji Tiger Beetle
	Curculionidae	<i>Bolbogaster stenostomoides</i>	Giraffe Weevil
	Gyrinidae	<i>Dineutes spp</i>	Whirligig Beetle
	Scarabaeidae	<i>Oyctes rhinoceros</i>	Rhinoceros Beetle
Diptera (flies)	Asilidae	<i>Promachus triumphans</i>	Giant Robber Fly
	Syrphidae	<i>Simosyrphus grandicornis(?)</i>	Orange Hoverfly
Hemiptera (true bugs)	Scutelleridae	<i>Tectocoris triumphans</i>	Emerald Green Stink Bug
Phasmida (mantidas)			
Hymenoptera (bees, ants, wasps & sawflies)			

Gastropod molluscs. Gillianne Brodie

Field Sampling Forest base camp (Niuvudi)

Monday 31st July 2017

To Marked plots of Andrew Powling (botanist)

31/07/17. *Site 1*. Up forestry track behind camp, at about 200 m along track, left turn into the secondary forest, about 30 m into forest to area with tagged trees. No snails found.

GPS: S 16 degrees 38.190 minutes; E 179 degrees 45.324 minutes.

31/07/17. *Site 2*. From Site 1 continue approx. another 100 m into forest away from forestry track, to top of low flat ridge. Second area with tagged trees. Two snails found.

GPS: S 16 degrees 38.184 minutes; E 179 degrees 45.363 minutes.



Figure 1. Site 2

Random searching in leaf litter found two empty land snail shells (Figures 2A & B), both are endemic to Fiji. *Callistocharis fulguratus* is a relatively common species of placostylid found on the islands of Viti Levu, Vanua Levu, Ovalau and Beqa (Brodie 2012) while *Callistocharis elobatus* is considered endemic to the island of Vanua Levu (Barker *et al.* 2016) and was last scientifically recorded by sighting of living specimens in 1972 (Brodie & Barker 2012a). Living populations of these species are considered as “least concern” and “vulnerable” respectively on the IUCN Redlist for threatened species.

The area sampled was relatively dry secondary forest that had been previously logged.



Figure 2A. Empty shell of *Callistocharis fulguratus* (Jay 1842) (= *Placostylus fulguratus*). Collector Holly Page. Location within 2 metres of Marked Tree No. 0725. Photograph G. Brodie.



Figure 2B. Empty shell of *Callistocharis elobatus* (Gould 1846) (= *Placostylus elobatus*). Collector Madeleine Brolly. Location within 2 metres of Marked Tree No. 0725. Photograph G. Brodie.

The local guide Tevita (David) was very surprised when we found these shells and said he has not seen them before, either as dead shells or living species. Permission for transfer of these two empty shells to USP was obtained from Ratu Gilbert. They will be placed in the curated collections on the lower Laucala campus.

01/08/17 Site 3. Road from camp, direction Natewa Village, for approx. 600 m, turn off to left for track towards the dam (supplying water to the camp). Follow track for approx. 800 m to a comparatively level area on true right bank of stream. Large trees right beside track, trees tagged. Snails found.

GPS: S 16 degrees 37.592 minutes; E 179 degrees 44.883 minutes.



Figure 3. Site 3

Introduced species

Only two of the possible nineteen introduced species of land snail known from Fiji were found during both targeted and opportunistic sampling. These were *Quantula striata* and *Parmarion martensi*. The latter will be discussed under invasive species below the former is considered as a low risk species. Fact sheets for both of these species are available



Figure 4. *Quantula striata* Photo G. Brodie

Invasive Species

What was not seen is probably just as important as what was seen.

The semi-slug *Parmarion martensi* which is currently considered the highest risk introduced/invasive snail currently in Fiji (Brodie & Barker, 2011) was seen but not in large numbers as observed in other forested areas of Fiji (Brodie & Copeland 2010; Brodie et al. 2014). *P. martensi* was also not observed in the forest camp at night which was surprising. This is expected to change overtime because the species is well adapted to the presence of humans (Brodie & Barker 2012b).



