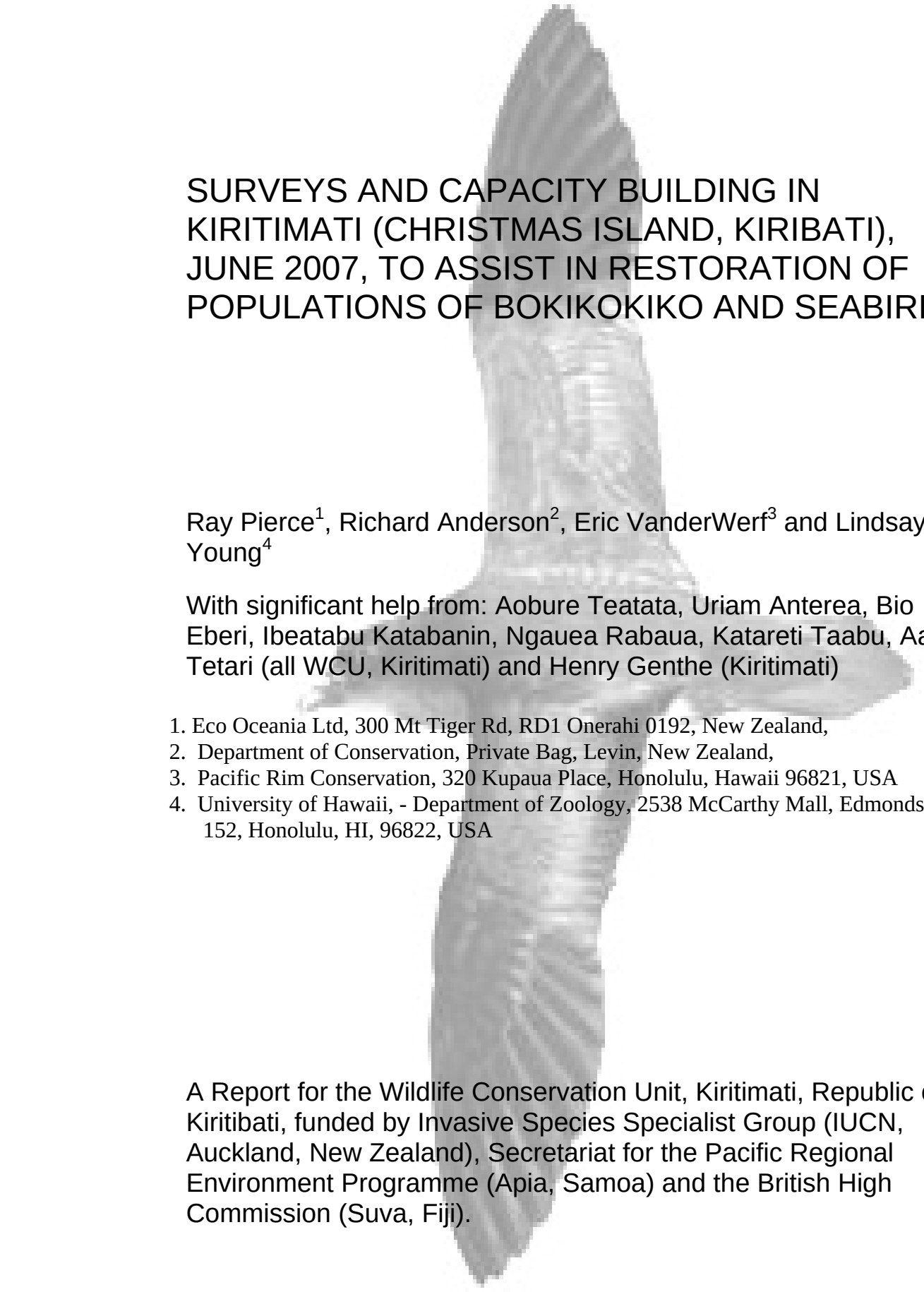


SURVEYS AND CAPACITY BUILDING IN KIRITIMATI (CHRISTMAS ISLAND, KIRIBATI), JUNE 2007, TO ASSIST IN RESTORATION OF POPULATIONS OF BOKIKOKIKO AND SEABIRDS

Ray Pierce[1], Richard Anderson[2], Eric VanderWerf[3] and Lindsay Young[4]

With significant help from: Aobure Teatata, Uriam Anterea, Bio Eberi, Ibeatabu Katabanin, Ngauea Rabaua, Katareti Taabu, Aana Tetari (all WCU, Kiritimati) and Henry Genthe (Kiritimati)

1. Eco Oceania Ltd, 300 Mt Tiger Rd, RD1 Onerahi 0192, New Zealand,
2. Department of Conservation, Private Bag, Levin, New Zealand,
3. Pacific Rim Conservation, 320 Kupaua Place, Honolulu, Hawaii 96821, USA
4. University of Hawaii, - Department of Zoology, 2538 McCarthy Mall, Edmondson 152, Honolulu, HI, 96822, USA

A Report for the Wildlife Conservation Unit, Kiritimati, Republic of Kiritibati, funded by Invasive Species Specialist Group (IUCN, Auckland, New Zealand), Secretariat for the Pacific Regional Environment Programme (Apia, Samoa) and the British High Commission (Suva, Fiji).

Contents

Fig 1.1 – Te ruru (Phoenix petrel) prospecting at Cook Island.

SUMMARY

Kiritimati (Line Islands, Kiribati) supports globally important populations of many seabird species including the largest breeding populations of two threatened species – Te ruru (Phoenix petrel, *Pterodroma alba;* Endangered) and Te bwebwe ni marawa (white-throated storm-petrel, *Nesofregetta fuliginosa;* Vulnerable). These and other seabirds and one landbird species are increasingly being threated by an increasing human population (5000+) and the impacts of mammalian pests, including the recent arrival of black rats (*Rattus rattus*).

In June 2007 we worked with the Wildlife Conservtion Unit (WCU) of Kiritimati to assist in the management of threatened and sensitive bird populations on Kiritimati. Work was focused at two levels – strategic (prioritisation of conservation tasks and locations) and practical (determining appropriate management approaches and capacity building for WCU staff).

Key activities undertaken were:

- Establish methodology for surveying Bokikokiko (Christmas Island warbler, *Acrocephalus aequinoctialis*) and begin surveys with WCU to determine its distribution, abundance and habitat preferences,
- Survey key seabird locations with WCU to determine distribution and abundance of the threatened Te ruru (Phoenix petrel) and Te bwebwe ni marawa (white-throated storm-petrel) and other sensitive seabirds,
- Establish pest survey methods with WCU and undertake pest surveys in key habitats of Bokikokiko and seabirds,
- Evaluate past and present pest control and quarantine methods,
- Work with WCU to refine methodology in all of the above.

Key findings were:

- Bokikokiko were widely but patchily distributied on the mainland and preliminary analyses suggested that abundance was controlled by combinations of te ren (*Tournefortia argentea*) height, te mao (*Scaevola taccada*) % cover and presence of ten tanini (*Cassytha filiformis*),
- Te ruru were confined to a few large islands (motu) with a minimum estimate of 2300-3800 pairs present. Motu Tabu, which is free of all mammalian pests, supported an estimated 1500-2000 pairs of Te ruru in June 2007. Important populations of Te ruru and many other seabirds occur in the Tanguoua Lagoon area, but they are being severely impacted by predators and poachers.
- Te bwewbwe ni marawa were confined to several motu (large islands) and islets (small islands, < 2 ha), notably Motu Tabu and islets in Manulu Lagoon and the Tanguoua Lagoon, at least some of which were rat-free. They were scarce on islands which supported Pacific rats (kimoa; *Ratttus exulans*),
- Pacific rats, but not cats (*Felis catus*), gain access to many of the motu and islets occupied by seabirds in the lagoon areas,

- Black rats (*Rattus rattus*) have been reported at wide-ranging locations on the mainland, but there is no evidence of them accessing motu and islets yet,
- There are significant risks that pests (rats, invasive ants, etc.) could access currently pest-free islands (e.g. Motu Tabu and Cook Island) due to frequent human visits and inadequate quarantine, advocacy and monitoring,
- Poaching is prevalent in some areas with Te taake (red-tailed tropicbird, *Phaethon rubricauda*), Te koota (red-footed booby, *Sula sula*) and Te eitei species (frigatebirds, *Fregata* spp.) being the preferred targets, but petrels, shearwaters and noddies were also taken. Poaching is causing localized and, in some cases widespread, declines in populations of these species,
- The WCU comprises a talented group of workers and with improved guidance and ongoing support, it will be in a good position to secure and restore populations of seabirds and Bokikokiko on Kiritimati.

Key recommendations are that:

- Quarantine activities be immediately stepped up for Motu Tabu and Cook Island to ensure that rats do not gain access (Priority 1),
- Quarantine activities be stepped up to ensure that Kiritimati does not receive any more invasive speces, e.g. Norway rat, invasive ants (Priority 1),
- Eradicate Pacific rats from key motu and islets for Te ruru and Te bwebwe ni marawa recovery – e.g. Drum and other specific islets in Tanguoua Lagoon, Motu Upua, possibly others (Priority 2),
- Eliminate poaching, focusing initially at keys sites, i.e. Motu Tabu, Cook Island (both Priority 1), and Motu Upua, Tanguoua Lagoon (Priority 2),
- Complete Bokikokiko surveys in likely habitat following methodology of June 2007, update database and provide data for specialist analysis (Priority 2),
- Continue rat-trapping surveys to determine *Rattus rattus* distribution and maintain database on this species (Priority 2),
- Set up long-term monitoring for key seabirds (Priority 3),
- Begin surveys of additional sites on islands and mainland sites for seabirds and predators with a view towards eventual local management (Priority 3).

Most of these objectives, e.g. improved biosecurity and eliminating poaching, will require greater community buy-in to the protection programmes than is currently the case. Details are provided of significant opportunities that are available in the short and medium term to support the GoK in this work.

ACKNOWLEDGMENTS

Other GoK staff who supported this work included Tererei Abete-Reema and Nenenteiti Teariki (MELAD) and Nautonga Anterea and Mamarau Kairirieta (Agricultural officers, Kiritimati). SPREP, ISSG and British High Commision (Suva) provided funding for the work, and Dave Butler and Alan Tye (SPREP) and Alan Saunders (ISSG) provided project liaison. Jill Key (SPREP) provided advice for advancing the training and capacity building opportunities, and Vince Kerr completed the maps.

Fig 1.2 – Te bwebwe ni marawa (white-throated storm-petrel).

Fig 1.3 – Bokikokiko and nest in te ren (*Tournefortia argentea*); nest woven entirely of ten tanini (*Cassytha filiformis*).

1. BACKGROUND

Kiritimati (Christmas Island) is located at 2 degrees North latitude, 157 degrees West longitude in the Line Islands of Kiribati. It is 53 km long and at 375 km^2 in area is the world's largest atoll in terms of contiguous land area. Most atolls have one large lagoon, but at Kiritimati the main lagoon occupies only about one third of the island interior and is succeeded by an intricate network of smaller lagoons, many of them interconnected, while others are completely isolated and hypersaline (Fig 1.4). The main lagoon and some smaller lagoons contain a number of motu and islets, important for nesting seabirds. Kiritimati has a human population of c.5000 which is increasing rapidly. Most people live in or near the capital, London, and there are two outlying villages – Banana (which is near the international airport) and the isolated village of Poland.

Kiribati is recognized as a Key Biodiversity Area in Conservation International's Critical Ecosystem Partnership Fund (CEPF), and it is also identified as an Important Bird Area (IBA) by BirdLife International. These international designations reflect the important seabird populations of the Phoenix Islands and Line Islands (including Kiritimati). Some 19 species of seabirds occur in the Phoenix and Line Islands, including the largest populations of two threatened species, Te Ruru (Phoenix petrel, Endangered) and Te Bwebwe ni marawa (white-throated storm petrel, Vulnerable). Unfortunately, populations of these two seabirds have crashed at the neighbouring Phoenix Islands in recent decades due to invasive species (Pierce et al. 2006), raising the importance of Kiritimati for securing the future of these two species.

Fig 1.4 - Aerial view of main lagoon of Kiritimati from overhead of Banana; Cook Island is in the lagoon entrance, London top right and Poland (distant top).

It is not clear how many Te ruru were formerly present on Kiritimati, but the numbers quoted have invariably exceeded those reported for all other locations combined. For example, Schreiber and Schreiber (1984) estimated 6500 Te ruru to be present at Kiritimati in the 1960s and Garnett (1983) estimated the population to be even greater at 20,000-25,000 adults in the late 1970s. These figures are substantially higher than reported in islands elsewhere, either recently or in the past, e.g. 220 birds in Phoenix Islands in the 1960s (Garnett 1983), 11+ pairs at Phoenix Islands (Pierce et al 2006) and c.100 pairs in the Marquesas in the 2000s (P. Raust pers. comm.).

The Kiritimati population of Te bwebwe ni marawa has been estimated to be 500-1000 pairs in the 1960s and 1970s, comparable to those in the Phoenix Islands in the 1960s (Garnett 1983). These combined populations were globally the most important concentrations of this species at that time. However, recent observations at Kiritimati (Aobure Teatata, GoK pers. comm.) suggest that both the Te ruru and Te bwebwe ni marawa populations may also have crashed since the 1980s, but there is no monitoring in place to ascertain how serious these declines may be (Environment Consultants Fiji 1999, Jones 2000, Anderson 2001, 2002).

Other important seabird populations present at Kiritimati include Te raurau (blue-grey noddy, *Procelsterna cerulea*), Te tarangongo (grey-backed tern, *Sterna lunata*), and one of the world's largest breeding populations of Te keeu (sooty tern, *S. fusca*).

Kiritimati also supports one endemic landbird, the threatened Bokikokiko or Christmas Island warbler, which frequents shrubland on the island (Birdlife 2006). There are concerns that its population is in decline, but again there is no monitoring in place and no quantitative information on its abundance over time to support this (Jones 2000, Birdlife 2006, A. Teatata, pers. comm.).

Invasive species are consistent factors in the loss of biota in the Pacific Islands and rats and cats are widespread on Kiritimati (Jones 2000, Sherley 2001), with Pacific rats (*Rattus exulans*) having had a long presence there. A key recent disaster is that black rats (*Rattus rattus*) have arrived on Kiritimati (Anderson 2001, 2002). Observations in the 1990s to 2002 suggested that the combined effects of predators (cats, Pacific rats and black rats), harvesting of seabirds by increasing numbers of people, and habitat loss, may be impacting on threatened species at Kiritimati, but the relative importance of each was unknown. Several consultants have provided a range of management recommendations spanning organizational and ecological needs (e.g. Environment Consultants Fiji 1999, Anderson 2001, Everett et al. 2002) and some have also provided practical assistance with specific management tasks (e.g. Anderson 2002). A number of international aid agencies have provided various forms of aid ranging from the practical (motorbikes and small dingy) to the less practical, e.g. large launch with computerized (locally unserviceable) motor.

The GoK recognized that while there had been substantial effort recommended or implemented for managing Kiritimati biota in recent years, this was not necessarily matched by conservation outcomes, so it sought technical assistance via SPREP and

ISSG for guiding future restoration. The current work addresses those needs, i.e. evaluates the current status and problems facing threatened species at Kiritimati, assists with local capacity building in the WCU and recommends appropriate ways of moving ecological restoration forward at Kiritimati.

2. OBJECTIVES

The GoK required guidance at two broad levels:

a) Strategic - to help determine priorities and best approaches for ecological restoration, and
b) Practical – capacity building and help in implementing practical management.

The current work addresses both strategic and practical needs with specific objectives as follows:

1) Bokikokiko
   - Determine distribution and status.
   - Determine feasibility of sustainable recovery.

2) Seabirds
   - Determine distribution and status of threatened and sensitive seabirds, particularly Te ruru, Te bwebwe and Te taake (red-tailed tropicbird).
   - Determine feasibility of sustainable recovery of seabirds.

3) Invasive species
   - Determine status of invasive species, particularly rats and cats, and their impacts.
   - Review the invasive species management programmes currently in place and their effectiveness.

4) Priorities for restoration
   - Determine priorities and feasibility for sustainable management.
   - Where possible prescribe ogoing work for the above threatened and invasive species.

5) Capacity building
   - Work with GoK personnel to enhance their skills in surveying, managing, and monitoring threatened and invasive biota.
   - Identify needs and opportunities to raise community awareness and involvement.
   - Identify opportunities for further learning, e.g. via Pacific Islands Learning Network (PILN).
   - Provide advice to assist the WCU in developing a strategy for sustainable management of biota including invasive species.
   - If possible, conduct at least one community meeting to summarise findings and invite feedback.

3. PERSONNEL, TIMETABLE AND GENERAL METHODS

3.1 Personnel

The original plan was for conservation biologists Richard Anderson and Ray Pierce from New Zealand to work with the WCU on the above objectives. Richard had previously worked with the WCU in the 1980s, 1990s and 2002, and Ray had previously worked with WCU leader Aobure Teatata in the Phoenix Islands in 2006. By coincidence Henry Genthe, a local resident at Kiritimati, had arranged for ornithologists Eric VanderWerf and Lindsay Young from Hawaii to develop practical public awareness initiatives for the WCU at about the same time. These two teams were subsequently combined with the WCU and comprised the following people:

Dr Ray Pierce – project team leader
Richard Anderson – responsible for rat and Bokikokiko surveys
Dr Eric VanderWerf - responsible for public awareness and bird survey support
Lindsay Young – responsible for public awareness and bird survey support
Aobure Teatata – WCU team leader
Uriam Anterea – WCU
Bio Eberi – WCU
Ibeatabu Katabanin – WCU
Ngauea Rabaua – WCU
Katareti Taabu – WCU
Aana Tetari – WCU
Henry Genthe – logistic support.

3.2 Timetable

All field work took place in June 2007, with Eric and Lindsay visiting in 6-19 June and Richard and Ray visiting in 13-27 June. The timetable of key work was as follows:

Date	Activity
6th	pm, Eric and Lindsay arrive, island reconnoiter with Henry
7th	am, meet WCU staff and discuss objectives; pm survey Manulu Lag islets
8th	am, with WCU check Manulu Lagoon rat traps; pm, brief survey Cook Is
9th	am, Eric and Lindsay sound recordings and observations of BKO; pm surveys of Tanguoua Lag and sound recordings of Te ruru and Te bwebwe
10th	Sunday
11th	Eric, Lindsay and Henry surveyed islets in Tanguoua
12th	Eric, Lindsay and Bio brief survey Motu Tabu and Motu Upua
13th	am, Richard and Ray arrive; pm meeting of full crew, logistics, BOK survey
14th	am, finalise BOK survey methods, meet with LINNIX 2nd Secretary; pm Cook Is team departs for overnight survey, BOK team surveys coast
15th	Cook Is team returns; BOK team surveys
16th	Survey with WCU of lagoon area, evening survey for seabirds same area

17th	am, data sheets (Ray), survey of Motu Upua Peninsula (Richard , Eric, Lindsay), pm BOK survey near London
18th	pm, Motu Tabu team overnight survey of seabirds/pests
19th	am, Motu Tabu team returns; pm Manulu rat traps, BOK survey, evening, seabird counts Manulu Lagoon
20th	am, Manulu traps checked, Eric and Lindsay leave; pm office meeting, provisional findings, Motu Upua team leaves for overnight seabird/pest survey am Motu Upua team returns; pm BOK survey, data sheets (Ray)
21st	
22nd	am, meeting with Agriculture staff (Nautonga and Mamarau); pm Carver Way rat traps, Drum Island overnight survey of seabirds, rats
23rd	am, Tanguoua Lagoons, drive to Poland and BOK surveys; pm survey western Tanguoua Islands and overnight seabird/pest survey on I3 Island
24th	am, Tanguoua survey team survey Isles 1 and 3; pm return to London
25th	am, BOK survey Boating Lagoon, data pm
26th	am BOK survey Boating Lagoon (replicate), revise Manulu L transect; pm meeting with all WCU staff to discuss findings, evening meal whole team
27th	am, data loading (Aana, Ray), drafted work timetable for WCU in weeks ahead and held final debrief with WCU and discussed priority work for next few weeks; pm Richard and Ray leave

3.3 General methods

General methods comprised the following:

- Review of past work.
- Rapid surveys of seabirds in situations where there appeared to be a maximum likelihood of finding high abundance of the threatened or sensitive species. Clearly the islands in the main lagoon together with many islands in the Tanguoua and Manulu Lagoon areas where high priority. Some other islands that had recently been evaluated by Rauzon et al. in 2002 were not visited.
- Specific surveys for some species of seabirds, e.g. evening observations (1800-1900 h) of Te bwebwe ni marawa (storm-petrels) returning to islands.
- Specific surveys for Bokokokiko using taped playback calls and assigning simple habitat characters based on vegetation composition and height.
- Rat surveys using spotlights/headlamps (on islands) and snap-traps baited with cooked coconut (islands and mainland). Traps were adpated for local issues, e.g. non-targets avoided by using tunnels or twigs and placing traps on bushes.
- Searches for poaching sign, particularly around the perimeters of islands.
- Inspection of the quarantine process at seaports and air terminal and discussion of procedures with Agriculture staff.
- Throughout the survey period, we ensured that the WCU staff were learning relevant survey techniques, etc.
- Contact with Kiritimati staff and Tarawa managers was maintained after our visit to assist with work plans for further survey of Bokikokiko, seabirds and rats and to help make improvements to quarantine methods.

4.0 BOKIKOKIKO

4.1 Objectives

The objectives of Bokikokiko work were as follows:

1. To determine general distribution of Bokikokiko.
2. To determine habitat preference.
3. To set up studies that will allow the WCU to monitor trends in numbers over the years, i.e. use the 2007 surveys as the baseline. Any changes in numbers of Bokikokiko can be related to any changes in local habitat and rat species.
4. Gather other useful information where possible, e.g. nest locations and proportion of pairs with juveniles (to provide a rough guage of productivity).

4.2 Methods

General approach

All WCU staff and biologists participated in testing and refining Bokikokiko survey methods to ensure that we were all proficient with the techniques of taped playback surveys and data recording. Trials took place mainly at the Manulu Lagoon Backroad population where we agreed on the following general approach:

Fig 4.2 –Ngauea (left) and Katareti surveying for Bokikokiko in an area of te mao (*Scaevola sericea*), te ren (*Tournefortia argentea*) and ten tanini (*Cassytha filiformis*).

