OBSERVATIONS ON ECOLOGY AND ABUNDANCE OF TE BOKIKOKIKO (*Acrocephalus aequinoctialis pistor*) ON TERAINA (WASHINGTON ISLAND), KIRIBATI, IN MAY 2019

Ray Pierce[1] and Katareti Taabu[2]

1. 165 Stoney Creek Rd, Speewah, Queensland, Australia *raypierce@bigpond.com*
2. Wildlife Conservation Unit, MELAD, Kiritimati, Kiribati *teeirak@gmail.com*

July 2019

Report for The Nature Conservancy (Hawaii) and Government of Kiribati

Table of Contents

Acronyms ……..3

Summary……3

1. Background……...3

2. Survey Objectives and Methods……..4

3. Bokikokiko Habitat……..6

3.1 Te Ren (Tournefortia argentea)-dominant zone 6
3.2 Te Buka (Pisonia grandis)-dominant forest 7
3.3 Village mosaics 8
3.4 Coconut plantations 9
3.5 Creek Riparian 10
3.6 Swampland 11

4. Frequency of Bokikokiko sightings in habitats and a coarse population estimate……12

5. Breeding observations……12

6. Threats……15

6.1 Invasive rats/kimoa 15
6.2 Habitat loss 15
6.3 Biosecurity needs 16

7. Discussion and Recommendations……16

References……17

Appendix 1 – Names of species mentioned in the text……18

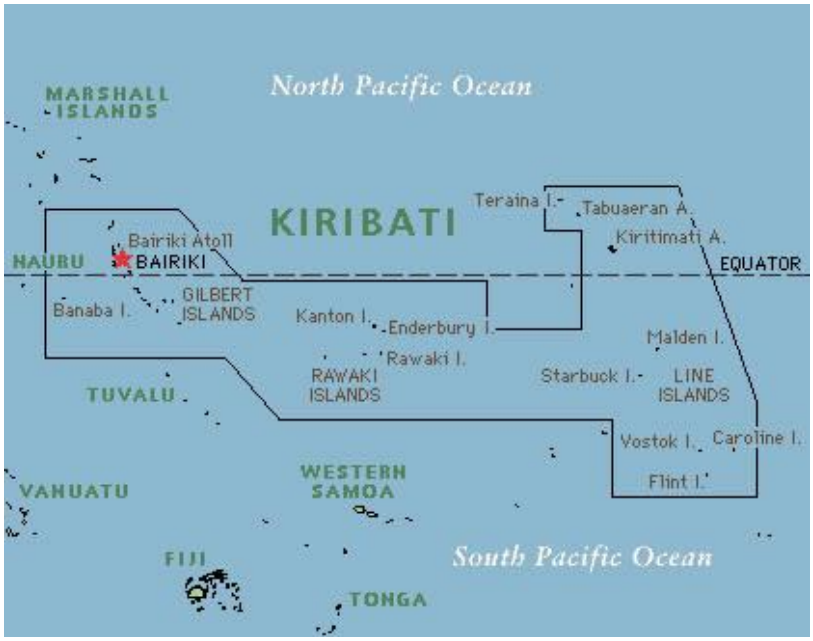

Fig 1 – Location map.

Acronyms

AA	Agriculture Assistant of MELAD
ALD	Agriculture and Livestock Division of MELAD
CXI	Kiritimati, Christmas Island
ECD	Environment and Conservation Division
IAS/IS	Invasive alien species or sometimes invasive species if it is a native species
KDP	Kiribati Development Plan
LFA	Little Fire Ant
MELAD	Ministry of Environment, Lands and Agricultural Development
MHWS	Mean High Water Spring (tide)
PB	Pacific Biosecurity
TNC	The Nature Conservancy
WCU	Wildlife Conservation Unit of ECD
YCA	Yellow crazy ant

Summary

Surveys for Bokikokiko (*Acrocephalus aequinoctialis pistor*) were undertaken on five mornings on Teraina (Washington Island, Kiribati) during the period 14-21 May 2019. We used standard survey methods that had previously been developed for the Kiritimati subspecies (VanderWerf and Pierce 2019). The birds were detected mainly in perimeter forest comprising Te Ren (*Tournefortia argentea*), Te Buka (*Pisonia grandis*) and Pandanus (*Pandanus tectorius*). Few birds were seen in the extensive dense coconut plantation (*Cocos nucifera*) and in inland swamps comprising extensive reedbeds of *Schoenoplectus californicus.* The population was estimated to be in the low hundreds, possibly 300-500 individuals.

