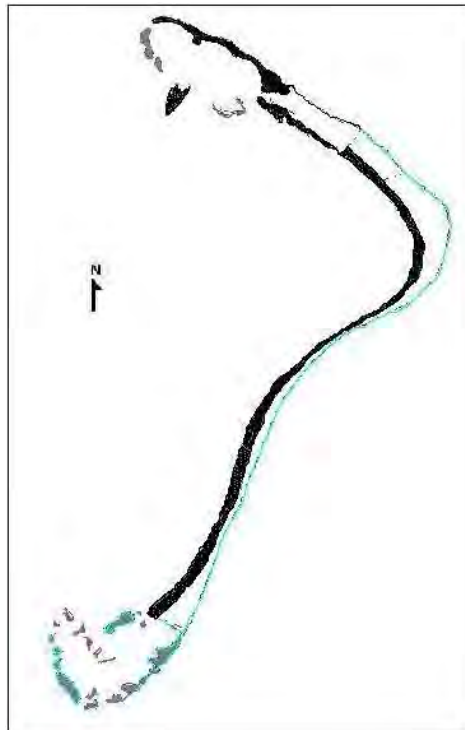




**KAP II TA - TOR 4.1, 4.2, 4.3**

# **MAIANA ATOLL**

Community Consultation, Risk Assessment & Adaptation,  
and Training



compiled by  
**Temakei Tebano PhD (KAP II National Consultant)**  
**Tion K. Uriam (MFMRD)**  
**Onikannara Arika (MWPU)**  
**Rosalind Kiata (KAP II National Consultant)**

For  
KAP II (Phase 2)  
Office of Te Beretitenti  
Bairiki, Tarawa

September 24<sup>th</sup> – 30<sup>th</sup>, 2008

## Table of Contents

<b>Table of Contents</b>	1
<b>Executive Summary and Recommendations</b>	3
<b>Acronyms</b>	6
<b>Chapter 1: INTRODUCTION</b>	7
1.1 Scope of the Report	7
1.2 Selection Criteria	7
1.3 Rationale of the Maiana Visit	7
Itinerary	7
1.4 Location of Kiribati	9
1.5 History and Background	9
1.6 Geography	11
1.7 Myths and Legends of Maiana Island	12
1.8 Information Collection Templates	13
Risk Assessment forms	14
Island profiling forms	14
1.9 Topography	21
1.10 Main Settlements	21
<b>Chapter 2: CONSULTATION FINDINGS</b>	23
2.1 Status of Natural Resources	23
2.1.1 Marine Resources	23
2.1.2 Terrestrial Plant Resources	26
2.1.3 Non-living Resources	28
2.2 Status of the Physical Environment	30
2.2.1 The Marine Environment	30
2.2.2 The Coastal Environment	31
2.2.3 The Land Environment	34
2.2.4 The Physical Structures	36
Public Structures	36
Private Structures, Seawalls	37
<b>Chapter 3: COMMUNICATION AND TRANSPORT</b>	38
3.1 Voice Communication, the Media	38
3.2 Road, Sea and Air Transportation	38

<b>Chapter 4: GENERAL DISCUSSION</b>	40
<b>ACKNOWLEDGEMENT</b>	44
<b>REFERENCES</b>	45
 <b>LIST OF FIGURES and TABLES</b>	
<b>Chapter 1:</b>	
1a Islands in the Gilbert Group	9
1b Map of Maiana	12
1c Map of Maiana showing main villages	22
 <b>Chapter 2:</b>	
2a Some scenes from Bubutei southern end	24
2b Moray eel trap	25
2c-1 Roaming chicken	28
2c -2Pig feeding	28
2d Water system at Tebikerai Primary School	29
2e Traditional coconut leaf seawall; eroded area	31
2f Reclaimed land (not a seawall)	31
2g Vulnerable area	33
2h Reclaimed land foundation	33
 Table1: Eroded areas and coordinates	 32

## **Executive Summary**

A visit to Maiana was carried out for the same purposes as in previous islands, Tamana, Beru, Kuria, Makin and others. Similar activities were carried out as part of the consultation process.