Year 1 baseline surveys (2007):

- Transects were set up in different parts of the island (refer Fig 4.31), each containing 5-10 stations with stations 200 m apart.
- Details of GPS points were recorded and stations marked in the field with temporary markers.
- General habitat and % plant cover was recorded.
- Taped Bokikokiko calls were played for 1 minute, with observers watching and listening for birds at the same time, and watching/listening for another 1 minute after that. Details were recorded of birds (adults, juveniles) seen or heard.
- Weather details were recorded at the end of the 2 minute period.
- Expand number of surveys to include other areas in order to more fully describe distribution and investigate habitat preferences.

In year 2 (2008) onwards WCU to:

- At the best Bokikokiko sites (e.g. aim for at least 5 transects, including Crystal Beach, Manulu Lagoon, Poland, Banana and possibly Boating Lagoon), repeat the transect surveys in the same month(s) in later years (e.g. initially June 2008 and June 2009), to help monitor changes in numbers.
- Keep to same methodology and use as many of the same observers as possible to ensure consistency. There is no need to record GPS points and general habitat in later years unless there are apparent changes to habitat.

Survey methods

Specific methods were developed in conjunction with the WCU for survey and annual monitoring as follows:

- Surveys should be carried out in calm to light windy conditions, preferably 7-10 am or 4-6.30 pm.
- Stations marked with markers, e.g. pile of coral on RHS road, and GPS the stations. Use GPS "odometer" to locate the next station 200 m along the road. When doing repeat surveys for monitoring change, use the GPS odometer to help find each station.
- One data sheet used for each transect and record the date and all names of observers; time at each station.
- Habitat- vegetation cover (0-4) 0 – very open; 4 - near total cover
  - Te mao- average height (nearest 0.5 m)
  - Te ren – average height (nearest 0.5 m).
- Plants - 0% cover of each plant out to c.100 m (5, 10, 20, 30% etc, √ - present but uncommon e.g. one or two coconuts, Te Ren (*Tournefortia*), Ten tanini (*Cassytha*) present etc, √√- lots present, e.g. Ten tanini on Te mao (*Scaevola*) etc. (Sunsequently we recognized the importance of ten tanini (*Cassytha*) and recommend a separate cover % score, refer Section 4.3).
- Play tape for 1 minute rotating the tape player 360˚. Listen and watch during that minute and for a second minute immediately after playing the tape. Note that birds can respond very quickly to start of playing the tape, often by

calling back or flying to top of a Te Ren. Therefore all observers must be alert right from the start of the 2 minute period.

- Record total number of birds.
- Record details of birds – adult seen/heard, juvenile seen/heard, i.e. AS, AH, JS, JH etc. If birds are seen or heard outside the 2 minutes, record in details column as e.g. (AS).
- GPS details - needed in year 1 only.
- Weather details - record at the end of the listening period.
  - Wind 0–4; 0 = calm, 4 = too windy for Bokikokiko work.
  - Cloud 0-4; 0 = nil, 4 = total cover.
  - Rain 0-4; 0 = none.
- Between surveys, keep tape player, tape and back-up tapes in a designated secure room that is also as cool an environment as possible. Eric has the original tape.

4.3 Preliminary Results

Reliability of the method

Playbacks of recorded calls greatly improved the efficiency of surveys for Bokikokiko by inducing birds to call or to move. During trials at 12 points in which a passive survey (without playback) was conducted for two minutes prior to the playback, only 0.92±0.26 birds were detected per station compared to 2.42±0.36 birds with playback, or an increase in detection rate of 263%. The average time to the first response to the playback was 19.7±3.9 seconds (range 2-50 seconds). Most of the additional birds probably were present during the passive survey, but were quiet and not visible during the two-minute count period and thus overlooked. A two minute observation period would not be long enough to adequately survey Bokikokiko using passive methods, but with playbacks two minutes is sufficient, allowing more ground to be covered in a shorter period of time.

Some of the additional birds detected with playback may have been attracted by the playback and moved closer to the observer. It is therefore not appropriate to calculate population density using distance-based methods, such as the variable circular plot, during surveys in which playbacks were used, because density estimates would be inflated by attraction. However, data from playback surveys can be used to estimate population density using a fixed-radius point count of 100 m because the distance between stations (200 m) probably is larger than the territory diameter in most cases. Birds may have been attracted to an observer at one station, but it is unlikely the same bird would be attracted at an adjacent station. An area of 3.14 ha was thus surveyed at each station. Bokikokiko were sometimes detected at distances of 100 m during surveys, and occasionally attracted from even farther away, but whether the entire 3.14 ha area was effectively surveyed may have depended on the conditions. Strong wind or loud surf noise would make it difficult to hear birds and harder for birds to hear the playbacks.

Distribution and abundance

Bokikokiko were widely but patchily distributed across the island, with birds being detected on three of four transects near London, two of four transects around Manulu Lagoon, one of one transect in the Tangioua Lagoon and one of two near Poland (refer Fig 4.31). Several areas with seemingly suitable habitat (see below) contained no birds, e.g. near Tabwakea Village. The total population of Bokikokiko may only be a few hundred birds. More information will be collected across the island by the WCU to assist in determining abundance in different areas, which will help to produce a more accurate total population estimate.

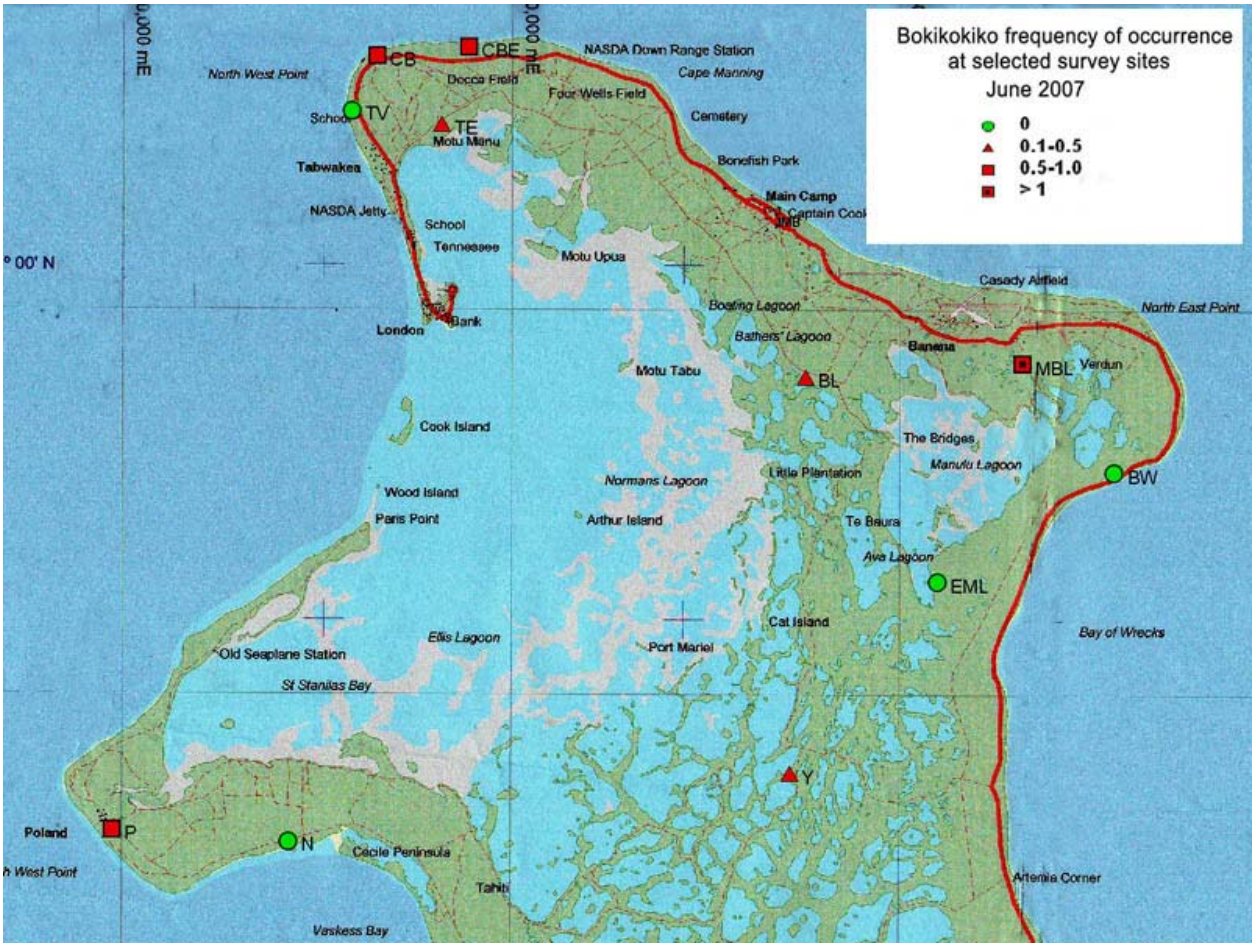


Fig 4.31 - Distribution and relative abundance of Bokikokiko in surveyed areas June 2007. Letters denote transect name (refer Table 4.31).

Table 4.31 - Summary of Bokikokiko abundance by transect.

Transect	# Stations	Detection rate (birds/ station)	Abundance (birds/ha)	Notes
Bay of Wrecks BW	3	0	0	1 bird heard outside survey period
Boating Lagoon BL	20	0.20±0.12	0.06±0.04	Same 10 points repeated twice
Crystal Beach CB	5	0.60±0.40	0.19±0.13	
Crystal Beach East CBE	10	0.70±0.40	0.22±0.13	
Manulu Lagoon Backroad MBL	16	1.60±0.39	0.51±0.12	Some stations repeated
Eastern Manulu Lagoon EML	5	0	0	
Nenaomi N	3	0	0	Windy conditions, should be redone
Poland P	3	0.67±0.33	0.21±0.11	Windy conditions, should be redone
Tabwakea Village TV	5	0	0	
Tabwakea East TE	9	0.11±0.11	0.04±0.04	
Y site Y	5	0.40±0.40	0.13±0.13	
Total all regions	84	0.54±0.11	0.17±0.04	

Habitat

Habitat preferences of Bokikokiko were investigated with a multiple regression analysis, using number of Bokikokiko recorded at each station as the response variable, and te mao (*Scaevola sericea*) height, te ren (*Tournefortia argentea*) height, percent cover of bare ground, grass, te mao, te ren, te aroua (*Suriana maritime*), te nii (*Cocos nucifera*), and bare ground, and presence or absence of ten tanini (*Cassytha filiformis*) vine at each station as independent variables.

The overall regression analysis was not significant ($F_{9,73} = 1.61$, $p = 0.13$, $R^2 = 16.6\%$); only 16% of the overall variation in Bokikokiko abundance was explained by the habitat variables used. However, there was some indication that certain variables were important, and it is likely that a larger sample of points, particularly points where Bokikokiko are present, would improve the performance of the regression. Results thus far indicate the most important habitat components for Bokikokiko are, in order of decreasing importance, abundance of te mao, presence of ten tanini, and height of te ren (Table 4.32). This is not surprising because Bokikokiko forage extensively in te mao, are known to nest only in te ren, and build nests exclusively from ten tanini.

The initial method of recording abundance of ten tanini, a tick mark to indicate presence or absence, may not adequately represent the importance of this habitat component. This method fails to distinguish sites where there is abundant ten tanini available for nest material and those where it is present but rare. Simple presence/absence also provides little resolution of sites with varying Bokikokiko abundance. Since ten tanini tends to grow on top of other plants, a more appropriate method might be to record the percent cover of ten tanini in addition to other cover types that sum to 100%.

Abundance of Bokikokiko was not strongly influenced by abundance of coconut trees (Table 4.32). However, Bokikokiko were only found in areas with relatively low coconut abundance, no greater than 25% cover; they were not found in dense coconut plantations, which do not provide suitable habitat.

Table 4.32 - Results of multiple regression analysis used to investigate habitat preference of Bokikokiko.

Predictor	Coefficient	T	p-value
Te mao height (m)	-0.05	-0.22	0.83
Te ren height (m)	0.14	1.2	0.23
% bare ground	0.01	0.57	0.57
% te mao	0.02	1.89	0.06
% te ren	0.03	1.03	0.31
% grass	0.0	-0.44	0.66
Presence of ten tanini	0.48	1.38	0.17
% te nii	0.0	-0.01	0.99
% te aroua	0.01	0.68	0.50

Fig 4.32 – Good habitat for Bokikokiko comprising te mao, te ren and ten tanini.

4.4 Conclusions and recommendations for Bokikokiko

Bokikokiko are patchily distributed throughout the main island and total numbers are probably in the low hundreds. Preliminary results indicate that they may be most common where there is abundant te mao, tall te ren and where ten tanini is present. Juveniles were found at 23% of Bokikokiko-occupied stations in June 2007. Because there have been no previous surveys on Bokikokiko, we cannot compare changes in abundance over time. It is important that further surveys and repeat monitoring of established stations is carried out to enable a robust assessment of population trends and causes of any local declines.

Potential problems for Bokikokiko include the following:

- habitat loss from fires, clearing for coconuts, development, etc.,
- habitat modification, e.g. proliferation of the weed *Pluchea indica* (shrubby fleabane, Asteraceae) following fire, further spread of coconuts,
- increased predation pressure from black rats.

Clearly, annual monitoring is needed to determine whether the population is in decline and if so, where and what are the causes, and what contingency plan is best implemented.

Key recommendations for Bokikokiko are:

- **Identify and map good habitat containing Bokikokiko.**
- **Advocate for protection of these good habitats from fire, development etc, e.g. by workshopping with key landowners, community and Government to identify risks, opportunities, solutions, etc and gaining better community buy-in (refer Section 8).**
- **Use external advice to address biosecurity issues, e.g. spread of *Pluchea* and the potential arrival of invasive ants (refer Section 6).**
- **Survey additional sites containing good habitat for Bokikokiko (e.g. near Poland and opposite Banana) and use data from these and other good sites for baseline (2007) monitoring information.**
- **All surveyed sites should have the habitat described as per Section 4.2 above and rat trapping surveys completed as per Section 6.**
- **Repeat Bokikokiko monitoring annually in June-July at the best transect lines (e.g. Crystal Beach, Crystal Beach East, Manulu Lagoon, opposite Banana, Poland), accompanied by rat trapping.**
- **Use external advice for annual survey/monitoring, including advice on methods, analysis, interpretation of results, management actions, etc.**
- **Investigate the feasibility of emergency translocations to another island, e.g Orona in Phoenix Islands (Pierce et al. 2006).**

The only other landbirds detected on Kiritimati were Te kura or Kuhl's lorikeet (*Vini kuhlii*). A pair was seen on the peninsula leading to Motu Upua on 17th June and a pair on the outsirts of London on 26th June, both in coconuts. The status of this species on Kiritimati needs further investigation, and all sightings should be documented.

5 SEABIRDS

5.1 Objectives

The key objectives were to:

- Determine the distribution and status of the Endangered Te ruru (Phoenix petrel), the Vulnerable Te bwebwe ni marina (white-throated storm-petrel), and other sensitive seabirds, including Te taake (red-tailed tropicbird) and shearwater species.
- Assess the impacts of predators and people on the viability of seabird populations.
- Determine the feasibility for sustainable recovery of seabird populations.

5.2 Methods

By necessity, methods were of a rapid assessment nature and were focused on sites that were considered to be priority areas, e.g. islands where relatively few predators would be able to gain access. Because Te ruru and Te bwebwe ni marawa were focal species, some rapid assessments were undertaken by observing late afternoon and evening fly-ons to specific islands. For Te ruru this assessment proved to be useful any time between about 1500 h and 1900 h, but for Te bwebwe ni marawa which return in the evening only, it was useful only from 1800 h to about 1915 h (dusk). Sometimes two or three islands could be watched concurrently by this method. During this time, a gauge of the importance of islands to other seabirds (e.g. Te tinebu, Te nna) was also obtained. When this approach revealed the presence of Te ruru and Te bwebwe ni marawa, these islands were visited to confirm seabird composition, breeding status and approximate numbers of breeding pairs, and to assess pest status and management options for the islands.

Some species-specific methods were used to evaluate population size and breeding status and these are summarized in Table 5.1 below. For Te ruru, counts of breeding pairs along some 5 x 20 m transects were made on four key islands and the approximate area of colony determined enabling numbers of pairs to be crudely estimated. One method that proved useful for tropicbirds was to undertake perimeter counts of nesting birds (most pairs were nesting under perimeter trees and shrubs) and calculate an index of nesting birds per km of island perimeter. This index could then be related to the level of poaching sign. The level of poaching sign was assessed by counting recently killed birds of all species (usually in piles of many beheaded birds with wings removed) and old remains or skeletons of poached birds.

Table 5.1 – Methods of estimating numbers of breeding birds, Kiritimati, June 2007.

Species	Area, density/ spotlight	Evening fly-ons	Perimeter counts	Colony counts	Coarse estimate	Anecdotal obs
Te ruru Phoenix petrel	✓	✓		✓		
Te tangiuoua W-tailed Shearwater					✓	
Te tinebu Christmas shearwater	✓	✓	✓		✓	
Te nna Audubon's shearwater	✓	✓	✓		✓	
Te bwebwe ni marawa W-thr storm-petrel		✓			✓	
Te taake Red-tailed tropicbird			✓			
Te ngutu White-tailed tropicbird						✓
Te mouakena Masked booby		✓			✓	✓
Te kibwi Brown booby		✓			✓	✓
Te koota Red-footed booby		✓	✓	✓		
Te eitei are e bubura Great frigate		✓	✓	✓		
Te eitei are e aki rangi ni bubura Lesser frigatebird		✓		✓	✓	
Te karakara Great crested tern				✓		
Te tarangongo Grey-backed tern				✓		
Te keeu Sooty tern	✓			✓	✓	
Te io Brown noddy				✓	✓	
Te mangikiri Black noddy				✓	✓	
Te raurau Blue-grey noddy		✓		✓	✓	

Fig 5.2 – Evening influx of seabirds at Cook Island.

5.3 Results

5.3.1 General patterns

Seabirds were found breeding or attempting to breed on most islands that we visited and on many parts of the mainland, particularly in the wildlife areas that are closed to the public, e.g. Tanguoua Lagoon area. The Te keeu (sooty tern) is one species that can arrive in enormous flocks virtually anywhere on the mainland and begin to breed, probably mostly unsuccessfully. However, the key sites that retain high diversity and numbers of seabirds, including the threatened Te ruru and Te bwebwe ni marawa, are a relatively small number of islands in the main lagoon and Tanguoua Lagoon and Manulu Lagoon. These key seabird islands are either pest free or at most have only Pacific rats as invasive pests.

The most important island is c.4 ha Motu Tabu, which is rat-free and supports large numbers of both Te ruru and Te bwebwe ni marawa and many other seabirds (Table 5.31). It is c.1 km offshore, therefore the chances of invasion by Pacific rats and most other invasive species by swimming is minimal, although there are sand flat "islands" exposed at low tide.

Fig 5.31 – Motu Tabu; the grasses, bushes and trees all provide nest sites for seabirds.

Cook Island (c.23 ha) is also rat-free and a very important site for seabirds generally, and is much larger than Motu Tabu, although Te Bwebwe ni marawa were absent from this island and Te ruru uncommon during our survey. Te ruru may in fact be colonizing the island as they were not detected there in earlier surveys (Garnet 1983, Schreiber and Ashmole 1970, Schreiber and Schreiber 1984, Environment Consultants Fiji 1999).

Several of the largest (up to c.10 ha) islands in the Tanguoua Lagoon support both Te ruru and Te bwebwe ni marawa, and many also support tropicbirds, 2-3 booby species and terns. However, all the large islands surveyed had Pacific rats and nesting success of all petrels, shearwaters and terns appeared to be low or very low. Most also experience high poaching pressure with boobies, frigatebirds and Te taake being the main poaching targets (refer Section 6.2).

Fig 5.32 – Ibeatabu, Katareti, Ngauea and Richard preparing to access an island (background) in the Tanguoua Lagoon.

Table 5.31 – Estimated birds present in key locations, June 2007; pr = pair, k = thousand, +(++) = likely to be more birds (significantly more birds) present in other areas. A few Te ngutu (white-tailed tropicbirds) were observed in and around London.

