

**SECOND MONITORING SURVEY OF VATUIRA ISLAND,
LOMAIVITI, FIJI**

JUNE 8TH – 11TH 2007

August 2007

VATUIRA – 2ND MONITORING VISIT, 8-11TH JUNE 2007

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ABBREVIATIONS AND ACRONYMS

- PMS Permanent Monitoring Station
- PVP Permanent Vegetation Plot

1 INTRODUCTION

Rats were removed from Vatuiira by BirdLife with support from the Pacific Invasives Initiative in mid July 2006.

This report relates to the second of the post rat-removal monitoring visits undertaken by NatureFiji-MareqetiViti with BirdLife International. The monitoring team comprised Dick Watling (NatureFiji-MareqetiViti); Elenoa Seniloli, Ronel Jit, Steve Cranwell, (BirdLife); Sione Gonewai (boat captain); Suliasi Waqalala, Nacanieli Vunisa and Akuila Qionibaravi (landowners). The team arrived on the island at 1200 on Friday 8th and departed at 1100 on Monday 11th June 2007.

1.1 WEATHER

The weather during the visit was fine throughout with sunny conditions and fresh south easterly winds during the days.

1.2 TASKS UNDERTAKEN

Monitoring covered the following activities:

1. At each of the 18 Permanent Monitoring Stations (PMS):
 - Rat snap traps; 1 wax chew tag; and, 1 tracking tunnel were setup.(Figure 1).
2. Total Count of all seabirds nesting on the island and documentation of nest stage:
 - Species nesting – Red-footed Booby; Brown Booby; Lesser Frigatebird; Crested Tern and Black-naped Terns
3. Location of four Permanent Vegetation Plots (PVP):
 - The four PVPs were located, the boundaries marked with hip chain thread and total inventories made of all regeneration within the four plots of 100m² each (5m x 20 m) (Figure 1);
4. Skink Transects:

Three transect lines totaling 547m were set up (Figure 1). Fifteen transect counts were made comprising five hours and fifty-five minutes of search time.

2 PERMANENT MONITORING STATIONS (PMS)

2.1 SET UP

The three lines and 18 stations established on the previous visit were set up as follows (Figure 1):

Plate 1: Pink Triangle marking location of PMS

Each site is identified with an individual number on a pink plastic triangle, screwed to a tree, where missing markers were replaced.

The following was set up within a 5m radius of each PMS marker

- two snap traps (five sites had a single snap trap) placed on fallen logs and sloping limbs generally between 50cm and a metre above the ground to exclude uga. Each trap was baited with burnt coconut. Locally available rat snap traps were used.
- a tracking tunnel placed on the ground containing a pre inked tracking paper secured by paper clips and baited with burnt coconut. Bait (burnt coconut) was wired to the inside of the roof of the tunnel – one at each end.
- a peanut butter-flavoured wax chew tag nailed to trees at random heights to exclude **uga** while remaining accessible to *Rattus exulans*

2.2 INSPECTIONS

All 18 PMS were inspected each morning, 9th-11th June. Tracking tunnel papers were checked for rodent ts and the presence of ants, cockroaches, and uga on the baits and immediately about the tunnel were recorded. Baits were replaced where missing or degraded. The same tracking paper remained in each tunnel for the three days.

Snap traps e checked for rodents and evidence of remains. Uga, ant, and cockroach presence was also recorded for each trap. Sprung traps were reset and baits replaced. Traps were checked again just before dusk reset and rebaited as necessary.

Wax chew tags were checked for evidence of rodent teeth marks. The presence of cockroaches, and ants on and about the tags were recorded. Wax was scraped smooth each day to remove existing marks.

2.3 RESULTS

Rat Traps No rats were caught in the snap traps, nor was there rat sign on sprung traps, the ink pads or the chew tags (refer Table 1).

There were 93 trap nights. Seventy (75%) of these were not sprung and the bait still present. The remaining sixteen trap nights (17%) caught one gecko *Gehyra oceanica* and the other traps were believed to have been sprung by small **uga**¹ which were not caught.

