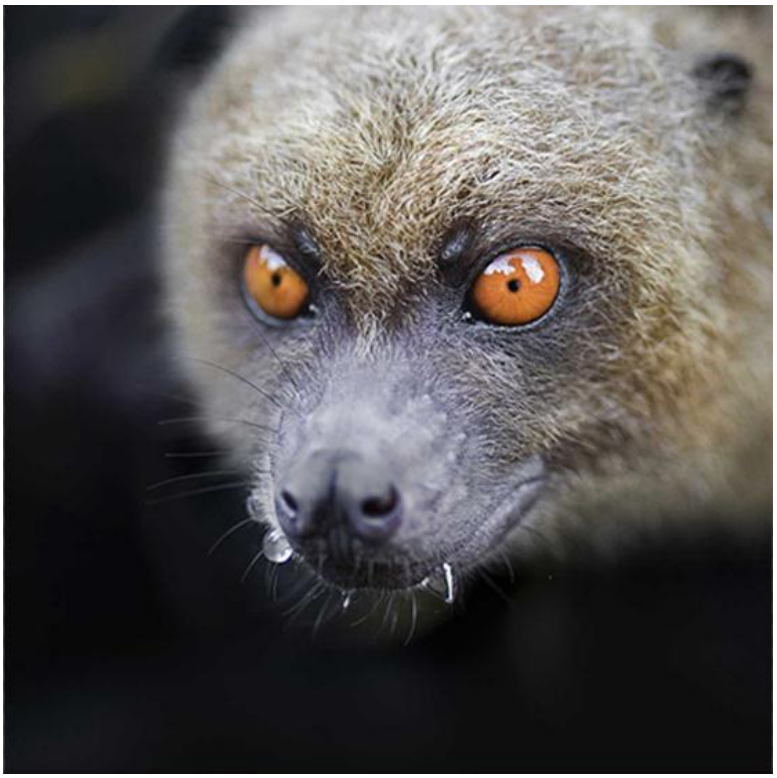
Survey for the Fiji flying fox (*Mirimiri acrodonta*)

On Taveuni Island, Fiji



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Cover page picture: *Mirimiri acrodonta*. © Jörg Kretzschmar

INTRODUCTION

The Fiji flying fox *Mirimiri acrodonta* (see figure 1) is Fiji's only endemic mammal. It occurs in the highlands of Taveuni Island, the third largest island on Fiji. The Fiji flying fox is listed as Critically Endangered on the IUCN Red List of Threatened Species (Helgen et al. 2008). It has been captured only six times since its discovery in 1978 (Hill and Beckon 1978). Its range seems to be severely restricted, the bat has only ever been caught and seen in the montane cloud forest around Des Voeux peak in Taveuni (see figure 2) (Flannery, 1995, Hill and Beckon, 1978, Scanlon, 2009).

Figure 1. *Mirimiri acrodonta.* Photograph by Guy Bottroff.

As part of a project on the 'Conservation of the Critically Endangered Fiji flying fox *Mirimiri acrodonta* on Taveuni Island, Fiji', NatureFiji-MareqetiViti (NFMV) has prepared a Species Recovery Plan for the Fiji flying fox (Watling, 2010). The first objective of this Recovery Plan is to determine the Fiji flying fox's distribution and landscape use on Taveuni. The Fiji flying fox has only been observed in the high altitude forests on Taveuni, and it has been presumed to occur only in forest above 800 m asl (Scanlon, 2009, Helgen, 2004, Flannery, 1995). However, there have been no significant surveys to provide any evidence for this. The proposed action was to undertake mist net trapping surveys in the lower altitude forest on Taveuni to determine whether its habitat extends beyond the montane cloud forests.

In April 2012, a survey for *Mirimiri acrodonta* on Taveuni was undertaken by Kelera Macedru, (Conservation Officer for NFMV), Hugh Spencer (bat researcher at the Australian Tropical Research Foundation) and Joanne Malotaux (intern at NFMV). The original aim of the trip was to do an exploratory or reconnaissance survey in the lower lying forest areas of Taveuni, to find out which areas would be suitable for mist netting surveys, and to start mist netting surveys for the Fiji flying fox. This report will detail the findings of this survey, and will offer several recommendations for further research on the Fiji flying fox.