The team that visited Maiana comprised Dr. Temakei Tebano (TheEcoCare Group and current National Consultant to KAP II for Components 4.1 and 4.2 and 4.3), Miss Rosalind Kiata (Media Consultant, KAP II), Ms Tion K. Uriam (Resource Information Officer, Mineral Unit, MFMRD) and Mr. Onikannara Arika (Civil Engineering Unit, MWPU). Also assisting were the IPO, ICW and Social Welfare officers of Maiana Island Council. The key areas discussed fell under water, coastal erosion, reduction in natural resources, overcrowding and the impact of sea level rise. Adaptation strategies to overcome or reduce risks and vulnerabilities related to climate change and sea level rise were discussed during all sessions.

The relocation issue in light of reduction in landmass due to accelerated coastal erosion, as the last resort, was discussed but the emphasis was on adapting to risks and vulnerabilities at an island level and finding solutions to those being faced by the Maiana people. Short briefings on project funding and how they can be accessed were provided by IPO Maria Kaoma and ICW Tabwebwe Kokoria. Mr. Uriam presented comprehensive information on how beaches and aggregates are formed, the need to protect and look after our coastal areas through limiting the amount of aggregate mining and enhancing mangrove and coastal vegetation planting to ensure surge storms have minimal impact.

Miss Kiata trained participants on information gathering and dissemination on all issues discussed in the consultation. The exercise provided participants with a feeling of satisfaction in that they heard and enacted issues of concern to our existence in light of climate change and sea level rise. A recorded drama by the Catholic Youth Group in Tarawa on all aspects of CC and SLR was screened at end of day 1 to give participants an overall view of the consultation and the issues most pertinent that they will enact as part of the participatory, risk assessment, awareness and adaptation process.

The bulk of the four-day consultation was spent on explaining the causes and factors contributing to global warming with subsequent events such as climate change and sea level rise and potential adaptation measures to reduce or counter their impact at a village and island level. Documentaries on CC and SLR and other relevant videos were screened.

A review on contributions to the 2007 consultation from various government and private sectors were summarized by Dr. Tebano. Dr. Tebano also presented his factual lectures on linkages between and among systems (on power point) and emphasized that all systems are linked in many ways most of which are not understood. Destroying one system will eventually affect other immediate or farther systems sooner or later. The connectivity between and among them is through air, energy, water currents and waves, food chain, and many more. He also strongly supported biblical writings in relation to man's responsibility to care for the Earth.

Each presentation by team members was followed by open discussion on risks and vulnerabilities, including problems related to CC and SLR, and potential strategies taking into account of traditional knowledge and workable measures in light of the increased intensity of drought, storm surges and unpredicted bad weather.

Village representations comprised youth groups(s), women interest group(s), church groups and other significant groups within each village set up. There were cases where those over 50 years and above participated. The selection was done through village councilors who then consulted village elders to witness the selection process. There were 60 participants four from each ward within a village. Tebangetua Youth members were also included.

Risk assessment and island profiling were partly done through consulting participants on the affected sites followed by site visits, filming and recording exact positions with a GPS. Issues related to island profiling were not gathered as there was no MISA staff accompanying the team.

Water is not a critical issue on Maiana at the time of the consultation. The rains fell occasionally hence there was enough rainwater for almost the overcrowding guest house with no ground water for most of the day. Excessive pumping with an electric pump draws in brackish water used for bathing and other purposes. It was reported that the latest drought had severe impact on ground water in wells close to the coastline, plant resources and people in general. Rainwater is available in homes with corrugated iron or aluminum roofing. Council and Government housing have some plastic water tanks but no concrete cisterns.

Tebikerai Village situated on Tebikerai Islet depends heavily on ground water resources but the wells would not stand prolonged droughts as had happened. It requires immediate water enhancement in terms of more permanent water catchments such as concrete cisterns to ensure there is rainwater for drinking for all residents as long as they can provide. A water system needs to be installed in terms of an overhead tank, a solar pump and a piping system. A concrete rainwater catchment is urgently required. A primary school at Tebikerai requires a proper water system for the children and teachers.

There is little agricultural activity in terms of vegetable and swine/poultry home farming. The village is busy with sorts of fishing activities. The most exploited marine resources are juvenile bonefish and goatfish. Tunas and other reef fish are rarely caught. An ice plant has few fish and some ice cubes for sale.

The Maiana people are not aware of CC and SLR as a follow up from the December 2007 consultation had not been carried out due to lack of support from the Island Council. There was no money for transport and material costs. Potential risks and adaptation measures have not been thought of seriously either. It was seen that intensifying training and consultation on CC and SLR complimented with media training in its various forms and with contributions from island councils and government ministries in their respective areas related to CC and SLR will boost the awareness level that should slowly lead to determining appropriate adaptation measures most appropriate to Maiana and other islands. The training and participation of IPOs, ICWs and village representatives is an important integral part of capacity building to ensure public awareness continues after the conclusion of the project.

