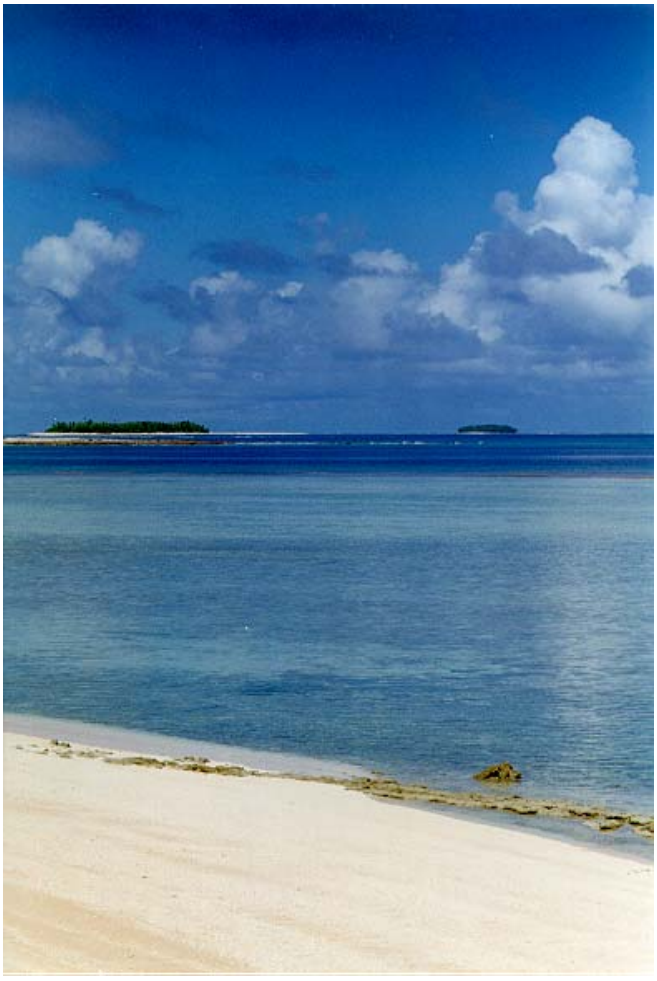

FUNAFUTI MARINE CONSERVATION AREA,

TUVALU

REPORT OF THE BIRD SURVEY

(August 31-September 11 1998)

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Funded by:

SOUTH PACIFIC BIODIVERSITY CONSERVATION PROGRAMME,

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Without the coordination and field assistance of Tataua Alefaio and Claudia Ludescher, the work could not have been completed and Semese Alefaio's boat skills and field assistance are gratefully acknowledged. Additional assistance for the nest counts was provided by Faleonofia Malosi and Amalei Pele.

"It should be mentioned that no comprehensive survey of (Tuvalu) has been carried out by a competent ornithologist, and thus there is a noticeable gap in the available literature of the Pacific birds" **(Child, 1960).**

Peter Child's observation is as true today as it was when he made it nearly 40 years ago.

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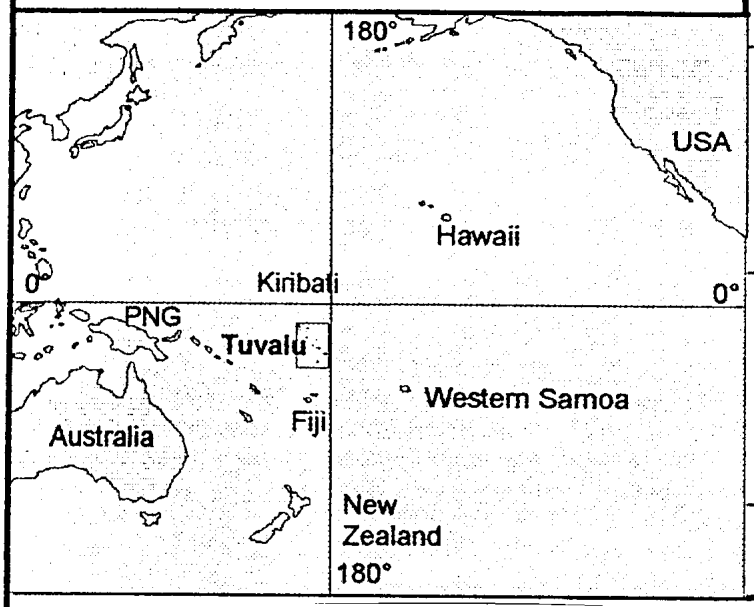
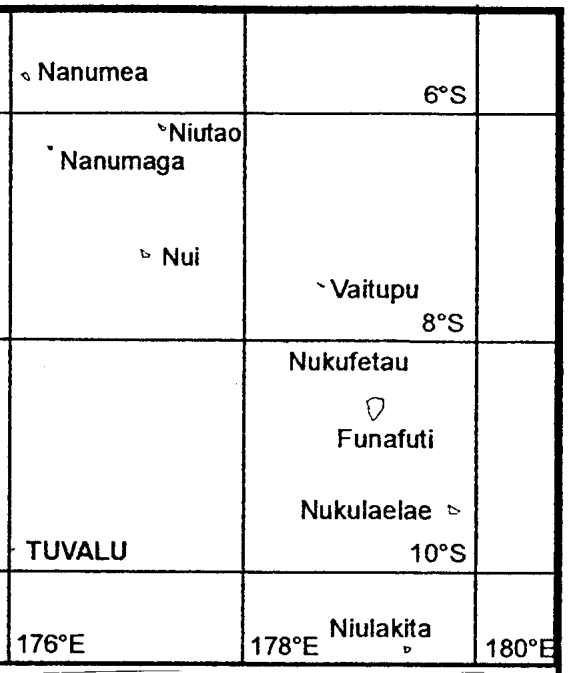
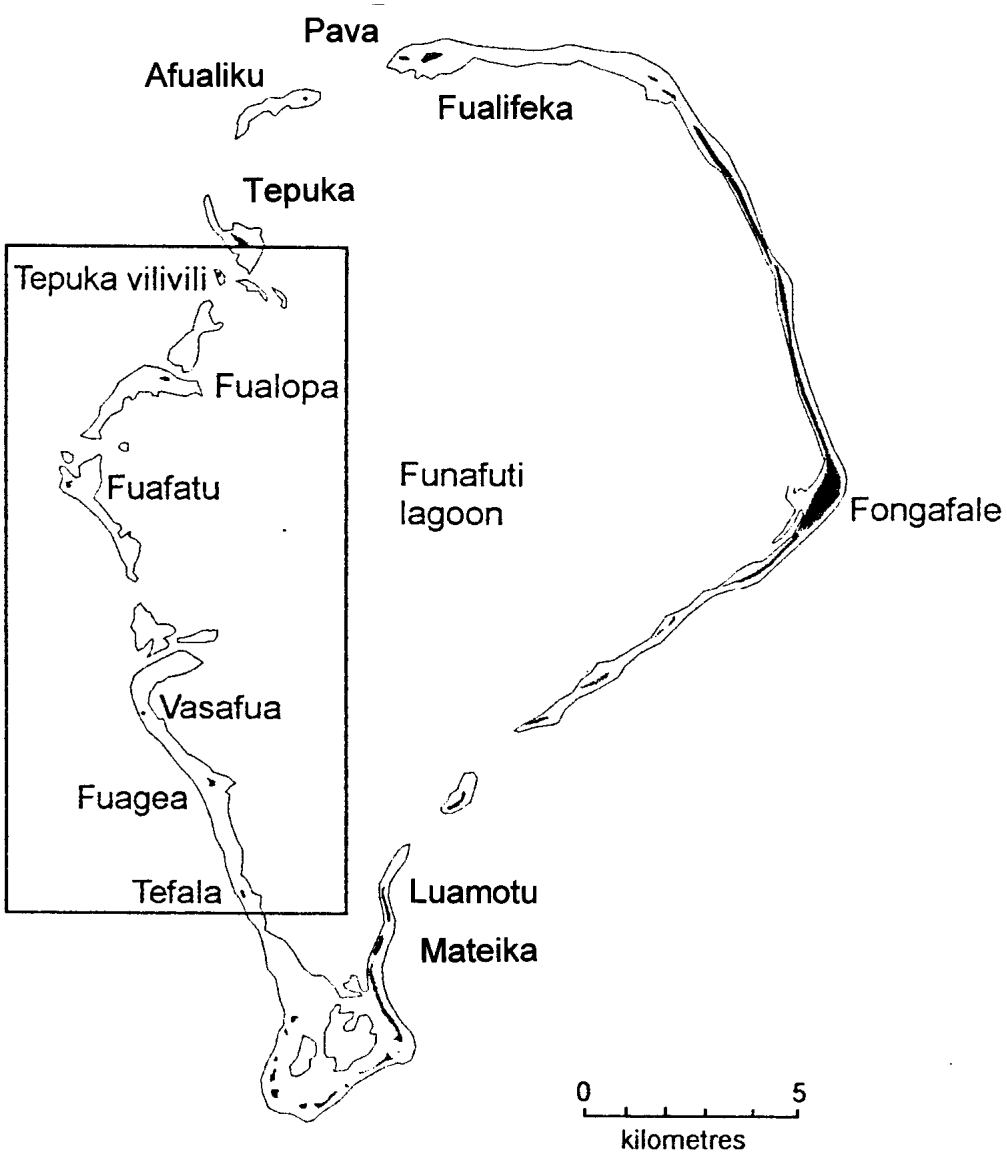




The Location of the Funafuti Marine Conservation Area in Funafuti Lagoon, with other motu visited during the survey.



SUMMARY

A survey of the birds of the Funafuti Marine Conservation Area (FMCA), Tuvalu and adjacent waters and motu, was undertaken between 31st September and 11 October 1998 by Dick Watling and staff of the FMCA.

Sixteen bird species were observed and four were found to be breeding. The survey was undertaken outside of the main wader season but during what was believed to be the breeding season of several seabirds.