Tracking Tunnels  tracking tunnel nights revealed no sign of rats on the ink pads (Appendix 2). The only recognisable tracks were those of **uga**. A gecko *Gehyra oceanica* was found in the tunnel on one occasion (underneath the cardboard tracking pad). Sign of ants and cockroaches were common. Baits from the tunnels were missing or quite frequently dropped, this is probably cockroaches and ants with **uga** removing the baits once they have dropped.




¹ Uga – small hermit crabs

Wax chew tags From xx chew tag nights no evidence of rats was detected and all tags showed sign of being eaten. Cockroaches were frequently observed feeding on the tags and uga, and geckos were also thought to have eaten some of the tags although this was not confirmed. Attempts were made to place all wax tags so as to be inaccessible to uga, however they did manage to get to some. xx of the tags were finished completely before the end of the survey.

General observations

Ants (do we know what species?) appeared to be more common than on the previous survey and were visibly abundant amongst the forest vegetation and leaf litter, the snap trap, tracking tunnel and wax tags were also often found completely covered by ants.

Uga (small Hermit Crabs) were believed to be less abundant than on the previous survey and only affected two or three monitoring sites

2.4 ABSENCE OF RATS

XX nights of snap trapping, tracking tunnels and wax tags revealed no evidence of rodents on the island. Vatuira was treated with brodifacoum eleven months prior to this monitoring and given the potential reproductive rates for *Rattus exulans* coupled with the small island size it is considered that rats would have been at detectable levels for this monitoring. Further confirmation of the absence of rats was:

- Several fallen eggs – both cracked and whole, not eaten;
- Seed-bearing grass not being eaten;
- Fish frequently observed on the ground (nestling food) uneaten
- Gecko eggs inside coconut husks (on the ground) not eaten

In light of this evidence MareqetiViti and BirdLife International considers *rattus exulans* to have been successfully eradicated from the 2.3ha Island of Vatuira.

Figure 1: Vatuira Island with Permanent Monitoring Stations, Permanent Vegetation Plots and Skink Transects



Table 1: Rat Trap Monitoring 

Date	Site #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Total	Sum	%
9-Jun-07	OK/BP	1			2	2	1			2	1	1	2	2	2			1		17	61	65.6
	OK/BG		2					1								1				4	12	12.9
	S/BP	1							1											2	6	6.5
	S/BG			2			1	1	1			1					1		1	8	14	15.1
	Comment																					93
10-Jun-07	OK/BP	2	2	2	2	2	1		1	1	1	1	2	2	2	1	1	1		24		
	OK/BG						1	1												2		
	S/BP											1							1	2		
	S/BG							1	1	1										3		
	Comment																					
11-Jun-07	OK/BP		2	2	2	2	2	2			1	1	2		1	1		1	1	20		
	OK/BG	2												2	1		1			6		
	S/BP									1		1								2		
	S/BG								2	1										3		
	Comment																					

Key: OK/BP Trap Set; Bait Present
 OK/BG Trap Set, Bait Gone
 S/BP Trap Snapped; Bait Present
 S/BG Trap Snapped, Bait Gone