Island location	Main lagoon			Tanguoua Lagoon area				Manulu Lag	Min total approx
Island group	Cook Is	Motu Tabu	Motu Upua	Drum	I1, I3, II2	Tabo	Isles Lag	Manulu Isles	
Island area (approx ha)	30	3	10	5-6	10	<10	10+	<10	
Species									
Te ruru Phoenix petrel	c.10 pr	1500-2k pr	200-400pr	200-400pr	400-1000 pr	10-40 pr	5-20 pr	0	2300-3800 pr
Te tangiuoua W-tailed Shearwater	c.50 pr	3k-5k pr	500-1k pr	500-1k pr	550-1100 pr	NC	NC	NC	4.5-8k pr ++
Te tinebu Christmas shearwater	1k pr	1k-3k pr	500-1k pr	500-1k pr	500-1k pr	P	P	P	4k-7k pr +
Te nna Audubon's shearwater	<10 pr	<100 pr	<10 pr	1500-2k pr	1500-2k pr	P	NC	P	3.1k-4.1k pr +
Te bwebwe ni marawa W-thr storm-petrel	0	100-400 pr	0	1-10 pr	5-20 pr	50-100 pr	P?	10+ pr	200-500 pr +
Te take Red-tailed tropicbird	200-400pr	30-50 pr	10-20 pr	250+ pr	320+ pr	5-20 pr	P	0	820-1.1k pr +
Te ngutu White-tailed tropicbird	0	0	0	0	0	0	0	0	2-10
Te mouakena Masked booby	1	2	1	10-20 pr	1-2 pr	1-10 pr	P	0	20-30 pr +
Te kibwi Brown booby	c.10	0	1	10-20 pr	0	1-10 pr	P	0	20-30 pr +
Te koota Red-footed booby	1k-2k	300-500	100-300	1k+	110-160 pr	50-100 pr	50-100pr	0	2.8k-4.4k +
Te eitei are e bubura Great frigatebird	200+	c.5	c.5	c.200 pr	c.35 pr	0	50-100pr	0	700-900 +
Te eitei are e aki rangi ni bubura; Lesser fbird	5+	c.30	c.25	P	0	0	P	0	100 +
Te karakara Great crested tern	100+	c.30	c.50	10+	0	0	0	0	200 ++
Te tarangongo Grey-backed tern	0	0	0	80+ pr	180+ pr	50-100 pr	5-10 pr	500-600pr	800-900 pr +
Te keeu Sooty tern	200k-500k pr	150k pr	<100	c.10	0	0	0	0	350-650k pr ++
Te io Brown noddy	10k-20k pr	5k-10k pr	500-1k pr	50-100 pr	160-210 pr	P	P	0	15k-31k pr +
Te mangikiri Black noddy	50k pr	50k pr	3k-5k pr	250-500pr	380+ pr	P	P	0	100k pr +
Te raurau Blue-grey noddy	250+	c.40	6	11	c.15	0	P	250+	570 +
Te matawa White tern	2000	300-400	50-200 pr	P	2-10 pr	P	P	P	2500 +
Te kun Pacific golden plover	0	0	1	0	0	1	0	0	2
Te kirikiri Wandering tattler	0	0	1	0	0	1	0	0	2
Te kewe Bristle-thighed curlew	1	1	6	2	0	0	0	0	10

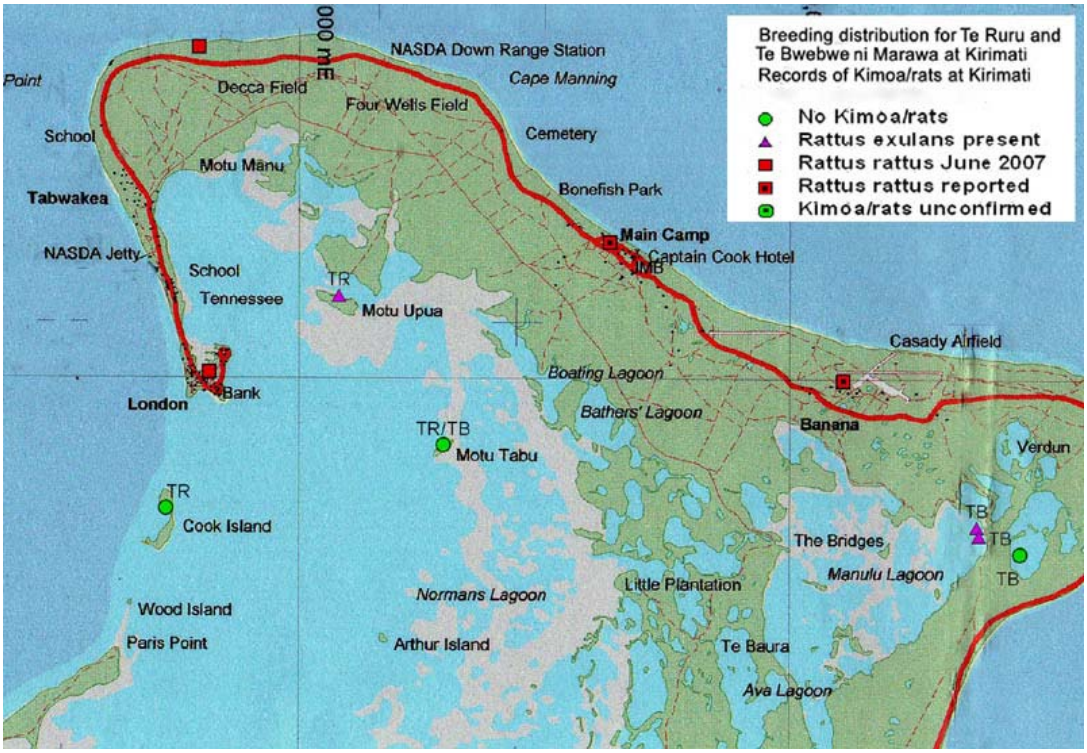
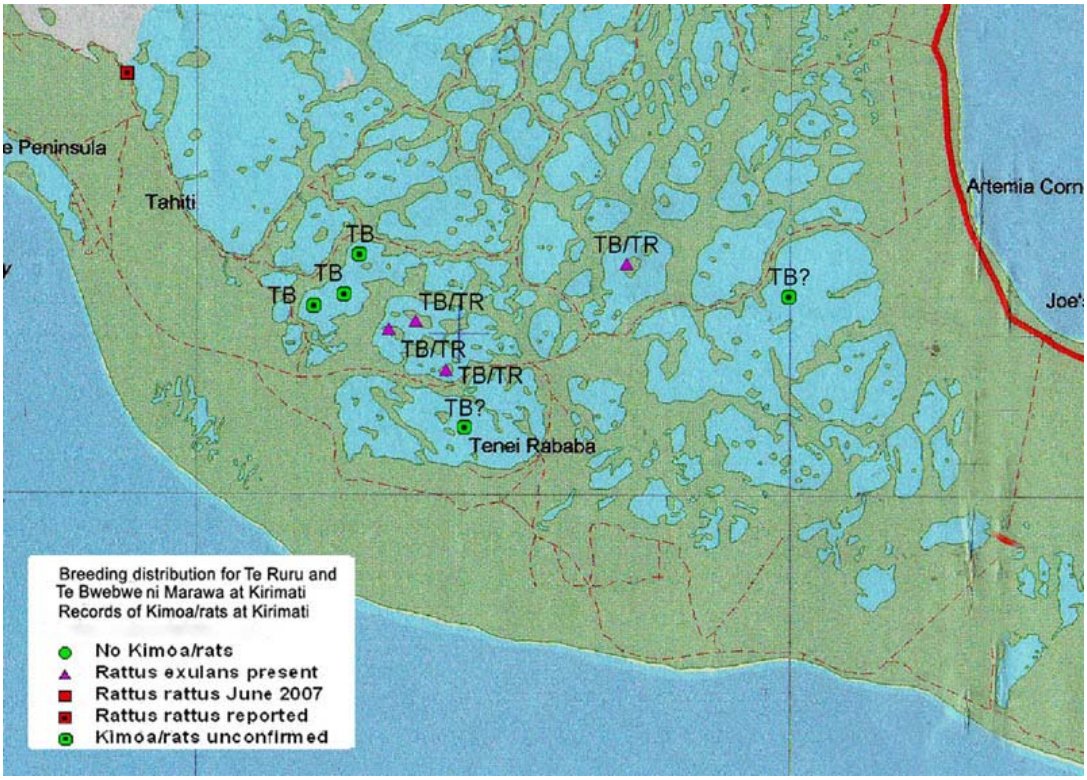


Fig 5.33 – Important seabird islands in the northern sector (above) and Tanguoua sector (below) of Kiritimati 2007. TR = Te ruru (Phoenix petrel) and TB = Te bwebwe ni marawa (white-throated storm-petrel) nesting areas. Colour symbols denote rat status.



Some small islands in the Manulu Lagoon and Tabo Channel area (the western TB islands in Fig 5.33) support significant numbers of Te bwebwe ni marawa, Te tarangongo and Te raurau. Some of these islands are rat-free, but most appear to support Pacific rats.

Motu Upua was an important seabird island in the 1970s to at least the 1990s, despite the presence of Pacific rats, and in 2002 there was an attempt to eradicate Pacific rats there (Anderson 2002). In 2007, seabird numbers and diversity was noticeably lower on Motu Upua than previously recorded there, with relatively few Te ruru and other petrels and no Te bwebwe ni marawa. There was clear sign of very high poaching pressure of adult Te ruru there in 2007 (refer Section 6.2) and nesting success of was low. Pacific rats were present indicating that either the eradication attempt had failed or that Pacific rats have recolonised (refer Section 6).

5.3.2 Species accounts

Te Ruru – Phoenix petrel (Endangered)

Four islands or island clusters are outstanding breeding areas for Te ruru – Motu Tabu and Motu Upua in the main lagoon and islets of Tanguoua Lagoon (Fig 5.32), with a minimum total estimate of 2300 pairs. Of these islands, Motu Tabu is currently the most important breeding site because:

1) With an estimated 1500-2000 pairs in June 2007, it supports by far the highest numbers and densities of Te ruru at Kiritimati and elsewhere,
2) Rats are absent from Motu Tabu and therefore productivity is higher here than at other sites,
3) Poaching pressure is low so adults are likely to be relatively long-lived here.

Table 5.32 – Summary of Te Ruru status and impacts.

Island	Motu Tabu	Motu Upua	Drum	Isles I1,I3, II2
Date	18-19 June	20-21 June	22-23 June	23-24 June
Estimated no.	1500-2000 pr	200-400 pr	200-400 pr	400-1000 pr
Nesting stage	**Prospecting, Eggs**, Young	**Prospecting**	**Prospecting, Eggs**	**Prospecting,** Eggs, Young
Pests	Nil	*Rattus exulans*	*Rattus exulans*	*Rattus exulans*
Poached Te ruru remains	Nil	18	0	0
Overall poaching pressure	Low	Very high	Low-moderate	Potentially moderate-high
Previous est. of no. in June-July[1]	1960s 1500 ad 1980 300 pr 1999 250 ad	1960s 3000 ad 1980 300 pr 1999 400 ads	None available	None available

Note 1: Different methods and timing preclude direct inter-year comparisons.

Te ruru are under pressure on the other three islands from combinations of predation of eggs by rats and poaching by people. Relatively few eggs and young were seen on the three islands infested with Pacific rats (Table 5.33). There was a high level of activity of adults on Motu Upua, Drum and Isles I1, I3 and II2 giving a superficial impression of large colonies being present. However, much of the activity was from very vocal prospecting birds and/or failed breeders, not adults returning swiftly and silently to relieve an incubating mate or feed a chick as occurs at healthy petrel colonies.

Table 5.33 – Nesting stages of Te ruru "nests" sampled on different islands June 2007.

Island	Motu Tabu	Motu Upua	Drum	Isles I1, I3, II2
Stage				
Prospect	28 (56%)	35 (83%)	45 (70%)	40 (69%)
Egg	17 (34%)	2 (5%)	6 (9%)	8 (14%)
Chick	4 (8%)	0	1 (2%)	1 (2%)
Failed egg	1 (2%)	5 (12%)	12 (19%)	9 (15%)
Total	50	42	64	58

On Motu Upua at least 18 beheaded carcasses of adult Te ruru were found and we probably missed many others, while some specimens would have been completely removed. A poacher was found with a freshly killed adult Te ruru during our first visit to Motu Upua. This island had previously been recognized as an important breeding island for Te ruru, with up to 3000 birds recorded here in the 1960s, but since then fewer have been recorded (Table 5.32), probably because of poaching and to a lesser extent low breeding success. Without intervention, the islands in the Tanguoua Lagoon area will also suffer more from poaching as numbers of Te taake, boobies and frigatebirds are depleted and poachers switch to alternative species including Te ruru.

Fig 5.34 – Remains of 10 Te ruru (right), two Te tangioua (top left) and two Te tinebu found in one pile on Motu Upua, June 2007.

Poaching on Kiritimati is particularly devastating for Te ruru and other seabirds, because breeding adults are killed along with other life stages. In the customary "muttonbirding" activities of New Zealand, Australia and some other locations, only the fledglings (not the adults) are harvested and to strict and sustainable controls.

Some other islands could become more important for Te ruru over time, e.g. birds appear to be colonizing Cook Island which, like Motu Tabu, is pest-free, while other islands in Tanguoua Lagoon could become more important once Pacific rats are eradicated. A very few birds had died from entanglement in *Cassytha filiformis* vine and there were also some oiled Te ruru, but most of these oiled birds appeared as though they would recover.

Numbers of Te ruru on Kiritimati are thought to have declined over the years based on visual observations (A. Teatata pers. comm.) and this appears to be backed up by data from Motu Upua. However, the Kiritimati population is still the most important population of this species globally and a sustainable recovery is very possible.

Urgent actions required now to protect Te ruru are:

- **Improve biosecurity especially for pest-free Motu Tabu.**
- **Eliminate poaching of Te ruru.**
- **Eradicate Pacific rats from the islands identified above (refer Section 7).**
- **Monitor outcomes for Te ruru.**

<u>Te Bwebwe ni Marawa – White-throated storm-petrel (Vulnerable)</u>

Determining the location of important islands for Te bwebwe ni marawa was more difficult to achieve than that for Te ruru. This was because:

- Te bwebwe ni marawa were not obvious during daytime surveys (we missed seeing them on some islands that were visited during the day, but saw them on some of these same islands during our evening or overnight visits).
- Birds did not start the evening return to the islands until about 1800 h, leaving only about one hour of light for the rapid survey method to pinpoint islands that birds were returning to, and
- Te bwebwe ni marawa nesting islands were often very small and time constraints prevented the many scores of potential nesting islands from being visited.

In the Tanguoua Lagoon area, it required several evenings of visits to finally determine the key breeding areas. Despite these limitations, our surveys were useful in determining

some of the nesting concentrations on Kiritimati (possibly all of them) and these are summarized in the Table below. Key sites were Motu Tabu, and many motu in the Tanguoua, Tabo, Isles and Manulu Lagoon areas (refer Fig 5.33).

Table 5.34 – Nesting centres for Te Bwebwe ni Marawa

Island	Motu Tabu	Drum	I1,I3, II2	Tabo	Isles Lagoon	Manulu Lagoon
Date	18-19 June	22-23 June	23-24 June	23 June	2002	19 June
Estimated no. prs	100-400	1-10	5-20	50-100	P	10+
Nesting stage	Pr, E	Pr	Pr	?	?	?
Pests	Nil	*Rattus exulans*	*Rattus exulans*	Possibly nil and *R exulans*	*Rattus exulans*	Nil and *R exulans*

Note: Isles Lagoon islets were covered by Everett et al (2002).

Fig 5.32 – Te bwebwe ni marawa outside nesting burrow on a Tanguoua Lagoon islet.

The total numbers of Te bwebwe ni marawa present at Kiritimati are probably only several hundred pairs. Given the decline of this species in the Phoenix Islands and

elsewhere (Pierce et al 2006), and apparently at Kiritimati, its conservation status probably merits Endangered as per Te ruru.

Urgent actions to protect Te Bwebwe are:

- **Iprove biosecurity of Motu Tabu and**

- **Eradicate Pacific rats from small islands in the Tanguoua, Isles and Manulu Lagoons (refer Section 7).**

Shearwaters – Te Tangioua (wedge-tailed), Te Tinebu (Christmas), Te Nna (Audubon's)

The three shearwater species were found on many of the islands and also on the Kiritimati mainland. On pest-free Cook Island and Motu Tabu productivity and survival appeared healthy. However, most other islands (and mainland sites in the Tanguoua Lagoon area) had old derelict burrows and sunken depressions indicative of former colonies, particularly of Te tangioua, which may have been present in millions in the past.

On Motu Upua there was clear evidence that poachers had been targeting shearwaters and Te ruru for some years (Table 5.35). Furthermore, on some of the small islands with Pacific rats, there was low breeding success (many rat-eaten shearwater eggs). It is not surprising that Te tangioua has declined, being the largest shearwater and prone to cat predation on the mainland, and rat predation and poaching in most areas.

Table 5.35 – Summary of shearwater status and impacts.
Te ta = Te tangioua, Te ti = Te tinebu.
Nesting stage: Pr = prospecting, E = egg, N = nestling; **Highlighted = main stage**

Island	Cook Island	Motu Tabu	Motu Upua	Drum	Ii, I3, II2
Date	14-15 June	18-19 June	20-21 June	22-23 June	23-24 June
Estimated no. prs	50 Te ta, 1000 Te ti, <10 Te nna	3-5000 Te ta 1-3000 Te ti <50 Te nna	500-1000 Te ta 500-1000 Te ti <10 Te nna	500-1000 Te ta 500-1000 Te ti 1500-2000 Te nna	550-1100 Te ta 500-1000 Te ti 1500-2000 Te nna
Nesting stage	**Pr, E, N**	**Pr, E, N**	**Pr, E**	**Pr,** E	**Pr, E, N**
Pests	Nil	Nil	*Rattus exulans*	*Rattus exulans*	*Rattus exulans*
Poached bird remains	Nil	Nil	12 Te tangioua, 2 Te tinebu	0	0
Overall poaching pressure	Low	Low	Very high	Low-Moderate	Potentially high

Te Taake – red-tailed tropicbird

Except for 5-10 nests observed on the manland in Tanguoua Area, all evidence of Te taake breeding was seen on islands that cats cannot gain access to. They are widespread and sometimes common on islands that afford good overhead cover for nests, e.g.

beneath Te mao and Te ren trees on Cook Island, Motu Tabu, Drum, Isles1-3 and other islands in the Tanguoua Lagoon area. Breeding success appears to be as high on Pacific rat-infested islands as it is on pest-free islands. However, poaching is a significant problem for this species and breeding birds are now rare on some of the more regularly poached islands, e.g. Motu Upua. **Poaching is the single greatest issue for this species and needs to be stopped (refer Section 6.2).**

Fig 5.33 – One live Te taake and remains of many others on an islet in Tanguoua Lagoon.

Table 5.36 – Summary of Te taake status and impacts.
Nesting stage: Pr = prospecting, E = egg or young nestling being brooded, N = older nestling; **Highlighted = main stage**

Island	Cook Island	Motu Tabu	Motu Upua	Drum	I1	I3
Date	14-15 June	18-19 June	20-21 June	22-23 June	23-24 June	23-24 June
Estimated no. prs	200-400	30-50	10-20	220+	40+	250+
No./km perimeter	50-100	70-100	5	195	33	92
Nesting stage	**E, N**	**E**, **N**	**E**	E	E 93%, N	E 89%, N
Pests	*Nil*	Nil	*Rattus exulans*	*Rattus exulans*	*Rattus exulans*	*Rattus exulans*
Poached Te taake remains	Nil	2	0	0	c.20	3
Overall poaching level	Low	Low	Very high	Low-Moderate	High	High

A very few white-tailed tropicbirds (*Phaethon lepturus*) were observed in and around London where they were centred on stands of coconuts and Pandanus.

Boobies – Te Mouakena (masked), Te Kibwi (brown), Te Koota (red-footed)

The ground-nesting Te mouakena and Te kibwi are widespread on Kiritimati and attempt to nest on mainland and island sites. Numbers are low for the available habitat (refer Table 5.31), probably a reflection of predation by cats and people. Te koota are however more widespread and common (refer Table 5.31), but they are a prime target of poachers (refer Section 6.2).

Fig 5.34 – Te kibwi juvenile (foreground) and adult left of great frigatebird and two Te mouakena juveniles (extreme left and right) on an islet in Tanguoua Lagoon June 2007.

Frigatebirds – Te Eitei are e Bubura (Great Frigatebird) and Te Eitei are e aki rangi ni Bubura (Lesser Frigatebird)

Te eitei are e bubara are widespread on Kiritimati, but breeding is confined to a few islands and parts of the mainland in the Tanguoua Lagoon area (refer Table 5.3). This species is a favored target of poachers and is clearly in decline (refer Section 6.2). The smaller species occurs throughout and may still breed in the Isles Lagoon and adjacent area to the south (Environment consultants Fiji 1999), but this area was not visited.

Te Karakara - Great crested tern

This species was found breeding only on Cook Island in June 2007, where several chicks were observed. Many were seen at other islands (refer Table 5.31) and on the mainland roosting at e.g. London and fishing in small lagoons in the Manulu Lagoon area, including birds in juvenile plumage.

Te tarangongo – Grey-backed tern

This species was found breeding only on islands in the Tanguoua Lagoon and Manulu Lagoon. Most of these islands were infested with Pacific rats which were preying on most eggs, and productivity of Te tarangongo was correspondingly low. Some small islands in Manulu Lagoon were Pacific rat-free and nesting appeared more successful (refer island survey appendices). The largest concentration was on a rat-free islet (Manulua Lagoon #3) in the far eastern portion of that Lagoon and supported several hundred pairs, with many eggs and chicks being seen there.

Fig 5.35 – Te tarangongo chick.

Te keeu – Sooty tern

This species was breeding prolifically at rat-free Cook Island and Motu Tabu. No breeding was observed on the other islands mainly infested with Pacific rats, but large concentrations of birds (possibly nesting) were seen on the south-eastern peninsula. No attempt was made to estimate numbers except at Cook Island at Motu Tabu, but our

impressions were that Kiritimati supported a population numbering in the low millions. Harvesting of eggs is reported to still occur opportunistically (A. Teatata pers. comm.).

Te Io – Brown noddy

This species was abundant only on rat-free Cook Island and Motu Tabu where they were at all breeding stages. Elsewhere, breeding was accompanied by many failures (refer Appendices for specific locations). An immature bird with a metal leg band was photographed on Motu Tabu.

Te Kirikiri – Black noddy

As with Te io, this species was abundant only at Cook Island and Motu Tabu, where breeding was at all stages. Density was moderately high on several of the islets, but these islets supported lower numbers of birds due simply to their smaller sizes. Nesting success appeared to be reasonably high even on islands where Pacific rats were present, perhaps because nests of this species were always placed in trees where they were less likely to be accessed by these rats. Some evidence of poaching was found, including a fire pit on one islet that contained many hundreds of bones.

Te Raurau – Blue-grey noddy

This species was generally uncommon. Highest numbers were found at Cook Island and some islets in Manulu Lagoon, some of which may have been free of Pacific rats. Nesting was underway at Cook Island and on some islets in Manulu Lagoon (eggs), but little sign of incubation was found on Pacific rat-infested islands. Falling water levels in Manulu Lagoon have transformed some islets into peninsulae, allowing access to predators and rendering them unusable for nesting by this species and most others. Several islets used for nesting by blue-grey noddies are now separated by only a narrow channel and will soon become connected if water levels continue to fall. Blue-grey noddy may have been impacted by this more than other species because it is, or at least was, concentrated in the Manulu Lagoon area.

Te Matawa – White tern

This species was common only at Cook Island and Motu Tabu where nesting was at all stages. It was surprisingly scarce on other islets and on the mainland of Kiritimati considering its tree-nesting habits and general tolerance of human presence.

6 IMPACTS OF INVASIVE PESTS AND POACHERS ON SEABIRDS

6.1 Mammalian pests and other pests present

Four invasive mammal species are present on Kiritimati – feral house cat (*Felis catus*), Pacific rat (*Rattus exulans*), black rat (*Rattus rattus*), and locally, pigs (*Sus scrofa*). Dogs can wander from the villages to some sensitive areas, but only seldom to the islands, e.g. one was removed from Cook Island in recent years (Katareti Taabu, WCU).

Feral house cats are distributed throughout the mainland. During our visit none were seen on islets in the lagoons, although it is likely that they can access some via stepping stones especially during dry periods. Efforts to reduce village cat productivity appear to be progressing well although we did not fully evaluate this.

Rattus exulans is widely distributed, being found throughout the mainland and on most motu that we visited. The only islands that we did not detect rats on were Cook Island, Motu Tabu and islands in the eastern end of Manulu Lagoon. It is likely that some of the very small islands in Tanguoua, Isles and other small ones in eastern Manulu Lagoon are also rat-free (Table 6.1). Pacific rats from Motu Upua were taken for genetic analyses at University of Auckland.

Table 6.1 - Location of rat sightings, captures, and survey effort June 2007.