This report documents the observations by species and by motu. It discusses the management issues and provides recommendations for monitoring and other initiatives by FMCA staff and SPREP.

The overall abundance of seabirds was considered to be well below what might be expected, however, this was a highly subjective assessment in the absence of any baseline or prior reliable observations or data. It does, however, corroborate anecdotal accounts in Tuvalu of a reduction in the seabird populations.

The principal threats to the seabirds of the FMCA are:

- Hunting and disturbance using shotguns and speedboats; and,
- Habitat loss through the loss of broadleaf woodland in favour of coconuts.

All the species recorded with one exception are widespread often pantropical species of little conservation concern. The exception being the Bristle-thighed Curlew *Numenius tahitiensis* which is regarded as an endangered species and which winters in Tuvalu.

A thorough survey of the literature was undertaken for this assignment and the published ornithological knowledge for Tuvalu was found to be based almost solely on the passing observations of an experienced ornithologist made over 40 years ago.

An incidental survey of the lizards of the motu of the FMCA was also undertaken and three (probably four) skinks and three geckos were recorded. One of the geckos could not be readily identified and requires formal identification.

1 INTRODUCTION

1.1 STUDY OBJECTIVES

The Study Objectives for the Bird Survey of the Funafuti Marine Conservation Area (FMCA), were as follows (extracted from Terms of Reference, Appendix 1):

1. design a baseline survey and monitoring program for seabirds and shore birds which will determine species richness, distribution and relative abundance of birds and nests within the Conservation Area (four Islets) and at control sites where birds are taken;
2. train a local survey team in survey methodology so that they may help with the baseline survey and carry on repeated surveys during various times of the year;
3. conduct the survey with the help of the local team;
4. prepare a database and report for the Funafuti Marine Conservation Area Project Office and SPREP.

In addition some specific questions were asked of the consultant (TOR, Appendix 1)

- What species of seabirds are found in the conservation area ?
- What is the relative abundance of each species / or indicator species surveyed (inside the Conservation Area and at control sites outside the area) ?
- Which islands are important nesting sites for species that are commonly hunted ?
- Are any rare or endangered bird species found in the CA ?
- Do any rare or endangered seabirds nest in the CA ?
- Are there any changes in bird densities within the CA over time (compared to control sites)
- When is the breeding season for important bird species ?

1.2 SURVEY APPROACH AND ACTIVITIES

1.2.1 Survey Approach

No authoritative account of the avifauna of the Conservation Area (FMCA) is available (nor for the whole of Tuvalu – refer section 1.3) and this determined the methodology and approach adopted, which was as follows:

1. Literature search to collate available data and prepare a presumed list of birds – undertaken prior to the Tuvalu visit from the consultant's office, Suva;
2. Reconnaissance survey of motus in the FMCA;
3. Discussion-meeting led by the consultant with FMCA staff and other invited guests, on species present, residential status, identification problems, conservation threats and opportunities, management needs and problems.
4. Follow up motu surveys/bird identification training sessions, including overnight surveys of species and numbers roosting on motus;
5. Total nest counts of breeding Black Noddy – Lakia on the FMCA motus and selected motus outside the FMCA; and,
6. Survey report preparation with monitoring recommendations and methodology.

Since it was learned that the lizard fauna of the FMCA motus was unknown, incidental searches to the bird survey were undertaken and voucher specimens collected for formal identification purposes.

1.2.2 Activities

Principal activities undertaken during the survey are summarised in Table 1.1

Table 1.1 Principal Activities of the Bird Survey, Funafuti Marine Conservation Area

Date	Morning Activities	Afternoon Activities
31/9/98	Flight Suva to Tuvalu	Briefing with FMCA staff and Project Manager, Sir Toaripi Lauti. Review of Office Reports
1/10/98	Field visit Tefala, Fuakea, Vasafua	Fuafatu, Fualopa
2/10/98	Field visit abandoned – thunderstorm and strong winds. Review reports, discussions with FMCA staff	Field visit Fualopa – observe roosting flights to Fualopa and other islands. Return after night fall
3/10/98	Field visit Tepuka, Afualiku	Fualifeka, Paava
4/10/98	Field visit Fuakea, Tefala	Data and journal collation
5/10/98		Field visit Fuafatu – overnight, observation and count of roosting birds
6/10/98	Returned from Fuafatu	Surveyed airport, borrow pits on Fogafale for shorebirds
7/10/98	Prepared material for Discussion-Meeting	Held Discussion-Meeting at FMCA office. Field visit Tefala – overnight, observation and count of roosting birds
8/10/98	Total Nest Count – Black Noddys on Tefala.	Prepare lizard specimens
9/10/98	Field visit Mataeiko, Luamotu	Data and journal collation – Final Report preparation
10/10/98	Total Nest Count – Black Noddys on Fualopu. Count on Fuafatu abandoned because of bad weather.	Report Writing
11/10/98	Meeting with Ministry of Natural Resources. Return Tuvalu to Nadi	Flight Nadi to Suva
12-15th/10/98	Final Report Preparation.	

1.3 Status of Ornithological Knowledge of the Study Area and Tuvalu

1.3.1 Ornithology of Tuvalu

Rodgers and Cantrell (1987) provides an annotated bibliography of the ornithology of Tuvalu which clearly illustrates a paucity of knowledge. Only 65 references were compiled, and of these only ten papers contain observations made this century.

A computer literature search (from 1985-1998) undertaken for this study, with one exception, adds no substantive new information. The exception is the arrival in about 1972, of a new land bird, the Banded Rail *Rallus philippensis* on the island of Niulakita where it is now established and breeding (McQuarrie 1991).

Currently, 42 species have been recorded from Tuvalu of which fourteen currently or formerly were recorded as breeding species. The majority of Tuvalu's recorded bird species are `vagrants' species which do not breed, and visit Tuvalu or pass through Tuvalu waters irregularly and/or in small numbers. Further work would increase the number of vagrants and possibly a small number of breeding species (Appendix 2 – Annotated List).

The principal work on the avifauna of Tuvalu is that of Peter Child, an Education Officer of the Colonial Government (Child 1960). It appears that Child's substantive paper (Child 1960) and its addition twenty years later (Child 1982) appear to represent the only ornithological field work undertaken by an experienced ornithologist this century. Even Child's work which was never intended as anything more than a general account and by no means an authoritative treatise, provides no more than a few references to the motus and the birds of Funafuti or the FMCA. In 1960, Peter Child observed:

"It should be mentioned that no comprehensive survey of the whole Colony has been carried out by a competent ornithologist, and thus there is a notceable gap in the available literature of the Pacific birds" (Child, 1960).

Child's observation is as true today as it was when he made it nearly 40 years ago and is a sad reflection on the status of Pacific ornithology.

1.3.2 Birds of Funafuti

No specific list of the birds of Funafuti has been published, though the FMCA staff have compiled an unpublished list of species recorded. This totals 26 species (Appendix 1), several of which are questionable records.

1.3.3 Baseline Condition

The lack of any previous reliable information precludes this survey being used to determine whether any change in status has occurred, although anecdotal information from Tuvalu and Child himself (Child 1980) is unequivocal about a decline in the bird population of Funafuti.

Thus, this survey is, of necessity, the first initiative in the drawing up of the baseline condition. Unfortunately one survey is not sufficient to complete this, because not all the birds breed at the same time, whilst the non-resident species are likely to visit at differing times and the survey was conducted outside the months when most northern migrants are present in Tuvalu.

2 THE ISLANDS OF THE CONSERVATION AREA

2.1 LANDFORM

Six motu are found within the FMCA, all are located on the reef platform. All the motu are small and narrow, the largest being only 3.3 ha in area. All but the smallest are composed of a number of landform units (refer Table 2.1)

Table 2.1 Landform Units of motu in the Funafuti Marine Conservation Area (Hectares). Source: McLean and Hosking 1992.

Islet	Oceanside Ridge	Lagoon Ridge	Central Depression	Interior Flat	Total (Ha)
Tefala		0.68			0.68
Fuagea	0.48	0.59		0.57	1.64
Vasafua		0.27			0.27
Fuafatu	1.39	0.89	0.98		3.26
Fualopa	0.62	0.54		1.00	2.16
Tepuka vilivili	0.03				0.03

2.2 VEGETATION

The vegetation of all the Funafuti motu were mapped into ten vegetation units by McLean and Hosking (1992). Five of these vegetation units were broadleaf woodland units and five were scrubland or other units. Table 2.2 shows the distribution of vegetation units by FMCA motu. Figure 2.1 is a map of these vegetation units. A description of the vegetation units is given in Appendix 3.

Table 2.2 Distribution of vegetation units by FMCA motu (hectares).

	Coconut	Coconut-broadleaf	*Cordia* woodland	*Pisonia* woodland	*Guettarda* woodland	Undifferentiated broadleaf woodland	*Scaevola* scrub	*Messerschmidia* scrub	*Scaevola* and *Messerschmidia* scrub	Undifferentiated scrub and coconuts	No vegetation	Total Scrub
Tefala		0.51						0.17				0.17
Fuagea	0.06					0.87				0.72		0.72
Vasafua		0.21			0.02		0.04					0.04
Fuafatu		0.49		0.35		1.99			0.43			0.43
Fualopa	0.11					1.35			0.70			0.70
Tepuka vilivili											0.03	0.03

Source: (McLean and Hosking 1992 – with modifications for Tepukavilivili).

3 ORNITHOLOGICAL SURVEY

3.1 SPECIES ACCOUNTS

3.1.1 General

Sixteen bird species were observed during the survey and four of them were found to be breeding. Several other species, specifically migrant shorebirds, may be regular visitors at other times of the year to the FMCA, although the status of the migrants will only be confirmed once some regular observations are recorded over a full annual cycle. Table 3.1 summarises these species and gives information on their Tuvaluan names, their residential status in respect of the FMCA and Funafuti, and their international distribution.