Several threats face the Bokikokiko on Teraina spanning habitat loss, rising sea-level and invasive species. This includes the presence of Black Rats (*Rattus rattus*), which have been present since at least 2012, although precise arrival times are unknown. Several old nests and many juveniles including dependent young were observed, indicating significant recruitment despite the presence of Black Rats. Several management options are suggested including translocation of some birds to establish a second population on a rat-free island (e.g. Palmyra), management of Teraina habitat, strengthening biosecurity and population monitoring.

1. Background

Te Bokikokiko or Christmas Island Warbler (*Acrocephalus aequinoctialis*) comprises two subspecies, A. a. *aequinoctialis* which is confined to Kiritimati (Christmas Island) and *A,c. pistor*, now confined to Teraina or Washington Island, Kiribati (Fig 1.1). The latter subspecies formerly also occurred on neighbouring Tabuaeran (Fanning Island), but it had died out there by 1963 (VanderWerf and Pierce 2019). Both these subspecies may have once been more widespread in the Line Islands, but the Pacific Island reed-warblers are noticeably prone to range contraction and extinctions. The causes of these declines are poorly known, but traditionally habitat loss and the introduction of invasive species such as feral cats and rats have been prime causative factors in other bird species declines (Steadman 2006).

Gaining a better understanding of the population size and habitat of the Teraina Te Bokikokiko population as well as assessing actual and potential threats and ongoing population trends are key objectives of the Conservation Action Plan of Bokikokiko (VanderWerf and Pierce in prep.). An opportunity to implement this research arose during 2019 via Pacific Biosecurity and The

Nature Conservancy. Dr Monica Gruber of Pacific Biosecurity was implementing projects with the Government of Kiribati to strengthen biosecurity on the ground at Tabuaeran, Teraina and other islands, and which also involved assessing current invasive species threats at the islands. Alex Wegmann of TNC agreed to fund a survey of Te Bokikokiko coinciding with the PB initiatives in May 2019, with the surveys being undertaken mainly by Katareti Taabu of the Wildlife Conservation Unit and Dr Ray Pierce of EcoOceania Pty Ltd.

Fig 2.1 –Teraina showing relative distribution of swamps (West and East Bog), Lake Washington, coconuts (dark green) and Te Buka (*Pisonia grandis*) light green). Photo courtesy Google Earth.

2. Survey Objectives and Methods

Objectives

1. To determine habitats used by Te Bokikokiko on Teraina (1000 ha) noting that the island's vegetation is diverse comprising Te Ren (*Tournefortia argentea*) forest, Pisonia (*Pisonia grandis*) forest, peatlands, freshwater riparian habitat, while still be dominated by coconut plantations and other cultivations.
2. To estimate Te Bokikokiko population size noting that past estimates have varied from low hundreds to low thousands.
3. Establish a subset of transects as part of 1-2 above that can be used for ongoing monitoring by the WCU/ECD.
4. Evaluate threats, e.g. feral animals and habitat degradation, noting that some distributional surveys of invasive ants, rats, feral cats and dogs will be undertaken concurrently or later by a VicLink project led by Dr Monica Gruber.
5. Raise awareness within the community of potential threats to Bokikokiko based on knowledge of threats to Pacific Island passerines in general.
6. Assess potential habitat remaining on Tabuaeran along with invasive species as part of Pacific Biosecurity project.

Key survey methods followed existing guidelines for Kiritimati (Pierce et al 2013, VanderWerf and Pierce 2018), with only slight adjustments detailed below and comprised:

1. Two experienced Bokikokiko observers (Ray Pierce and Katareti Taabu) for 5 mornings during the period 14-21 May 2019.
2. Habitat areas were estimated on the ground and from Google Earth.
3. The sampling regime was based on the transect line method currently used at Kiritimati, i.e. stations at 200 m intervals along continuous transects through representative/all habitat types. Transects are outlined in red in Fig 2.2.
4. We followed Kiritimati methodology i.e. trying to count birds during the morning (0700-1100 h). Time was limited on Teraina, however, with frequent morning rain. This together with the fact that the birds were active throughout the day caused us to extend some survey times until c.1300 h, and a few were completed in the late afternoon.
5. Specific methodology comprised:

- Using c.1 minute of playback calls followed by two minutes of listening. Using the CXI MP3 player and speaker on most surveys (and digital audio files provided by EVW for surveys that RP conducted alone).
- Playing the audio soon after arrival at each station
- Playing audio at Volume 15 on the CXI player, while the observer rotates 360 degrees
- Looking and listening throughout the 1 minute of audio playing and the following 2 minutes, for a total of 3 minutes
- 1-4 observers, where possible focusing on different sectors to maximize coverage.
- Once a single bird was detected, one person focused on that bird to see if it is joined by a mate, while other observers scan more widely (or single multi-tasked observer).
- Recording the number of pairs as well as total number of individuals per station.
- Noting if pairs/individuals at a station are thought to be the same as any birds observed at the previous station. VanderWerf and Young (2007) found that nearly all resident birds respond to this approach, usually in 30 seconds or less
- ranking vegetation as per the CXI Bokikokiko data sheet.

4. Decide which of the transect lines completed could be used as monitoring lines in the future (ideally 3) and repeat for a second morning if time allows.

Fig 2.2 – Extent of transects completed for Bokikokiko survey Teraina May 2019. Yellow dots indicate sites of incidental encounters with Bokikokiko.

3. Bokikokiko Habitat

Six discrete vegetation types were observed being used to varying degrees by Bokikokiko at Terraina comprising as follows (from littoral to island interior): Te Ren zone, Te Buka forest, Village mosaics, Coconut plantation, Creek riparian and Swamps. These are discussed in the following pages with accompanying representative photos.

3.1 Te Ren (*Tournefortia argentea*)-dominant zone

A narrow and discontinuous zone of Te Ren-dominant vegetation extended around the 15 km perimeter of the island immediately above MHWS tide levels and was estimated to cover less than 50 ha (<5 % of the island). It occupied sandy substrate with associated *Pandanus tectorius*, *Pisonia grandis*, *Calophyllum inophyllum*, *Cordia subcordata* and *Guettarda speciosa* trees, with an understory dominated by *Scaevola taccada* and *Sida fallax* shrubs, plus grasses and sedges. In the more modified areas, *Scaevola* and other shrubs were often replaced by cultivated breadfruit (*Artocarpus altilis*), cut nut (*Barringtonia* sp.) and Te Noni *Morinda citrifolia* and exotics, e.g. *Pluchea odora* (Fig 3.1). Until recently there had been an extensive area of Te Ren-dominant vegetation in the NW of the island, now occupied by the airport runway and buffer.

Fig 3.1 - Te Ren occupied a narrow zone between the ocean beach and island perimeter road (above and lower left) and in the airport area (below right).

3.2 Te Buka (*Pisonia grandis*)-dominant forest

Inland from the Te Ren zone, Te Buka trees transitioned to form a mixed association with Te Ren and Pandanus trees and Coconut forest, with scattered *Cordia subcordata* and locally large specimens of *Ficus* sp. As with Te Ren, this zone formed a discontinuous band around the island and was most extensive in the eastern sector of the island where a band extended for c.3.5 km and up to 200 m wide (Fig 3.2). Another band extended from behind the Agriculture Nursery for about 1 km towards the airport and scattered small groves and trees occurred elsewhere. The area of this zone was estimated at c.30 ha (<5 % island). The Te Buka understory included seedling *Pisonia* and the ground layer included dominant ferns (*Phymatosurus scolopendria*. and *Asplenium pacificum*).

Fig 3.2 - Tall Pisonia in Eastern Teraina (above); below *Pisonia* forest and fig association near the airport, all with Bokikokiko territories.

3.3 Village mosaics

The villages supported widely varying diversity and abundance of trees and shrubs (Fig 3.3), typically including cultivated Breadfruit, open areas of Coconuts, Cutnut, Te Noni, Papaya, Frangipani and Mango, and weeds such as *Pluchea* and *Lantana.* Indigenous vegetation remnants sometimes included Te Ren, Te Buka, *Calophyllum, Cordia, Scaevola*

Fig 3.3 – Agriculture nursery (above) at 4.6897 N; 160.4070 W and environs in which one Bokikokiko family party was centred in May 2019. Below – typical village garden where one bird fed in Noni, Breadfruit and Te Mao.

3.4 Coconut plantations

Coconut plantation comprises the most dominant island habitat, occupying more than 50% of the island's land area. Tree spacing is typically very dense, with closed stands allowing little light penetrating to the understorey, where there was correspondingly little or no regeneration of coconuts or indigenous vegetation, except for ferns. Being the wet season much of the floor of the forest was seasonally flooded (Fig 3.4). Coconuts have been present on Teraina for centuries, having been noted during the mid-nineteenth century, followed by increased planting initiatives later that century and the 1900s (Wester et al 1992).