Figure 5. *Parmarion martensi* (photo www.NatureLoveYou.sg)

Significantly, not seen was the highly invasive flatworm *Platydemus manokwari* well documented by Justine *et al.* (2015), which was scientifically recorded in Fiji for the first time in 2012 (Brodie *et al.* 2014) and has since spread to Viti Levu (personal observation). This species is a well-recognized threat to native snails world wide and particularly Fiji's endemic snail species.

Marine base camp

Friday August 4th 2017

There was an abundance of living and empty shells of the land snail *Pythia scarabaeus* (Linnaeus 1758) present in the coastal vegetation around the marine camp. The species is common and wide spread in the Indo-Pacific . When searching for these species I notice wide spread ant activity beyond expected levels. These ants appeared to be non-stinging and were also present on tents in the camping area. My guess would be yellow crazy ants which are documented in Fiji (Sarnat & Economo 2012).



Figure 6. Living specimen of *Pythia scarabaeus* Photo G. Brodie

Nearshore benthos

An hour was spent snorkeling off shore a few kilometres to the north east of the marine camp looking for a suitable site to set up seagrass monitoring. The fauna close to the creek mouths was smothered by runoff but trying hard to recover. A project to prevent this soil erosion impacting on the reef would be worthwhile, perhaps a good project with NFMV. The fauna in general close to shore was excellent and a wide diversity of marine fauna particularly invertebrates was observed in a short space of time. I would be very interested to help look at marine invertebrate fauna in this benthic habitat.

A very small sample of the single species seagrass found (*Halophila ovalis subspecies bullosa* – see photograph below) was returned to USP to contribute to a molecular taxonomic study of Fiji species currently being undertaken by one of my PhD students, the specimen was also flowering (marked in photograph which was unexpected and useful data. This subspecies is endemic to Fiji, Tonga and Samoa (Tuiwawa et al. 2014).



Figure 7. Photograph by Shalini Singh. Sampled collected by G. Brodie August 4th, 2017, location is 2km north of Operation Wallacea Marine Camp, ~5 kms south of Natewa Village, on western side of Natewa Bay. Approximate GPS location is S 16.38, E 179.42. ~ 10 metres off shore, estimated depth 2-3 metres.

An hour was spent snorkeling directly off shore at the marine station, the area is also diverse and relatively health considering its usage.

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- Appendix 1: USP Fact Sheets on introduced snail species *Quantula striata* and *Parmarion martensi*. Available as separate files.

Trees, shrubs and other flora. Andrew Powling

FOREST QUADRATS

Methods

The site for each quadrat was chosen for being representative of a part of the forest. Quadrats were normally situated on or close to the line of a transect through the forest, in a position where access to all parts of the quadrat was possible. The measurements and recording in the quadrat were shared among a group of people, which included at least four students.

The quadrats were 20 m x 20 m in size. A 20m baseline was established, then two side lines at 90 degrees were measured along a compass bearing. The fourth side was measured to ensure it was also 20 m long, with slight adjustments being made to the side lines if necessary. The four corners were marked with pink flagging tape which was left after the work. Tape measures marking the sides of the quadrat were left in place during the work. The height of one tree was calculated. A tree was chosen with visible top and bottom. The distance to the base of the tree was measured and the angle to the top of the tree measured using an Invicta clinometer; the tangent of the angle was then obtained. The distance and the tangent were multiplied to give the height of the tree above the horizontal. A similar procedure was used to measure the difference between the bottom of the tree and the horizontal. These figures were then added or subtracted as appropriate to give the actual height of the tree above ground level. This tree was then used as a standard reference for the visual estimation of the heights of the other trees in the quadrat. All height estimates were made to the break-of-crown rather than to the highest point. The estimates were all made by one person (AP) to ensure consistency, but as the upper parts of some trees were not visible from below these estimates represent a source of inaccuracy in the work.