The Tuvalu names for the different birds is somewhat uncertain, and those presented in Table 1 are not to be considered as authoritative. It is very probable that there are differences between islands both in the use of the same name for different species and in the use of completely different names. Scientific names for all species may be found in Appendix 2.

3.1.2 Frigatebirds – Katafa

Lesser Frigatebirds were observed daily, especially over Tefala, but also in attendance at other islands where other seabirds were breeding. Approximately 2-300 were present at Tefala on 1st September. All but a very small minority of the Lesser Frigatebirds observed were males, both mature and immature. No Greater Frigatebirds were observed during the visit. Child (1960) reported that the Lesser was not as common as the Greater though he did not distinguish location and this might be the case in Kiribati. Interestingly, in 1980 when he visited Tuvalu again, he reported that Lesser Frigatebirds were by far the commoner (Child 1982).

Breeding is not recorded from Funafuti or Tuvalu, and is unlikely to occur – both species are timid breeders and require undisturbed breeding sites.

Distinguishing between the two species is very difficult and unless a mature adult male Greater Frigatebird is observed (completely black underparts – no white at all) – it is not recommended that FMCA staff attempt to distinguish between these two species until considerable experience has been gained. The best reference is Harrison (1985).

3.1.3 Brown Booby – Kanapu

Brown Booby's were observed daily and they were roosting in relatively small numbers (< 100) on Tefala and even fewer on Fuafatu.

The Brown Booby is the species commonly observed perched on reef marker posts, it readily alights on structures and roosts in trees, however, it only nests on the ground, never in trees or bushes.

Breeding is not recorded from Funafuti or Tuvalu, and is unlikely to occur – it is a species which usually requires undisturbed breeding sites.

Table 3.1 Birds of the Funafuti Marine Conservation Area (* - not observed during current survey).

English	Funafuti Names[1]	Other names recorded[1]	Residential Status in FMCA	International Status
SEABIRDS				
Frigatebirds (Greater and Lesser)	Katafa	Manulasi; Talakul or Katakula (males with red pouch); Upaitoi (young)	Non-breeders. Lesser is likely to be a common visitor, present all the year round.	The Lesser is widespread in the Indian Ocean and Western Pacific. The Greater is widespread throughout tropical Western and Indian Oceans.
Red-footed Booby	Kanapu,	Kotaa(SS); Te-Kena(SS);; Tapuka; Talanga ?	Non-breeder. Roosts on Tefala, Fuafatu, Fualopu	Pantropical
Brown Booby	Kanapu	Kotaa(SS); Kanopatau	Non-breeder. Roosts on Tefala, Fuafatu, Fualopu	Pantropical – commonest and most widespread Booby
Masked Booby *	Te-Kena	Kena, Loka	Occasional visitor	Pantropical
Reef Heron	Matuku	Matuku kena (white phase); Matuku uli (grey phase); Matuku pulepule (mottled phase)	Probably breeds in FMCA, certainly somewhere in Funafuti	Oriental tropics and Southwest Pacific
Black-naped Tern	Matapula (SS)	Akiaki	May breed (TePuka Vilivili). Breeds elsewhere - Afualiku	Tropical Indian and Pacific Oceans
Crested Tern	Tala		Non-breeder – small numbers	Much of tropical and subtropical Indian and Pacific Oceans.
Sooty Tern *	Talaliki	Talaalofi	Recorded as breeding on Afualiku (xxx)	Pantropical
Bridled Tern			?Visitor – Non-breeder.	Pantropical but patchy distribution, supposedly absent central and eastern Pacific.
Black Noddy	Lakia	Taketake	Resident, Breeds	Tropical and sub-tropical Pacific and Atlantic Oceans
Brown Noddy	Gogo	Uli	Resident, Breeds	Pantropical
Fairy Tern	Akiaki	Matapula, Kiakia	Resident, Breeds	Pantropical
White-tailed Tropicbird	Tavake	Tavaepuka; Tavakelau	Occasional visitor – Non-breeder	Pantropical and subtropical
Red-tailed Tropicbird *	Tavaketoto		Occasional visitor – Non-breeder	Tropical and subtropical Pacific and Indian Oceans.

SHOREBIRDS				
Turnstone	Kolili	Kolikoli	Regular northern migrant, small numbers stay all year	Northern migrant, breeds circum-polar
Pacific Golden Plover	Tuli	Tuli alo malala (summer plumage)	Regular northern migrant, small numbers stay all year	Northern migrant, breeds, eastern Siberia, and Alaska
Bar-tailed Godwit *	Kaka	Kotau	Regular northern migrant	Northern migrant, breeds Siberia and western Alaska
Wandering Tattler	Kilikilitai	Vivitai; Litai; Kapo; Tulianinamo	Regular northern migrant, small numbers stay all year	Northern migrant, breeds Alaska and western Canada
Bristle-thighed Curlew, Whimbrel	Founga	Kovee, Koree	Regular northern migrant	Northern migrant. Very limited breeding range in Alaska

LANDBIRDS				
Long-tailed Cuckoo *	Kaleva	Suvii	Regular southern migrant	Migrant from New Zealand
Pacific Pigeon	Lupe		Small numbers resident in FMCA, probably breeds.	Tonga/Samoa to islands off Northern New Guinea.

Note: 1 Funafuti names based on discussion of a draft list at Funafuti Town Council, 7/9/98; SS – Mr S.Seluka Unpublished Mss with Conservation Area Staff. Others from Rodgers & Cantrell 1987.

3.1.4 Red-footed Booby – Kanapu

Red-footed Booby's were observed roosting (<30) in small numbers at both Tefala and Fuafatu. Although the Red-footed Booby has a confusing array of colour phases it is always relatively simple to distinguish, being a much slighter bird. The Red-foot nests in trees and could, probably would, nest in the FMCA provided it received adequate protection from disturbance.

A `new' breeding colony was recorded at Niuoko motu, Nukulaelae (Child 1982), the only breeding colony recorded for Tuvalu. The status of this colony is currently unknown.

3.1.5 Masked Booby – Te Kena

Masked Booby's were not observed and are probably rare. They are a much more pelagic species than the other two Boobies and are rarely seen close to land.

3.1.6 Reef Heron – Matuku

Reef Herons are observed daily. The three forms, grey, white and mottled are present. No breeding sites were located in the FMCA but it may well breed there. Nests can be located in almost any undisturbed situation.

3.1.7 Black-naped Tern – Matapula

A breeding colony of the Black-naped Tern was observed on Afualiku motu, outside the FMCA, approximately 60 birds were present. This number included some immatures. One clutch with two eggs was found. It was not clear whether this was an early or a late breeding attempt. However, the colony was active and exhibiting the territorial behaviour characteristic of this species.

Child (1960) recorded this species as breeding on Pukasavilivili.

Away from this colony the species was only observed on rare occasions.

3.1.8 Great-crested Tern

Although seen on several occasions, it appears to be uncommon, no more than two were seen at any one time both inside the FMCA and at other locations. It was not associated with any particular islet.

3.1.9 Sooty Tern – Talaliki

Not observed, but recorded as breeding on Te Afualiku (Child 1960) and from anecdotal evidence (Tataua pers. comm.). This is a pelagic species which is ordinarily absent from the vicinity of land and its breeding site, but returns in very large numbers to breed at these sites. It is believed not to breed on Afualiku any longer, but this needs confirmation.

3.1.10 Bridled Tern

A single individual seen in the lagoon. No breeding records known, and it may be just an occasional visitor. Child (1960) recorded this species on Afualiku motu where he was informed that it nested.

3.1.11 Black Noddy – Lakia

The nest count revealed approximately 1,000 AON (Apparently Occupied Nests) with the largest number on Fuafatu - 688. A few breed on islands outside the FMCA (Table 3.1). Nests appear to be built only in Pukavai *Pisonia grandis* or Pukavaka *Hernandia nymphaeifolia* trees at Funafuti, although it is not so restricted elsewhere in its range.

Eggs and young nestlings were observed during the counts. Some birds were also building new nests, although it was not clear whether these were intended for breeding which would indicate a fairly long breeding season.

3.1.12 Brown Noddy – Gogo

Common and a resident breeder. Breeds at the base of coconut fronds or in *Pandanus*-Fala vao. Such nests are not very conspicuous making this a much harder species to count than the Lakia. The number in the FMCA would be similar or slightly less but it is likely to breed in the coconuts on many other motu as well, whereas the Lakia is essentially restricted by the abundance of Pukavai and Pukavaka trees to the motu of the FMCA.

A few birds were observed sitting on nests but on most motu, the Gogo appeared to be engaged in courtship and selecting nesting sites at the time of the survey.

3.1.13 Fairy Tern – Akiaki

Common and a resident breeder. All islands inside and outside the FMCA had attendant Akiaki, although never in large numbers – usually 20-50 per motu. Eggs and fairly advanced downy nestlings were observed.

3.1.14 White-tailed Tropicbird – Tavake

A single distant and unconfirmed observation of this species.

3.1.15 Turnstone – Kolili

Common in small numbers wherever there was exposed reef indicating that a small number of Turnstones stay the year round on Funafuti. The largest number – 35 was observed on the airfield runway during a high spring tide.

3.1.16 Pacific Golden Plover – Tuli

Common in small numbers. As with the Turnstone and Wandering Tattler, a small number clearly stay the year round on Funafuti. About 40 were recorded on the airfield runway during a high spring tide.

3.1.17 Wandering Tattler – Kilikilitai

Small numbers of Tattlers in ones, two's or three's were observed on every island, both inside and outside the FMCA. No great effort was taken in checking to see if *H.brevipes* was present, however, all those identified were the Wandering Tattler *H.incanus*. A few *H.brevipes* apparently reach Tuvalu, as noted by Child (1982), and they are best distinguished from *H.incanus* by their call.

3.1.18 Bar-tailed Godwit

Not observed during the survey but very likely to be quite common later in the year.