-----

Drought affected water resources, fruit trees and vegetation in general, impact is still visible at the time of consultation.

Water is saline at guesthouse, only one or two wells provide good drinking water. In all village wells close to shoreline are affected. At Tebikerai two water sources provide drinking water for residents.

Water pumps from public wells or good ground water sources are visible on a road-side, all are defunct due to no spare parts and lack of maintenance. Most wells inspected have concrete cement walls surrounding them, covered with aluminum or board, most are not covered; those with no concrete walls are fenced instead. Pigs and chicken roam the villages.

Lagoon fish plentiful, bonefish, goatfish, trevally, snappers at CPP, tuna rare. Anadara disappeared, Fisheries is bringing them back re-seedling; nikatona and koikoi from Bubutei area declining as seawall/causeway under construction;

Banana few but cultivated, babai is being worked as rice is getting more expensive, toddy is cut but sugar is preferred; double-hull canoes and speed boats more commonly used for fishing; splash method is used together with gill-netting; bylaw forbidding splash method is dead as te unimwane relaxed it during a long stay of kaain Tabiteuea on Maiana two years ago; *babai* pits sold off to raise money to feed guests.

Night fishing with pressure lamp to catch octopus and lobsters still popular; handlining hardly heard today; yagona consumption is on the rise, many young and old are spending their time drinking away and doing nothing; skin dryness on the rise; *yagona* bars are popular on the island. Undersize lobsters are landed in numbers, no bylaw for undersize fish on Maiana.

In almost all cases coastal erosion is linked with land reclamation by KPC and RC compounds, eg. Bubutei, Tebiauea and Tebanga. Others are linked with seawalls or natural causes such as rising sea level. Human destructive activities are the main causes of erosion on Maiana and very little to do with CC and SLR.

Mangrove grows well on Maiana and areas with mangrove tend to be more protected than those exposed.

Sea cucumber is over-exploited and the lagoon is becoming a growing area for a filamentous green algae, reports of increasing density was mentioned during the four day consultation.

Light showers fell during the seven day visit but no heavy showers however.

Relocation is not an issue but adaptation strategies are interesting topics to participants. Doubts over the second flood popped up but was well taken with caution in light of human continuous destruction of the atmosphere and the earth.

## ACRONYMS

ACP	Asia-Caribbean-Pacific
AG	Attorney General
CCA	Climate Change Adaptation
CPUE	Catch per unit effort
DRCS	Digital radio concentrator system
EC	European Commission
ECD	Environment Conservation Unit
EDF	European Development Fund
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
IC	Island Council
ICT	Information Communication Technology
ICW	Island Community Worker
IPO	Island Project Officer
JSS	Junior Secondary School
KAP II	Kiribati Adaptation Project II
KCCSC	Kiribati Climate Change Steering Committee
KPC	Kiribati Protestant Church
LDC	Least developed countries
MDGs	Millenium Development Goals
MELAD	Ministry of Environment, Lands and Agricultural Development
MFMRD	Ministry of Fisheries and Marine Resources Development
MISA	Ministry of Internal and Social Affairs
MPWU	Ministry of Public Works and Utilities
MTR	Medium Term Range
RC	Roman Catholic
SEC	Solar Energy Company
SLR	Sea Level Rise
SPC	Secretariat of Pacific Communities (formerly South Pacific Commission)
SWO	Social Welfare Officer
TCH	Tungaru Central Hospital
TK	Tiibi Kauntira (Chief Council)
TOR	Terms of Reference
UNCDF	United Nations Conservation Development Fund
UNDP	United Nations Development Program
USA	United States of America
WHO	World Health Organization

## **Chapter 1: INTRODUCTION**

### **1.1 Scope of the Report**

This report focuses on the status of terrestrial physical environments, marine physical environment, marine and terrestrial resources (living and non-living), communication and transport, the general discussion and recommendations on issues needing immediate action to counter or reduce risks and vulnerabilities that are affecting the lives of Maiana residents on a daily basis. The island profiling aspect is compiled by MISA staff accompanying the team.

### **1.2 Selection Criteria**

The selection criteria are discussed fully in the Tamana report by Tebano, *et al.*, 2008). KAP II senior management presented them in early May to the KCCSC and was approved unanimously in the July meeting.