The circumference at breast height (cbh) of trees was measured; all trees with a cbh ≥ 30 cm (and therefore a diameter of ≥ 9.5 cm) were recorded and marked with a tree tag. Heights of these trees were estimated and an identification of their species was obtained from our local forest guide, Tevita Raicoi (David).

The slope of the ground in each quadrat was measured using a clinometer, from one side to the opposite side along the line of the maximum angle. To obtain a measure of the number of stems with cbh between 30cm and 3cm, 4m x 4m quadrats were marked out in each corner of the 20m x 20m quadrat. A count of such stems was made in each smaller quadrat. The positions of some quadrats were recorded using a GPS receiver but, due to the accidental loss of a receiver, this was not done for all quadrats. The following information gives instructions for finding the quadrats. The presence of tags on the trees and flagging tape at the corners will show the exact position and extent of a quadrat. Tevita Raicoi (David) would be of great assistance in re-finding these quadrats.

Quadrat positions

Quadrat 1. (13/06 + 14/06). From the lower, northerly end of Transect E go past the first ravine and continue for approx. 50 m to the foot of a slope. The Quadrat covers the slope. GPS: S 16° 38.241'; E 179° 45.200'.

Quadrat 2. (16/06). Follow the forestry track from behind the camp to its end where it meets the top of Transect E. Turn right into the forest and go in approx. 10 m. Alternatively follow Transect E to its higher, southerly end.
GPS: 16° 38.365'; E 179° 45.287'.

Quadrat 3. (21/06 + 23/06). Follow the road from the camp in the direction of Natewa village, to the start of Transect A. Enter the forest and continue for approx. 100m to where the transect climbs steeply. The quadrat covers the slope to left and right of the transect path, the trees being marked with tags. No GPS reading.

Quadrat 4. (28/06). Up forestry track behind camp (Transect F), at about 200 m along track, left turn into the secondary forest, about 30 m into forest to area with tagged trees.
GPS: S 16° 38.190'; E 179° 45.324'.

Quadrat 5. (29/06 + 30/06). From Quadrat 4 continue approx. another 100 m into forest away from forestry track, to top of low flat ridge. Second area with tagged trees.
GPS: S 16° 38.184'; E 179° 45.363'.

Quadrat 6. (05/07). As for Quadrat 3 and continue along Transect A path for approx. another 100m to the start of another steep upward slope. The Quadrat extends left and right from the path with the trees tagged. No GPS reading.

Quadrat 7. (12/07). Follow the road from camp, direction Natewa Village, for approx. 600 m. At the start of the first steep hill turn off to left along track towards the dam (supplying water to the camp). Follow track for approx. 1000m to a comparatively level area on true right bank of stream. Large trees right beside track, trees tagged.
GPS: S 16° 37.592'; E 179° 44.883'.

Quadrat 8. (13/07 + 14/07). From Quadrat A continue upstream for approx. 50 m, then go right for approx. 30 m to the foot of a steep slope forming the side of the valley. The quadrat runs up the slope.
GPS: S 16° 37.565'; E 179° 44.882'.

Quadrat 9. (19/07 + 21/07). Follow the road from camp, direction Natewa Village, for approx. 400 m, turn left along broad track, cross the stream and continue approx. 50m to the start of Transect C on the right. Follow the transect to its end, descend steeply to the stream, cross the stream and scramble 10m up the other side to the tagged trees. The quadrat extends up the side of the valley. No GPS reading.

Quadrat 10. (27/07). Follow the road from camp, direction Natewa Village, for approx. 550 m, turn left onto the broad flat track and follow Transect B. Continue along the transect path for approx. 600m to a more or less flat area following a steep scrambling ascent. The quadrat with tagged trees is to the left of the track. No GPS reading.

Quadrat 11. (28/07). As for Quadrat 10, continue for approx. another 50m. The quadrat is to the left of the transect path. No GPS reading.