Locality	Date set/ obs	Traps (and trap-nights)	Spot-light hours	No. *exulans*	No. *rattus*	Rat status
Manulu Lagoon #1	7	0	0	0	0	Rat-free
Manulu Lag #2	7	10 (10)	0	3	0	*R exulans*
Manulu Lagoon #3	8	0	0	0	0	Rat-free
Cook I	14	24 (24)	3	0	0	Rat-free
Motu Tabu	18	0	3.5	0	0	Rat-free
Crystal Beach	19-21	10 (30)	0	0	3	*R rattus*
Motu Upua	20	15 (30)*	3.5	23	0	*R exulans*
Banana	20-22	15 (45)	0	?	?	?
Drum I, Tanguoua	22	10 (10)	3	3	0	*R exulans*
Islet I1,I3,II2 Tanguoua	23	15 (15)	3.5	10	0	*R exulans*
Carver Way, Isles L	24	9 (9)	0	1?	0	R sp.

Note: Spot-lighting was used to verify Rat presence/absence on some islands;
* On Motu Upua, Rat traps were re-set during the single night of trapping.

During this study, three *Rattus rattus* individuals were trapped at Crystal Beach, one was seen at London, and recent sightings of singles were reported to us from Banana Village and from the southern edge of the main lagoon near Poland (refer Fig 5.21). No black rats were trapped on Motu Upua and on islets in Tanguoua Lagoon where *R. exulans* was

common. No black rats were seen while driving between Tanguoua Lagoon and London on the night of 16 June. It appears that black rats arrived and established at London in the late 1990s (Anderson 2001, 2002). Trapping to further refine the distribution of rat species is being continued by the WCU in conjunction with Bokikokiko surveys (refer Section 5).

Fig 6.1 – Pacific rats were active by late afternoon in most areas visited in June 2007.

No assessment of invasive ants has been undertaken on Kiritimati (D. Ward, NZ Landcare Research; Nautonga Anterea, Agriculture Department, Kiritimati, pers. comm.). During this study, the large native red ant *Camponotus chloroticus* was found on Cook Island and Drum Island as well as on the mainland.

A number of invasive plant species are present including *Lantana* and especially *Pluchea indica*, the latter of which appears to be extremely invasive after fire disturbance, with implications particularly for regeneration of Bokikokiko habitat.

6.2 Assessment of impacts of mammalian predators on seabirds

Predators (cats and rats) have all but eliminated most of the smaller species of seabird from the Kiritimati mainland. This includes the threatened and sensitive species (Te ruru, Te bwebwe ni marawa, Te taake, most terns and noddies). Nearly all of the other species (particularly shearwaters, but also boobies and frigatebirds) are also now greatly depleted on the mainland. If low productivity and low adult survival continues then these mainland colonies will eventually be lost.

Fortunately the network of small islands in the main lagoon and smaller lagoons has ensured the survival, till now at least, of the full complement of Kiritimati seabirds. Cats appear to be unable to access the islands that are more than a few tens of metres offshore, which ensures that adult survival of most seabird species can be maintained at high levels. Pacific rats, however, are present on many of these islands and disrupt the breeding and recruitment of Te ruru, Te bwebwe ni marawa, all shearwaters, terns and noddies. Colonies on islets where Pacific rats are present are likely to decline in the future due to poor recruitment and may eventually disappear unless Pacific rats are removed. These islets also may act as sinks, drawing prospecting birds away from Pacific rat-free islets where productivity would be higher.

Fig 6.2 – Eggs of Te tarangongo (grey-backed tern) eaten by Pacific rats.

The apparent impacts of Pacific rats and other predators are summarized for Kiritimati in Table 6.2. Pacific rats are likely to have only low to moderate impact on larger birds, but highest impact on the smaller Te bwebwe ni marawa and blue-grey noddy because all life stages from egg to adult can be killed by Pacific rats. Cats are likely to be having a high impact on most seabirds because of their ability to kill adults of all ground-nesting seabirds, as well as their eggs and young. Poaching impacts are primarily to larger seabirds and these appear to be serious, with only modest numbers of most large seabird species now being present at Kiritimati.

One pest whose impact is not yet known at Kiritimati is the black rat, which has recently arrived (Anderson 2002). If it spreads around the island as seems likely, then it will also access most of the smaller motu of Kiritimati because its swimming ability is superior to

that of *Rattus exulans* and cats. In time it will become an extremely serious management issue for seabirds and Bokikokiko.

Table 6.2 – Estimated severity of impacts of different pest species on Kiritimati seabirds.

Severity of impact	Poaching	Cat (mainland only)	*Rattus exulans*	*Rattus rattus*
Timing	Current	Current	Current	Future
Low-moderate	Te bwebwe, noddies, terns	Possibly some tree nesters, i.e. red-footed booby, black noddy, white tern	Te taake, boobies, frigate-birds, black noddy, white tern	Boobies, frigate-birds
Serious	Shearwaters, Te ruru, possibly sooty tern eggs	All other seabird species are at this level of impact or higher	Te ruru, Te tarangongo, Te raurau, brown noddy,shearwaters	Te taake, all terns, brown and black noddies (or higher impact)
Catastro-phic	Te ruru on Motu Upua and potentially elsewhere, Te taake, boobies, frigatebirds	Te ruru, Te bwebwe, boobies, shearwaters, frigatebirds, te taake, blue noddy, terns/brown noddy	Te bwebwe, and possibly Te raurau	Te ruru, Te bwebwe, all shearwaters, Te raurau, possibly all 6 spp. of terns and noddies

6.3 Assessment of poaching impacts on seabirds

Large numbers of carcasses of poached birds were found in June 2007 (Fig 6.3).

Fig 6.3 – Katareti assessing remains of poached seabirds at Tanguoua Lagoon.

Species that appear to have been poached the most frequently are Te taake, Te koota (red-footed booby) and te eitei, (frigatebirds), but many others were also taken (Table 6.3). For example, on Motu Upua where the above three preferred species have been nearly eliminated, Te ruru and two species of shearwaters were also taken. In addition, firepits containing apparent noddy bones were found at the Tanguoua Lagoon. Currently, the species mostly being impacted at the population level by poaching are Te taake, Te koota, Te eitei and probably Te ruru and Te tangioua.

Numbers of breeding Te taake may prove to be a useful indicator of poaching and the rate of population recovery if poaching is stopped or significantly decreased. The localized impacts of poaching on Te taake are illustrated in Fig 6.4 by graphing the number of breeding pairs in relation to poaching intensity as gauged by numbers of poached birds (all species) found in the area. In the three areas that had little or no sign of poaching, Te taake were present in consistently high numbers per kilometer of island perimeter, but in two of three areas where poaching was rife, there were few Te taake present. More visits to additional islands are needed to test this relationship.

Table 6.3 – Summary of poached birds found in different islands sites.

	Main lagoon			Tanguoua Lagoon				Manulu Lgoon			
Poached birds found	Cook I	Motu Tabu	Motu Upua	Drum	I1	I3	II2	M1	M2	M3	Total
Te Ruru, Ph Pe	0	0	18	0	0	0	0	0	0	0	18
Te Tangioua, WTSW	0	0	12	0	0	0	0	0	0	0	12
Te Tinebu, Xmas SW	0	0	2	0	0	0	0	0	0	0	2
Te Taake, RTTB	0	2	1	2+	20+	3	20	0	20+	0	68+
Te Koota, RFBo	0	0	0	5+	12+	16	10	0	Few	0	43+
Te Etei, Frigate	0	0	0	0	23+	21+	10	0	1	0	55+
Noddies	0	6	0	0	0	0	Many	0	0	0	6+
Unidentified	0	0	0	0	10+	10+	0	0	Many	0	20+
Total	0	8	33	7+	65+	50+	40+	0	21+	0	224+

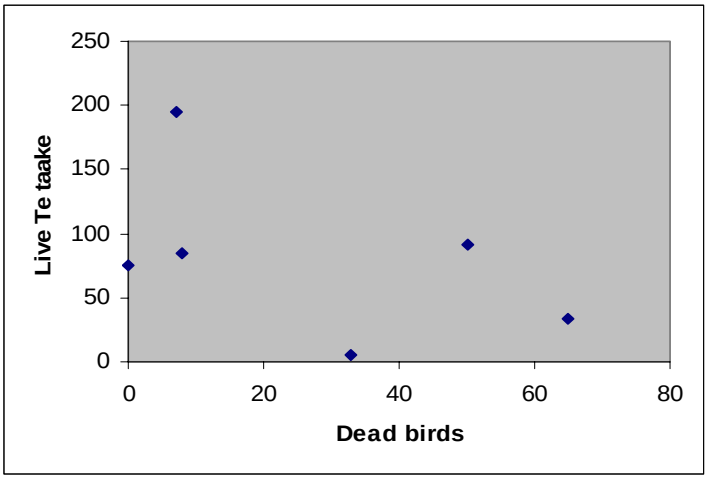


Fig 6.4 – Relationship between number of nesting Te taake and local poaching index.

6.4 Past work to control pests and poaching

6.4.1 Predator control, eradication and island quarantine

During the 1980s the Wildlife Conservation Unit was established to manage seabirds on Kiritimati (Environmental Consultants 1999). Meanwhile island quarantine was dealt with by the Agriculture Department. Since the 1980s the New Zealand Wildlife Service and subsequently New Zealand Department of Conservation have provided advice and helped set up pest control and quarantine initiatives at Kiritimati (Anderson 2001, 2002). Recent and current initiatives include the following:

Biosecurity of Kiritimati

Nautonga Anterea and Mamarau Kairirieta were the Agriculture officers on Kiritimati in June 2007 and we met and discussed the quarantine process at the ports of entry. Basically these comprise a visual inspection of cargoes that arrive at the island, either on board the craft (some boats) or ashore (airport, some boats). Key biosecurity risks identified during the meeting with Nautonga and Mamarau included:

- Variety of vessels arriving, e.g. cargo, fishing boats, liners, recreational;
- Variable attitude of landing parties, e.g. often ad hoc, prepeated landings;
- Lack of pest-proof facilities for inspections;
- Lack of insecticide;
- Lack of rodenticide – the existing brodifacoum bait they had in store was many years old and going mouldy;
- No advance warning of planes and ships arriving;
- No information on ants present at Kiritimati.

It is a top priority that the above problems are rectified urgently.

Biosecurity of Motu Tabu and Cook Island

In 2002 a system was established for inspecting boats that were intending to visit these highly sensitive islands. In addition poison bait stations were established on each of these sensitive islands (Anderson 2002). However, all of this work was subsequently discontinued. **It is a top priority that this quarantine work is reinstated, involving island closure, permitting, advocacy, and inspection of boats for rats and ants etc. (refer Section 7).** There is little point in relying on baiting these two islands as recent work in New Zealand suggests that invading rodents would ignore the bait and eat the natural food first (i.e. the hundreds of thousands of seabirds).

Attempted eradication of Pacific rats on Motu Upua

In March-April 2002 three hand-spreads of brodifacoum occurred across the island in three 5 kg/ha pulses 10 days apart (Anderson 2002). There was apparently no follow-up monitoring until our visit in June 2007 when Pacific rats were found to be common. However, we do not know whether the poison operation failed or Pacific rats subsequently recolonised, or both. This island is still important to revisit in terms of Pacific rats eradication, but lower in priority than the Tanguoua Lagoon islands, because

of the lack of Te bwebwe and several other species and close proximity of the island to some poacher's residences.

Cat control in the Tanguoua Lagoon complex

This work also took place in 2002 and comprised placing Victor Oneda traps for cats in the network of peninsulas and lagoon edges of the Tanguoua Lagoon (Fig 6.3), aimed at protecting colonies of Te ruru, shearwaters, Te koota, Te eitei and others (Anderson 2002). This work was apparently discontinued soon after. At present this cat control is not a priority to reinstate, but once the three priority actions (biosecurity, Pacific rat eradications, poaching control) are back on track, then cat control should be readdressed. Techniques for cat control have greatly improved since the early 2000 period. De-sexing of cats and dog control has, however, been maintained in London and the villages.

Poaching control at Kiritimati

The WCU has continued in its efforts to minimize poaching on the island by undertaking regular patrols, particularly in the Tanguoua Lagoon area. On average six apprehensions are made each year resulting in prosecutions and fines in the order of Au$50 per person (A. Teatata pers. comm.). The lagoon islands are less frequently patrolled because of the lack of a small boat. A large boat with a complex motor was provided by an Aid agency in the past but this proved impractical.

Fig 6.4 – Some mainland colonnies of boobies, frigatebirds and shearwaters still persist in the Tanguoua Lagoon area, but they are vulnerable to cats, rats and poachers.

7 POTENTIAL FOR RECOVERY OF KEY SEABIRD SPECIES

The recovery of Te ruru, Te bwebwe ni marawa and other sensitive seabirds at Kiritimati depends on three critical management requirements:

a) **Maintaining the pest-free status of key islands that are currently pest-free, i.e. Motu Tabu, Cook Island and some islets in the smaller lagoons.**

b) **Eradicating Pacific rats from key motu and islets that currently have declining numbers of Te ruru, Te bwebwe and other sensitive species, and maintaining them as pest-free motu.**

c) **Minimising the poaching of Te ruru, Te taake and other seabirds.**

In addition a fourth monitoring component is needed:

d) Determine the responses of Te ruru, Te bwebwe ni marawa and other species to conservation management.

Are the three management requirements (a-c) above feasible? Below is a discussion of each requirement and details of the specific needs for successful implementation.

1. Maintaining pest-free status of key motu

It is critical that Motu Tabu and Cook Island remain pest-free. Currently there is a very high risk that Pacific rats and other invasive species (e.g. foreign ants) will reach these islands as there are currently no biosecurity precautions in place. It would be a relatively simple process to implement effective quarantine of these islands (focussing on the source of boats), but some additional resourcing would be needed to monitor compliance at the island end. Key needs are:

- **Agricultural staff and WCU staff should plan an effective quarantine system to protect Motu Tabu and Cook Island that includes the following:**
  - Permit and landing requirements need to be advised at all potential boat departure sites (main port, hotels) and advertised via community radio and newspaper.
  - Ideally no landing should be allowed, particularly at Motu Tabu. It should be noted that in other parts of the world islands containing these sorts of very high values would be designated nature reserves, i.e. no landing without specific approved management or scientific tasks to be undertaken.

- All boats permitted to visit these islands need to have rodenticide bait on the boats and replaced as determined by an Agriculture inspector or WCU staff member.
- All boats permitted to visit these islands need to be inspected by Agriculture or WCU staff prior to departure.
- Rat poison must be on these boats at all times (including when boats are moored, in sheds, etc) and replaced regularly (before bait starts to become smelly, i.e, before visible signs of mould).
- Do not take wood or other equipment ashore in case it contains ants, especially a queen, which could found a new colony. If ants are present on a boat, that boat must not be used to go to the islands on that day or the following day. Owners must kill ants using insecticide as directed by Agriculture and additional supplies may be needed. Current advice from Ministry of Agriculture and Fisheries in New Zealand is to use a stock of multipurpose gel based toxic bait (Exterminant or Extinguish), apply and monitor over 48 hrs. Nautonga may need to order supplies of this.
- Talk with boat owners to ensure they understand risks and needs (WCU to coordinate).
- Increase surveillance of Motu Tabu and Cook Island – this will require the purchase of a small (e.g. aluminium boat). The WCU have a suitable motor.

- **Additional general biosecurity work is needed to ensure that other invasive species do not arrive and establish at Kiritimati itself.** For example, if Norway rats or fire ants established at Kiritimati, they would devastate the remaining seabird populations (Norway rats are good swimmers and would easily reach Motu Tabu and Cook Island, while fire ants could access islands over time via careless landing parties). Key needs are:
  - Implementation of pre-border biosecurity, pest-free status of vessels, etc.
  - Ensure all incoming cargoes, supplies and equipment are carefully inspected;
  - Ensure that if invasive species are detected in incoming goods, that means of containing and eliminating them are adequate and readily available, e.g. pest-proof store-rooms, pest-specific toxins and fumigants. All of these items will need to be addressed, purchased, and maintained is usable condition;
  - Carry out an ant survey at key arrival points, i.e. port, wharves, nearby warehouses, timber stockpile areas, airport buildings, villages, construction sites. Follow guidelines for surveying ants in the Pacific Ocean Islands, e.g. MAF 2006, but adapt for local needs, e.g. shorter sampling periods in hot weather.

All of the above actions aimed at protecting specific motu and Kiritimati generally are feasible provided the WCU and Agriculture are given clear direction and the resources to

carry out the work. There was an indication from Agriculture and WCU that some of this work (e.g. checking boats to Motu Tabu, etc) could and would be implemented immediately. Additional support and advice from external agencies are desirable for the planning and implementation of these actions.

2. Eradicating Pacific rats from key motu and subsequently keeping those motu pest-free

Several islands in Tanguoua Lagoon (Drum Island and Isles I1-3 and II2) and Isles Lagoon, together with Motu Upua, could be fully restored by eradicating Pacific rats. There are few non-target issues, with manai (*Cardisoma* sp.) and other crabs being notable by their absence or scarcity on most of these islands in June 2007, therefore rodenticide bait could be hand-spread across the islands.

Only Motu Upua had significant numbers of crabs with manai densities reaching up to one per 5-7 m^2 and these were in a band around the perimeter of the island extending up to c.40 m inland. In these perimeter areas, it would be advisable for Pacific rat eradication to be approached using crab-proof bait stations in addition to hand-spreading baits.

Other significant non-target issues are kewe (bristle-thighed curlew, *Numenius tahitiensis*), which are seasonally common at Kiritimati, but most are back at their breeding grounds in Alaska during the period May-July. In June 2007 up to 6 of these birds were seen together on and around Motu Upua, but they were scarce elsewhere. May-July would be optimal poisoning time in terms of avoiding poisoning of the kewe, which could take baits directly or become secondarily poisoned. Drum Island supported significant numbers of nesting Te eitei (frigatebirds) which could potentially prey on dying Pacific rats and gain some level of poisoning (the level of risk to Te eitei is unknown).

There are few logistic issues in eradicating Pacific rats from these islands. All islands are accessible to small boats and relatively small amounts of bait are needed per island. Risk of rain is an issue, but weather forecasting here is more accurate than in the Phoenix Islands. Any islands experiencing rain on baits could be re-baited at a later date. With a number of small islands being targeted (probably only one or two per day), there is increased risk of one or a few baiting operations being jeopardized by rain, but most will not experience this.

There may also be opportunities to create more islands in the future, e.g. by raising the level of some lagoons after strong tidal surges and closing the lagoon entrance at a higher level using a mechanical digger. Alternatively islands could be created by excavating channels across existing peninsulas as has been suggested in the past (Environment Consultants Fiji, Everett et al. 2002). These initiatives should be lower priority than the above eradication proposals because, besides the excavation work, they are generally now devoid of birds (long history of cat and Pacific rat predation) so recolonisiation by Te

ruru, Te bwebwe and most others would occur much more slowly than the projected recovery on an island they already occur on.

There is a risk of Pacific rats reinvading the islands again in the future. Although this risk is likely to be relatively low for each island because of the swimming distance involved (c.50-600 m), it could occur on some islands through careless human visitors. However, this risk can be managed as per actions for Motu Tabu above. The risks are also outweighed by the immediate gains for Te bwebwe ni marawa in the Tanguoua and Isles Lagoons area through higher adult survival and higher nesting success. In addition Te ruru, shearwaters and terns will all have higher nesting success, which would contribute towards these species improved status at Kiritimati (and globally for Te ruru and Te bwebwe).

There seems little point in trying to control *Rattus rattus* on the island because eradication would require island-wide approach. However, the dispersal of the species needs to be monitored annually. If it does invade the sensitive seabird islands, then tactics for dealing with that will need to be addressed. It would be advisable to begin to experiment with ways of intercepting invading *Rattus rattus* and, to this end, Motu Upua may be the most useful island, given its proximity to London and high potential for receiving these rats in the not too distant future.

It is desirable for international agencies to assist with the planning and implementation of these eradication actions and provide ongoing advice for dealing with *Rattus rattus* and other pests. The eradications could be used as training opportunities for ongoing Kiritimati and Phoenix Islands eradications and associated activities, including biosecurity, pest monitoring, bird monitoring and public compliance and law enforcement (refer Section 8).

3. Minimising poaching

Poaching is a very serious problem at Kiritimati being carried out by average members of the poplace who depend primarily on fish for their families' protein needs. The level of poaching (or temptation towards poaching) could very well increase as the human population increases and the sustainability of fisheries declines. This problem needs to be addressed in conjunction with improved biosecurity and pest eradications. Poaching needs to be addressed at two levels – firstly law enforcement and secondly education and community buy-in. If both are addressed satisfactorily then pressure will come off key threatened and sensitive species. If the corresponding pest biosecurity and pest eradications are successful, then the key bird populations will stabilize and then begin to recover. Key aspects required to stop poaching are:

- Focus on the most important bird areas, i.e. those containing the highest values and where maximum losses to poaching can occur and therefore where maximum gains can be made. These are islands that are free of cats and where adult bird survival would increase significantly if poaching could be stopped. They are:

    - Motu Tabu – highest numbers of Te ruru, high diversity of birds.
    - Cook Island – high diversity of birds, colonizing Te ruru.
    - Drum – high numbers of Te ruru, Te taake, Te koota, Te eitei.
    - I1-3, II2 – high numbers of Te ruru, Te taake, Te koota, Te eitei.
    - Motu Upua – high but declining numbers of Te ruru.
- Erect clear signage depicting no entry, no hunting etc.
- Patrol these areas regularly, camping out on islands if possible and catching poachers in the act of killing birds.
- Photograph all incriminating evidence.
- Remove poached birds from the sites and document species and numbers (this also sens a message to poachers that the sites are being monitored).
- Advocate for higher penalties, e.g. in New Zealand, fines are approximately NZ$1000 per bird killed and/or lengthy prison or community service periods.
- There is less urgency to patrol areas that are on the mainland because bird populations there are more diffuse (having crashed) and there will also be high losses occurring to cats whether poaching occurs or not. Once the above islands are satisfactorily protected, the mainland sites and perhaps some other islands become the next priority locations and they should be integrated with cat and other pest control.
- Resources needed to assist WCU in this work include:
    - Legal changes to penalties, etc.
    - Motor-bikes – 2 in stock, but may require repair.
    - Small dingy for accessing islands – motor in stock.
    - Hand-held radios.
    - GPS units – one now in stock.
    - Binoculars – 2 now in stock.
    - Digital camera – 1 now in stock.
    - Notebooks.
    - Operating budget greatly increased to cover fuel requirements.
    - Camping gear.