Table 2: Peanut Baits Monitoring Data

Date	Site #	1	2	3	4	5	6	7	8	9
9-Jun	Peanut	OK	OK	OK	OK	OK	OK	OK	OK	OK
	Comment	Ants+, cockroaches	Ants ++	Ants+	Ants++	Ants+	Ants ++	Ants+	Ants+	Ants+
10-Jun	Peanut	concave teeth mrks	10%eaten	OK	OK	OK	OK	OK	OK	OK
	Comment	Geckos?	cockroaches		Ants++	Ants++	Ants ++	Ants+	Ants ++	
11-Jun	Peanut	concave teeth mrks	OK	OK	OK	OK/BP	OK/BP	OK	OK	OK
	Comment	Gecko or Roach?	Ant +	Ants++	Ants++	Ants+++	Ants ++	Ants++	Ants++	Ants++
Date	Site #	10	11	12	13	14	15	16	17	18
9-Jun	Peanut	OK	OK	OK	OK	OK	OK	OK	OK	OK
	Comment	Ants+	Ants+++& Cockroaches?	Ants++	Ants++	Ants+++&cock roach marks	Cockroaches& Ants+	Ants+	Ants +	Ants ++
10-Jun	Peanut	OK	finished	OK	OK	OK	OK	OK	OK	OK
	Comment	Ants+	Last night saw cockroaches here	Ants+++& cockroaches	Gecko mrks	Ants+++& cockroach marks	40% eaten Uga ++			Ants+& Cockroach es
11-Jun	Peanut	OK	finished yesterday	scratches	scratches	1/2 eaten scratches	75% finished	slightly marked	OK	OK
	Comment	Ant++							Ants ++	Ants++

Table 3: Tracking Tunnels Monitoring Data

Date	Site #	1	2	3	4	5	6	7	8	9
9-Jun	T/Tunnel	Okay	Okay	Okay	Okay	Okay	Okay	Okay	Okay	Okay
	Comment	Ant ++	Ants++	Ants++	Ants++	Ants+	Ants+++& Uga trail	Ants++	Ants+& uga	Ant+,Uga++
10-Jun	T/Tunnel	Okay	Okay	ok	Okay	Okay	Okay	ok	Okay	Okay
	Comment	Ant +&1 bait missing	Ant++	Ant+	Ant++	Ant++	Ant+	Ants+	Ant+	Uga+
11-Jun	T/Tunnel	BG	OK	Ok	Okay	Okay	Okay	BG	Okay	Okay
	Comment	Gehyra inside; Ant +	Ant ++	Ant ++	Ant ++	Ant ++	Ant ++	Cockroach +	Cockroach ++	Cockroach ++
Date	Site #	10	11	12	13	14	15	16	17	18
9-Jun	T/Tunnel	Okay	Okay	Okay	Okay	Okay	Okay	Okay	Okay	Okay
	Comment	Ants++,	Ants+& Cockroach shit	Ants++	Ants++& Cockroach	Ants+& cockroach shit	Ants++& Cockroach shit	Ants+++& uga++	Cockroach mrks?	Ants++
10-Jun	T/Tunnel	Okay	ok	Okay	Okay	Okay	Okay	Okay	BG	BG 1
	Comment	Ants++,	Ants+&hes shit	Ants++	Ants++	Ant +	Cockroaches ++	Uga +	Uga++	Uga+& 1
11-Jun	T/Tunnel	Okay	BG 1	Okay	Okay	Okay	BG 1	Okay	Okay	Okay
	Comment	Ants++,	Ant+	Ants++	Ants++	Ants ++	Ant++	Ants++& uga+	Uga+,Ants+	Ants++

3 TOTAL COUNT OF ALL SEABIRDS NESTING ON THE ISLAND

3.1 BIRD SPECIES PRESENT ON THE ISLAND

Reef Heron - Two grey phase seen on most days.

Lesser Frigatebird - All frigatebirds identified were of this species. Breeding was under way; refer below and there was in addition a large roosting population, over 200 were counted on one occasion.

Red-footed Booby – Nesting was well underway, refer below. A large roosting population was also present. Approximately 500 birds counted on one occasion.

Brown Booby – As on the previous visit Brown Boobies were common, approximately 100 were counted roosting and many of these were present during much of the day, mainly on the southern cliff face, but also some on the northern stack and the eastern hill. Two pairs were breeding on the eastern hill, one with a downy nestling (front cover plate) and another with 2 eggs. Seven pairs were nesting on the rocks on the southern end, all presumed sitting on eggs.

Brown Noddy – No nesting. About 20 seen around the island, usually first thing in the morning on the northern stack.