STUDY SITE

Taveuni is the third largest island in the Fiji group with a total land area of 435 km^2. The island is of volcanic origin, and volcanic cones form a high ridge down the spine of the island (see map in figure 2). Montane cloud forest covers the highlands of Taveuni, in particular around Taveuni's two highest mountains, Uluigara (1241 m) and Des Voeux Peak (1195 m). Rainfall at Des Voeux Peak is over 10 m annually (recorded by Public Works Department). Taveuni has a high proportion of undeveloped forests, including intact ridge-to-reef ecosystems. Among Taveuni's ecosystems are steep upland cloud forests, coastal and wetland forests, including mangroves (Environmental Consultants Fiji 2012). Much of the southern and western coastal plains of the island have been cleared for coconut

(copra) plantations. These areas are now partly used for agriculture, cassava and dalo, or are abandoned and overrun with the native vine *Merremia peltata*.

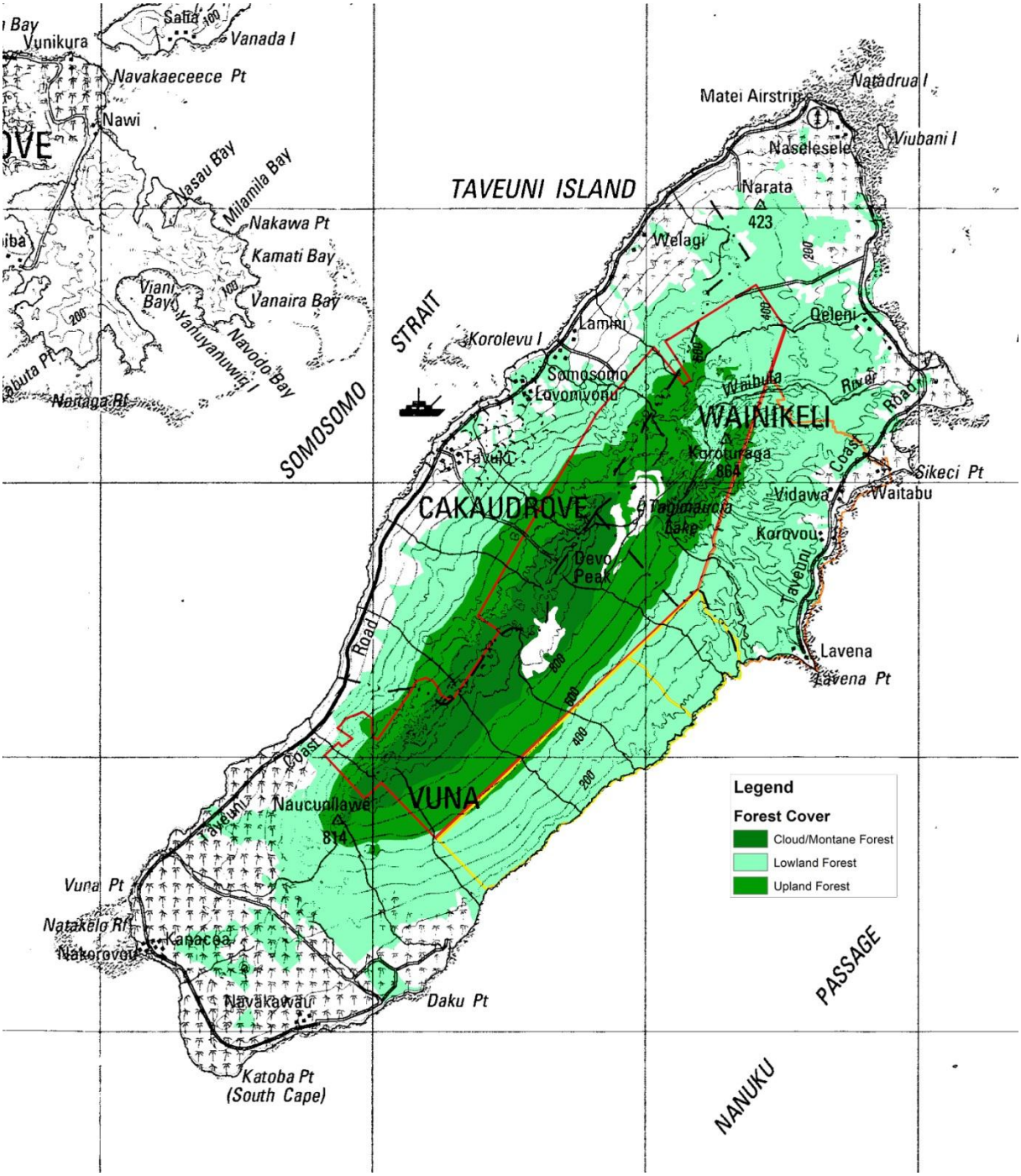

Figure 2. Map of Taveuni Island. Des Voeux Peak is mistakenly spelled as Devo Peak on the map. The red lines indicate the boundaries of Taveuni Forest Reserve, the yellow lines show the boundaries of the Ravilevu Nature Reserve, and the orange lines the boundaries of the Bouma National Heritage Park. Map by Departments of Lands and Survey, colour overlay by National Trust of Fiji.