Tree and shrub species recorded on the Natewa Peninsular, July/August 2017. Anrew Powling

BINOMIAL	LOCAL NAME	HABITAT	STATUS
Agathis macrophylla	Dakua ('makadre' 'makandre')	Forest	Indigenous
Alstonia costata	Bulei	Forest	Indigenous
Alstonia macrophylla	Vavaoia	Forest, Roadsides	Introduced, Naturalising
Alstonia vitiensis	Drega ('Ndrenga')	Forest	Endemic to Fiji
Artocarpus altiss	Uto	Gardens, Roadsides	Introduced, Cultivated
Atuna acemosa	Makita	Forest	Indigenous
Balaka macrocarpa		Forest	Endemic to Vanua Levu & Taveuni
Balaka seemannii		Forest	Endemic to Vanua Levu & Taveuni
Barringtonia asiatica	Vutu	Coastal	Indigenous
Barringtonia edulis	Vutu	Forest	Indigenous
Bischofia javanica	Koka	Forest	Indigenous
Burckia fijiensis	Bulu	Forest	Endemic to Fiji
Calophyllum feraciferum		Roadside	Endemic to Fiji
Calophyllum inophyllum	Dilo	Coast	Indigenous
Calophyllum vitiense	Damanu	Forest	Endemic to Fiji
Cananga odorata	Makosoi	Coastal	Indigenous
Casuarina quisetifolia	Nokonoko	Coastal, Villages	Indigenous
Cerbera manghas	Vasa	Forest	Indigenous
Cinnamomum spp.	Macou ('Mathou')	Primary forest	Endemic to Fiji
Cocos nucifera	Niu	Plantations, Habitations	Introduced
Cordia subcordata	Nawanawa	Coastal	Indigenous
Cyathia unulata (or medullaris)		Forest, Grassland	Indigenous
Dacrydium nidulum	Yaka	Forest	Indigenous
Decaspermum vitiense	Nuqanuqa ('Nunganunga')	Forest	Endemic to Fiji
Dendrocnide harveyi	Salato ('Sialato')	Forest	Indigenous
Dracontomelon vitiense	Tarawau	Coastal	Indigenous
Dysoxylum lenticellare	Tarawaukeikaka	Forest	Endemic to Fiji
Elaeis guineensis		Planted, Forest	Introduced
Endospermum obbeianum	Kauvula	Forest	Endemic to Fiji
Fagraea racilipes	Buabua ('Mbumbua')	Forest	Endemic to Fiji
Ficus benjamina	(Lolo)	Planted, Villages	Introduced, Cultivated
Ficus ficabra	(Lolo)	Forest	Indigenous
Ficus elastica	(Lolo)	Planted, Villages	Introduced, Cultivated
Ficus fulvo-pilosa	(Lolo)	Forest	Endemic to Fiji
Ficus greenwoodii	(Lolo)	Forest, Beside streams	Endemic to Fiji
Ficus masonii	(Lolo)	Forest	Endemic to Fiji
Ficus obliqua	(Lolo)	Forest	Indigenous
Ficus mithii var. robusta	(Lolo)	Forest	Indigenous
Ficus vitiensis	(Lolo)	Forest	Endemic to Fiji
Geissosternata	Vure ('Vureh')	Forest, Roadsides	Indigenous
Glochidion f. mentuligerum	Molau ('Tagane')	Forest	Endemic to Fiji
Glochidion seemannii	Molau	Forest	Endemic to Fiji
Gmelina vitiensis	Rosawa	Forest	Endemic to Fiji
Grewia krenata	Siti	Forest	Indigenous
Guettardia speciosa		Coastal (Savusavu)	Indigenous
Gymnostoma vitiense	Caukuro ('Thaukuro')	Forest	Endemic to Fiji