Complementing this approach is a need for education to improve awareness and advocacy about the global importance of the local birds and the huge impact that poaching and alien species are having on their populations. This aspect has been a major focus of Eric's and Lindsay's during June 2007. Work completed includes the following:

- Kiritimati bird identification guide comprising photos and text covering distinguishing features, distribution, ecology, and threats. Currently the guide is written in English (but with Kiribati bird names), and translation into Kiribati is needed;
- Interagency co-operation between Fisheries, Police, Agriulture and WCU
- Educational poster illustrating birds of Kiritimati, with symbols to show their diet and nesting habits. Two copies were printed and provided to the WCU and MELAD, but more are needed for distribution to schools, stores, airport, hotels, etc.;

- Digital photos of birds, rats, cats, poaching, predation, etc. that can be used for educational or scientific purposes as needed by the WCU;

Other advocacy work that should be addressed in future includes:

- Revamping a school advocacy kit developed by Richard in the early 2000s;
- Providing generic educational material for schools etc – this appears to be available at SPREP;
- Community workshops to achieve better community ownership of problems.

Finally, consideration should be given to finding other options for providing communities with food on the island, e.g. fish-farming possibilities and potentially also the controlled harvesting of sooty tern eggs.

4. Monitoring outcomes for seabirds

Some earlier consultants recommended that a few years should be dedicated to surveying and monitoring seabirds prior to implementing management initiatives. We do not concur with this recommendation as we believe there is sufficient background information to enable informed management decisions, the outcomes of which need to be monitored in an appropriate way. Undoubtedly, more detailed information will come to hand as additional areas are surveyed, but these are unlikely to significantly change management direction.

We suggest that the key survey and monitoring needs for seabirds are as follows:

- Determine accurate population estimates for Te ruru that can be used for baseline monitoring.

- Determine full distribution and more accurate population estimates of Te bwebwe ni marawa and the pest status of their motu and islets.

- Determine trends in Te ruru and Te bwebwe populations under pest management regimes.

- Determine general responses of Te raurau, Te tarangongo and other sensitive species to removal of Pacific rats from key islands.

- Determine general responses of Te taake, Te eitei, Te koota and other poached species to improved law enforcement.

- Determine mainland sites where populations of shearwaters, petrels and other species could recover under an intensive pest management regime that includes control to low levels of cats, rats and poaching; determine population densities at these sites to enable baseline monitoring.

These monitoring needs are summarised by island in Appendix 3. The WCU will need some technical assistance in setting up this progrmme (refer Section 8).

8 CAPACITY BUILDING AND RESOURCING TO SUSTAIN THE CONSERVATION IMPETUS ON KIRITIMATI

In June 2007 we placed heavy emphasis on WCU staff participation and training, including field work for bird and pest survey and database work for recording results of field work. During the field sessions there was a strong representation of the WCU (sometimes all 7 staff participating together), including during the weekends and over-nighting on islands.

Capacity building in the field

Field methods that the WCU staff learned or revised included the following:

- Taped playback - use of tape recording playbacks for surveying Bokikokiko (refer Section 4); all WCU stafff participated in this, honing their skills in detecting Bokikokiko by sight and sound.
- Vegetation descriptions – WCU and biologists derived descriptotrs and then applied them for Bokikokiko work; included overall vegetation density, % area and height of key plant species, and weather variables (refer Section 4); initially there was often debate about which category of height, density, etc, applied to specific vegetation, but later this was generally consistently agreed.
- Rat-surveys – WCU and biologists refined rat-trapping methods to include innovations that would avoid non-targets (crabs, seabirds, Bokikokiko), e.g. by tying traps onto trunks of shrubs, covering traps with artificial covers or twigs; they also learnt the usefulness of and techniques for spotlight/headlamp surveys and sign left on egg shells, to determine the status of rats on islands.
- Quarantine methods – discussion and agreement among WCU, Agriculture and biologists on methods to ensure that rats do not access Motu Tabu and Cook Island, field application during island visits, including checking boats and equipment for sign of rats. We encouraged the future collaboration of WCU and Agriculture to ensure that the best possible staff and techniques available on the island were being applied.
- Seabird surveys – WCU and biologists planned and implemented observations tailored for particular species, e.g. evening fly-on of Te bwebwe ni marawa (storm-petrels), perimeter census methods for Te taake (red-tailed tropicbirds).

Fig 8.1 – Discussing vegetation scores, from left, Ibeatapu, Ngauea, Aana, Dick and Eric.

- Use of binoculars – WCU now better able to identify birds from a distance, e.g. evening fly-ons of seabirds and counting and ageing of Bokikokiko.
- GPS – WCU used GPS for fixing positions, calculating distances, island perimeters, etc.
- Data sheets – WCU and biologists developed data sheets and WCU collected relevant data on seabirds and Bokikokiko.
- Database entry – WCU staff entering data from field sheets to computer database.

Equipment

Some equipment was left with the WCU to enable more information to be collected on key species and issues. For Bokikokiko work there is a need for more information on habitat and rat species composition, therefore field instructions and tape-player, tapes, binoculars, digital camera, rat-traps and GPS were left with the WCU. The binoculars, camera and GPS will also assist with seabird work. These are basic tools of their work and need to be housed in as cool and ventallated sites as possible, preferably with anti-desicants like silica gel, and a staff member(s) designted to look after them. There should also be a modest annual budget for replacement equipment.

In addition, the WCU and Agriculture need to be supplied with sufficient resourcing to cover their operational needs, e.g. vehicles, boat, pesticide and herbicide supplies, other equipment and traps, uniforms, insignia, administrative and advocacy materials, etc. In an earlier review of avifauna conservation on Kiritimti, Environmental Consultants Ltd

Fiji (1999) provided a number of recommendations for improvement, e.g. better resourcing, better equipment, and better, more efficient vehicles. We generally endorse those views and have provided a list of resources needed by the WCU (refer Section 7.3).

Ongoing advice, support and communication

Results of the June field work were analysed and feedback on this was provided to the WCU along with the bird identification guide prior to the completion of this report. For this sort of ongoing advice and support to be efficient, communication via email and telephone is highly desirable. In June 2007 two staff members had access to email and attachments could be down-loaded. Hopefully this system will continue and more staff will be "on-line".

A simple but effective way of building on this work is as follows:

1. The WCU collects more information on key prescribed aspects in their workplans (Bokikokiko, rats, seabirds) and their updated spreadsheets are emailed to consultants (Eric and Ray) involved in the June 2007 survey.
2. These results are analysed and summaries and recommendations are returned to the WCU.
3. All communications are copied to MELAD at Tarawa and all pest-realted work is copied to Agriculture at Kiritimati; and all telephone conversations are summarized and copied to all parties including MELAD.

There are also several important opportunities for capacity building and training that will assist pest quarantine, pest eradication, improved compliance and biota monitoring at Kiritimati. These include:

1. Phoenix Islands pest eradications – preliminary training for the planned eradications should be undertaken at Kiritimati (and some WCU staff should take part in the PIPA eradications provisionally timetabled for mid 2008).
2. PILN workshopping of pest quarantine and monitoring needs at Kirtimati.
3. WCU staff training in sustainable resource use, pest control and compliance and law enforcement with Nga Whenua Rahui/DOC in New Zealand.

Details of these capacity building opportunities and other opportunities are provided in Table 9.1 in Section 9.

We had planned to hold a community meeting during this work and on Day 2 requested the Ministry and WCU to arrange for one. This meeting did not occur apparently because the first secretary was away from Kiritimati. However during the visit, key communities were identified as being desirable for meetings (London, Poland, Banana). Information collceted during the surveys will be useful for future meetings, but it needs to be presented in i-Kiribati (not English). In terms of progressing the initiatives expressed in

this report we recommend that the position of wildlife warden also be confirmed as soon as is convenient.

9. CONCLUSIONS AND FINAL RECOMMENDATIONS

Kiritimati supports globally important populations of many seabird species, including the world's largest breeding populations of Te ruru (present in low thousands) and Te bwebwe ni marawa (present in hundreds). The endemic warbler, the Bokikokiko, is widespread on the island though its distribution is patchy. The main issues facing Kiritmati birds are as follows:

- Habitat loss – Bokikokiko is losing some habitat containing the important plant components te ren, te mao and ten tanini to human-induced changes, particularly development, fire, weeds and coconut plantings.
- Predation by humans – adults and young of Te ruru, Te taake, Te koota, Te eitei, and others are killed for food, resulting in local and island-wide impacts on populations.
- Predation by cats – except for Te keeu nearly all seabirds have been eliminated from the mainland through a long history of cat predation. Only relict seabird colonies remain on the mainland in e.g. the Tanguoua Lagoon complex.
- Predation by *Rattus exulans* – this rat has eliminated Te bwebwe ni marawa from the mainland and from most accessible motu and islets. It has also depleted populations of Te ruru, Te tinebu, Te nna, Te raurau and Te tarangongo through predation of eggs and chicks and subsequent low recruitment of these bird populations.
- Predation by *Rattus rattus* – the black rat has recently arrived on Kiritimati. It is larger and more aggressive than *R. exulans*, a better climber and a better swimmer, all of which imply future potentially catastrophic impacts on Bokikokiko and most seabirds.
- Small island quarantine – the crucially important seabird islands of Motu Tabu and Cook Island are not well protected from mainland influences, e.g. rats could easily be transported there and destroy the last secure colonies of Te ruru, Te bwebwe ni marawa and others.
- Kiritimati quarantine – resources are insufficient to ensure additional catastrophic events do not occur, e.g. there is high potential for the arrival and establishment of other invasive species such as Norway rat, invasive ants, snakes and weeds.
- Climate change and potentially rapid sea-level changes.

These issues are challenging. However, with adequate resourcing, a staged approach (addressing highest priority needs first), will ensure that the biota of the island is defended and restored. Basic needs are:

Priority 1 (Urgent – need to implement now)

- **Small island quarantine** – increase the vigilance of Motu Tabu and Cook Island by formalizing the permit process, and if any operators are allowed to visit, then appropriate precautions are in place as per Section 7.1.
- **Kiritimati quarantine** – increase the effectiveness of quarantine at the ports of Kiritimati generally by better resourcing, equipment and contingency methods, e.g. fumigation, pesticides.

Priority 2 (Begin implementation in 2007-08)

- **Pacific rat eradications** from key islands for Te ruru and Te bwebwe ni marawa recovery – Drum, Isles I1-3, II2 (Tanguoua), Motu Upua, possibly others.
- **Look to eliminate poaching** particularly from keys sites, i.e. Motu Tabu, Cook Island, Motu Upua, Drum, Isles I1-3, II2, et al. via advocacy (schools, communities, radio, books, camp at sensitive sites to apprehend poachers, statutory process, etc.
- **Bokikokiko surveys** – complete surveys of likely habitat, collect data on habitat and rats (especially *Rattus rattus* distribution), maintain database, analyze data.
- ***Rattus rattus* distribution** – trap new areas and maintain database of captures, and sightings and reports of this species.

Priority 3 (Begin implementation 2008-09)

- **Set up long-term monitoring** sites for seabirds.
- **Begin surveys of additional sites** on islands and mainland sites for seabirds and predators with a view towards eventual local management.
- Promote strategic planning for Pacific-wide restoration packages, assess needs for seabird translocations, etc.

Some of these priorities are already being implemented in WCU work plans following the June 2007 collbarative work and others are planned or are being considered. Based on discussions with GoK, PII/ISSG and SPREP staff, the following table provides recommendations on how these priority activities could be effectively implemented.

Table 9.1 – Recommended key actions to improve security of Kiritimati fauna.

Goal	Actions/needs	Responsibility	Timing
Small island quarantine – Motu Tabu, Cook, etc	Focus on priority tasks in workplans, i.e. • Declare Motu Tabu and Cook I as prohibited areas until biosecurity is re-established and effective; • Inspect for rats and ants any small vessels that are leaving London etc to go out on the lagoon (and so potentially visiting rat-free islands); • Advocate island sensitivities, closed	WCU	Ongoing

	islands, signage, etc • Monitor threatened seabirds		
	PILN Workshop 1 involving community stakeholders and agencies to identify issues, risks, and better methods for maintaining biosecurity of small islands	SPREP/PILN	March-April 2008
Kiritimati quarantine	Boat and aircraft checks for rodents, ants, etc	GoK/Ag	Ongoing
	PILN Workshop 1 to involve GoK agencies, seaport and airport authorities in identifying risks, current precautions, and further quarantine needs, better tools of trade, communication, etc, reference to MAF, NZDOC, SPREP, etc systems	SPREP/PILN	March-April 2008
	Survey likely invasion points for alien ants, e.g. port facilities, airport facilities, warehouses, etc, could be worked into PILN training	PII/PILN	March-April 2008
Kimoa/rat eradications	PIPA pest eradications due mid 2008 and training workshps best undertaken on Kiritimati. Training and capacity building to include survey of "new" islands for rats and rat removal from one or more of the Tanguoua Lagoon islets (e.g. Drum); derive monitoring methods for rodents, crabs (and other non-targets) and seabirds	PII/contract	April 2008
	Evaluate outcome of above training/ eradication and apply for funding to eliminate rats from additional islands	GoK/PII	As per sponsor timetables
Eliminate poaching	Work plans need to identify priority areas for patrol, i.e. rat-free islands and good islands in Tanguoua, Motu Upua	WCU	Ongoing
	Apply for Rare Pride funding to encourage community buy-in to seabird protection and raise this in PILN Workshop 1 (but poaching not workshopped at this time)	SPREP/PII	ASAP
	Implement Rare Pride programme on Kiritimati - includes workshopping (probably PILN Workshop 2) with communities at Poland, Banana and London, covering seabird values, issues, options, recommended way forward, etc; identify island champions for the project, field activities (e.g. simple identifying and counting birds flying over the mainland, schools etc), developing advocacy	SPREP/PII to coordinate	Apply soon as may take 2 years to implement

	materials for schools, public areas etc.		
	Explore possibility of bringing WCU staff to New Zealand for capacity building with Nga Whenua Rahui programme – iwi Maori-based protection programmes (two in North Island would be suitable as they involve traditional management, sustainability questions, poaching issues, rat and predator control)	NWR (Dick Anderson) to sponsor NZ activities and coordinate	NZ summer 2007-08 onwards
Bokikokiko and *Rattus rattus* trend surveys	Annual monitoring using bird and rat techniques and sites established in 2007	WCU with advice from Eric and Ray	June-July each year
	Survey of BOK and rats at new sites that "look good" following recommended methods 2007	WCU	Any time
	Advisors to analyse information as it comes in and provide appropriate feedback to WCU	Ideally Eric and/or Ray	Ongoing

REFERENCES

Anderson R. 2001 Kiritimati trip report April-May 2001. Report to SPREP, Samoa.

Anderson R. 2002. Kiritimati Trip Report March-April 2002. Report to Ministry of Line and Phoenix Group, Kiritimati.

Birdlife 2006. Bokikokiko Factsheet.

Birdlife 2007. Handbook of the Birds of the World, Vol 11, Lynx Edicions.

Environment Consultants Fiji 1999. Review of the status of avifauna conservation, Kiritimati Atoll, Kiritimati. Report for SPREP.

Everett W.T., M.J. Rauzon, H. Lee Jones 2002. Feasibility, prioritization and plans for eradication of kimoa from selected motus and islets. Prepared for URS Corporation, Hawaii.

Jones H. L. 2000. Maiuia Mannikibani: The birdlife of Christmas Island. Dames and Moore.

MAF 2006. Ministry of Agriculture and Forestry 2006. Annex A. Specification for Pacific Island Invasive Ant Surveillance 2005-06 Season. Wellington, Ministry of Agriculture and Forestry, Biosecurity New Zealand.

Pierce R.J., T. Etei, V. Kerr, E. Saul, A. Teatata, M. Thorsen, G. Wragg. 2006. Phoenix Islands Conservation Survey April-May 2006: a feasibility study for the ecological restoration of the Phoenix Islands, Kiribati. Eco Oceania Ltd, unpublished report for CI and PII, 109 pp.

Sherley G., 2001. Bird conservation priorities and a draft avifauna conservation strategy for the Pacific Islands region. SPREP, Samoa.

Schreiber R.W. and Asmole N.P., 1970. Seabird breeding seasons on Christmas Island, Pacific Ocean. Ibis 112: 363-394.

Schreiber R.W. and Schreiber E.A. 1984. Central Pacific seabirds and the El Nino Southern Oscillation: 1982 to 1983 perspesctives. Science 225: 713-716.

Appendix 1 - Plant and animal names mentioned in the text.

A - Plant names

Kiribati name	Species	English name	Family
Teutente ni mane	*Lepturus* sp.	Male weed (a grass)	Graminae
Te nii	*Cocos nucifera*	Coconut palm	Palmae
	Boerhavia sp.		Nyctaginaceae
	Pisonia grandis		Nyctaginaceae
Uteuten toari	*Sesuvium portulacustrum*		Alzoaceae
	Portulaca sp.		Portulaceae
Ten tanini	*Cassytha filiformis*	Orange vine	Lauraceae
Te aroua	*Suriana maritime*		Surianaceae
Te koura	*Sida fallax*		Malvaceae
	Heliotropium procumbens		Boraginaceae
Te ren	*Tournefortia argentea*	Areotrope	Boraginaceae
	Lantana camara		Verbenaceae
Te mao	*Scaevola sericea*	Saltbush	Goodeniaceae

B - Bird names

Kiribati name	Species	English name	Family
Te ruru	*Pterodroma alba*	Phoenix petrel	Procellaridae
Te tangiuoua	*Puffinus pacificus*	Wedge-tailed shearwater	Procellaridae
Te tinebu	*Puffinus nativitatis*	Christmas shearwater	Procellaridae
Te nna	*Puffinus lherminieri*	Audubon's shearwater	Procellaridae
Te bwebwe ni marawa	*Nesofregetta fuliginosa*	White-throated storm-petrel	Hydrobatidae
Te take	*Phaethon rubricauda*	Red-tailed tropicbird	Phaethontidae
Te gnutu	*Phaethon lepturus*	White-tailed tropicbird	Phaethontidae
Te mouakena	*Sula dactylatra*	Masked booby	Sulidae
Te kibwi	*Sula leucogaster*	Brown booby	Sulidae
Te koota	*Sula sula*	Red-footed booby	Sulidae
Te eitei are e bubura	*Fregata minor*	Great frigatebird	Fregatidae
Te eitei are e aki rangi ni bubura	*Fregata ariel*	Lesser frigatebird	Fregatidae
Te karakara	*Sterna bergii*	Great crested tern	Sternidae
Te tarangongo	*Sterna lunata*	Grey-backed tern	Sternidae
Te keeu	*Sterna fuscata*	Sooty tern	Sternidae
Te io	*Anous stolidus*	Brown noddy	Sternidae
Te mangikiri	*Anous minutus*	Black noddy	Sternidae
Te raurau	*Procelsterna cerulea*	Blue-grey noddy	Sternidae
Te matawa	*Gygis alba*	White tern	Sternidae
Te kun	*Pluvialis fulva*	Pacific golden plover	Charadridae
Te kirikiri	*Heteroscelus incanus*	Wandering tattler	Scolopacidae
Te kewe	*Numenius tahitiensis*	Bristle-thighed curlew	Scolopacidae
Te kitibwa	*Arenaria interpres*	Ruddy turnstone	Scolopacidae
	Larus atricilla	Laughing gull	Laridae
Taobe, Bitin, Rube	*Columba livia*	Rock dove	Columbidae
Te kura	*Vini kuhlii*	Kuhl's lorikeet	Psittacidae
Te Bokikokiko	*Acrocephalus aequinoctialis*	Christmas Island warbler	Muscicapidae

Appendix 2 WCU Kiritimati – Island Survey Data Sheet – Main Lagoon

Island: COOK ISLAND **Island location** (give GPS for small islands): Main lagoon
Approx. size: c.23 ha **Date/time:** 14th–15th June 2007, 1530-1000 h
Observers: Ray Pierce, Katareti Taabu, Eric VanderWerf, Lindsay Young
Kimoa: Absent – spotlighted length of island 1.5 h, trapped length of island (30 traps) for no sign. Abandoned seabird eggs intact, not smashed, no unusual gnawing, some dieback on *Portulaca*.
Poaching: Nil

Poached birds and age	Recent	Old	Comments
Te Ruru, Ph Pe			
Te Tangioua, WTSW			
Te Tinebu, Xmas SW			
Te Taake, RTTB			
Te Koota, RFBo			
Te Etei, Frigate			
Other/Unidentified			

Perimeter count of Te Taake nests and GPS distance: 200-400 per 4 km (estimate)

Other threats/notes: clusters of 4 and 10 coconut trees at N end of island incl juveniles – high no. (>5/m^2) of makau (hermit crabs) at these trees, low elsewhere. Large red ants = *Camponotus chloroticus*. 5 green turtles seen on 20 min boat trip from London to Cook I. No cats, but one had been dispatched here in past by WCU.

Live Birds – estimated numbers present

Species	Adults/prs	Nesting - Y/N, details
Te Ruru, Phoenix Petrel,	c.10 pr	Y, 6+ birds overhead together and vocal from 1600 h, prospecting N half island
Te Tangiuoua, WT Shearwater,	c.50 pr	Y, colony in Lepturus NW sector
Te Tinebu, Xmas Shearwater	1000+ pr	Y, breeding throughout island - all stages
Te Nna, Audubon's Shearwater	<10 pr	Y? central and N sector of island
Te Bwebwe ni marawa, WTSP	0	No birds detected during evening fly on and 1.5 h spotlighting
Te Taake, Red-tailed Tropicbird	200-400 pr	Y, breeding all stages, but mainly medium sized chicks
Te Mouakena, Masked Booby	1	N, adult offshore
Te Kibwi, Brown Booby	c.10	Y? 7 adults, 3 juveniles roosting.
Te Koota, Red-footed Booby	1000-2000	N, few during day but important night roost, no nests
Te Etei area e bubura, Gt Frigate	200+	N
Te Etei are e aki rangi ni bubura	5+	N
Te Karakara, Great Crested Tern	100+	Y, 2 small colonies with eggs and chicks
Te Tarangongo, Gy-backed Tern,	0	
Te Keeu, Sooty Tern	200,000 - 500,000 pr	Y, colony S half of island, many medium sized chicks
Te Io, Brown Noddy	10000-20000 pr	Y, breeding all stages
Te Mangikiri, Black Noddy	c.50,000 pr	Y, breeding all stages
Te Raurau, Blue-grey Noddy	250+	Y, 2 x 1-egg nests found
Te Matawa, White Tern	c.2000	Y, all stages especially eggs
Others, Te Kun, Te Kirikiri	0	
Te Kewe, Bristle-thighed Curlew	1	N

WCU Kiritimati - Island Survey Data Sheet – Main Lagoon

Island: MOTU TABU **Island location** (give GPS for small islands): Main lagoon
Approx. size: 3-4 ha **Date/time:** 18th–19th June 2007, 1600-1000 h
Observers: Ray Pierce, Eric VanderWerf, Katareti Taabu, Henry Genthe
Kimoa: absent – spotlighted and head-lamped most of the perimeter of the island, and also in Pisonia. Large numbers of abandoned seabirds' eggs and dead seabirds intact.
Poaching: Two Te Taake had been killed in recent weeks.