Fig 3.4 – Coconuts fringing Washington Lake (above); below, interior of flooded plantation.

3.5 Creek Riparian

Many streams entering the swamps and Washington Lake were flanked by *Cyperus* sedges, rushes (*Schoenoplectus californicus*), ferns, swamp taro, shrubs, *Pandanus* and Coconuts.

Fig 3.5 – Creek margin near beach (above); creek and swamp near Washington Lake (below).

3.6 Swampland

Extensive, dense reed-beds of continuous *Schoenoplectus californicus* occupies the West Bog and East Bog, the latter fringing Washington Lake. Flanking the rushes and on high points in the swamps were areas of *Cyperus* sedge, swamp taro, *Pandanus* and occasionally coconuts, giving way to dense coconut stands on the flanks of the swamps.

Fig 3.6 – Extensive *Schoenoplectus* beds above; below – high points support additional flora.

4. Frequency of Bokikokiko sightings in habitats and a coarse population estimate

Frequency of sightings in different habitats

Except for two stations in the swamp's *Schoenoplectus*, all Bokikokiko detected during the formal transect surveys were at sites with Te Buka or Te Buka/Te Ren associations (Table 4.1). This included all sightings in village stations where birds were associated with Te Buka or Te Buka/Te Ren. However, we did have two incidental sightings outside of survey times of birds in village Breadfruit and Papaya trees where Te Ren and Te Buka were absent or scarce, and some residents reported that Te Bokikokiko occasionally pass through their properties which also lacked those trees. Except for one incidental sighting on the edge of a coconut plantation, we found no evidence that there was any significant use of the dense coconut monoculture, but again, birds are likely to use coconuts for dispersal.

Table 4.1 – Frequency of sightings of Bokikokiko in different habitats.

Habitat	Total no. stations	No. stations BOK present	Total no. BOK	Mean no. BOK per station
Te Ren/Te Buka	23	13	19	0.83
Te Buka	11	11	22	2.0
Village mosaics	33	7	13	0.39
Coconut plantation	5	0	0	0
Swampland	10	2	3	0
Total	82	33	57	Av. 0.70

Population estimate

Given the focus of Bokikokiko on Te Buka-Te Ren associations in an otherwise sea of coconuts, the population is clearly dependent on the health and extent of indigenous trees. This band of suitable habitat encompasses the island but varies widely in width from a few 10s of metres to c. 250 m wide. The average width of this band is in the order of 150 m for which 15 km of circumference amounts to little more than 200 ha of prime habitat. If we detected an average of 0.7 birds per station (7 per 10 station transect), this would equate to about 0.35 birds per ha based on Kiritimati calculations of density (VanderWerf and Pierce 2019), so a total population in excess of 150 birds. This is probably a conservative estimate as the extensive Te Buka stands of SE Teraina were not well sampled due to short time frame and logistic issues. Our sampling of Te Buka-dominant vegetation suggested relatively high numbers of birds with 2 birds per station (or 1 bird per ha) being detected. If this density is typical in Te Buka habitat it would place the Teraina Bokikokiko population more in the vicinity of 300+ birds. Additional lower densities occur in the extensive reedbeds of the swamp, so 300-500 birds is a realistic population estimate.

5. Breeding observations

Breeding was well underway in mid May 2019 with pairs having established territories and adults reacted strongly to playback recordings of Kiritimati birds. Several pairs were feeding dependent juveniles which included broods of one (1), two (3) and three (1). Many apparently independent juveniles were also seen suggesting that successful breeding has been underway

since at least March 2019, perhaps earlier, which seems earlier than the situation on Kiritimati. The El Nino Southern oscillations weather pattern at the time of the survey had been bringing a particularly high rainfall season to the island and at Kiritimati, and WCU plan to check Bokikokiko lines there to test whether Kiritimati birds are breeding earlier this year.

We observed four recently used nests and noted two other reports of nests as per Table 5.1.

Table 5.1 – Nest sites details of four observed nests and two reported nests.