3.1.19 Bristle-thighed Curlew – Founga, Kovee

Two individuals seen, one inside (Fualopa) and one outside the FMCA. A rare and poorly known Curlew with an international profile and a species which is generally regarded as `endangered'.

3.1.20 Long-tailed Cuckoo – Kaleva

None recorded during the survey but well known to those Tuvaluans who were spoken to.

3.1.21 Pacific Pigeon – Lupe

Recorded only from Fuafatu inside the FMCA, and also from Tepuka and Luamotu outside. Obviously surviving only in very small numbers in Funafuti. This species is a renowned inter-island wanderer and if, as is likely, it breeds in the FMCA then increased protection could help boost its population both inside and outside the FMCA.

3.2 BIRD OBSERVATIONS ON DIFFERENT MOTU

3.2.1 General

The motu of Funafuti are used for nesting by three (possibly four) seabird species and roosting/resting by the remaining species. The degree of use by birds of the individual motu of the FMCA and those adjacent to it varies greatly. Not all of this could be attributed to vegetation or physical characteristics, although it was quite clear that the FMCA motu have a far higher proportion of native vegetation than the others (refer section 5.1). The gradual transition of broadleaf woodland to coconut and pandanus `plantation' is clearly detrimental to seabirds' use of the motu. Table 3.1 summarises the observations made on different motu, where the motu were visited more than once, average figures are given, except where the numbers are of special interest.

3.2.2 Tefala

Tefala is a small motu of 0.7 ha (Table 2.1). It is, however, an important bird island which currently supports approximately 200 breeding pairs of Black Noddy-Lakia, as well as breeding Fairy Tern-Akiaki and Brown Noddy-Gogo (Table 3.2). It is also the most important night roost in the FMCA for the larger seabirds such as Frigates (2-300 seen on one occasion) and Boobies (up to 100). A large number of Noddys and Fairy Terns also roost on the island but there numbers are more difficult to count, approximately 4-500 was the estimate.

3.2.3 Fuagea

Fuagea is an enigmatic motu which is almost completely shunned by seabirds for no obvious reason. No birds were breeding on the island, there was no sign of roosting and only a single FairyTern-Akiaki and two Brown Noddys-Gogo were observed over the island during two visits. The *Pisonia*-Pukavai are of a smaller stature than on other motu (10-13m as opposed to 13-18m+) and this may be a factor in their sutiability for nesting and roosting.

Figure 3.1. Bird observations on Motu of the Funafuti Marine Conservation Area and adjacent locations

Birds	Tuvalu Name (Funafuti)	Tefala	Fuagea	Vasafua	Fuafatu	Fualopa	Tepuka	Afualiku	Pava	Fualifeka	Mateika	Luamotu
SEABIRDS												
Lesser Frigatebird	Katafa	1/9 2-300, 7/9 35 roosting			c. 50 roosting							
Red-footed Booby	Kanapu	c10 roosting			c. 75 roosting, mainly Brown							
Brown Booby	Kanapu	c 50 roosting				c.30						
Reef Heron	Matuku	4		3	1					6	5	
Black-naped Tern	Matapula							c.60 (nesting)				
Bridled Tern						1						
Crested Tern	Tala*	2									1	
Black Noddy	Lakia	191 AON			Black - 688 AON.	83 AON + small number roosting			21 AON			3 AON
Brown Noddy	Gogo	c.50		c.30		c.30		c.50 (nesting)		c.30	4	1 AON; 15-20 prs probably nesting
Fairy Tern	Akiaki	c.50 - 4 on egg;1 yng	1	4	c.2,500 mixed roosting	c20 prs, 2 incubating	2		5	4	c.18	

Figure 3.1. Bird observations on Motu of the Funafuti Marine Conservation Area and adjacent locations (contd.)

Birds	Tuvalu Name (Funafuti)	Tefala	Fuagea	Vasafua	Fuafatu	Fualopa	Tepuka	Afualiku	Pava	Fualifeka	Mateika	Luamotu
SHORE & LANDBIRDS												
Turnstone	Kolili	7			12	4				4	7	
Pacific Golden Plover	Tuli				5	6				3		1
Wandering Tattler	Kilikilitai				2	1					5	3
Bristle-thighed Curlew						1						
Pacific Pigeon	Lupe				2		>2					1

3.2.4 Vasafua

A rocky motu with a sand, coral rubble veneer. A single rather sick *Calophyllum*-Fetau, eleven mature coconuts, a few *Pandanus*-Fala and *Scaevola*-Gasu. Approximately 30 Brown Noddy-Gogo, four Fairy Tern-Akiaki and three Reef Heron-Matuku were present on the island during our visit – there was no sign of nesting. Clearly this motu has lost a lot of vegetation based on the vegetation descriptions of McLean & Hosking (1992) and Appendix 3.

3.2.5 Fuafatu

The largest of the FMCA motu at 3.3 ha. Fuafatu is an important motu for breeding and roosting seabirds. It holds the largest concentration of breeding Black Noddy-Lakia with approximately 688 pairs. About 30 pairs of Brown Noddy-Gogo also appeared to be getting ready to nest there, and a similar number of Fairy Tern-Akiaki were in attendance during the day.

The island is an important roost for Noddys and the Fairy Tern – about 2,500 (mixed) roosted there on the evening surveyed, as well as approximately 50 Frigatebirds and 75 mainly Brown Boobys.

3.2.6 Fualopa

Fualopa has a small breeding colony of Black Noddy-Lakia (83 AON). Brown Noddy-Gogo appeared to be ready to nest in small numbers and there may have been a similar number of Fairy Tern-Akiaki (<50 prs) breeding or about to breed at the time of the survey. Fualopa is a large motu (2.2 ha) with a large stand of *Pisonia*-Pukavai. Only small numbers of bird roost on the island

3.2.7 Tepuka Vilivili

Tepuka Vilivili is a small coral rubble bank. No birds were present on the motu when we passed but it could be suitable for nesting terns or roosting waders. Child (1960) records Black-naped Tern – Akiaki nesting on this motu. This motu has recently lost all its vegetation.

3.2.8 Tepuka

Tepuka is a large motu (c.4 ha) outside and just to the north of the FMCA and is a motu with comparatively good soil resources and looks fertile. The vegetation is highly modified in favour of coconut. Breadfruit trees present and also some Taro in cultivation, a lot of human activity plainly evident. In the middle of the island four large concrete foundations were found with heavy bolts protruding - remnants of a war installation - gun, aerial ?? Very few *Pisonia*-Pukavai remaining. Some fine other broadleaf tree species and the most extensive herb and shrub layer of all the islands visited with nearly a dozen species not observed on other motu.

No birds were found nesting on Tepuka and there were only a few in attendance, Brown Noddy-Gogo and Fairy Tern-Akiaki, there was no sign of roosting birds.

Tepuka was found to have cats – the only motu visited where these were observed and this may account for the absence of breeding/roosting birds.

3.2.9 Afualiku

A small (c. 0.3 ha) motu composed entirely of coral rubble substrate. Coconuts look healthy, the only other vegetation noted - a group of six *Pandanus*-Fala and three Birds Nest Fern-Lauluu. A breeding colony of c. 60 Black-naped Tern-Matapula was on the island at the time of the visit, one clutch of 2 eggs was seen. It was not clear whether this was an early or very late (2nd ?) clutch as juvenile/immature birds were present. Nests of Brown Noddy-Gogo in the axils of coconut trees were easily seen on this island but only one bird was apparently incubating. Two other nests contained dead birds (one was retrieved and found to be an advanced fledgling). There may have been 30 nests in all and approximately 50 birds in attendance at the island.

Child (1960) records Sooty Tern – Talaliki and Bridled Tern breeding on this motu.

3.2.10 Pava

A small group of about a dozen but very large *Pisonia*-Pukavai grow in the centre of this motu which is approximately 2 ha in area. Otherwise coconuts are very dominant although the substage is profusely covered with *Morinda*-Nonu and Pandanus-Fala. The *Pisonia*-Pukavai support 21 AON of Black Noddy-Lakia. About 5 Fairy Tern-Akiaki were on the island at the time but no Brown Noddy-Gogo.

3.2.11 Fualifeka

A tin and coconut frond house which is obviously used sporadically has been constructed on the motu- there is also a lot of evidence of semi-permanent habitation - taro, breadfruit, banana, pawpaw, old pig's pen, ditches and mounds, some *Pisonia*-Pukavai cut down etc. A cycad *Cycas rumphii* grows near the house. Coconut gatherers were on the motu at the time of our visit and left with a boat super-laden with coconuts. A large concrete pad with a 1.25m trench in it, is evidence of war-time occupation.

No species appeared to be nesting but Brown Noddy-Gogo, Fairy Tern and six Reef Heron were observed on the island.

3.2.12 Laumoto

Almost entirely coconut with a small complement of *Guettarda*-Pua and *Pandanus*-Fala. Ground and herb layer effectively absent, little soil mostly coral rubble. No birds seen to be nesting but about 15prs of Fairy Tern-Akiaki were in attendance and may have been attempting to breed.

Five Reef Heron- Matuku, five Tattler-Kililvilitai and seven Turnstone-Kolili recorded.

3.2.13 Mateiko

Vegetation better developed than neighbouring Luamotu, a bit wider and less windswept inside. Coconut vastly dominant, *Asplenium*-Lauluu and *Nephrolepis* very well established. *Pandanus, Guettarda*-Pua v. common, plus *Morinda*-nunu abundant as understorey. A large stand of rapidly colonising *Neisosperma oppositifolium* – very dominant.

A small stand of *Pisonia*-Pukavai in two places c. 6 trees. 3 AON Black Noddy-Lakia. 1 AON Brown Noddy-Gogo in *Pandanus*-Fala, but probably 15-20 pairs nesting or about to nest on the island together with c. 20 pairs Fairy Tern. A sole Pacific Pigeon seen and also three Tattler-Kilikilitai, two Reef Heron-Matuku, one Golden Plover-Tuli.