Poached birds and age	Recent	Old	Comments
Te Ruru, Ph Pe			
Te Tangioua, WTSW			
Te Tinebu, Xmas SW			
Te Taake, RTTB	2		
Te Koota, RFBo			
Te Etei, Frigate			
Other/Unidentified	6		Noddies

Other threats/notes: many apparently oiled Te Ruru and 16 dead individuals that died 1-6 weeks ago, a few older than this. One Te Ruru had died in the last 24 h from entrapment in *Lepturus* and *Cassytha*. A western fisherman and guide were fishing while standing in shallow water beside the island. Should rats ever arrive and need removal, hand spreading of bait is an option as there are low densities (<1/10 m^2) of crabs (3 species – *Cardisoma*, ghost crab and one other).
Perimeter count of Te Taake nests and GPS distance: 30-50/400 m

Live Birds – estimated numbers present

Species	Adults/prs	Nesting - Y/N, details
Te Ruru, Phoenix Petrel,	1500-2000 pr	Y, throughout island; prospecting, eggs and chicks; up to 200 adults visible in air at once. Average 1 occupied nest/14 m^2 over much of island
Te Tangiuoua, WT Shearwater,	3000-5000 pr	Y, throughout island prospecting, eggs
Te Tinebu, Xmas Shearwater	1000-3000 pr	Y, throughout island; all stages
Te Nna, Audubon's Shearwater	<100 pr	Y? Seen on ground
Te Bwebwe ni marawa, WTSP	100-400 pr	Up to 44 birds seen at any one time during evening fly on, many landed; nest scrape and 1 e nest seen in Lepturus
Te Taake, Red-tailed Tropicbird	30-50 pr	Y, breeding all stages, but mainly medium sized chicks
Te Mouakena, Masked Booby	2	N, adult/juvenile offshore/roosting
Te Kibwi, Brown Booby	0	
Te Koota, Red-footed Booby	300-500	N, no nests, night roost,
Te Etei area e bubura, Gt Frigate	c.5	N
Te Etei are e aki rangi ni bubura	c.30	N
Te Karakara, Great Crested Tern	c.30	Roosting
Te Tarangongo, Gy-backed Tern,	0	
Te Keeu, Sooty Tern	150,000 pr	Y, eggs and chicks
Te Io, Brown Noddy	5000-10000 pr	Y, breeding all stages
Te Mangikiri, Black Noddy	c.50,000 pr	Y, breeding all stages
Te Raurau, Blue-grey Noddy	c.40	Unconfirmed, behaving as if nesting
Te Matawa, White Tern	300-400	Y, all stages especially eggs
Others, Te Kun, Te Kirikiri	0	
Te Kewe, Bristle-thighed Curlew	1	N

WCU Kiritimati - Island Survey Data Sheet – Main Lagoon

Island: MOTU UPUA **Island location** (give GPS for small islands): Main lagoon
Approx. size: c.2**0** ha **Date/time:** 20th-21st June 2007, 1600-0900
Observers: Richard Anderson, Bio Ebere, Ray Pierce, Katareti Taabu
Kimoa: Abundant - active from 4 pm onwards. 100% trap catch, n = 20.
Poaching: Three piles of old seabird kills, one fresh Te Tangioua specimen.

Poached birds and age	Recent	Old	Comments
Te Ruru, Ph Pe		18	
Te Tangioua, WTSW	1	11	
Te Tinebu, Xmas SW		2	
Te Taake, RTTB		1	
Te Koota, RFBo			
Te Etei, Frigate			
Other/Unidentified			

Other threats/notes: coconuts are re-establishing following felling of trees in 2002. A local spear fisherman was fishing from boat in shallow water c.100 m from island. Old oil pipeline could provide rats access. Hand bait spread is an option to remove rats due to low densities of Manai (*Cardisoma* crabs) in most places except for a narrow (20-40 m wide) band above high water extending back into the te ren area and where densities of Manai reach 1 per 5-7 m^2 - bait stations would be needed in these Manai areas.
Perimeter count of Te Taake nests and GPS distance: 2 in 400 m.

Live Birds – estimated numbers present

Species	Adults/prs	Nesting - Y/N, details
Te Ruru, Phoenix Petrel,	200-400 pr	Y, low densities throughout island; mainly prospecting, few eggs and no chicks; many failed nests; up to 80 adults visible in air at once.
Te Tangiuoua, WT Shearwater,	500-1000 pr	Y, throughout central part of island, pr, few eggs; many collapsed/derelict burrows
Te Tinebu, Xmas Shearwater	500-1000 pr	Y, throughout island; many failed nests, 0 eggs, 2 chicks
Te Nna, Audubon's Shearwater	<10 pr	Y? 1 seen on ground
Te Bwebwe ni marawa, WTSP	0	0 flying to island at dusk, 0 spotlighted
Te Taake, Red-tailed Tropicbird	10-20 pr	Y, eggs, few pairs despite good habitat
Te Mouakena, Masked Booby	1	N, juvenile roosting
Te Kibwi, Brown Booby	1	N, juvenile roosting
Te Koota, Red-footed Booby	100-300	N, no nests, night roost,
Te Etei area e bubura, Gt Frigate	c.5	N
Te Etei are e aki rangi ni bubura	c.25	N
Te Karakara, Great Crested Tern	c.50	Roosting
Te Tarangongo, Gy-backed Tern,	0	
Te Keeu, Sooty Tern	< 100	N, some birds at night
Te Io, Brown Noddy	500-1000 pr	Y, breeding all stages, many failures
Te Mangikiri, Black Noddy	3000-5000 pr	Y, breeding all stages, many failures, impt night roost
Te Raurau, Blue-grey Noddy	6	N, possibly prospecting
Te Matawa, White Tern	50-200 pr	Y, few nests
Others, Te Kun	1	Feeding on NW tidal flat
Te Kirikiri	1	Feeding on NW tidal flat
Te Kewe, Bristle-thighed Curlew	6	Feeding on NW tidal flat

WCU Kiritimati – Island Survey Data Sheet – Tanguoua

Island: ISLET II2. **Island location** 01 49 26.8 N, 157 25 12.0 W
Approx. size: 2-4 ha **Date/time: 8** June 2007, 1050-1110h
Observers: Eric VanderWerf, Lindsay Young
Kimoa: *Rattus exulans* common
Poaching: Much sign

Poached birds and age	Recent	Old	Comments
Te Ruru, Ph Pe			
Te Tangioua, WTSW			
Te Tinebu, Xmas SW			
Te Taake, RTTB	c.20	Y	
Te Koota, RFBo	10	Y	
Te Etei, Frigate	10	Y	
Other/Unidentified	Y	Y	Probably noddies in fire-pit

Perimeter count of Te Taake nests and GPS distance: 40 nests.

Other threats/notes:
Small islet c.50 m offshore. *Sesuvium, Scaevola, Lepturus, Boerhavia*.
15 Te Bwebwe ni marawa flying across Carver Way E-W 1825-1840 h.

Live Birds – estimated numbers present

Species	Adults/prs	Nesting - Y/N, details
Te Ruru, Phoenix Petrel,	20 ads	Y; 3nests
Te Tangiuoua, WT Shearwater,	3 ads	Y; 1 large chick, 2 ads in burrows
Te Tinebu, Xmas Shearwater	5 ads	Y; 1 egg,, 2 prospecting
Te Nna, Audubon's Shearwater	10 ads	Y; all in burrows, 2 with eggs, 1 large chick
Te Bwebwe ni marawa, WTSP		
Te Taake, Red-tailed Tropicbird	40 prs	Y; eggs to large chicks
Te Mouakena, Masked Booby	3 ads	N; 1 immature and 3 ads
Te Kibwi, Brown Booby	1	N; flying past
Te Koota, Red-footed Booby	30+ prs	Y; 30 nests
Te Etei area e bubura, Gt Frigate	10	N; c.10 perched, no nests seen
Te Etei are e aki rangi ni bubura		
Te Karakara, Great Crested Tern		
Te Tarangongo, Gy-backed Tern,	c.300	Y; nests with eggs, small chicks, few juvs
Te Keeu, Sooty Tern	P	N; flying overhead
Te Io, Brown Noddy	150 prs	Y; mostly eggs, few small to large chicks
Te Mangikiri, Black Noddy	c.250 prs	Y; eggs to large chicks
Te Raurau, Blue-grey Noddy	P	N; flying only
Te Matawa, White Tern	2 ads	Y?; 1 begging call heard
Others, Te Kun, Te Kirikiri		
Te Kewe, Bristle-thighed Curlew		

WCU Kiritimati - Island Survey Data Sheet - Tanguoua

Island: ISLET 1 Island location (give GPS for small islands): Tanguoua
Approx. size: 2-4 ha **Date/time:** 24 June 07, 0900-1000 h.
Observers: Richard Anderson, Bio Eberi, Ray Pierce, Katareti Taabu
Kimoa: *Rattus exulans*.
Poaching: High levels – 6 piles of dead birds, 4 recent, 2 old

Poached birds and age	Recent	Old	Comments
Te Ruru, Ph Pe	0		
Te Tangioua, WTSW	0		
Te Tinebu, Xmas SW	0		
Te Taake, RTTB	13		
Te Koota, RFBo	10	2+	Dried bones
Te Etei, Frigate	13	10+	
Other/Unidentified		10+	Burnt bones

Perimeter count of Te Taake nests and GPS distance: 28 (26 nests, 2 chicks), 850 m.

Other threats/notes: Could eradicate rats here as recolonisation is likely to take considerable time, or not occur at all. No crab issues.

Live Birds – estimated numbers present

Species	Adults/prs	Nesting - Y/N, details
Te Ruru, Phoenix Petrel,	20-40 pr	Y; mainly in interior of island
Te Tangiuoua, WT Shearwater,	40-100 pr	Y
Te Tinebu, Xmas Shearwater	10-50 pr	Y
Te Nna, Audubon's Shearwater	10-50 pr	Y; eggs, prospecting
Te Bwebwe ni marawa, WTSP	2+ pr	Probably attempting to nest – seen over island in evening
Te Taake, Red-tailed Tropicbird	40+ pr	Y; 28 perimeter nests
Te Mouakena, Masked Booby	1-2 pr	Y; immature present
Te Kibwi, Brown Booby	0	
Te Koota, Red-footed Booby	50-100 pr	Y; eggs, chicks
Te Etei area e bubura, Gt Frigate	c.20	N
Te Etei are e aki rangi ni bubura	0	
Te Karakara, Great Crested Tern	0	
Te Tarangongo, Gy-backed Tern	100+ pr	Y; eggs, few chicks, many kimoa-eaten eaten eggs.
Te Keeu, Sooty Tern	0	
Te Io, Brown Noddy	100+ pr	Y
Te Mangikiri, Black Noddy	200+ pr	Y; all stages
Te Raurau, Blue-grey Noddy	1	N
Te Matawa, White Tern	2	N?
Others, Te Kun, Te Kirikiri	0	
Te Kewe, Bristle-thighed Curlew	0	

WCU Kiritimati – Island Survey Data Sheet - Tanguoua

Island: ISLET 2. Island location 01 49 37.3 N, 157 25 36.3 W
Approx. size: 2 ha **Date/time:** 11 June 2007, 1500-1630 h
Observers: Eric VanderWerf, Lindsay Young, Henry Genthe
Kimoa: *Rattus exulans* - 5 seen
Poaching: Much sign

Poached birds and age	Recent	Old	Comments
Te Ruru, Ph Pe			
Te Tangioua, WTSW			
Te Tinebu, Xmas SW			
Te Taake, RTTB	5	12	
Te Koota, RFBo	10	5	
Te Etei, Frigate	5	1	
Other/Unidentified			

Perimeter count of Te Taake nests and GPS distance: 29 nests (c.75% trees sampled).

Other threats/notes:
Small islet c.75 m offshore. Open area in middle.

Live Birds – estimated numbers present

Species	Adults/prs	Nesting - Y/N, details
Te Ruru, Phoenix Petrel,	23+ prs	Y; nests scrapes, flight courtship
Te Tangiuoua, WT Shearwater,	4+ prs	Y; 4 nests with eggs, 4 with chicks
Te Tinebu, Xmas Shearwater	4+ prs	Y; 2 nests with eggs, 3 juvs
Te Nna, Audubon's Shearwater	11+ prs	Y; 1 chick, others with eggs or prospecting
Te Bwebwe ni marawa, WTSP		
Te Taake, Red-tailed Tropicbird	29+ prs	Y; mostly eggs, 1 med chick
Te Mouakena, Masked Booby	1 imm	N
Te Kibwi, Brown Booby		
Te Koota, Red-footed Booby	11+ prs	Y; 11 nests
Te Etei area e bubura, Gt Frigate		
Te Etei are e aki rangi ni bubura		
Te Karakara, Great Crested Tern		
Te Tarangongo, Gy-backed Tern,	7	N; all flying
Te Keeu, Sooty Tern		
Te Io, Brown Noddy	8 prs	Y; nests, 1 med chick
Te Mangikiri, Black Noddy	135 prs	Y; nests – eggs-large chicks
Te Raurau, Blue-grey Noddy	3 ads	N
Te Matawa, White Tern	2 pr	Y, 1 nest with egg
Others, Te Kun, Te Kirikiri		
Te Kewe, Bristle-thighed Curlew		

WCU Kiritimati – Island Survey Data Sheet - Tanguoua

Island: ISLET 3. **Island location** 01 49 46.4 N, 157 25 30.1 W
Approx. size: 5-7 ha **Date/time:** 11 June 2007, 1645-1815 h
Observers: Eric VanderWerf, Lindsay Young, Henry Genthe
Kimoa: *Rattus exulans* - 4 seen
Poaching: Much sign

Poached birds and age	Recent	Old	Comments
Te Ruru, Ph Pe			
Te Tangioua, WTSW			
Te Tinebu, Xmas SW			
Te Taake, RTTB	2		
Te Koota, RFBo	5		
Te Etei, Frigate	4		
Other/Unidentified		Y	

Perimeter count of Te Taake nests and GPS distance: 45 nests (c.50 perimeter sampled).

Other threats/notes:
Linked by very narrow coral bar to islet 1.

Live Birds – estimated numbers present

Species	Adults/prs	Nesting - Y/N, details
Te Ruru, Phoenix Petrel,	150+ in air, 16 nests	Y; 1 small and 1 med chick seen, c.1% area searched
Te Tangiuoua, WT Shearwater,	4+ prs	Y; 4 nests
Te Tinebu, Xmas Shearwater	9+ prs	Y; nests and juvs
Te Nna, Audubon's Shearwater	13+ prs	Y; nests
Te Bwebwe ni marawa, WTSP	4 ads	Y; 1 tunnel under *Lepturus*
Te Taake, Red-tailed Tropicbird	45+ prs	45 nests in 50% perimeter, mostly eggs, few small to large chicks
Te Mouakena, Masked Booby		
Te Kibwi, Brown Booby		
Te Koota, Red-footed Booby	52+ prs	Y; 52 nests, eggs to large chicks
Te Etei area e bubura, Gt Frigate	14+ prs	Y; eggs to large chicks
Te Etei are e aki rangi ni bubura		
Te Karakara, Great Crested Tern		
Te Tarangongo, Gy-backed Tern,	150 ads	Y; eggs mainly eaten by rats
Te Keeu, Sooty Tern	P	N; flying over
Te Io, Brown Noddy	12+ prs	Y; eggs to chicks
Te Mangikiri, Black Noddy	47+ prs	Y; eggs to large chicks
Te Raurau, Blue-grey Noddy	2 ads	N
Te Matawa, White Tern		
Others, Te Kun, Te Kirikiri		
Te Kewe, Bristle-thighed Curlew		

WCU Kiritimati - Island Survey Data Sheet - Tanguoua

Island: ISLET 3. Island location (give GPS for small islands): Tanguoua
Approx. size: 5-7 ha **Date/time:** 23-24 June 07, 1830h-0900h.
Observers: Richard Anderson, Bio Eberi, Ray Pierce, Katareti Taabu
Kimoa: *Rattus exulans;* 3 in 10 trap nights, moderate density.
Poaching: High levels – 4 piles of dead birds, 2 recent, 2 old

Poached birds and age	Recent	Old	Comments
Te Ruru, Ph Pe	0		
Te Tangioua, WTSW	0		
Te Tinebu, Xmas SW	0		
Te Taake, RTTB	1	2+	Dried bones
Te Koota, RFBo	11	5+	Dried bones
Te Etei, Frigate	16	5+	
Other/Unidentified	0	10+	Dried bones

Perimeter count of Te Taake nests and GPS distance: 92 (82 nests, 10 chicks), 1003 m.

Other threats/notes: Could eradicate rats here as recolonisation is likely to take considerable time, or not occur at all. No crab issues.

Live Birds – estimated numbers present

Species	Adults/prs	Nesting - Y/N, details
Te Ruru, Phoenix Petrel,	400-1000 pr	Y; sample: prospecting (40), eggs (8) , failed egg (9), chick (1) mainly in interior of island
Te Tangiuoua, WT Shearwater,	500-1000 pr	Y; many prospecting, some incubating, 2 rat-eaten eggs.
Te Tinebu, Xmas Shearwater	500-1000 pr	Y; c.1 pr/5 m perimeter, 300+ pr in interior
Te Nna, Audubon's Shearwater	1500-2000 pr	Y; c. 1 pr/ m perimeter and 500+ pr in interior; Sample - prospecting 40, eggs, 2, chick 1.
Te Bwebwe ni marawa, WTSP	1-10 pr	Y; one pair prospecting, others seen flying low in evening
Te Taake, Red-tailed Tropicbird	250+ pr	Y; 152 nests and 43 chicks seen on perimeter
Te Mouakena, Masked Booby	10-20 pr	Y; prospecting 3, fledglings 2, juveniles 8.
Te Kibwi, Brown Booby	10-20 pr	Y; prospecting 2, incubating 3, juveniles 5.
Te Koota, Red-footed Booby	1000+	Y Nests and important roosting island
Te Etei area e bubura, Gt Frigate	c.200 pr	Y; 61 eggs, 121 chicks, many juveniles
Te Etei are e aki rangi ni bubura	Present	N; many present in evening/night
Te Karakara, Great Crested Tern	10+	N; evening roost
Te Tarangongo, Gy-backed Tern	80+ pr	Y; 5 eggs, c.10 chicks, scores of kimoa-eaten eaten eggs.
Te Keeu, Sooty Tern	c.10	N; evening roost
Te Io, Brown Noddy	50-100 pr	Y; prospecting, eggs and few chicks
Te Mangikiri, Black Noddy	250-500 pr	Y; all stages
Te Raurau, Blue-grey Noddy	11	Y?; no eggs found but appear to be attempting to breed
Te Matawa, White Tern	Present	N?
Others, Te Kun, Te Kirikiri	0	
Te Kewe, Bristle-thighed Curlew	0	

WCU Kiritimati - Island Survey Data Sheet - Tanguoua

Island: DRUM ISLAND (VII3) Island location (GPS for small islands): Tanguoua
Approx. size: 6-8 ha **Date/time:** 1730-1930 16 June 07 viewed from 1 km to E
Observers: Ray Pierce
Kimoa: Rattus exulans – refer later visit
Poaching: Refer later visit

Perimeter count of Te Taake nests and GPS distance: refer later visit.

Other threats/notes: refer later visit. Notes below refer to birds present at or returning to island in evening.

Live Birds – estimated numbers present

Species	Adults/prs	Nesting - Y/N, details
Te Ruru, Phoenix Petrel,	200+ pr	Y? Up to 80 birds in air together peaking 1845 h, many landings seen
Te Tangiuoua, WT Shearwater,	10+ pr	Y? Birds beginning to circle and land
Te Tinebu, Xmas Shearwater	5+ pr	Y? 5+ circling 1839 onwards
Te Nna, Audubon's Shearwater	20+ pr	Y? Circling and landing from 1825 h; many more proceeding to SW
Te Bwebwe ni marawa, WTSP	2+ pr	Y? Circling and landing from 1845 and 1853; 4 others proceed SW to NNW
Te Taake, Red-tailed Tropicbird	30+	Y?
Te Mouakena, Masked Booby	c.10	N? Evening roost on SW shore
Te Kibwi, Brown Booby	14	N? Evening roost on S shore
Te Koota, Red-footed Booby	1000+	Y Nests and important roosting island
Te Etei area e bubura, Gt Frigate	Present	Hundreds frigate sp arrive evening
Te Etei are e aki rangi ni bubura	Present	Hundreds frigate sp arrive evening
Te Karakara, Great Crested Tern	20+	N? Evening roost
Te Tarangongo, Gy-backed Tern,	c.60	Y. Colony and evening roost; also colony on motu 5, 2 km to S
Te Keeu, Sooty Tern	c.100	N? Evening roost
Te Io, Brown Noddy	500+	Y?
Te Mangikiri, Black Noddy	1000+	Y
Te Raurau, Blue-grey Noddy	100+	Y? Evening roost; nesting pairs on neighbouring small islands
Te Matawa, White Tern	Present	Y?
Others, Te Kun, Te Kirikiri	0	
Te Kewe, Bristle-thighed Curlew	2	N

WCU Kiritimat - Island Survey Data Sheet - Tanguoua

DRUM ISLAND (VII3) Island location (give GPS for small islands): Tanguoua
Approx. size: 6-8 ha **Date/time:** 22-23 June 07, 1730h-0900h.
Observers: Richard Anderson, Bio Eberi, Ray Pierce, Katareti Taabu
Kimoa: *Rattus exulans;* 3 in 10 trap nights, moderate density.
Poaching: No sign

Poached birds and age	Recent	Old	Comments
Te Ruru, Ph Pe	0		
Te Tangioua, WTSW	0		
Te Tinebu, Xmas SW	0		
Te Taake, RTTB	0	2+	Dried bones
Te Koota, RFBo	0	5+	Dried bones
Te Etei, Frigate	0		
Other/Unidentified	0		

Perimeter count of Te Taake nests and GPS distance: 195 (152 nests, 43 chicks), 1002 m.