Date	Habitat	Host species	Veg height (m)	Nest height (m)	Observer
15 May 2019	Village	Mango	15	12	KT et al
16 May 2019	Te Ren	Te Ren	8	5	RP
18 May 2019	Pisonia	*Pisonia*	15+	11	RP et al
18 May 2019	Te Ren	Te Ren	?	5	KT et al
Early 2019	Swamp	*Schoenoplectus*	2	1	N Moaieta
Sept 2012	Riparian	*Cyperus* Sedge	-	-	WCU 2012

Nests appeared to be constructed of fine strands of coconut and pandanus fibre (Fig 5.1). No *Cassytha* nest material (used for nests at Kiritimati) was seen and this vine is uncommon on the island compared with that at Kiritimati.

Fig 5.1 – Nest in secondary branch of Te Ren tree on 16 May 2019.

Fig 5.2 - Juveniles waiting for another feed, 15 May 2019.

Fig – 5.3 – Bokikokiko in swamp Pandanus.

6. Threats

Current threatening processes identified included habitat loss, presence of Black Rats and potentially feral House Cats, invasive weeds and climate change. These are discussed in more detail below.

6.1 Invasive rats/kimoa

The only rat species detected on Teraina was the highly invasive Black Rat (*Rattus rattus*) with six being trapped at the Agriculture Nursery on the outskirts of the village. No Pacific Rats (*R. exulans*) were detected on Teraina which seems surprising given that Tabuaeran still supported *R. exulans* as well as *R. rattus* in 2019 (refer Pierce et al 2019 for morphometrics and photographs). The Teraina nursery area was frequented daily by a family of Te Bokikokiko with 3 young, so it was encouraging to see Te Bokikokiko nest successfully in the presence of these rats. Traps were left with the AA to continue trapping at the nursery and in other habitats to help understand rat status on the island (refer Recommendations).

6.2 Habitat loss

The human population of Teraina comprises nearly 2000 inhabitants which is considered the maximum optimal number by the KDP (2008). Despite the low population and moderate rate of growth, there have been some significant developments on Teraina, including the recent construction of an airport, the encroachment of dense coconut plantations, arrival of new weeds and sea-level rise.

Airport

The airport, which was opened in 2016, involved the removal of over 10 ha of what appears to have been prime Te Ren-dominant forest with Te Buka associations (Fig 3.1). The impact of this loss may be greater as no Bokikokiko were detected in the remnant coastal sliver of Te Ren between the runway and ocean.

Coconut plantation

The coconut plantations do not appear to have been well maintained in the past resulting in very dense spacing and closed canopy, resulting in low light penetration and a depauperate understorey (refer Recommendations - restoration opportunities).

Weeds

Lantana, Pluchea and other weeds are increasingly in competition with indigenous plants, and although the impacts are currently localised, they have the potential to greatly expand (refer Recommendations – weed management).

Sea-level rise

The western coastline is showing signs of increased erosion which is placing pressure on the integrity of the coastal fringe of Te Ren association.

6.3 Biosecurity needs

None of the world's worst invasive ant species were detected on Teraina, but YCA were discovered on nearby Tabuaeran in May 2019 (Pierce et al 2019 in prep). This means that interisland shipping (especially Tabuaeran to Teraina) needs to undergo stringent biosecurity to ensure no YCA invade with key risky items including *Pandanus* for roof thatching, copra, drums, timber, etc. The Teraina Council and Agriculture Assistant were made aware of this need in May 2019. The concern previously raised re yachts from Hawaii and French Polynesia (where YCA, LFA and other invasives occur) is theoretically lessened, because Teraina is not an entry port, this role instead being assumed by Tabuaeran and Kiritimati boarding parties. However, it is prudent that all incoming vessels at Teraina are checked by the Teraina AA irrespective of permits and past biosecurity checks. It is also prudent for Agricultural reps to check Teraina- bound vessels at the departure points at Kiritimati and Tabuaeran.

7. Discussion and Recommendations

The Bokikokiko is moderately common and the birds have access to a wider variety of habitats than on Kiritimati, and this includes Te Buka forest and swampland. However, the population is estimated to be only in the low hundreds because the optimal habitat is constrained to a narrow perimeter of Te Buka and Te Ren-dominant forest, with coconut plantations being too dense to allow significant regeneration of native trees. *Rattus rattus* was first recorded here in 2012 (WCU 2012), whereas 20 years earlier Watling (1995) reported only *R exulans.* It is encouraging to see successful breeding in the face of *R. rattus*, impacts of which may be mitigated by nest site selection (tree selection, height, outer branches, etc.) and lower density of rats due to unknown habitat constraints.