4 LIZARDS

4.1 GENERAL

There appears to have been no observations published on the lizards of Tuvalu and none specifically on those of the FMCA. Although a definitive lizard survey was outside the scope of the current survey, the opportunity was taken to make observations and provide a preliminary list.

Six (perhaps seven) species were observed and voucher specimens collected[1], three (perhaps four) skinks and three geckos.

4.2 SKINKS

Skinks are the normally diurnal thin `fingered' reptiles seen moving rapidly around in the vegetation and the strand area.

4.2.1 Copper Striped Skink *Emoia cyanura/impar*

The Copper Striped Skink, long classified as *Emoia cyanura* has recently been separated as two sibling species – *E.cyanura* and *E.impar* (Ineich 1987; Ineich & Zug 1991). These are difficult if not impossible to separate in the field but it did appear that both species are present in the FMCA, although preliminary identification of voucher specimens appeared to contain only *E.cyanura*.

This lizard(s) is common to abundant and is probably on every motu with significant vegetation. Although primarily a ground skink this species can be seen clambering up all vegetation and venturing quite high up some trees.

4.2.2 Pygmy Snake-eyed Skink *Cryptoblepharus eximius*

Observed and common on every motu with the exception of Vasafua. This is the common lizard of rocks and rubble of the upper shore line. It is also found well inside the motu and is quite arboreal in its activity.

4.2.3 Moth Skink *Lipinia noctua*

This is a cryptic species never venturing out into the open. It is usually found in rotten wood, under bark or piles of coconut husks.

4.3 GECKOS

Geckos are normally nocturnal, hiding during the day, and have broad `fingers' and very good climbing ability.

4.3.1 Oceanic Gecko *Gehyra oceanica*

This is the large nocturnal gecko which is commonly found under loose bark or at the base of coconut fronds.

[1] Voucher specimens were collected because of the lack of any available information on the lizards of Tuvalu. These will be formally identified and deposited on loan at the Smithsonian Institute, Washington under the care of Dr. George Zug. The submission of this report has not waited for positive identifications, these will be communicated to the FMCA Staff and SPREP when received.

4.3.2 Mourning Gecko *Lepidodactylus lugubris*

The Mourning Gecko is generally restricted to buildings and their surrounds. Finding it on uninhabited motu is a little surprising.

4.3.3 Unidentified Species

An unidentified dark, almost black gecko with vivid yellow underparts, probably *Lepidodactylus* was recorded on two motu. It is definitely not the Mourning Gecko and bears more characteristics of Rotuma's endemic gecko *Lepidodactylus gardineri.* This will require formal identification

Table 4.1 Preliminary list of the lizards of the Funafuti Marine Conservation Area and adjacent motu. (Key: **S** – sight record; **V** – voucher specimen).

		Tefala	Fuagea	Vasafua	Fuafatu	Fualopa	Tepuka	Afualiku	Pava	Fualifeka
SKINKS										
Emoia cyanura/impar	Copper Striped Skink	**V**	**S**		**S**	**S**	**V**		**S**	**S**
Cryptopblepharus eximius	Pygmy Snake-eyed Skink	**V**	**V**		**S**	**S**	**S**	**V**	**S**	**S**
Lipinia noctua	Moth Skink	**S**							**S**	**V**
GECKOS										
Gehyra oceanica	Oceanic Gecko		**V**		**S**	**S**				**V**
Lepidodactylus lugubris	Mourning Gecko		**V**		**S**					**V**
Lepidodactylus sp.			**V**				**V**			

5 MANAGEMENT ISSUES

5.1 STATE OF KNOWLEDGE AND SIGNIFICANCE OF THE TERRESTRIAL ECOSYSTEMS

The current state of knowledge of Tuvalu's avifauna and that of the FMCA is very poor, a tentative list of species which may be observed has been produced (Rodgers & Cantrell 1987), but it is essentially the product of very limited work over forty years ago (Appendix 2). The location and distribution of breeding colonies and sites is almost completely undocumented and the residential status of many birds only vaguely known. Overall the state of knowledge is certainly inadequate to make any informed decisions regarding management interventions or, for instance, the sustainability of seabird harvesting.

The first priority is to accumulate some basic ecological data which was initiated during the current survey, of which the following are the most important:

- which birds, in what numbers and at what times are present in the FMCA ?
- which birds breed, when, in what numbers and on which motu ?
- which migrants and in approximately what numbers visit Funafuti and the FMCA, where are the high tide resting locations ?

The above data is very basic, but without it informed conservation management cannot be initiated.

Conservation of the FMCA's terrestrial ecosystems is a minor but a key component of the overall objectives of the FMCA. While the FMCA covers only 3% of the land area of Funafuti, it contains almost 40% of the all the native relict broadleaf woodland on the atoll (SPREP 1995). Currently, it appears that this woodland is vital for the breeding and roosting of the majority of Funafuti's seabirds and that Funafuti's seabirds have a very limited future if the broadleaf woodlands of the FMCA motu are destroyed in favour of coconuts.

5.2 THREATS

5.2.1 Overview

The principal threats to the birds of Funafuti and the FMCA are effectively the same for both resident breeding species and the visitors. However, these threats do vary in significance between the groups and when combined are of special significance for breeding species:

- Breeding Birds:
  - Loss of breeding habitat ie Broadleaf Woodland and/or shingle beaches;
  - Excessive disturbance of breeding locations; and,
  - Hunting
- Visiting – non breeding Birds:
  - Excessive disturbance to roosting/resting sites
  - Hunting

5.2.2 Loss of Broadleaf Woodland

It is considered probable that the reduction of Broadleaf Woodland in favour of coconuts is a relatively recent activity stimulated by copra production schemes instituted in the colonial period. Prior to this need, the traditional benefits of the Broadleaf Woodland (including its high habitat value for harvestable birds) would have tended to maintain its presence. Copra production is currently negligible in Tuvalu.

5.2.3 Power boats and mobility

Perhaps the greatest overall change in the relationship between birds and man in Funafuti has been brought about by the ready access to power boats. Tefala, the furthest island of the FMCA from the township can be reached in almost any weather in 30 minutes. It is this mobility, if used destructively, which poses the greatest threat to all of Funafuti's birds. Controlled access is, therefore, an important management requirement which will need to be balanced against landowner's and others' access for activities which do not impact the birds.

5.2.4 Hunting

Taking of birds is a cultural activity for all Tuvaluans, however, there are many who now realise that the use of power boats and shot guns will inevitably destroy the resource. This is not an hypothetical issue, it is a certainty and is just a matter of time.

During the survey, three visits were made to Tefala, on each occasion there was fresh evidence of hunting visits:

Visit 1: over 60 shotgun cartridges and a wounded Brown Noddy-Gogo and dead Frigatebird-Katafa;

Visit 2: Climbing strings and a fire were evidence of a visit the previous night;

Visit 3 – overnight roost count: Unaware of our presence on the island, a boat pulled up at about 2030.

Shotgun cartridges were also found on Fuafatu (<12).

It is clear, therefore, that hunting still continues within the FMCA and probably at a high level, despite the widespread knowledge of the FMCA in the community.

There is no easy solution to the problem. It is probable that policing and legislation alone will not be an effective short term solution, though without gradually increasing enforcement, there is unlikely ever to be a solution. The issue is very much a community based one and will require community-based solutions.

5.3 CURRENT STATUS OF FUNAFUTI'S BIRDS

5.3.1 Nature of Breeding Birds.

Currently the species that breed in the FMCA and Funafuti can be considered as resilient species – Brown Noddy-Gogo, Black Noddy-Lakia, slightly less so the Fairy Tern-Akiaki and Black-naped Tern-Matapula. Another relatively, resilient species, the Red-footed Booby-Kanapu does not breed, likewise the more timid and/or ground-nesting species, Brown Booby-Kanapu, both species of Tropicbird-Tavake, Sooty Tern-Talaliki, ?Bridled Tern and others.

All of these could be expected to breed on the motu of the FMCA provided conditions were right and these relate almost solely to hunting and disturbance.

5.3.2 Visiting Seabirds

For management purposes it is important to appreciate that the majority of birds (seabirds and all shorebirds) currently observed in Funafuti and the FMCA are visitors, they breed elsewhere. Therefore good FMCA management will not necessarily ensure that their numbers are maintained or increase, it will be breeding success at their breeding colonies (elsewhere in Tuvalu but more likely the uninhabited or sparsely inhabited islands of the Phoenix and Line islands) which will determine population levels. Provided there are no problems at these breeding sites, these visiting birds will keep on coming irrespective of conditions in the FMCA but disturbance and hunting will reduce their numbers and tend to make them move to undisturbed locations. The Frigates will remain only as long as there are breeding seabirds and to a lesser extent roosting birds as they are `klepto-parasites' on such birds.

5.3.3 Decreasing Bird Numbers.

Without the benefit of previous work, there is no baseline on which to make any judgements. However, several lines of evidence indicate that there has been a loss of species and numbers in Funafuti, these include:

1. Anecdotal evidence from Tuvaluans themselves tend strongly to indicate a decline in bird numbers ;
2. Child (1960) reported:

   `It seems almost certain that there has been a general decrease in the resident bird population of (Tuvalu and Kiribati) over the past two or three human generations, particularly among the more timid ground-nesting species. Old men who can remember back before the turn of the century have often told me of birds which used to nest on their islands but which are now rarely, if ever seen. "

3. And then on his subsequent visit in 1981 he noted

   `Because of the growing human population influx to the capital and increasing numbers of rifle permits being issued, the shooting of birds for food is a matter of concern on Funafuti. Seabird numbers seem to have fallen drastically there in 25 years …..' (Child 1982)

4. The Sooty Tern-Talaliki formerly nested on Afualiku (Child 1960, Tataua pers. comm.) but apparently no longer nests there or elsewhere in Funafuti.
5. Numbers of seabirds observed during the current survey appeared low by what one should perhaps expect in similar circumstances. A total breeding population of less than 1000 prs of Black Noddy-Lakia for Funafuti would appear to be a very low number – one should not be surprised to find this sort of number nesting on a single motu of the FMCA. These, however, are very subjective impressions. In addition the survey was undertaken during a severe El Nino year and the effects of this in Tuvalu are unknown but could be quite disruptive and severe.