Other threats/notes: Could eradicate rats here as recolonisation is likely to take considerable time, or not occur at all. No crab issues.

Live Birds – estimated numbers present

Species	Adults/prs	Nesting - Y/N, details
Te Ruru, Phoenix Petrel,	200-400 pr	Y; sample: prospecting (45), eggs (6) , chick (1) mainly in interior of island, failed egg (12)
Te Tangiuoua, WT Shearwater,	500-1000 pr	Y; many prospecting, some incubating, 2 rat-eaten eggs.
Te Tinebu, Xmas Shearwater	500-1000 pr	Y; c.1 pr/5 m perimeter, 300+ pr in interior
Te Nna, Audubon's Shearwater	1500-2000 pr	Y; c. 1 pr/ m perimeter and 500+ pr in interior; Sample - prospecting 40, eggs, 2, chick 1.
Te Bwebwe ni marawa, WTSP	1-10 pr	Y; one pair prospecting, others seen flying low in evening
Te Taake, Red-tailed Tropicbird	250+ pr	Y; 152 nests and 43 chicks seen on perimeter
Te Mouakena, Masked Booby	10-20 pr	Y; prospecting 3, fledglings 2, juveniles 8.
Te Kibwi, Brown Booby	10-20 pr	Y; prospecting 2, incubating 3, juveniles 5.
Te Koota, Red-footed Booby	1000+	Y Nests and important roosting island
Te Etei area e bubura, Gt Frigate	c.200 pr	Y; 61 eggs, 121 chicks, many juveniles
Te Etei are e aki rangi ni bubura	Present	N; many present in evening/night
Te Karakara, Great Crested Tern	10+	N; evening roost
Te Tarangongo, Gy-backed Tern	80+ pr	Y; 5 eggs, c.10 chicks, scores of kimoa-eaten eaten eggs.
Te Keeu, Sooty Tern	c.10	N; evening roost
Te Io, Brown Noddy	50-100 pr	Y; prospecting, eggs and few chicks
Te Mangikiri, Black Noddy	250-500 pr	Y; all stages
Te Raurau, Blue-grey Noddy	11	Y?; no eggs found but appear to be attempting to breed
Te Matawa, White Tern	Present	N?
Others, Te Kun, Te Kirikiri	0	
Te Kewe, Bristle-thighed Curlew	0	

WCU Kiritimati - Island Survey Data Sheet - Tanguoua

VARIOUS ISLANDS IN TANGUOUA LAGOON **Island location:** Tanguoua Lag.
Approx. size: all <5 ha **Date/time:** 16 June 1530-1930 - viewed from Carver Way
Observers: Ray Pierce, Richard Anderson, Eric VanderWerf, Lindsay Young, Henry Genthe
Kimoa: refer later visits
Poaching: High - refer later visits

Perimeter count of Te Taake nests and GPS distance: refer later visits.

Other threats/notes: refer later visits. Notes below refer to birds present at or returning to island in late afternoon/evening.

Live Birds – estimated numbers seen ashore or circling:

Island	IX	Isles Lag.	VII	X 17-21	VII 1-3	II 4	II 2	VII 5-6
Time	1530	1540	1550	1605	1630	1645	1650	1720
Species								
Te Ruru, Phoenix Petrel,	2	0	7	6	20	0	6	0
Te Tangiuoua, WT Shearwater,	0	0	0	0	0	0	0	0
Te Tinebu, Xmas Shearwater	0	0	1	0	0	0	0	0
Te Nna, Audubon's Shearwater	0	0	0	0	0	0	0	0
Te Bwebwe ni marawa, WTSP	0	0	0	0	0	0	0	0
Te Taake, Red-tailed Tropicbird	0	0	0	P	P	0	P	0
Te Mouakena, Masked Booby	0	0	0	1	0	0	0	0
Te Kibwi, Brown Booby	0	0	0	2	0	0	0	0
Te Koota, Red-footed Booby	0	50+	1	P	P	0	0	0
Te Etei area e bubura, Gt Frigate	0	100+	0	P	200	10	P	0
Te Etei are e aki rangi ni bubura	0	P	0	?	P	?	?	0
Te Karakara, Great Crested Tern	0	0	0	0	0	0	0	0
Te Tarangongo, Gy-backed Tern	0	2	0	0	10+	0	50+	120+
Te Keeu, Sooty Tern	0	0	0	0	0	0	0	0
Te Io, Brown Noddy	P	P	P	0	P	0	0	0
Te Mangikiri, Black Noddy	0	0	0	0	0	0	P	0
Te Raurau, Blue-grey Noddy	0	1	1	P	5+	0	0	2
Te Matawa, White Tern	0	0	0	0	0	0	0	0

WCU Kiritimati - Island Survey Data Sheet - Tanguoua

ISLANDS IN AMBO-TIBO CHANNELS **Island location:** Tanguoua Lagoon
A = Ambo Channel 300 m NE of Causeway
B = Ambo Channel 500 m N of Causeway
C = Ambo Channel 500 m SW of Causeway
D = Ambo Channel 1 km SW of Causeway
E = Tibo Channel 600 m NW of Causeway.
Approx. size: all <5 ha **Date/time:** 23 June 1530-1830 - viewed from shore
Observers: Ray Pierce, Katareti Taabu
Kimoa: Unknown – need to visit these islands
Poaching: Unknown

Perimeter count of Te Taake nests and GPS distance: Unknown

Other threats/notes: These islands are mainly grass and Sesuvium, two (A and E) also have trees. During 1820-1845h over 100 Te Bwebwe ni marawa moved through the lagoon area on the south side of the causeway, feeding and progressively making there way towards islands in the area – several seen to land on the islands below, while others made there way toward I1 and I3 in Tangiuoua Lagoon. These storm-petrels flew in from the east and from the west ides of the main island, suggesting that the islands in this area forms a major breeding centre on Kiririmati. One te kun and one te kirikiri seen here earlier in day.

Live Birds – maximum numbers seen ashore at any one time 1530-1830

Island	A	B	C	D	E
Species					
Te Ruru, Phoenix Petrel,	3	2	1	1	2
Te Tanguoua, WT Shearwater,	0	0	0	0	0
Te Tinebu, Xmas Shearwater	0	0	0	1	0
Te Nna, Audubon's Shearwater	0	0	0	0	0
Te Bwebwe ni marawa, WTSP	1 flying over	2 landed	2 (4 landed)	1 (2 landed)	0
Te Taake, Red-tailed Tropicbird	0	0	0	0	1
Te Mouakena, Masked Booby	0	0	0	0	3
Te Kibwi, Brown Booby	1	0	0	0	4
Te Koota, Red-footed Booby	P	0	0	0	P
Te Etei area e bubura, Gt Frigate	0	0	0	0	0
Te Etei are e aki rangi ni bubura	0	0	0	0	0
Te Karakara, Great Crested Tern	0	0	0	0	0
Te Tarangongo, Gy-backed Tern	0	0	0	50+	0
Te Keeu, Sooty Tern	0	0	0	0	0
Te Io, Brown Noddy	0	0	0	0	0
Te Mangikiri, Black Noddy	P	0	0	0	P
Te Raurau, Blue-grey Noddy	0	0	0	0	0
Te Matawa, White Tern	P	0	0	0	P

WCU Kiritimati - Island Survey Data Sheet – Manulu

Island: ISLET 1 Island location: Manulu Lagoon 01 56 59.3N 157 20 11.6W
Approx. size: <1 ha **Date/time:** 7 June 2007, 1245-1315
Observers: Aobure Teatata, Eric VanderWerf, Lindsay Young
Kimoa: No sign.
Poaching: Nil

Poached birds and age	Recent	Old	Comments
Te Ruru, Ph Pe	0	0	
Te Tangioua, WTSW	0	0	
Te Tinebu, Xmas SW	0	0	
Te Taake, RTTB	0	0	
Te Koota, RFBo	0	0	
Te Etei, Frigate	0	0	
Other/Unidentified	0	0	

Perimeter count of Te Taake nests and GPS distance: 0

Other threats/notes: Sesuvium and Portulaca the only plants. No crabs seen.

Live Birds – estimated numbers present

Species	Adults/prs	Nesting - Y/N, details
Te Ruru, Phoenix Petrel,		
Te Tangiuoua, WT Shearwater,	10 ads	Y; active burrows, 2+ with eggs. Similar no. inactive.
Te Tinebu, Xmas Shearwater		
Te Nna, Audubon's Shearwater	3 ads	Y; active burrows, 1 with egg
Te Bwebwe ni marawa, WTSP		
Te Taake, Red-tailed Tropicbird		
Te Mouakena, Masked Booby		
Te Kibwi, Brown Booby		
Te Koota, Red-footed Booby		
Te Etei area e bubura, Gt Frigate		
Te Etei are e aki rangi ni bubura		
Te Karakara, Great Crested Tern		
Te Tarangongo, Gy-backed Tern,		
Te Keeu, Sooty Tern		
Te Io, Brown Noddy	c.25 ads	Y; nests mostly with eggs, 1 downy and 1 medium chick, several just-flying juveniles
Te Mangikiri, Black Noddy		
Te Raurau, Blue-grey Noddy	c.15 ads	Y; all with 1 egg.
Te Matawa, White Tern		
Others, Te Kun, Te Kirikiri		
Te Kewe, Bristle-thighed Curlew		

WCU Kiritimati – Island Survey Data Sheet - Manulu

Island: ISLET 2 Island location Manulu Lag 01 56 38.5N 157 20 25.1 W
Approx. size: c. 2 ha **Date/time:** 7 June 2007, 1330-1500h
Observers: Aobure Teatata, Eric VanderWerf, Lindsay Young
Kimoa: Present – *Rattus exulans* saw 5-6.
Poaching: Much sign

Poached birds and age	Recent	Old	Comments
Te Ruru, Ph Pe			
Te Tangioua, WTSW			
Te Tinebu, Xmas SW			
Te Taake, RTTB	20+		Skulls and feathers
Te Koota, RFBo	Several		
Te Etei, Frigate	1		Also frigatebird spp. bones in fire-pit
Other/Unidentified		Many	

Perimeter count of Te Taake nests and GPS distance: Some nests – see below

Other threats/notes:

Live Birds – estimated numbers present

Species	Adults/prs	Nesting - Y/N, details
Te Ruru, Phoenix Petrel,	0	
Te Tangiuoua, WT Shearwater,	21+ prs	Y; 21 active burrows and similar no. inactive, 1 rat-eaten downy chick
Te Tinebu, Xmas Shearwater	2 ads	N; pair on ground 8 June
Te Nna, Audubon's Shearwater	2 prs	Y; 2 nests
Te Bwebwe ni marawa, WTSP	0	
Te Taake, Red-tailed Tropicbird	16 pr	Y; 16 nests, 15 eggs, 1 downy chick. 2 old rat-eaten eggs.
Te Mouakena, Masked Booby	4+ ads	Y; 1 nest with downy chick
Te Kibwi, Brown Booby		
Te Koota, Red-footed Booby	c.20 ads	Y; 3 active nests
Te Etei area e bubura, Gt Frigate		
Te Etei are e aki rangi ni bubura	1 ad	N
Te Karakara, Great Crested Tern		
Te Tarangongo, Gy-backed Tern,	10 ads	N?; 1 juv with broken wing, possibly could have flown here
Te Keeu, Sooty Tern		
Te Io, Brown Noddy		
Te Mangikiri, Black Noddy		
Te Raurau, Blue-grey Noddy	20 ad	Y/N; not well searched for nests
Te Matawa, White Tern		
Others, Te Kun, Te Kirikiri		
Te Kewe, Bristle-thighed Curlew		

WCU Kiritimati – Island Survey Data Sheet - Manulu

Island: ISLET 3 Island location Manulu Lag 01 57 095 N, 157 19 34.1 W
Approx. size: c. 2 ha **Date/time: 8** June 2007, 1050-1110h
Observers: Eric VanderWerf, Lindsay Young
Kimoa: No sign.
Poaching: Nil

Poached birds and age	Recent	Old	Comments
Te Ruru, Ph Pe	0	0	
Te Tangioua, WTSW	0	0	
Te Tinebu, Xmas SW	0	0	
Te Taake, RTTB	0	0	
Te Koota, RFBo	0	0	
Te Etei, Frigate	0	0	
Other/Unidentified	0	0	

Perimeter count of Te Taake nests and GPS distance: Nil

Other threats/notes:

Live Birds – estimated numbers present

Species	Adults/prs	Nesting - Y/N, details
Te Ruru, Phoenix Petrel,		
Te Tangiuoua, WT Shearwater,		
Te Tinebu, Xmas Shearwater		
Te Nna, Audubon's Shearwater		
Te Bwebwe ni marawa, WTSP		
Te Taake, Red-tailed Tropicbird		
Te Mouakena, Masked Booby		
Te Kibwi, Brown Booby		
Te Koota, Red-footed Booby		
Te Etei area e bubura, Gt Frigate		
Te Etei are e aki rangi ni bubura		
Te Karakara, Great Crested Tern		
Te Tarangongo, Gy-backed Tern,	1000+ ads	Y; nests with eggs, small and medium chicks, flying juvs
Te Keeu, Sooty Tern		
Te Io, Brown Noddy	c.100 ads	Y; a few nests, not searched carefully
Te Mangikiri, Black Noddy	c.10 ads	N; adults sitting on shore
Te Raurau, Blue-grey Noddy	c.50 ads	Y?; probably nesting, not searched carefully
Te Matawa, White Tern		
Others, Te Kun, Te Kirikiri		
Te Kewe, Bristle-thighed Curlew		

WCU Kiritimati - Island Survey Data Sheet - Manulu

ISLANDS IN MANULU LAGOON **Island location**: Manulu Lagoon
Approx. size: all <5 ha **Date/time:** 17 June 1220-1235 - viewed from shore
Observers: Richard Anderson, Ray Pierce, Eric VanderWerf, Lindsay Young, WCU
Kimoa: Unknown – likely to be resident or visit
Poaching: Unknown

Perimeter count of Te Taake nests and GPS distance: none present.

Other threats/notes: Artificially lowered water levels mean that rats and possibly cats can probably access all islands.
Island locations:
A = 01 56.046N, 157 20.970W
B = 01 56.159N, 157 20.890W
C = 01 54.443N, 157 20.559W
D = flats to N of 01 56.674, 157 20.362W

Live Birds – estimated numbers seen ashore or circling:

Island	A	B	C	D
Time	1220	1225	1230	1235
Species				
Te Ruru, Phoenix Petrel,	0	0	0	0
Te Tangiuoua, WT Shearwater,	0	0	0	0
Te Tinebu, Xmas Shearwater	0	0	0	0
Te Nna, Audubon's Shearwater	0	0	0	0
Te Bwebwe ni marawa, WTSP	0	0	0	0
Te Taake, Red-tailed Tropicbird	0	0	0	0
Te Mouakena, Masked Booby	0	0	0	0
Te Kibwi, Brown Booby	0	0	0	0
Te Koota, Red-footed Booby	0	0	0	0
Te Etei area e bubura, Gt Frigate	0	0	0	0
Te Etei are e aki rangi ni bubura	0	0	0	0
Te Karakara, Great Crested Tern	0	0	0	0
Te Tarangongo, Gy-backed Tern	0	0	70	0
Te Keeu, Sooty Tern	0	0	0	0
Te Io, Brown Noddy	0	0	12	0
Te Mangikiri, Black Noddy	0	0	0	0
Te Raurau, Blue-grey Noddy	65 N	7	c.40	c.60
Te Matawa, White Tern	0	0	0	0

WCU Kiritimati - Island Survey Data Sheet - Manulu

ISLANDS IN MANULU LAGOON **Island location**:

Approx. size: all <5 ha **Date/time:** 19 June 2007, 1800-1900 h - viewed from shore
Observers: Ray Pierce
Kimoa: Apparently absent 8 June on A (refer above); likely to be resident or visit B.
Poaching: Unknown

Perimeter count of Te Taake nests and GPS distance: none present.

Other threats/notes: Artificially lowered water levels mean that rats and possibly cats could access B. Important islands for Te bwebwe ni marawa.
Island locations:
A = 01 57 095 N, 157 19 34.1 W
B = 2 islands at 01 57.397, 157 19.930

Live Birds – estimated numbers seen ashore or circling:

Island	A	B
Time	1800-1835	1840-1700
Species		
Te Ruru, Phoenix Petrel,	0	0
Te Tangiuoua, WT Shearwater,	0	0
Te Tinebu, Xmas Shearwater	0	2
Te Nna, Audubon's Shearwater	0	6
Te Bwebwe ni marawa, WTSP	4	4+
Te Taake, Red-tailed Tropicbird	0	0
Te Mouakena, Masked Booby	0	0
Te Kibwi, Brown Booby	0	0
Te Koota, Red-footed Booby	0	0
Te Etei area e bubura, Gt Frigate	0	0
Te Etei are e aki rangi ni bubura	0	0
Te Karakara, Great Crested Tern	0	0
Te Tarangongo, Gy-backed Tern	c.200	0
Te Keeu, Sooty Tern	0	0
Te Io, Brown Noddy	0	0
Te Mangikiri, Black Noddy	0	0
Te Raurau, Blue-grey Noddy	c.80	c.20
Te Matawa, White Tern	0	0

Appendix 3 – Provisional recommendations for monitoring seabirds at Kiritimati (depends on programme proceeding for Pacific rat eradications and increased poacher control).

Species	Measurement (and months)	Frequency
Motu Tabu		
Te ruru	Setup baseline in 2008. No. pairs in sample of five 5x20 m quadrats in June or early July, determine approx productivity same quadrats in August. Repeat about Dec/Feb for late year breeders. Use petrel shoes (like snow shoes) to minimize damage to burrows.	Annually for at least 2 years, then biennially
Te bwebwe ni marawa	1. Count returning adults July 2008, 3 nights 1800-1915 h (maximum at any one time and numbers going ashore viewed from NW point sign) and compare with 3 nights in August 2008; 2. Search same 5+ quadrats set up for Te ruru for nests July 2008	Annually for at least 2 years, then biennially
Te take	Perimeter count of nests June or July 2008	Annually, then biennially
All birds	Estimate numbers present as per 2007	Each visit
Cook Island		
Te ruru	Set up baseline in 2008. July spotlighting – count all birds N end and determine breeding status	Biennially
Te raurau	1. Estimate adults present in evening. 2. Count nests in July or August in random permanent quadrats	Biennially
Te take	Perimeter count of nests June or July 2008	Annually, then biennially
All birds	Estimate numbers present as per 2007	Each visit
Motu Upua		
Te ruru	Quadrats as for Motu Tabu but probably requires 10-20 quadrats for sample	As for Motu Tabu
Te take	Perimeter count of nests June or July 2008	Annually
Te raurau	Maximum count of adults as per June 2007	Annually
All birds	Estimate numbers present as per 2007	Each visit
Drum I and Isles 1-3 Tanguoua		
Te ruru	Quadrats as for Motu Tabu and Motu Upua, use petrel shoes	As above
Te bwebwe ni marawa	Count returning adults from a fixed point – probably best view from NW point – as per Motu Tabu	As for Motu tabu
Te taake	Perimeter count of nests June or July 2008	Annually,

		then biennially
Te eitei and Te koota	2007 baseline; total island counts of nests June or July	Annually then biennially
Te raurau and Te tarangongo	1. Estimates of adults present in evening 2. Counts of eggs/nestlings and failed eggs as per June 2007	Annually then biennially
All birds	Estimate numbers present as per 2007	Each visit
Small islets of Tibo Channel and Isles Lagoon		
Te bwebwe ni marawa	Count returning adults from a fixed point – best view of Tibo Channel islets is from causeway; Isles lagoon sites as per kimoa eradications	As for Motu Tabu
All birds	Estimate numbers present as per 2007	Each visit
Tanguoua Lagoon		
All birds	Survey mainland sites to determine where areas of highest numbers and diversity of seabirds (and Bokikokiko) occur and which of these may be defendable against predators	Survey in June-December

Appendix 4 - BOKIKOKIKO SURVEYS – WCU KIRITIMATI

% plant cover - abbreviations

bare – sand, coral, water
tm – te mao – salt bush - *Scaevola*
tr – te ren – heliotrope – *Messerschmidia* (*Tournefortia*)
g – teutente ni mane – grass - (*Lepturus* and other grasses)
tt – ten tanini – orange vine - *Cassytha*
tn – te nii – coconut – *Cocos*
ta – te aroua – ironbush – *Suriana*
tb – tabeua riki – other/ unidentified

Template form

BOKIKOKIKO SURVEYS - WILDLIFE CONSERVATION UNIT KIRITIMATI																				
Transect name:				Date:		Observers:														
Stn no.	GPS reference		Time start	Total no. birds, (1) = +1 out of time	Details of birds	Weather			General habitat Openness 0 = mostly bare, 4 = dense vegetation			% plant cover: bare = rock, coral, sand, water, tm= te mao, tr= te ren, g = grass, tt = ten tanini, tn = te nii, ta=te aroua, tb = tabeua riki, 8= ✓ = present but <5%								
	N	W			Ad/H, Ad/S, J/H, J /S	Wd 0-4	Cld 0-4	Rn 0-4	Open-ness 0-4	Av ht (m) te mao	Av ht (m) te ren	Bare	tm	tr	g	tt %	tn	ta	tb	8
																0				
																0				
																0				
																0				
																0				
																0				
																0				
																0				
																0				
																0				
Notes:																				

Results to date

BOKIKOKIKO SURVEYS - WILDLIFE CONSERVATION UNIT KIRITIMATI																				
Transect name: Manulu Lagoon backroad				Date: 14/06/07				Observers: WCU, Richard , Eric Lindsay, Ray												
Stn no.	GPS reference		Time start	Total no. birds, (1) = +1 out of time	Details of birds	Weather			General habitat Openness 0 = mostly bare, 4 = dense vegetation			% plant cover: bare = rock, coral, sand, water, tm= te mao, tr= te ren, g = grass, tt = ten tanini, tn = te nii, ta = te aroua, tb = tabeua riki, 8 = ✓ = present but <5%								
	N	W			Ad/H, Ad/S, J/H, J /S	Wd 0-4	Cld 0-4	Rn 0-4	Openness 0-4	Av ht (m) te mao	Av ht (m) te ren	Bare	tm	tr	g	tt	tn	ta	tb	8
M5	01 58.890	157 20.371	0800	4	AS AK 2JH	2	0	0	2	1	3	5	50	15	✓	✓	0	10	0	
M6	01 58.828	157 20.464	0840	2	2AS	2	0	0	2	1	2	20	50	10	10	✓	0	10	0	
M7	01 58.673	157 20.569	0915	2	2AS	2	1	0	2	2	3	25	30	5	10	✓	15	10	0	
M8	01 58.676	157 20.457	0920	0		2	1	0	2	2	3	50	20	5	10	✓	5	10	0	
Notes: this transect was subsequently extended in either direction later to link the earlier back-road stations with 3 on main road																				

BOKIKOKIKO SURVEYS - WILDLIFE CONSERVATION UNIT KIRITIMATI																				
Transect name: Crystal Beach (C)				Date: 15-6-07				Observers: Richard , Eric, Aana												
Stn no.	GPS reference		Time start	Total no. birds, (1) = 1 out of time	Details of birds	Weather			General habitat Openness 0 = mostly bare, 4 = dense vegetation			% plant cover: bare = rock, coral, sand, water, tm= te mao, tr= te ren, g =grass, tt = ten tanini, tn = te nii, ta = te aroua, tb = tabeua riki, 8= ✓ = present but <5%								
	N	W			Ad/H, Ad/S, J/H, J /S	Wd 0-4	Cld 0-4	Rn 0-4	Openness 0-4	Av ht (m) te mao	Av ht (m) te ren	Bare	tm	tr	g	tt	tn	ta	tb	8
C1	02 02 37.7	157 29 29.2	1525	2	1Ad 1J	3	0	0	2	3	4.5	?	?	?	0	✓	0	?	0	
C2	02 02 40.7	157 29 23.5	1550	0		2	0	0	1	2	4	10	30	10	0	✓	0	?	0	
C3	02 02 42.7	157 29 17.3	1605	0		3	0	0	1		5	10	5	25	0	✓	0	?	0	
C4	02 02 44.7	157 29 11.2	1614	1	1Ad	3	0	0	1		4.5	10	5	15	0	✓	0	?	0	
C5	02 02 46.3	157 29 04.7	1625	0		3	0	0	2		5.5	10	5	30	0	✓	0	?	0	
Notes: extensive pureu																				

BOKIKOKIKO SURVEYS - WILDLIFE CONSERVATION UNIT KIRITIMATI																				
Transect name: Bay of Wrecks				Date: 16-6-07		Observers: WCU, Richard , Eric, Lindsay, Ray														
Stn no.	GPS reference		Time start	Total no. birds, (1) = 1 out of time	Details of birds	Weather			General habitat Openness 0 = mostly bare, 4 = dense vegetation			% plant cover: bare = rock, coral, sand, water, tm= te mao, tr= te ren, g =grass, tt = ten tanini, tn = te nii, ta = te aroua, tb = tabeua riki, 8= ✓ = present but <5%								
	N	W			Ad/H, Ad/S, J/H, J /S	Wd 0-4	Cld 0-4	Rn 0-4	Open-ness 0-4	Av ht (m) te mao	Av ht (m) te ren	Bare	tm	tr	g	tt	tn	ta	tb	8
Bw1	01 56’59.5	157 18’39.4	0915	(1)	Ad/H	3	0	0	3	1.5	3	10	85	5	0	✓	0	0	0	
Bw2	01 56’56.8	15718’45.3	0945	0		3	0	0	3	1.5	0	15	85	0	0	✓	0	10	0	
Bw3	01 56’53.7	157 18’51.0	1015	0		3	0	0	2	1.5	0	10	90	0	0	✓	0	0	0	
Best to do sites near sea only if low surf noise!																				