Bokikokiko are clearly in a precarious situation due to many threats however (Section 6), and it is recommended that management approaches include:

- Translocation – establishing a second population, at e.g. rat-free Palmyra (225 km NW of Teraina) as an insurance population if anything goes wrong on Teraina
- Biosecurity strengthened to prevent YCA and other invasives arriving at Teraina
- Habitat protection – protect the remaining Te Buka and Te Ren on Teraina
- Coconut thinning – aim for Kiritimati-style coconut management at Teraina with 5-20 m spacing between coconuts which allows BOK to utilise the understorey of Te Ren and Te Mao (on CXI) and potentially Te Buka and Te Ren, as well as promoting healthier coconuts.
- Monitoring lines – use some of those used at Teraina in May 2019, e.g. 1. (Airport), 3 (Arabweta backroad), 5 (Anouea), potentially backroad near airport, and aim for May every year initially if possible to set reliable baseline, and then every 2-3 years as per Kiritimati. Note if juveniles are being recruited.
- Undertake a feasibility study for the eradication of *Rattus rattus* at Teraina. If achievable this would also benefit Te Kura which is an Endangered species susceptible to *Rattus rattus*. Also confirm whether *R exulans* is still present.
- Eradicate other invasives establishing, e.g. *Lantana.*

References

KDP 2008. Kiribati Development Plan 2008-11. Government of Kiribati.

KIEP 2013. Kiribati Integrated Environment Plan. Government of Kiribati.

K-NISSAP. Kiribati National Invasive Species Strategy and Action Plan. Government of Kiribati.

Pacific Biosecurity. Pacific Invasives Ant Toolkit http://www.piat.org.nz/citing-the-toolkit

Pierce R, Brown D, VanderWerf E and Taabu K 2013 (2018 revised). Guidelines for Monitoring birds and invasive species at Kiritimati, Kiribati.

Pierce R, Tanako T, Taabu K, Ioane N, Teatoa K 2019 (draft). Biosecurity awareness and invasive species surveys at Tabuaeran and Teraina, Kiribati, May 2019.

Steadman DW. 2006. Extinction and biogeography of tropical Pacific birds. Chicago. University of Chicago Press.

Watkins, D. and K. Batoromaio 2014. Directory of Wetlands of Kiribati. Report to Secretariat of the Pacific Regional Environment Programme.

Watling D. 1995. Notes on the status of Kuhl's Lorikeet Vini kulii in the Northern Line Islands, Kiribati. Bird Conservation International 5: 481-489.

Wester L. 1985. Checklist of the vascular Plants of the Northern Line Islands. Atoll Research Bulletin 287: 1-38.

Wester L, Juvik J, Holthus P 1992. Vegetation history of Washington Island (Teraina), Northern Line Islands. Atoll Research Bulletin 358: 1-50.

Wildlife Conservation Unit 2012. Surveys of Teraina.

VanderWerf E and Pierce R 2019 (draft). A Conservation Action Plan for the Bokikokiko (*Acrocephalus aequinoctialis*) 2019-2024.

Appendix 1 – Names of species mentioned in the text

Feral Dog - *Canis familiaris*
Feral House Cat - *Felis catus*
Giant Bulrush - *Schoenoplectus californicus*
Giant Swamp Taro - *Cyrtosperma merkusii*
Lantana -*Lantana cantareus*
Singapore Daisy - *Wedelia trilobata*
Sweet-scent - *Pluchea odorata*
Te Ango - *Premna serratifolia*
Te Bokikokiko, Christmas Island reed-warbler - *Acrocephalus aequinoctialis pistor*
Te Buka - *Pisonia grandis*
Te Itai - *Calophyllum inophyllum*
Te Kaina - *Pandanus tectorius*
Te Kanawa - *Cordia subcordata*
Te Kaura - *Sida fallax*
Te Kimoa or Pacific Rat sometimes includes Black Rat - *Rattus exulans/R rattus*
Te Kinongo or Yellow Crazy Ant - *Anoplolepis gracilipes*
Te Kura or Rimatara Lorikeet - *Vini kuhlii*
Te Mao - *Scaevola taccada*
Te Ntenenei - *Cassytha filiformis*
Te Ni - *Cocos nucifera*
Te Noni - *Morinda citrifolia*
Te Ren or Heliotrope - *Tournefortia argentea*
Te Ruku - *Ipomoea littoralis*
Te Utuete - *Lepturus repens*