5.3.4 Seabird Harvesting

Notwithstanding that seabird harvesting is a traditional Tuvaluan activity – continued unrestricted harvesting utilising motor boats and shotguns, in addition to traditional methods, will undoubtedly result in the loss of the remaining seabird colonies. With the loss of these breeding species, the Frigatebirds which are attendant on the breeding

colonies will disperse to other colonies. Other species which breed elsewhere and currently visit Funafuti waters using the FMCA motu as resting and roosting sites will continue to visit providing their breeding colonies elsewhere remain productive and they are not excessively disturbed on the FMCA motu. Excessive disturbance will result in their dispersal elsewhere too.

Providing the breeding colonies on the FMCA motu with complete protection will very likely result in considerable and rapid expansion in numbers of those species breeding now, while other species (Red-footed Booby etc.) may begin to breed in the FMCA. These would be indicators of a successful conservation initiative.

With vibrant colonies on the FMCA motu, satellite colonies will be established on motu outside the FMCA. When this happens would be the appropriate time to establish guidelines for seabird harvesting outside the FMCA. None of the species concerned are rare and/or endangered on an international scale and there is no intrinsic reason why these species should not be harvested[2]. But as in similar cases elsewhere (muttonbirds in New Zealand, Australia), this is only sustainable if it is well controlled and based on sound ecological knowledge. The only species with an international profile and one which is classified as endangered is the Bristle-thighed Curlew-Founga.

Given the current lack of knowledge, any harvesting of seabirds from within the FMCA has no ecological basis and seriously undermines the concept of conservation for sustainable use.

[2] It should be noted, however, that some of the species currently hunted in Funafuti and the FMCA are protected by national Tuvalu legislation.

6 MONITORING ACTIVITIES

6.1 RATIONALE FOR MONITORING

`Monitoring' is currently an omnibus term which covers a wide variety of rather disparate activities. As noted above the state of knowledge of the FMCA sea and shorebirds is very limited and the current survey has initiated a knowledge of the baseline condition. In these circumstances, the activities which are most appropriate for the FMCA staff, bearing in mind that there is a need to gradually upgrade their skills, would be better termed as `surveillance' – defined as:

> *An extended programme of surveys, undertaken in order to provide a time series, to ascertain the variability and/or range of states or values which might be encountered over time but without predetermined standard or the degree of deviation from an expected norm. (Hellawell 1994)*

It is important that the activities and programme selected are achievable by the staff given the constraints of lack of experience and motivation, and technical resources.

6.2 MOTU VISITS

Basic information on fluctuations and changes in the numbers and activities of both seabirds and shorebirds can be most quickly built up by regular completion of `Motu Vist Sheets. An example is provided as Table 6.1 – used as a prototype, this can be developed and improved through regular use. Each time any member of the FMCA visits a motu, time should be taken to gather some information for these sheets. In addition to *ad hoc* visits, each motu should be visited at least once every month. Certain control motu should be visited during the seabird breeding seasons to record the level of breeding activity on these islands, so that any changes in the FMCA can be compared with sites outside the FMCA which are likely to be exposed to regular harvesting/hunting. It is suggested that the control motu to be visited be:

Luamotu; TePuka, Pava, Fualifeka.

However, other motu not visited in the current survey could be more appropriate as control sites and visits to other motu should be undertkane by FMCA staff to finalise these `control sites'.

Initially data can be readily entered onto a simple spreadsheet and when developed and standardised as appropriate for the FMCA, then a database could be designed.

6.3 NEST COUNTS

6.3.1 Apparently Occupied Nest-site

Nest counts, if accurately counted, are a very reliable and useful ecological indicator. The standard used for seabirds such as the Noddys is **`The Apparently Occupied Nest-site'** (AON). This is defined slightly differently for different species but could be adopted as follows for the Black Noddy-Lakia:

> *A substantial or well-constructed nest capable of holding an egg and occupied by at least one bird on or within touching distance of the nest.*

Counts of AONs should be made in the late incubation to early nestling period when attendance at any given colony is likely to be at its greatest. The timing will differ between species and may need some refinement, Black Noddy-Lakia nesting was fully

underway during the current survey and it was an appropriate time to undertake the counts. However, it may be that the species has a very long breeding season and that some birds have finished before others commence. Only more detailed observations combined with regular completion of Motu Visit Data Sheets will reveal this.

6.3.1.1 Black Noddy-Lakia

The conspicuous nests of the Black Noddy-Lakia in *Pisonnia*-Pukavai and *Hernandia*-Pukavaka trees make it readily amenable to total nest counts and these should be undertaken by FMCA staff.

Accurately counting nests on the motu of the FMCA is more difficult than it would at first appear as it is easy to become disoriented and count trees twice. A system of non-permanent marking of trees during the count would be needed.

A standard form for the AON count should be adopted and linked to a standard Spreadsheet for data storage. An example is provided – Table 6.2.

6.3.1.2 Brown Noddy-Gogo

The nests of the Brown Noddy-Gogo are placed in *Pandanus*-Fala foliage and at the base of coconut fronds. They are far less conspicuous than those of the Black Noddy and more care and experience will be needed to obtain accurate counts. It may be easiest to develop the technique on an island such as Afualiku where the coconuts are easily viewed. Following development of the necessary expertise counting AONs could be extended to other islands but this should not be attempted immediately.

6.3.1.3 Fairy Tern-Akiaki

Fairy Tern-Akiaki lay their eggs directly onto the bare branch of trees – there is no nesting material gathered and in the absence of the adult the egg is almost impossible to locate. Counting `nesting' Fairy Terns is difficult and should not be attempted initially.

6.3.2 Black-naped Tern-Matapula

Black-naped Tern-Matapula may well move their nesting colony between years and so it is important to search all the likely sites each year (and this should include sites outside but close to the FMCA, ie Afualiku). Disturbance of the colonies should be minimised (by FMCA staff as well). The recommended method for counting nesting terns is the Direct Count. For this method the counting unit is the Apparently Occupied Nest site, defined as *those birds sitting tight and apparently incubating eggs or brooding chicks*. Ideally these AONs are counted from a position where the whole colony can be viewed. Problems can arise if the whole colony cannot be observed from one spot and when both members of the pair sit slightly apart and are both counted as incubating. Nevertheless this method produces accurate results if used with care and is most useful in smaller colonies.

Another method which should be attempted only if the Direct Count is unsatisfactory is the Flushing Count. For this method the counting unit is the flying bird. The procedure is to flush all birds from the colony into the air using a loud noise and then count the birds several times whilst they are in the air.

6.4 SEABIRD ROOST COUNTS

Counting the number of birds using the motu for roosting may be a useful source of data, however, it will have to be developed and a reasonable level of accuracy assured. During the Survey, roost counts were attempted at three islands:

Fualopa – very few birds flew in to roost on the motu, no more than 100. However, large numbers were seen flying south to roost on Fuafatu or Tefala.

Fuafatu – a major roosting location. Reasonable counts could be made – a minimum of four people covering the entire coastline would be required, with the largest number of birds flighting in from the west – the closest point between the motu and the outer reef. Observers need to be in place at about 1715 and continue to count until well after dark – c. 1830. Noddys and Fairy Tern should be `lumped', similarly both species of Booby.

A night just before full moon would be the best time to make the count.

Tefala – in contrast to Fuafatu, it is probably not possible to count roosting birds on Tefala with any degree of accuracy, this is because of the tendency of all species to flight in and then fly round and sometimes out and away from the motu before coming back in.

Counting flocking birds is quite difficult – some well used techniques are explained in Figure 6.1.

6.5 SHOREBIRD ROOST COUNTS

Counting the numbers of migrant shorebirds on a regular basis may be a useful source of information although it will not have major management implications. It is of little use just counting the waders in the FMCA as they will fly in and out of the FMCA dependant on tides, counts should be made for all of Funafuti and the feasibility of this will need to be examined.

Shorebirds are forced to retreat to higher ground during high tides. On such occasions most of the wader population will be concentrated at a few high-tide roost sites where they can be counted. Accurate counts of these sites allow total population levels, population changes and seasonal patterns of movement to be assessed.

Counts of waders at their roost sites are made 2 hours either side of high tide on the highest spring tide of the month. Counting effort should be focused on the northern winter period (September to March) when movements tend to be least and the numbers of birds highest.

Wader roosts are usually traditional and it is important that sufficient time is expended to locate them prior to any counting. To locate roosts, all suitable habitats such as the air field, coral rubble beaches and spits should be visited on a rising tide when birds are beginning to congregate.

In small roosts (a few hundred waders) individual birds can usually be counted from a suitable vantage point at high tide when all the birds are in the roost. Larger roosts, and those comprised of small species (turnstone, tattlers), are more difficult to count accurately, and considerable care must be taken when arriving at totals. One, or a combination, of the following techniques is usually successful.

(1) Count all the birds as they fly from their feeding grounds to roost sites, repeating counts where possible. Counts should start at least 2 hours before high water.

(2) Count the stationary birds whilst they are roosting at high tide, repeating the counts several times. This is the best method as long as the birds are not too tightly packed, as is often the case for small species.

(3) Count birds on the ebbing tide when they are leaving the roost, repeating the counts where possible. This method works particularly well for those species that disperse quickly from the roost to start feeding.

At some roosts a combination of all three methods will be needed to produce accurate totals, and with roosts of smaller species which are tightly packed the most reliable estimates will be obtained when the whole flock is in flight and can be counted using methods outlined in Figure 6.1.