Hernandia myrphaeifolia	Evuevu	Coastal (Savusavu)	Indigenous
Hibiscus illicaceus	Vau	Coastal	Indigenous
Inocarpus fagifer	Ivi	Coastal	Indigenous
Intsia bijuga	Vesi	Coastal	Indigenous
Kleinhovia hospita		Coastal	Indigenous
Lantana camara		Ruderal	Introduced, Naturalised
Lumnitzera littorea		Coastal	Indigenous
Macaranga spp. (inc. harveyana, magna, Se-Rote) ('Roteh')		Forest	Indigenous (all three spp.)
Mangifera indica		Villages	Introduced, Cultivated
Maniltoa loribunda (or M. vestita)	Cibicibi ('Thibithibi')	Forest	Endemic to Fiji (both spp.)
Metrosideros collina var. collina	Vuga ('Vunga')	Forest, Roadsides	Indigenous
Milletia pinnata	Vesivesi	Coastal	Indigenous
Morinda citrifolia	Kura	Coastal	Indigenous
Mussaenda aiataensis	Bobo	Forest	Indigenous
Myristica spp. (inc. grandifolia)	Male ('Maleh')	Forest	Endemic to Fiji (M. grandifolia)
Neolamarckia adamba	Kadaba ('Kandamba')	Plantations, Roadsides	Introduced
Neonaucalea forsteri	Vacea ('Vathea')	Primary forest	Indigenous
Palaquium thornei	Sacau ('Sathau')	Forest	Endemic to Fiji
Palquium porphyreum	Bauvudi ('Bauvundi')	Forest	Endemic to Fiji
Pandanus tectorius s.l.	Vadra ('Vandra')	Coastal	Indigenous
Parinari insularum	Seai ('Seah')	Forest	Indigenous
Pinus taribaea		Plantations, Roadsides	Introduced, Cultivated
Piper dundum	Yaqoqona ('Yangangona')	Forest	Introduced, Naturalised
Podocarpus heriifolius	Kuasi	Forest	Indigenous
Pometia pinnata	Dawa	Forest	Indigenous
Pritchardia pacifica	Seiki ('Masei')	Planted, Habitations	Introduced, probably
Psidium guajava	Guava	Roadsides	Introduced, Naturalised
Retrophyllum vitiense	Dakua ('alusalu')	Forest	Indigenous
Rhus amarubifolia	Manawi	Forest	Indigenous
Samanea saman	Vaivali ('Vavalagi, Mocemoce' 'Mot')	Habitations, Coastal	Introduced, Cultivated
Scaevola accada		Coastal (Savusavu)	Indigenous
Serianthes melanesica	Vaivali ('Vavalagi')	Forest, Roadsides	Endemic to Fiji
Spathodea ampanulata	Pisipisi	Forest, Roadsides	Introduced, Naturalised
Swietenia macrophylla	Mahogany ('large leaf')	Roadsides, Plantations	Introduced
Swietenia mahogani	Mahogany ('small leaf')	Roadsides, Plantations	Introduced
Syzygium malaccense	Kavika	Forest	Introduced, Naturalised
Syzygium neurocalyx	Lebai ('Lemba')	Primary forest	Indigenous
Syzygium spp. (inc. S. wolfii)	Yasiasili ('Yasimoli')	Forest	Endemic to Fiji (S. wolfii)
Terminalia toralis	Tavola	Coastal	Indigenous
Terminalia spp.	Tivi	Forest	Endemic to Fiji
Thespesia populnea		Coastal	Indigenous
Veitchia lillifera		Forest	Endemic to Vanua Levu & Taveuni
Veitchia joannis		Forest, Coastal	Endemic to Fiji