Black Noddy – As on the previous visit, no significant nesting, although young from two nests were noted as about to fledge. About 1 hour before dusk, black noddys started congregating off the western coast in an increasingly large fast wheeling flock. As the evening progressed individuals came ashore with most coming to roost after dark. Impossible to estimate how many but certainly over 500. All leave before dawn.

Black-naped Tern – Up to about 30 were present in the early mornings usually on the northern stack and rocks immediately offshore with fewer remaining all day. One pair was nesting on a rock ledge on the east coast with two eggs which hatched during our visit. Two pairs were recorded as presumed sitting on eggs, on rocks at the southern end. One recently fledged young was noted in the flock around the island.

Crested Tern – A flock of 35 were present most of the time. A noisy flock with signs of breeding – pairs and courtship flights. One or two ‘runners’ were present. Two predated eggs found on the northern stack could be from this species or Brown Noddy.

Bridled Tern – No birds present

White-tailed Tropic Bird – None seen.

Plate 2: One day old chick of Black-naped Tern

3.2 RED-FOOTED BOOBY AND LESSER FRIGATEBIRD BREEDING

The method used to survey Red-footed Booby and Lesser Frigatebirds, was the same as used for the previous visit, and follows a simplified methodology to estimate the rate of seabird egg-laying as described by McCormack 1991 (Unpubl. Mss; Attachment 2).

A complete count of all the trees on the island was undertaken. This took less than 1.5 days using all five personnel spread around a particular tree at which point the number of nests and their contents were called out aloud until there was agreement. Wherever possible adjacent slopes or trees were climbed to allow the contents of nests to be better observed. With most Boobys sitting on eggs or nestlings being able to see into the nest was particularly useful in distinguishing the breeding phase. However as the contents of the majority of nests could not be seen it is likely that the number of nestlings and downy chicks was underrepresented because unless something could be seen, sitting birds were recorded as sitting on eggs.

Red-footed Booby

333 occupied nests² were counted. Figure 2 shows the rate of egg-laying (number of clutches started per week) of the Red-footed Booby. This presumes that Red-footed Boobys are growing at the same rate as those for which the model was developed – a 23 week period from egg laying to fledging. In 2007 it would appear that the Red-footed Boobys on Vatuira started laying nearly two months earlier than they did in 2006 (see Figure 3) and there was 30% increase in the number of pairs with eggs.



Figure 2. Rate of egg laying of the Red-footed Booby on Vatuira – mid 2007.

² Nests with an adult sitting on the nest or a nestling-juvenile in the nest. Adults sitting next to (presumed empty) nests were not included.

Figure 3: Rate of Egg-laying of the Red-footed Booby on Vatuira– mid 2006***Lesser Frigatebird***

A total of 177 occupied nests were counted. The nesting period for Lesser Frigates is 31 weeks. Figure 4 shows the 2007 rate of egg-laying (number of clutches started per week). This is a very different seasonality to early 2006 when there was a much more even spread, less seasonal breeding (refer Figure 5).

Figure 4: Rate of Egg-laying of the Lesser Frigatebird on Vatuira in late 2006 and 2007**Figure 5: Rate of Egg-laying of the Lesser Frigatebird on Vatuira – early/mid 2006**

Is there anything that can be said in comparing numbers of birds observed this time with last time?

4 VEGETATION

4.1 VEGETATION OF VATUIRA

Two additional species were recorded during the survey, an unidentified grass and the creeper *Mikania micrantha*³ bringing to a total of 33 species of plant recorded on Vatuiira. One or two species will invariably turn up during later visits. The vegetation is described in the report of the August 2006 visit.

4.2 PERMANENT VEGETATION PLOTS

Four Permanent Vegetation Plots (PVP) were established in 2006 as identified in Figure 1. The four plots are 5m wide by 20 m in length and were selected to be representative of the vegetation of the flat land on Vatuiira. Each PVP was relocated without a problem.