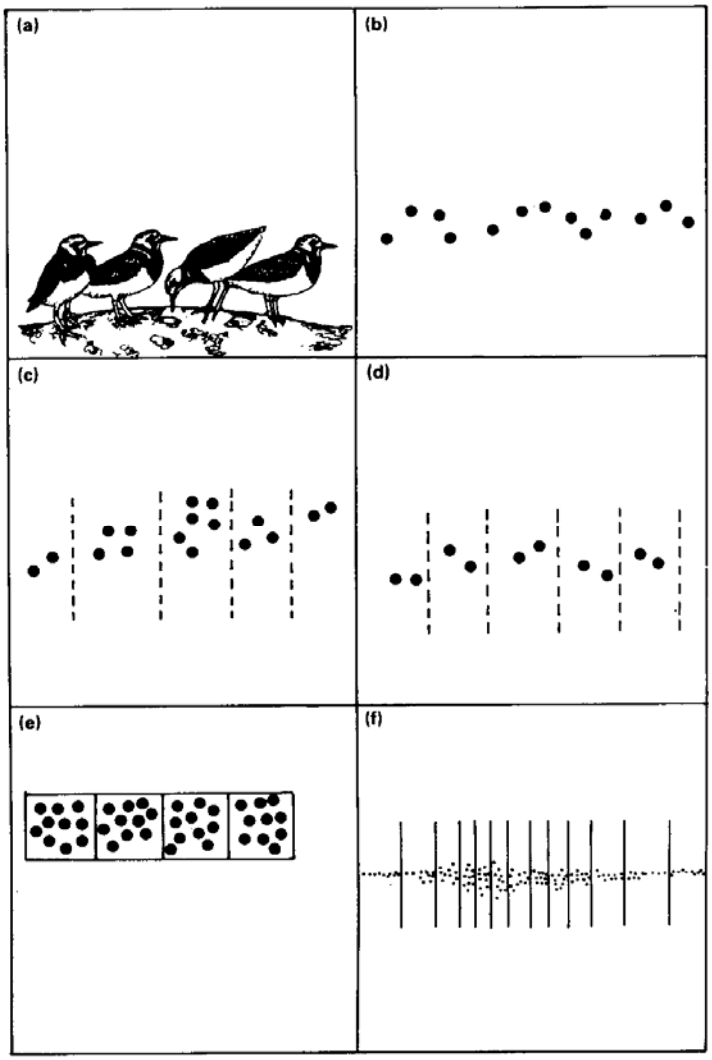


Figure 6.1 Methods for estimating numbers of birds in flocks (Bibby *et al* 1992)

Key: (a) In small roosts and feeding flocks, the number of birds can be counted directly.

(b) For small flying flocks of even density, the birds can be counted individually (1, 2, 3, 4, 5, etc.) to produce an accurate total If a suitable landmark is present it can be used to help to count the birds.

(c) In unevenly distributed flocks with small groups of varying size, each group of birds should be rapidly counted and added together.

(d) For larger numbers of birds in evenly distributed flocks the birds should be counted in multiples e.g. 2, 4, 6, 8, or 3, 6, 9, 12, etc. Again if landmarks are present they can be used to help divide the flocks in order to count them more accurately.

(e) For densely packed flocks in flight or at a roost, the birds should be counted in estimated blocks. The size of the blocks used (10, 100, 1000, etc.) varies according to the size of the flock. The largest flocks of 10000 birds or more present the biggest counting problems with even the block method giving a very rough estimate of numbers. (f) Flying flocks often bunch in the centre. In this case it is important that the blocks are closer together in the centre of the flock than towards the edges, but in practice this may be difficult to achieve.

Figure 6.2

LAKIA - BLACK NODDY: NEST COUNT DATA SHEET

MOTU: Tefala **RECORDER:** Dick Watling

Date: 8th September 1998 **Observer:** Tataua A.,Semese A.

Weather: Overcast,windy, light rain **Time Started:** 0840-0935

Method: Apparently Occupied Nest-sites (AON). Nests of the current season - even if no adult is sitting or adjacent Do not count suspected old nests. Enter number of nests per tree even if nil. View all Pukavai and Pukavaka over 10 m. Record `Other' species onl

Pukavai		X	X	X	2	4	X	4	1	X	X	X	3	X	X	X
Pisonia		X	X	2	X	X	X	2	15	X	2	X	8	X	X	1
4	X	4	9	9	8	3	5	2	1	2	12	6	X	2	X	7
4	4	6	X	1	13	13	X	1	X							
												Trees Counted:			57	
												AON sub-total:			160	
Pukavaka		X	X	X	1	3	X	X	1	5	14		2	5	X	
Hernandia																
												Trees Counted:			14	
												AON sub-total:			31	
Other																
												Trees Counted:				
												AON sub-total:				
												Total Trees Counted:			71	
												Total Apparently Occupied Nests:			141	

LAKIA BREEDING STATUS (+ Observed; ++ Many; +++ Majority)			**OTHER BIRDS BREEDING** AKIAKI	GOGO	MATAP.
Nest Building:		Ad. with building material in beak			
Sitting Adults:	+++	Includes adjacent adult	+		
Young Visible:	+	Any stage - nestling, fledgling	+		
Empty Nests:	+	No sitting or adjacent adult			

COMMENTS/OTHER OBSERVATIONS:

Difficult counting conditions;

Difficulties in ensuring all trees counted and others not double counted

7 RECOMMENDATIONS

The work initiated during the current survey in the gathering of basic identification, distributional and ecological data on the birds of the Funafuti Marine Conservation Area, needs to be continued on a regular basis and sustained through several annual cycles.

It is recommended that FMCA staff undertake the following activities:

1. Monthly surveillance/monitoring visits to each of the motu to record basic data on the bird species present. In addition, Motu Visit Data Sheets should be completed following every visit to an FMCA motu. Combined these will be critical to the development of basic ornithological skills of FMCA staff.
2. Monthly or bimonthly visits should be made to `control' motu, the identification of which needs to be finalised.
3. Total counts of Apparently Occupied Nest-sites of the Black Noddy-Gogo should be undertaken annually on each FMCA motu and the control motu, when the majority of the colony is at late incubation or early nestling period.
4. An attempt to undertake similar counts of the Brown Noddy Gogo on Afualiku should be made and the results and difficulties inherent in this species evaluated before undertaking counts on other islands.
5. Seabird Roosting counts are of a lower priority, more attempts could be made at Fuafatu to develop an appropriate methodology and enable a more objective analysis of the accuracy of results.
6. The location of major shorebirds roosting sites all round Funafuti should be identified and a programme of counts initiated at the major ones, and occasionally at all of them.
7. To undertake the field work required to collect the above data, the following equipment will be required by the FMCA staff:
   - Two more pairs of binocular (one supplied);
   - Three pairs of oil-skin or equivalent;
8. Most of the seabirds that may be observed in the FMCA do not breed there – their continued presence depends on breeding success elsewhere. The current breeding sites and species elsewhere in Tuvalu is unrecorded. The FMCA staff should initiate a programme to document these. The first stage could be to combine this with a public awareness programme of Tuvalu Seabirds and through a programme on the radio request information to be forwarded to the Staff. This could be very effective under the guidance and leadership of the Project Manager, Sir Toaripi Lauti. With the information documented, follow up ground surveys could be more efficiently planned and undertaken.
9. If Recommendation 8 provides good information, then a programme of ground surveys to these sites should be made by FMCA staff together with an experienced ornithologist, SPREP should be requested to find funding for this.
10. It is recommended that SPREP assist the FMCA with an annual, or every two years, review and programme strengthening visit by an experienced ornithologist.

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APPENDIX 1

TERMS OF REFERENCE

FUNAFUTI MARINE CONSERVATION AREA

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SEABIRD SURVEYS IN THE FUNAFUTI CONSERVATION AREA,
TUVALU, CENTRAL PACIFIC

TERMS OF REFERENCE

Background:

A number of species of seabirds including several terns and noddies, boobies and frigate birds are hunted for food in Tuvalu. Funafuti atoll is the capital of Tuvalu and its human population has increased four fold during the past 20 years (now over 4000). According to observations by local resource users, abundances of the above mentioned food species have declined over this period as a result of overharvesting.

The Funafuti Marine Conservation Area covers 33 square kilometres of lagoon, reef, channel and island habitat on the western side of Funafuti atoll, including six small islets. the Conservation Area has recently been established by the Government of Tuvalu and the people of Funafuti, with funding from SPREP's South Pacific Biodiversity Conservation Program (SPBCP). The goal of the Conservation Area is to conserve the marine and terrestrial biodiversity of funafuti atoll based on the sustainable use of natural resources for the benefit of the Funafuti community and their decendents. Monitoring and assessment of natural resources within the area are important tools used to determine management measures required in order to reach this goal. A reef biodiversity baseline survey was completed in November last year and vegetation, insect, bird and coconut crab surveys are planned for February-March this year.

Bird species observed in Tuvalu

*Ruddy Turnstone - *Arenaria interpres*	*Wandering tattler - *Heteroscelus brevipes*
*Great crested tern - *Sterna bergii*	*White tern - *Gygis alba*
*Whimbrel - *Numenius phaeopus*	Bristle-thighed curlew - *Numenius tahitiensis*
*Brown noddy - *Anous stolidus*	Grey-backed tern - *Sterna lunata*
Long tailed cuckoo - *Eudynamis taitensis*	*Great frigatebird - *Fregata minor*
*Lesser frigatebird - *Fregata ariel*	*Sanderling - *Calidris alba*
Masked booby - *Sula dactylatra*	*Brown booby - *Sula leucogaster*
*Black noddy - *Anous minutus*	Wedge-tailed shearwater - *Puffinus pacificus*
*Pacific pigeon - *Ducula pacifica*	*Black naped tern - *Sterna sumatrana*
*Pacific reef heron - *Egretta sacra*	Sooty tern - *Sterna fuscata*
grey-headed gull - *Larus cirrocephalus*	Red tailed tropic bird - *Phaethon lepturus*
Red footed booby - *Sula sula*	*Lesser golden plover - *Pluvialis dominica*
Pluver - *Pluvialis apricaria*	Muscovy duck - *Cairina moschata*

* species that I have observed in the conservation area.