Photo guide to trees and shrubs of Natewa Peninsular, Andrew Powling

TREE FERNS

CYATHEACEAE

Cyathea lunulata



GYMNOSPERMS

ARAUCARIACEAE

Agathis macrophylla *Dakua makadre*



PINACEAE

Pinus caribaea (Introduced to Fiji)



PODOCARPACEAE

Dacrydium nidulum Yaka



Podocarpus neriifolius Kuasi



Retrophyllum vitiense Dakua salusalu



ANGIOSPERMS

ANACARDIACEAE

Dracontomelon vitiense Tarawau (Coastal)



Rhus simarubifolia Manawi



APOCYNACEAE

Alstonia costata Bulei



Alstonia macrophylla Vavaoia (Introduced to Fiji)



Alstonia vitiensis Drega ('Ndrenga')



Cerbera manghas Vasa



BIGNONIACEAE

Spathodea campanulata Pisipisi (Introduced to Fiji)



BORAGINACEAE

Cordia subcordata Nawanawa (Coastal)



CASUARINACEAE

Casuarina equisetifolia Nokonoko (Coastal)



Gymnostoma vitiense Caukuro ('Thaukuro')



CHRYSOBALANACEAE

Atuna racemosa Makita



Parinari insularum Sea (Seah) / Sa



CLUSIACEAE

Calophyllum vitiense Damanu



Calophyllum cf. *cerasiferum*



COMBRETACEAE

Lumnitzera littorea Sagale (Coastal)



Terminalia litoralis Tavola (Coastal)



Terminalia sp. Tivi



CUNONIACEAE

Geissois ternata Vure ('Vureh')



EUPHORBIACEAE

Bischofia javanica Koka



Endospermum robbianum Kauvula



Glochidion seemanii Molau



Glochidion cf. *amentuligerum* Molau tagine



Macaranga harveyana Rote ('Roteh')



Macaranga magna Rote



Macaranga seemanii Rote



HERNANDIACEAE

Hernandia nymphaeifolia Evuevu (Coastal)



LAURACEAE

Cinnamomum sp. *Macou* ('Mathou')



LECYTHIDACEAE

Barringtonia asiatica *Vutu* (Coastal)



Barringtonia edulis *Vutu* (Forest)



LEGUMINOSAE (FABACEAE)

Maniltoa floribunda or *vestita* Cibicibi ('Thibithibi')



Serianthes melanesica Vaivai ni Vavalagi / Vaivai ni viti



Inocarpus fagifer Ivi (Coastal)



Millettia pinnata Vesivesi (Coastal)



LOGANIACEAE

Fagraea gracilipes Buabua ('Mbumbua')



MALVACEAE

Hibiscus tiliaceus Vau



Thespesia populnea



MELIACEAE

Dysoxylum lenticellare Tarawaukeikaka



Sweitenia macrophylla Mahogany (Large-leaved, introduced to Fiji)



Sweitenia mahoganiana Mahogany (Small leaved, introduced to Fiji)



MORACEAE

Artocarpus altilis Uto



Ficus benjamina (Introduced to Fiji)



Ficus elastica (Introduced to Fiji)



Ficus fulvo-pilosa



Ficus greenwoodii



Ficus masonii



Ficus obliqua



Ficus cf. scabra



Ficus smithii var. *robusta*



Ficus vitiensis



MYRISTICACEAE

Myristica grandifolia Male ('Maleh')



MYRTACEAE

Decaspermum vitiense Nuqunuqu ('Nunganunga')



Metrosideros collina var. *collina* Vuga ('Vunga')



Syzygium malaccense Kavika (Introduced to Fiji, naturalised)



Syzygium neurocalyx Leba ('Lemba')



Syzygium wolfii Yasiyasi / Yasimoli



PALMAE

Balaka seemanii



Balaka macrocarpa



Cocos nucifera Niu



Elaeis guineensis (Introduced to Fiji)



Pritchardia pacifica Seiki / Masei



Veitchia filifera



Veitchia joannis



RUBIACEAE

Morinda citrifolia Kura



Mussaenda raiateensis Bobo



Neolamarckia cadamba Kadama ('Kandamba', introduced to Fiji)



Neonauclea forsteri Vacea ('Vathea')



SAPINDACEAE

Pometia pinnata Dawa



SAPOTACEAE

Burckiella fijiensis Bulu



Palaquium hornei Sacau ('Sathau')