Species Composition

In 2006, only seven species of plant were recorded in the PVPs and these were vastly dominated by *Pisonia* as shown in Table 4. The occurrence of regeneration as opposed to mature vegetation was correspondingly low and probably representative of the overall occurrence.

Summary	Number of trees/plants				Index of Abundance	
	Plot Number					
Species	1	2	3	4		
<i>Pisonia grandis</i>	19	17	20	20	76	1900
<i>Terminalia catappa</i>	1				1	25
<i>Tournefortia argentea</i>			6		6	150
<i>Barringtonia asiatica</i>		1			1	25
<i>Cocos nucifera</i>		1	2		3	75
<i>Cyperus stoloniferus</i>			1	1	2	50
<i>Lepturus repens</i>	1				1	25
Plot Total	21	19	29	21	90	
Mature					88	2200
Regeneration					2	50

Table 4: Plant Species Recorded in the Permanent Vegetation Plots and their Abundance in 2006

Index of Abundance: Relates to the overall number of individual plants of a given species encountered in all the plots combined. Calculated as Number recorded divided by number of plots multiplied by 100.

Regeneration

In 2006, the amount of regeneration (trees under 1m and newly germinated herb/shrubs) was very small. Two regenerating trees were recorded inside the four plots and another two just outside PVP (1 excluded from the analysis). *Pisonia* appears to regenerate mainly from broken branches taking root in the mulchy soil. This was not recorded as regeneration.

In 2007, there was more regeneration, 29 instances varying from grasses to trees such as vutu, although overall it should still be considered a very low abundance, refer Table 5.

Anecdotally this low regenerative response is particularly evident within the forest interior where seedlings and an understory remain absent. This appears less so along the forest margin, exposed

³ All plants found were destroyed.

rocky outcrops and in ‘light wells’ where grasses, ferns and (??) are establishing and beginning to form dense thickets.

Table 5: Regeneration Recorded in the Permanent Vegetation Plots in June 2007

Regeneration Species	Number of regeneration - trees/plants				
	Plot Number 1	2	3	4	
Unid Grass	7				
Portulaca oleracea	1				
Cordia subcordata	1		1	3	
Coconut			1		
Achyranthes aspera					10
Hernandia peltata					1
Scaevola taccada					1
Barringtonia asiatica					1
Unid Dicot					2
Plot Total	9	0	2	18	29

4.3 WEEDS

(XX What did we pull out?) covering a 5m² area approx 20m to the south of Camp in a ‘light gap’ within the forest interior was hand pulled. All plant material was spread out on the beach below mean high water. This was the only infestation of XX observed on the island. Two Taro were also observed to have been planted in the area.

Also there were observations of some pan-tropical shrub thing encroaching along the littoral fringe, comment on this?

4.4 DEFOLIATION RECOVERY

Think it would be good to include a short description of what was observed with the defoliation (any pics?) and the subsequent response ie only 2-3? trees seen this trip that had evidence of the caterpillar?

5 SKINKS & GECKOS

5.1 SKINK TRANSECTS

One species of skink is found on Vatuiira, the pygmy snake-eyed skink *Cryptoblepharus eximus*. It is possible that its numbers could rise significantly in the absence of rats. To monitor its numbers, three transects have been identified (Figure 1). *Cryptoblepharus* is strongly heliophile and counts should only be made on bright sunny days.

The three transects were counted five times during the visit. Each transect was generally of a similar location but, varied in length to those monitored in August 2006. The habitat types sampled were broadly defined as ‘forest edge/forest interior’, ‘forest interior’, and ‘non-vegetated rocky and coastal strand’ (Table).