Taveuni currently has three Protected Areas (PA) which comprise 38% of the land area of Taveuni. These are the Taveuni Forest Reserve (FR), the Ravilevu Nature Reserve (NR), and the Bouma National Heritage Park (NHP). Legislation and management in these PA's is limited; management is

merely passive in the Taveuni FR and Ravilevu NR, but Bouma NHP is successfully managed by the local communities.

The interior of Taveuni is quite difficult to access. A road runs along the coast around about three quarters of the island. From Wairiki village on the west coast of the island, one road runs inland, up to Des Voeux Peak. This road is regularly used for maintenance of the two radio towers on top of the mountain, and is occasionally used by tourists as well. Other than this road, there are few tracks leading inland. Large parts of the interior of the island appear unexplored.

SURVEYS

The previous surveys for the Fiji flying fox have all taken place on and around Des Voeux Peak, above 800 m asl. No surveys for the Fiji flying fox have been executed in the vast stretches of forest below 800 m asl. During this survey, several locations in Taveuni have been visited to assess the suitability for further tracking, and to search for alternative research methods. We were accompanied by Sipiriano, a National Trust Officer at the Bouma National Heritage Park, who functioned as guide and contact person.

Mist netting surveys were done on locations along the eastern coast; near Lavena village, near Waitabu village, and more inland and at a somewhat higher elevation in the Bouma NHP. The exercise was also meant to look for the Fijian blossom bat (*Notopteris macdonaldi*), a cave roosting bat species. The only known roosts of this species are located on Viti Levu. However, this species is known to occur on Taveuni as well. 56% of the bats that Scanlon (2009) caught during surveys at Des Voeux Peak were individuals of *Notopteris macdonaldi*, but no roost has been located yet. The surveys were done using two 40-foot nets, suspended between 13-foot telescopic aluminium poles. The nets were set up just after dusk, and left for 1-3 hours. No bats were caught during these surveys. This might be due to the heavy rain and strong winds during the surveys. Another improvement would be to use taller poles, or suspend the nets between trees, higher in the canopy.

The full length of Taveuni's coastal road was travelled, to explore the landscape and search for potential field work sites. There are very few roads running into the interior of the island, and locals reported that few people venture inland. All villages are located along the coast. Near Vidawa village on the east coast of Taveuni, a track runs up to a forest camp, from which bird surveys have been conducted. This would be a potential location for mist netting, although it would require tall poles or a pulley system to suspend the mist nets between trees. Further exploration of several reported tracks leading into the interior of Taveuni might yield further potential field work locations.

Apart from the mist netting surveys, we visited Des Voeux Peak, to become familiar with the conditions in which the Fiji flying fox has been observed and caught. The top of Des Voeux Peak is cleared around the two radio towers which are located on the top of the ridge. Bad weather conditions and insufficient equipment prevented us from doing any mist netting surveys in this area, and in the lower lying areas adjacent to the road up to Des Voeux Peak. The top of Des Voeux Peak allows a view of a large part of the lower-lying interior of the island (see figure 3). The interior is very densely forested, and, as stated earlier, not easily accessible. An alternative to mist netting surveys would be a radio tracking project. Mist netting at random locations at lower altitudes in Taveuni will be a difficult exercise, and the chances of finding any individuals of *M. acrodonta* will be extremely unlikely, especially given the historically small success that attempts to capture Mirimiri have had in the past (Scanlon, 2009). Mist netting for *M. acrodonta* in the area where it is known to occur has a

larger chance of success. In the following chapter, I will outline a suggestion for further research on *M. acrodonta.*

Figure 3. View from Des Voeux Peak over a large part of the lower-lying forested interior of Taveuni island. Photograph by Joanne Malotaux.