Habitat

All islets within the conservation area are low coralrock and sand islands between 0.68 & 3.26 ha in size. Some have zones of coral rock platforms which are utilised by wader birds. The vegetation is dominated by Pisonia grandis, coconuts, pandanas, Messerchmidia and Scaevola scrub with an understory of birds nest ferns.

Breeding seasons

The black noddy (Lakia), brown noddy (Ngogo) and fairy tern (Matapula) breed between June and December in the *Pisonia* trees and some Coconut trees.

The pacific reef heron (Matuku) and the brown booby (Kanapu) breed between April and September. The heron is said to nest on low bushes (such as *Scaevola*) and in the coconut trees in some areas. The booby is said to nest also in the *Pisonia grandis*.

Tefala Islet is the most important breeding site within the Conservation Area. Fualopa Islet is also an important nesting place.

Migration

Wader birds are found on the islets mainly between September and March/April. However some plovers, wandering tattlers and turnstones seem to hang around all year.

Use

The black and brown noddies, the fairy tern, the booby and the frigate birds (Katafa) are hunted for food (caught with nets during the night or shot with guns). Recently there has been concern about people shooting birds for sport. The Pacific pigeon was also eaten but is now considered very rare in Funafuti. (a pair of pigeons were seen on Fuafatu Islet during our vegetation survey).

Conservation Status

Seabird numbers are conspiciously low on the capital islet of Fogafale and recent community surveys show that most people have observed a decrease in the number of noddies and terns over the past 10-15 years - due to overharvesting.

Interestingly all bird species currently hunted are protected by national Legislation. However this has never been enforced to date.

Local knowledge

There are people present who have a large knowledge of things such as numbers of eggs layed, seasonality, breeding habits etc. However such information comes to light bit by bit. I will try to gather some more data before your arrival.

Research

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The consultant ecologist will be required to:

1. satisfy consultant employment criteria set by SPREP;

2. design a baseline survey and monitoring program for seabirds and shore birds which will determine species richness, distribution and reletive abundance of birds and nests within the Conservation Area (four Islets) and at control sites where birds are taken;
3. be available to work in Tuvalu for 2-3 weeks in mid 1998 and bring any necessary field equipment that is not available in Tuvalu;
4. train a local survey team in survey methodology so that they may help with the baseline survey and carry on repeated surveys during various times of the year;
5. conduct the survey with the help of the local team;
6. prepare a database and report for the Funafuti Marine Conservation Area Project Office and SPREP.

Some questions to be asked

- What species of seabirds are found in the conservation area
- What is the reletive abundance of each species / or indicator species surveyed (inside the Conservation Area and at control sites outside the area
- Which islands are important nesting sites for species that are commonly hunted
- Are any rare or endangered bird species found in the CA
- Do any rare or endangered seabirds nest in the CA
- Are there any changes in bird densities within the CA over time (compared to control sites)
- when is the breeding season for important bird species

Equipment Available in Tuvalu

- boat for transport to the conservation area
- accommodaton on Fogafale - Government housing or Hotel/guest house
- simple camping equipment for use on the islets if necessary
- computer facilities (Microsoft word and Excell spreadsheet)
- overhead projector and slide machine

Equipment to be supplied to the Conservation Area Project Office by the Consultant

- One set of binoculars
- Reference books: *Seabirds: An identification guide* by Peter Harrison and

  Shorebirds: an identification guide by Peter Hayman, John Merchant and Tony Prater
- Any other equipment considered necessary for completing the training and survey work

Airline information

- There is currently one flight to and from Nadi and one flight to and from Suva (Fiji) per week (Friday through to monday) cost ~ $1,140 Aust. return. Connections to Europe are from Nadi Airport but Aeroplane transferes to Suva are available. An overnight stay in Fiji is usually unavoidable.

APPENDIX 2

THE BIRDS OF TUVALU:
A FAUNAL LIST AND ANNOTATED BIBLIOGRAPHY

(Rodgers & Cantrell S.PAC.J.NAT.SCI 1987 (9):83-109)

APPENDIX 3

DESCRIPTION OF VEGETATION UNITS OF FUNAFUTI CONSERVATION AREA MOTU

DESCRIPTION OF VEGETATION UNITS OF FUNAFUTI CONSERVATION AREA MOTU

A brief description of the vegetation units extracted from SPREP 1995 but based on McLean & Hosking (1992) is presented below.

1. Coconut woodland

Coconut woodland is the major vegetation type in Funafuti but is a minor vegetation type in the conservation area, where coconut trees are more likely to be found mixed with broadleaf vegetation. Pure stands of coconut trees are only found in two small areas on Fuagea and Fualopa, where the trees are randomly scattered of varying heights and ages.

2. Coconut and Broadleaf woodland

This vegetation type is found on Tefala, Vasafua and Fuafatu. This mixed vegetation type occurs within areas of medium density coconut woodland or adjacent to purer stands of broadleaf woodland. Broadleaf trees are predominantly *Pisonia* and *Hernandia* Groundcover is dominated by *Asplenium* and other ferns.

3. *Pisonia* woodland

Pisonia grandis (pukavai) dominated woodland is only found on Fuafatu. It is associated with dark soils, in the case of Fuafatu, dark gravelly soils. The trees are up to 15m high and up to 1m in diameter. The undergrowth is relatively open with a groundcover dominated by *Asplenium* ferns, which is dense in places even when the trees are widely spaced. *Pisonia* trees are thought to be favoured sites for seabird rookeries.

4. *Guettarda* woodland

In the conservation area, woodland dominated by *Guettarda speciosa* (pua) is only found in one small patch at the northern end of Vasafua where recent sand accumulation has occurred. In this case *Guettarda* trees grow to about 10m high, although in most places the tree but is of low stature and could more appropriately be called scrub. Other scrub species are subordinate.

5. Undifferentiated broadleaf vegetaion

This vegetation unit is found in the interior of the larger islets of Fuagea, Fuafatu and Fualopa. Undifferentiated broadleaf vegetation includes mixtures of broadleaf trees with no obvious dominant as well as broadleaf woodland mapped but not verified on the ground. Mixed broadleaf woodland includes a wide range of species such as *Pisonia, Cordia, Calophyllum, Ochrosia* and *Guettarda* and also *Hernandia, Morinda, Hibiscus*, *Terminalia* and *Thespesia*. Of these *Pisonia* and *Hernandia* are the most common species. Understory cover includes *Ficus* and *Pipturus* scrub and the groundcover includes ferns such as *Asplenium* and *Nephrolepis*.

6. *Scaevola* scrub

Although common in Funafuti, this vegetation unit is rare in the conservation area, being found as a pure stand only on the oceanside shore of Vasafua. The dense fleshly branches of *Scaevola* are sometimes covered with creepers such as *Cassytha* or *Canavalia* and make penetration of the scrub difficult.

7. *Messerschmidia* scrub

A small area of *Messerschmidia* (synonyms are *Tournefortia* and *Argusia*) scrub is found on the lagoon coast of Tefala where it forms a 25m wide strip. The scrub is relatively open with individual bushes reaching 6-8m tall.

8. *Scaevola* and *Messerschmidia* scrub

This mixed scrub unit is found on Fuafatu where it occurs on the steep rubble ridge around the exposed western side of the islet and also on the southern shore of Fualopa where active sand accretion is evident. This unit forms a fringe near the coast less than 30m wide, merging into broadleaf woodland in the interior of the islets.

9. *Scaevola, Panadanus* and Coconut scrub

In this vegetation unit, sparse coconut palms form the open canopy, *Pandanus* the middle level and *Scaevola* the understory. In the conservation area, this unit is only found on Tepuka vilivili where there are 8 coconut palms and several *Pandanus* emergent above the *Scaevola* understory.

10. Undifferentiated scrab and coconuts

This unit is characteries by a variety of scrub species and sparse coconuts and is only found around the northern periphery of Fuagea. Plants commonly found in this unit include mixtures of *Scaevola, Messerchmidia* and *Guettarda* with *Morinda, Pipturus*, *Ficus* and *Hibiscus*. A groundcover of grasses, ferns and the creepers *Boerhavia* and *Cassytha* are found below the scrub.

APPENDIX 4

PLATES

Key to Plates – Left to right down the page.

Plate 1 – Some Motu of the Funafuti Marine Conservation Area and adjacent waters:

Afualiku; Fuagea; Fualopa; Tefala; Vasafua; Pava and Fualifeka (right); Tepuka; Vegetation of Fuagea.

Plate 2 – Some Birds of the Funafuti Marine Conservation Area:

Brown Booby-Kanapu *Sula leucogaster*; Red-footed Booby–Kanapu *Sula sula* (White phase); Greater Frigatebird-Katafa *Fregata minor* (adult male); Black-naped Terns-Matapula *Sterna sumatrana*; Black Noddy-Lakia *Anous minutus*; Brown-Noddy *Anous stolidus*; Pacific Golden Plover *Pluvialis dominica*; Wandering Tattler *Heteroscelus incanus*.

Plate 3 - Other fauna from the Funafuti Marine Conservation Area.

Bristle-thighed Curlew-Founga *Numenius tahitensis*; Bar-tailed Godwit-Kaka *Limosa lapponica*; Egg of the Fairy Tern-Akiaki *Gygis alba* in typical nest position; Clutch of Black-naped Terns-Matapula *Sterna sumatrana* on Afualiku; Common `Red Crab' sp. indeterminate; Copper-striped Skink *Emoia cyanura* complex; Moth Skink *Lipinia noctua*; Mourning Gecko *Lepidodactylus lugubris*.