Palaquium porphyreum Bauvudi ('Bauvundi')



TILIACEAE

Grewia crenata Siti



URTICACEAE

Dendrocnide harveyi Salato / Silato



VERBENACEAE

Gmelina vitiensis Rosawa



Non-tree species recorded on the Natewa peninsular, June to August 2017

BINOMIAL	LOCAL NAME	PLANT TYPE	COMMENT
<i>Huperzia phlegmaria</i>		Clubmoss	Forest epiphyte
<i>Lycopodium cernuum</i>		Clubmoss	Open ground
<i>Selaginella sp./spp.</i>		Clubmoss	Forest ground level
<i>Angiopteris evecta</i>		Fern	Streamsides in forests
<i>Antrophyum alatum</i>		Fern	Forest epiphyte
<i>Asplenium cf. longissimum</i>		Fern	Forest edges
<i>Asplenium nidus</i>		Fern	Forest epiphyte
<i>Blechnum orientale</i>		Fern	Tracksides, open situations
<i>Dicranopteris linearis</i>		Fern	Open situations
<i>Dipteris cf. conjugata</i>		Fern	Road cuttings
<i>Drynaria cf. rigidula</i>		Fern	Forest scrambler
<i>Lygodium reticulatum</i>		Fern	Forest epiphyte
<i>Phymatodes sp.</i>		Fern	Forests
<i>Pyrrosia lanceolata</i>		Fern	Forest epiphyte
<i>Schizaea dichotoma</i>		Fern	Forest ground level
<i>Stenochlaena cf. palustris</i>		Fern	Forest climber
<i>Trichomanes aff. elongatum</i>		Fern	Forest ground level
	Gasau ni		
<i>Arundo donax</i>	valalagi	Grass	Introduced, roadsides, very common
<i>Centotheca lappacea</i>		Grass	Forest openings
<i>Cyperus aromaticus</i>		Sedge	Wet places
<i>Imperata cylindrica</i>	Gi ('Ni')	Grass	Open situations, very common Roadsides, open vegetation, very common
<i>Miscanthus floridulus</i>	Gasau	Grass	common
<i>Paspalum conjugatum</i>		Grass	Open ground
<i>Saccharum x edule</i>		Grass	Cultivated near streams
<i>Sacciolepis indica</i>		Grass	Open ground
<i>Ageratum conyzoides</i>		Herb	Open ground
<i>Alocasia macrorrhiza</i>		Herb	Wet places in forests
<i>Alternanthera sessilis</i>		Herb	Open ground
<i>Caladium bicolor</i>		Herb	Planted in forest camp
<i>Desmodium triflorum</i>		Herb	Grassy places
<i>Erechthites valerianifolia</i>		Herb	Open ground
<i>Lindernia crustacea</i>		Herb	Open ground
<i>Lindernia sessilifolia</i>		Herb	Open ground
<i>Ludwigia hyssopifolia</i>		Herb	Open ground
<i>Melastoma sp.</i>		Herb	Roadsides
<i>Mimosa pudica</i>		Herb	Common, roadsides, open ground
<i>Oxalis corniculata</i>		Herb	Open ground