RADIO TRACKING MIRIMIRI ACRODONTA

Objectives

To tag several individuals of *M. acrodonta* with short-lived high-output glue-on transmitters and do radio tracking survey over a 24 hour period for as long as the transmitter operates. Des Voeux Peak is a suitable location for radio-tracking. It has good height gain, which is the effective increase in signal strength as a result of elevation above the overall landscape, and has a large field of view over a large part of the central forest, including Lake Tagimoucia. Des Voeux Peak has two separate peaks, on each of which a radio tower is located. The radio tracking survey will be a two-point triangulation survey, with the two separated parts of Des Voeux Peak serving as the baseline. The accuracy is of necessity limited. A third site – for example on one of the northern ridge peaks – would increase accuracy, but would greatly increase complexity, and necessitate significant trail cutting.

This radio tracking survey would provide information on home range, travel patterns, times of activity and distances travelled, and can potentially enable us to locate roost areas and feeding areas. Due to the inherent accuracy limitations of triangulation from a fairly narrow baseline (the top of the mountain) we can expect large areas of uncertainty at the edge of the range. Nevertheless, the knowledge gained would vastly increase our understanding of this enigmatic animal.

A directional (null-peak) radio tracking project would require a set of paired high gain (Yagi) antennas mounted on a rotatable mast. This arrangement allows a high degree of directional accuracy, which can be augmented by allowing one antenna to be remotely reversed in phase to the other. This results in a signal null (disappearance) when the array points directly at the transmitter, assuming that the signal is strong enough. This arrangement has far higher sensitivity and accuracy compared to a conventional hand held antenna. This is an area of Dr. Spencer's expertise.

Technical issues

A major complicating factor is the presence of the telecom towers which produce a large amount of radio 'noise'. As radio-tracking technology relies on the detection of extremely weak signals from the transmitter (often just above the 'noise' background), any external signal that 'leaks' into the radio-tracking receiver 'deafens' it, to the degree that it becomes useless. This is the situation at Des Voeux Peak, as there are two very large microwave and phone repeater stations, which blanket the peak

with radio-frequency signals. In order to overcome this, the signals from the radio-tracking antenna have to be shielded from this noise to a high degree. Part of this shielding involves the use of very narrow band filters. This issue is fairly easily addressed and we have the opportunity to obtain suitable diplexer filters for the 175MH ISM band.

Other issues

The first challenge in this project would be to catch several individuals of *M. acrodonta.* The last and most extensive survey for *M. acrodonta* consisted of 35 trap nights and 68,265 mist net hours on Des Voeux Peak (Scanlon 2009), which resulted in the capture of only one female *M. acrodonta.* One of the reasons Scanlon gives for the low number of bats captured (41 bats in 35 nights) is poor weather conditions, as well as possible low resource availability. Studies on resource availability for bats at Des Voeux Peak could be used to better time the surveys (Scanlon 2009). If possible, good weather conditions should be exploited for trapping, to improve the chances of catching *M. acrodonta.* Scanlon also advises to conduct surveys around and/or just below 800 m asl, as the conditions here are milder and more predictable. The conditions on Des Voeux Peak are particularly harsh, the top receiving an average yearly rainfall of more than 10 m (Ash 1987).

FURTHER RECOMMENDATIONS

As noted in the previous sections, further research on *M. acrodonta* can focus on exploring the interior of Taveuni, or initiating a radio tracking project in search of the bat. Exploring the interior is difficult because of the terrain and the dense forests. Radio tracking could provide significant and critical information on home range and resource use, even with only one animal. Very little information on the ecology of this species is known, which makes it difficult to identify potential threats and direct conservation efforts. Further surveys should focus on subjects such as diet, habitat use and home range. Aside from the recommended surveys on Taveuni island, other potential study areas include the highlands of the island of Vanua Levu. However, given that Taveuni is a known habitat for the bat, surveys of Vanua Levu would be a later exercise.

Additional research could include gathering more detailed climatic information from the peak, in particular as the most recent rainfall measurements date from 1987. Vegetation resource surveys could provide valuable information on food availability for the flying foxes.

Conservation efforts should include formal protection of all the upland forests of Taveuni. NatureFiji-MareqetiViti is currently advocating for the merger of Taveuni Forest Reserve, Ravilevu Nature Reserve and Bouma Natural Heritage Park into Taveuni National Park. Increased legislation and management resulting from the establishment of a National Park would contribute to the protection of the habitat of *M. acrodonta*.

Furthermore, continuation of public awareness activities on Taveuni is needed, as support of the local communities for forest habitat conservation is essential to the long term survival of *M. acrodonta.*

ACKNOWLEDGEMENTS

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