Table

Transect description	Habitat Type	Distance (m) Aug 2006	Distance (m) June 2007
Transect 1 Following the western littoral margin from PMS 1 to the rock stack at the Northern end of the island doubling back to continue along the eastern coast ending on the south side of the small ‘grassy’ clearing near PMS 7	Forest edge/forest interior (c. 80% of transect) & Non-vegetated rocky and coastal strand (c. 20% of transect)	213	256
Transect 2 Continuing south from Transect 1 (at PMS 7) through the centre of the island (forest interior) to PMS 11 and the base of the hill continuing west along the base of the hill to the western littoral margin	Forest interior (100% of transect)	194	122
Transect 3 Continuing north from Transect 2 following mean high water along the western coast ending on the northern side of the ‘grassy’ clearing at the adjacent rock stack	Forest edge/forest interior (c. 85% of transect) & Non-vegetated rocky and coastal strand (c. 15% of transect)	191	169
TOTAL		598	547

Observations as well as the transect counts show that the skink is most common where there is rock, either loose or fissured – especially the northern and eastern stacks and along the east coast where 94% of all skinks were observed. They avoid the centre of the island or parts of the transects where there are no rocks, just soil and vegetation.

The data can be reported either by observations per minute or per metre walked (Table 6) or as densities by using Distance software – the latter needs are a relatively large number of transects or data points to be useful. For this method, the transects are set out by laying a hip-measurer thread along the ground and this is used as the centre of a transect. The perpendicular distance to the thread for each skink seen is measured or estimated within band widths (0;0.1-0.5;0.6-1;1.1-2;2.1-3;3.1-4;4.1+ m) as an observer walks slowly along the transect. The data can then be computed using Distance software to provide a density (Watling 2001).

During the August 2006 visit, bad weather prevented any useful data being collected until the last day when a single set of transects was counted, 88 skinks were counted on that transect. This was the same (89) as highest count during the present visit.

Tansect # (see Fig 1)	Length (m)	Range (min- max skinks counted)	Total Skinks Seen	Average – 5 counts	Average seen per metre	Average seen per minute
1	213	9-15	58	11.6	0.27	0.43
2	194	0-10	14	2.8	0.07	0.13
3	191	4-64	169	33.8	0.88	1.63
Combined	598	14-89	241	48.2	0.40	0.69

Table 6: Skink Transects and Count

5.2 GECKOS

No standardized survey of geckos have been carried out. Both *Gehyra oceanica* and *Lepidodactylus lugubris* were recorded from the island but casual records of both were exceedingly rare (a single sighting of *G.oceanica* at night; no record of *L.lugubris*) during the August 2006 visit. During the present visit, eggs of *L.lugubris* were recorded from three locations and one adult found on a *Tournefortia argentea* tree near the camp. One *G.oceanica* was caught in a snap trap and another found hiding in a tracking tunnel. Two others were seen at night near peanut butter tabs. Based on these observations, there would appear to be an increase in the number of geckos.

6 BIOSECURITY

Vatuirā is to some extent protected from invasive species incursions by its remote location and low level of use. The landowners that accompanied us for this monitoring noted that no one from their villages had been to the island since the BirdLife visit nine months earlier. Among those that visit Vatuirā almost all are believed to be fishermen many of whom are not from the local clans. Despite infrequent visits potentially these people coming from rat infested areas with open boats, containers and associated fishing equipment that could harbour invasive species posing a significant risk to sustaining the islands pest free status. Furthermore their activities of collecting eggs, killing birds, lighting fires and cutting vegetation on the island also places at risk the values sought for protection.

To prevent the accidental introduction of rats or other invasive species the importance of Vatuirā and activities that threaten the Islands fauna and flora need to be communicated widely. A low level of bio security knowledge occurs among villages with which BirdLife have had direct contact but given the dispersed location of island visitors this needs to be expanded. Equally this awareness needs to be supported by contingency and control measures on the island. Such a coordinated response is best served through the development of a biosecurity plan which should include;

- Permanent control measures on the island (ie permanent poison bait stations & updating the island sign)
- A means for increasing awareness of Vatuirā and biosecurity protection generally particularly among key audiences such as fishermen (national publicity, leaflets, presentations etc)
- Identify quarantine standards required for BirdLife and associated personnel visiting the island
- Develop a contingency response in the event rodents are detected

Presently Vatuirā is recognised as a site of National Significance which affords little additional protection to the conservation values present. Landowners accompanying this monitoring trip expressed an interest in wanting to have formalised protection recognising the islands natural significance and giving legal authority to prevent unauthorised access. If a higher protected areas status could be achieved in addition to securing the landowners interests long-term this may also help to improve biosecurity protection.