BOKIKOKIKO SURVEYS - WILDLIFE CONSERVATION UNIT KIRITIMATI																				
Transect name: Y Site				Date: 16-6-07		Observers: WCU, Richard , Ray, Lindsay, Eric														
Stn no.	GPS reference		Time start	Total no. birds, (1) = +1 out of time	Details of birds	Weather			General habitat Openness 0 = mostly bare, 4 = dense vegetation			% plant cover: bare = rock, coral, sand, water, tm= te mao, tr= te ren, g =grass, tt = ten tanini, tn = te nii, ta = te aroua, tb = tabeua riki, 8= ✓ = present but <5%								
	N	W			Ad/H, Ad/S, J/H, J /S	Wd 0-4	Cld 0-4	Rn 0-4	Open-ness 0-4	Av ht (m) te mao	Av ht (m) te ren	Bare	tm	tr	g	tt	tn	ta	tb	8
Y1	01 52’ 29.7	157 23’31.1	1325	2 (1)	Ad/S U/H (Ad/S)	2	2	0	2	1	5	20	5	15	5	✓	0	5	50	
Y2	01 52’36.0	157 23’29.9	1355	0	0	3	2	0	2	1	3	40	20	5	20	✓	0	✓	15	
Y3	01 52’41.9	157 23’27.2	1410	0	0	3	1	0	1	0.5	2	55	10	10	20	✓	0	5	✓	
Y4	01 52’48.4	157 23’23.5	1425	0	0	3	0	0	1	0.5	2	60	5	01	20	✓	0	✓	5	
Y5	01 52’49.6	157 23’17.1	1435	0	0	3	2	0	2	1	3	50	15	5	20	✓	0	10	✓	
In Y1 we saw 1 ad and heard a second bird of unknown age during the count, then after the count we saw 2 adults (that were not a pair), and saw 1 ad feed a juv. Tb = mainly Sesuvium and Sida																				

BOKIKOKIKO SURVEYS - WILDLIFE CONSERVATION UNIT KIRITIMATI																				
Transect name: Tabwakea East					Date: 17/06/07				Observers: Richard , Eric, Lindsay											
Stn no.	GPS reference		Time start	Total no. birds, (1) = +1 out of time	Details of birds	Weather			General habitat Openness 0 = mostly bare, 4 = dense vegetation			% plant cover: bare = rock, coral, sand, water, tm= te mao, tr= te ren, g = grass, tt = ten tanini tn = te nii, ta = te aroua , tb = tabeua riki, 8= ✓ = present but <5%								
	N	W			Ad/H, Ad/S, J/H, J /S	Wd 0-4	Cld 0-4	Rn 0-4	Open-ness 0-4	Av ht (m) te mao	Av ht (m) te ren	Bare	tm	tr	g	tt	tn	ta	tb	8
TE1	2 01 16.7	157 29 00.3	0924	0		2	1	0	3	2	-	20	70	0	0	0	70	10	0	
TE2	2 01 21.5	157 28 55.6	0929	0		2	1	0	3	2	-	20	70	0	0	0	50	10	0	
TE3	2 01 25.8	157 28 50.5	0935	0		2	1	0	2	2	-	20	40	0	0	0	50	40	0	
TE4	2 01 30.1	157 28 45.3	0941	0		2	1	0	2	-	-	20	0	0	0	0	50	80	0	
TE5	2 01 34.2	157 28 39.6	0950	0		2	1	0	2	-	-	10	0	0	0	0	70	90	0	
TE6	2 01 58.5	157 27 30.0	1030	0		3	0	0	2	-	3	55	0	20	20	0	0	5	0	
TE7	2 01 54.6	157 27 17.8	1049	0		3	0	0	1	2	3	60	5	15	20	0	0	0	0	
TE8	2 00 56.3	157 25 35.9	1115	1	Ad/S	3	1	0	1	1.5	2.5	70	10	5	5	✓	5	10	0	
TE9	2 01 54.6	157 26 16.9	1235	0		3	1	0	3	2.5	-	5	35	0	20	0	30	0	40	
Notes: At TE8 bird responded after 50 sec from >100m away. AT TE9 there had been a recent fire, large amount of invasive Pluchea coming in (= score for tb).																				

BOKIKOKIKO SURVEYS - WILDLIFE CONSERVATION UNIT KIRITIMATI																				
Transect name: Tabwakea					Date: 17/06/07				Observers: Richard , Eric, Ray											
Stn no.	GPS reference		Time start	Total no. birds, (1) = +1 out of time	Details of birds	Weather			General habitat Openness 0 = mostly bare, 4 = dense vegetation			% plant cover: bare = rock, coral, sand, water, tm= te mao, tr= te ren, g = grass, tt = ten tanini tn = te nii, ta = aroua, tb = tabeua riki, 8= ✓ = present but <5%								
	N	W			Ad/H, Ad/S, J/H, J /S	Wd 0-4	Cld 0-4	Rn 0-4	Open-ness 0-4	Av ht (m) te mao	Av ht (m) te ren	Bare	T m	tr	g	tt	tn	ta	tb	8
T1	2 01.382	157 29.602	1620	0		3	0	0	2	1.5	3.5	15	35	5	25	✓	✓	0	20	
T2	2 01.271	157 29.537	1627	0		3	0	0	2	2	4	20	35	5	20	✓	15	0	5	
T3	2 01.170	157 29.492	1638	0		2	1	0	2	1.5	5	10	10	5	25	20	20	0	10	
T4	2 01.064	157 29.441	1642	0		2	1	0	2	1.5	-	5	20	0	30	0	40	0	5	
T5	2 00.959	157 29.391	1650	0		2	1	0	2	2	6	5	20	5	30	0	25	0	15	
Notes e.g. behaviour of birds - feeding young or mate, etc:																				

BOKIKOKIKO SURVEYS - WILDLIFE CONSERVATION UNIT KIRITIMATI																				
Transect name: Crystal Beach 2 (CB)					Date: 17/06/07				Observers: Richard , Eric, Ray											
Stn no.	GPS reference		Time start	Total no. birds, (1) = +1 out of time	Details of birds	Weather			General habitat Openness 0 = mostly bare, 4 = dense vegetation			% plant cover: bare = rock, coral, sand, water, tm= te mao, tr= te ren, g = grass, tt = ten tanini tn = te nii, ta = te aroua, tb = tabeua riki, 8= ✓ = present but <5%								
	N	W			Ad/H, Ad/S, J/H, J /S	Wd 0-4	Cld 0-4	Rn 0-4	Open-ness 0-4	Av ht (m) te mao	Av ht (m) te ren	Bare	tm	tr	g	tt	tn	ta	tb	8
CB1	2 02.816	157 28.572	1710	0		2	1	0	2	2	4	20	5	20	25	20	5	0	5	
CB2	2 02.806	157 28.466	1715	3	2AS JS	3	1	0	1	2	5	55	5	10	5	15	5	0	5	
CB3	2 02.790	157 28.358	1720	0		3	0	0	1	2	6	15	10	15	40	15	5	0	0	
CB4	2 02.796	157 28.250	1730	1	1AH	3	0	0	2	2	4.5	10	15	15	40	15	5	0	0	
CB5	2 02.815	157 28.135	1735	0		3	0	0	2	3	4	10	30	10	40	5	5	0	0	
CB6	2 02.789	157 28.030	1740	3	3AS	2	0	0	2	3	6	5	35	15	35	5	5	0	0	
CB7	2 02.794	157 27.916	1750	0		2	1	0	1	3	6	15	10	10	40	10	15	0	0	
CB8	2 02.797	157 27.804	1755	0		2	1	0	1	0.5	3	20	✓	15	40	5	20	0	0	
CB9	2 02.805	157 27.687	1800	0		2	1	0	2	2	3.5	10	5	15	30	5	20	0	15	
CB10	2 02.821	157 27.573	1810	0		2	1	0	1	2	4	25	10	10	25	5	20	0	30	

BOKIKOKIKO SURVEYS - WILDLIFE CONSERVATION UNIT KIRITIMATI																				
Transect name: Eastern Manulu Lagoon				Date:18/6/07		Observers: WCU, Richard , Eric, Lindsay, Ray														
Stn no.	GPS reference		Time start	Total no. birds, (1) = +1 out of time	Details of birds	Weather			General habitat Openness 0 = mostly bare, 4 = dense vegetation			% plant cover: bare = rock, coral, sand, water, tm= te mao, tr= te ren, g = grass, tt = ten tanini, tn = te nii, ta=te aroua, tb = tabeua riki, 8= ✓ = present but <5%								
	N	W			Ad/H, Ad/S, J/H, J /S	Wd 0-4	Cld 0-4	Rn 0-4	Open-ness 0-4	Av ht (m) te mao	Av ht (m) te ren	Bare	tm	tr	g	tt	tn	ta	tb	8
EML1	1 55.846	157 21.299	1130	0	0	3	2	0	2	1	2.5	35	15	15	10	✓	0	5	20	
EML2	1 55.771	157 21.380	1135	0	0	2	3	1	2	1	1.5	50	15	20	✓	0	0	10	5	
EML3	1.55.689	157 21.456	1150	0	0	1	2	0	2	1	2	40	10	25	✓	0	0	20	5	
EML4	1 55.645	157 21.565	1155	0	0	3	3	0	1	0.5	1	60	10	15	✓	0	0	5	10	
EML5	1 55.442	157 21.670	1214	0	0	3	4	1	1	1	2	50	5	15	15	0	0	15	0	
Notes: Open, low vegetation																				

BOKIKOKIKO SURVEYS - WILDLIFE CONSERVATION UNIT KIRITIMATI																				
Transect name: Manulu Lagoon backroad				Date: 18/6/07		Observers: WCU, Richard , Eric, Lindsay, Ray														
Stn no.	GPS reference		Time start	Total no. birds, (1) = +1 out of time	Details of birds	Weather			General habitat Openness 0 = mostly bare, 4 = dense vegetation			% plant cover: bare = rock, coral, sand, water, tm= te mao, tr= te ren, g = grass, tt = ten tanini, tn = te nii, ta=te aroua, tb = tabeua riki, 8= ✓ = present but <5%								
	N	W			Ad/H, Ad/S, J/H, J /S	Wd 0-4	Cld 0-4	Rn 0-4	Open-ness 0-4	Av ht (m) te mao	Av ht (m) te ren	Bare	tm	tr	g	tt	tn	ta	tb	8
M1	01 58.890	157 20.457	1715	5	3AS 2JS	2	1	0	4	1.5	3.5	15	60	5	20	✓✓	✓	✓	0	
M2	01 58.828	157 20.464	1720	3	2AS JS	2	1	0	4	2	5	10	45	10	10	✓✓	✓	25	0	
Notes: On main road – now part of Manulu Lagoon Backroad Transect – see 26 June when entire transect resurveyed																				

BOKIKOKIKO SURVEYS - WILDLIFE CONSERVATION UNIT KIRITIMATI																				
Transect name: Nenaomi				Date: 23/06/07		Observers: Bio, Katareti, Richard , Ray														
Stn no.	GPS reference		Time start	Total no. birds, (1) = +1 out of time	Details of birds	Weather			General habitat Openness 0 = mostly bare, 4 = dense vegetation			% plant cover: bare = rock, coral, sand, water, tm= te mao, tr= te ren, g = grass, tt = ten tanini tn = te nii, ta = te aroua, tb = tabeua riki, 8= ✓ = present but <5%								
	N	W			Ad/H, Ad/S, J/H, J /S	Wd 0-4	Cld 0-4	Rn 0-4	Open-ness 0-4	Av ht (m) te mao	Av ht (m) te ren	Bare	tm	tr	g	tt	tn	ta	tb	8
N1	01 51.619	157 30.330	1100	0		3	2	0	2	2	5	50	40	5	5	✓	0	0	0	
N2	01 51.582	157 30.444	1105	0		3	2	0	2	2	5	20	35	5	40	✓	0	✓	0	
N3	01 51.336	157 31.302	1118	0		3	2	0	3	2	5	30	35	5	30	✓	0	✓	0	
Notes: Too windy																				

BOKIKOKIKO SURVEYS - WILDLIFE CONSERVATION UNIT KIRITIMATI																				
Transect name: Poland					Date: 23/06/07				Observers: Bio, Katareti, Richard , Ray											
Stn No.	GPS reference		Time start	Total no. birds, (1) = +1 out of time	Details of birds	Weather			General habitat Openness 0 = mostly bare, 4 = dense vegetation			% plant cover: bare = rock, coral, sand, water, tm= te mao, tr= te ren, g = grass, tt = ten tanini tn = te nii, ta = te aroua, tb = tabeua riki, 8= ✓ = present but <5%								
	N	W			Ad/H, Ad/S, J/H, J /S	Wd 0-4	Cld 0-4	Rn 0-4	Open-ness 0-4	Av ht (m) te mao	Av ht (m) te ren	Bare	T m	tr	g	tt	tn	ta	tb	8
P1	01 51.033	157 31.895	1125	0		3	1	0	3	2.5	4	25	50	5	20	✓	0	0	0	
P2	01 51.291	157 32.794	1135	1	AH	4	1	0	3	2.5	4	10	40	10	30	✓	0	0	0	
P3	01 51.454	157 33.363	1210	1	AS	4	1	0	3	2	5	10	30	15	40	✓	0	0	0	
Notes: Too windy – repeat on calmer day and try for 10 stations in this excellent looking habitat																				

BOKIKOKIKO SURVEYS - WILDLIFE CONSERVATION UNIT KIRITIMATI																				
Transect name: Boating Lagoon					Date: 25/06/07				Observers: Bio, Richard , Ibeatabu, Iriam, Katareti, Ngaeua, Ray											
Stn No.	GPS reference		Time start	Total no. birds, (1) = +1 out of time	Details of birds	Weather			General habitat Openness 0 = mostly bare, 4 = dense vegetation			% plant cover: bare = rock, coral, sand, water, tm= te mao, tr= te ren, g = grass, tt = ten tanini tn = te nii, ta = te aroua, tb = tabeua riki, 8= ✓ = present but <5%								
	N	W			Ad/H, Ad/S, J/H, J /S	Wd 0-4	Cld 0-4	Rn 0-4	Open-ness 0-4	Av ht (m) te mao	Av ht (m) te ren	Bare	tm	tr	g	tt	tn	ta	tb	8
BL1	01 58.652	157 23.759	1045	0		3	3	0	3	2	4	✓	20	10	0	0	0	70	0	
BL2	01 58.555	157 23.713	1103	1	AH	2	3	0	2	2	4	✓	20	10	0	0	0	70	0	
BL3	01 58.456	157 23.671	1118	0		2	2	0	3	3	4	✓	30	5	0	0	5	55	0	
BL4	01 58.360	157 23.613	1132	0		3	2	0	3	2	4	10	10	✓	0	0	20	60	0	
BL5	01 58.304	157 23.523	1152	0		3	2	0	2	1.5	3	50	10	10	0	✓	10	10	0	
BL6	01 58.257	157 23.433	1218	1	AH	2	2	0	3	2	2	20	50	5	0	✓	20	5	0	
BL7	01 58.216	157 23.333	1229	0		3	3	0	3	2	3.5	30	35	5	0	✓	25	5	0	
BL8	01 58.187	157 23.227	1239	0		3	3	0	2	1	3	30	20	10	0	10	15	15	0	
BL9	01 58.151	157 23.124	1248	0		3	3	0	3	2	3	30	10	5	0	5	20	30	0	
BL10	01 58.116	157 23.022	1258	0		3	3	0	3	1	2	20	20	20	20	✓	5	5	0	
Note: nest in te ren between stations 6 and 7 – low density te nii																				

BOKIKOKIKO SURVEYS - WILDLIFE CONSERVATION UNIT KIRITIMATI																				
Transect name: Boating Lagoon					Date: 26/06/07				Observers: Aana, Aobure, Bio, Richard , Ibeatabu, Iriam, Katareti, Ngaeua, Ray											
Stn No.	GPS reference See 25/6/07 data sheet		Time start	Total no. birds, (1) = +1 out of time	Details of birds	Weather			General habitat Openness 0 = mostly bare, 4 = dense vegetation			% plant cover: bare = rock, coral, sand, water, tm= te mao, tr= te ren, g = grass, tt = ten tanini tn = te nii, ta = te aroua, tb = tabeua riki, 8= ✓ = present but <5%									
	N	W			Ad/H, Ad/S, J/H, J /S	Wd 0-4	Cld 0-4	Rn 0-4	Open-ness 0-4	Av ht (m) te mao	Av ht (m) te ren	Bare	tm	tr	g	tt	tn	ta	tb	8
BL1			0809	0		1	1	0												
BL2			0814	0		1	1	0												
BL3			0820	0		1	1	0												
BL4			0825	0		2	1	0												
BL5			0830	0		1	2	0												
BL6			0835	0		2	2	0												
BL7			0841	2	2AS	2	2	0												
BL8			0848	0		2	2	0												
BL9			0852	0		3	1	0												
BL10			0857	0		3	1	0												
Notes: Replicate count of 25 June, earlier in day and in calmer conditions																				

BOKIKOKIKO SURVEYS - WILDLIFE CONSERVATION UNIT KIRITIMATI																				
Transect name: Manulu Lagoon					Date: 26/06/07				Observers: Aana, Aobure, Bio, Richard , Ibeatabu, Iriam, Katareti, Ngaeua, Ray											
Stn No.	GPS reference		Time start	Total no. birds, (1) = +1 out of time	Details of birds	Weather			General habitat Openness 0 = mostly bare, 4 = dense vegetation			% plant cover: bare = rock, coral, sand, water, tm= te mao, tr= te ren, g = grass, tt = ten tanini tn= te nii, ta = te aroua, tb = tabeua riki, 8= ✓ = present but <5%								
	N	W			Ad/H, Ad/S, J/H, J /S	Wd 0-4	Cld 0-4	Rn 0-4	Open-ness 0-4	Av ht (m) te mao	Av ht (m) te ren	Bare	tm	tr	g	tt	tn	ta	tb	8
M1	01 58.890	157 20.371	1037	1	AS	1	0	0	4	1.5	3.5	15	60	5	20	✓✓	✓	✓	0	
M2	01 58.828	157 20.464	1045	2	2AH	2	0	0	4	2	5	10	45	10	10	✓✓	✓	25	0	
M3	01 58.673	157 20.569	1022	0		2	0	0	3	1	2.5	25	30	5	10	✓	15	10	0	
M4	01 58.676	157 20.457	1015	3	3AS	2	0	0	1	1	2	50	20	5	10	✓	5	10	0	
M5	01 58.575	157 20.411	0920	2	2AS	2	1	0	2	1	2.5	35	15	15	✓	✓	0	5	0	
M6	01 58.480	157 20.393	0925	1	AH	2	0	0	2	1	1.5	50	15	20	✓	0	0	10	0	
M7	01 58.079	157 20.057	0929	1	AH	2	0	0	2	1	2	45	10	25	✓	0	0	20	0	
M8	01 58.279	157 20.015	0934	0		2	0	0	1	0.5	1	30	10	15	✓	0	0	5	0	
M9	01 58.188	157 20.261	0942	0		3	0	0	1	1	2	50	5	15	✓	0	0	15	0	
M10	01 58.095	157 20.205	0948	0		2	1	0												
Notes: linked the earlier back-road stations with 3 on main road																				