<i>Phyllanthus sp.</i>		Herb	Open ground
<i>Piper methysticum</i>	Kava	Herb	Cultivated
<i>Tridax procumbens</i>		Herb	Grassy places
<i>Calanthe hololeuca</i>		Orchid	Ground, in sec. forests
<i>Dendrobium cf. spathulatum</i>		Orchid	Epiphytic on trees
<i>Dendrobium cf. takai</i>		Orchid	Epiphytic on trees
<i>Dendrobium catillare</i>		Orchid	Epiphytic on trees
<i>Liparis elegans</i>		Orchid	Epiphytic on trees
<i>Oberonia heliophora</i>		Orchid	Epiphytic on trees
<i>Peristylus maculifer</i>		Orchid	Epiphytic on trees
<i>Spathoglottis pacifica</i>		Orchid	Roadsides, bare ground
<i>Clidemia hirta</i>		Shrub	Secondary forests
<i>Colubrina asiatica</i>		Shrub	Coastal
<i>Costus spiralis</i>		Shrub	Roadsides, open vegetation
<i>Lantana camara</i>		Shrub	Open situations Disturbed habitats, roadsides, pink flowers
<i>Stachytarpheta mutabilis</i>		Shrub	flowers
<i>Stachytarpheta urticaefolia</i>		Shrub	Roadsides, spikes with blue flowers
<i>Hydnophytum cf. longistylum</i>		Epiphyte	Ant plant
<i>Flagellaria indica</i>		Scrambler	Secondary forests
<i>Ipomoea indica</i>		Scrambler	Open situations
<i>Merremia peltata</i>		Scrambler	Forest edges, very common
<i>Mikania micrantha</i>		Scrambler	Open situations
<i>Passiflora foetida</i>		Scrambler	Open situations
<i>Rubus moluccanus</i>		Scrambler	Open vegetation
<i>Entada phaseoloides</i>		Liana	Forests, very large pods
<i>Freycinetia storckii</i> or <i>impavida</i>	Mere	Climber	Sword leaves
<i>Smilax vitiensis</i>		Climber	Forest vine

Ant Plants (Hydnophytinae: *Squamellaria*) and Ants (Dolichoderinae: *Philidris*)

Introduction

The taxonomy of Fijian ant plants has been recently revised by Chomicki and Renner (2016) and their association with ant hosts investigated. They identify 12 species in the genus *Squamellaria* (up from 3) of which 9 species are in the Fijian clade of which five are reported from Vanua Levu. They also produced a Key to the species. *S. tenuiflora*, *S. wilkinsonii* and *S. jebbiana* are not possible to separate from their morphology but on Vanua Levu the species would probably be *S. wilkinsonii*.

Squamellaria grayi Vanua Levu /Taveuni

S. major Taveuni

S. huxleyana Vanua Levu

S. thekii Taveuni

S. imberbis Vanua Levu

S. wilsonii Taveuni

S. tenuiflora Viti Levu

S. wilkinsonii Vanua Levu

S. jebbiana Taveuni

Three other species are identified : *S. kajawskii* and *S. guppyana* from the Solomons and *S. vanuatuensis* from Vanuatu.

Observations

In the field we could only identify the ant plant to Genus. The leaves of the plants observed were thin and fleshy on wood twigs. Leaf length/breadth approximately 575mm x 200mm; twig length



Squamellaria sp. From Vanua Levu base camp. Ants are *Philidris nagasau*, endemic to Fiji.

approximately 30cms long. The widest cross-sectional diameter of the swollen stem was approximately 9cms. Its length was not measured. The outer epidermis was rough but not hairy and entrance holes were slightly raised. Absorptive white tubercles/warts, seen dotted on the inside walls of the some chambers, are thought to collect nutrients from decaying ant faeces and cadavers. Chambers occupied by ant larvae and eggs are generally smooth.

The ants are *Philidris nagasau* (Subfamily Dolichoderinae). The top of the head is deeply concave in full face view. These were also studied by Chomicki et al (2016) who found that the ants farmed 6 species of ant plants by embedding seeds in cervices in tree bark. They regularly visited the seedlings and occupied the chambers in the mature plants. It seems that 3 million years ago the ants lost the ability to build nests which is coincident with the ant-plants ability to grow roots into bark.

We found that all stages of ant development were present in the chambers and faecal remains and a dead body were observed in some chambers that were unoccupied.



Philidris nagasau from *Squamellaria*
sp. Ant plant

References

Chomicki G, Renner S. S. (2016) Evolutionary Relationships and Biogeography of the Ant-Epiphytic Genus *Squamellaria* (Rubiaceae: Psychotrieae) and Their Taxonomic Implications. PLoSONE11(3): e0151317.doi:10.1371/journal.pone.0151317.

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