7 RECCOMENDATIONS

7.1 RODENTS

- *Rattus exculans* be declared to have been successfully eradicated from Vatuira
- Future rodent monitoring be conducted annually and coincide with optimal timing for seabird monitoring?
- A check list be compiled of all the monitoring equipment and associated quantities

7.2 BIRDS

- Monitor annually (Optimal timing?)

7.3 LIZARDS

- That each transect be permanently marked with markers fixed to trees (Permolat or Plastic triangles using long nails or screws) and the transect route be recorded with a GPS. Each transect observed be consistent in length and location with the marked route in subsequent monitoring visits
- That each transect be confined to a single broad habitat type
 - Forest margin
 - Forest interior
 - Rocky coastal habitat
- Confirmation that the ‘distance’ measurements collected are suitable for determining density
- Transects be observed only between the hours of 8am and 3pm? (*or is there a likelihood of then excluding other species active earlier or later in the day?-that may be present but are presently not known to be*)
- Identification material should be made available to observers illustrating each species likely to be encountered
- A monitoring form be compiled of standardised data to be recorded for each transect observation (ie Date, Transect number, Observer, Observation start & end times, Distance categories (0, 0.1-0.5, 0.6-1, 1.1-2, 2.1-3, 3.1-4, 4+), Species, Wx categories (Sunny, Cloudy, Overcast; Wind: calm, light, moderate, strong; Temp: cool, warm, hot), Additional comments)

7.4 BIO-SECURITY

- Immediate priority be given to establishing rat poison stations at strategic locations on the island and assistance sought from the visiting dive company to maintain these
- Prior to the next visit BirdLife to compile a biosecurity plan detailing activities that could result in rodent or other invasive incursions and how these should be prevented, and in the event of an incursion what the response will be. In doing so the plan will identify actions, roles and responsibilities for its implementation
- In conjunction with landowners investigate options for achieving a suitable protected area status for Vatuira?

**APPENDIX 1:
TRACKING TUNNELS**

**APPENDIX 2:
SIMPLIFIED METHOD TO ESTIMATE THE RATE OF EGG-LAYING
OF SEABIRDS
(McCORMACK 1991, UNPUBL. MSS.)**

**APPENDIX 3:
SEABIRD NESTING DATA**

**APPENDIX 4:
PERMANENT VEGETATION PLOT DATA AND PHOTOGRAPHS**

**APPENDIX 5:
VATUIRA PHOTOGRAPHS**

Plate 3: View of Vatuirā, approaching from the west with the Southern Hill to the right and the Northern Stack clearly visible to the left.

Plate 4: View of the Pisonia clad Southern Hill from the Eastern Stack

Plate 5: View of the Pisonia clad Southern Hill from the tip of the Northern Stack

Plate 6: View of Vatuirā looking from the lighthouse foundation, north to the Northern Stack over the 'lowland' area of Pisonia. Eastern stack and ridge on the upper right of the photograph.

Plate 7: Southern Cliffs – favoured roosting site of Brown Booby

Plate 8: PMS 7 on the Northern Stack

Plate 9: Eastern Stack

Plate 10: Beach Sedge *Cyperus stoloniferus* a common sedge of beach cays and small islands. Root nodules are aromatic and used by Fijians for scenting coconut oil (*Malaga* or *Paku*).

Plate 11: Typical view inside Pisonia woodland on the island flat. Completely bare substrate with Pisonia leaf mulch

Plate 12: Another typical view inside Pisonia woodland on the island flat. Completely bare substrate with Pisonia leaf mulch. PMS 9.

Plate 13: Picture taken in December 2003 when the Black Noddys breed on the island in very large numbers.