### **1.3 Rationale of the Maiana Visit**

A visit to Maiana is similar to previous visits that aim to assess, record and report potential risks and vulnerabilities related to CC and SLR. This exercise falls under public awareness and consultation, TOR Component 4.2 of the Consultant (Dr. Temakei Tebano) and Training Component 4.3 now under the same TOR. Butaritari is the seventh island visited under this assignment.

.....

### **Itinerary**

24<sup>th</sup> September, 2008:

Left Tarawa at 5.30 pm for Maiana, arrived 5.45 pm. Picked up at airstrip at Tekaranga village, arrived at Tebangetua IC guest house at 6.20 pm. Only two rooms available 12 new arrivals (4 KAP II and 7 MELAD), not enough beds, no sleeping gears, etc., water system not good, no water for toilet and shower most of the time. Kitchenware few and incomplete, no mob, no broom, kitchen cupboard draws dirty, toilets dirty. Five men sleep on *te bwii*a, girls sleep in meeting lounge.

25<sup>th</sup> September

9 am: Training for IPO, ICW, Social Welfare. General inspection of problem areas (coastal erosion) from Bubutei to Tebangetua by Tion K. Uriam and Onikannara Arika.

26<sup>th</sup> September

9 am – 5 pm: Day 1 of Consultation taken up by Dr. Tebano, Mr. Uriam, Mr. Arika, Mr. Farran Redfern, IPO Maria and ICW Tabwebwe, the remaining half hour was taken by Ms. Rosalind Kiata (media training).

27<sup>th</sup> September

9 am – 5 pm: Day 2 of consultation taken up by Ms Kiata. Inspection of seawall/causeway at Bubutei, inspection of eroded lagoon shorelines at KPC and RC compounds and neighbours' land in same village; inspection of coastal areas around RC land reclamation at Tebiauea village.

28<sup>th</sup> September

9 am – 5 pm: Day 3 of consultation; morning sessions taken by Ms Teiti Teariki (MELAD), Mr. Redfern (MELAD) and Dr. Tebano (KAP II); afternoon session was taken by Mr. Uriam, Mr. Arika, IPO and ICW. Ms Kiata took the last

29<sup>th</sup> September

9 am – 5 pm: Day 4 of consultation taken up by Miss Kiata. Inspection of coastal areas at northern villages from Temangaua – Tekaranga.

30<sup>th</sup> September

9 am – 5 pm: Trip to Tebikerai village to inspect water and coastal erosion reported by Tebikerai participants.

#### 1.4 Location of Kiribati

The full text on this topic can be cited in previous similar reports on Tamana (Tebano, *et. al*, 2008), Beru (Tebano and Abeta, 2008), Onotoa (Tebano, 2008) and Tarawaieta (Tebano, 2008). There are numerous sources on the internet that provide comprehensive updated backgrounds on Kiribati. Maiana is one of the islands in the central Gilbert Group and is the eighth island visited in this KAP II outer island consultation exercise.



Figure 1a: Islands in the Gilbert Group, Kiribati.

#### 1.5 History and Background

Maiana is an island in the northern part of the Kiribati Group. It has an area of 15.9 km<sup>2</sup> and an estimated population of around 2,000 (Census, 2005). The Central Gilberts or *nuka* have traditionally included Maiana, Abemama, Kuria and Aranuka. However, the latter three are considered the main islands that have unique historical and cultural characteristics which distinguish the Central Gilberts from the north and south.

Maiana is popularly known for bluffing or ‘white lie’. It is a form of humor but can derail issues of importance. The Maiana people are kind and friendly. One will find himself acquainted within

hours of arrival on the soils of Maiana. The best dancers and singers in Kiribati can be found on Maiana where the ancient and almost forgotten Kiribati words are kept alive through song compositions.

#### *1.5.1 Prehistory and discovery by Europeans*

Prior to the Gilberts' discovery by Europeans, the islands had been inhabited by Micronesians for several millennia. The first such parties were 1788 Captain Thomas Gilbert in the *Charlotte* and Captain John Marshall in the *Scarborough*. Messrs. Gilbert and Marshall crossed through Abemama, Kuria, Aranuka, Tarawa, Abaiang, Butaritari, and Makin without attempting to land on shore. In the years that followed, many ships ran across the little islands and atolls of the Gilberts in the course of their travels in the central Pacific.

#### *1.5.2 Further exploration*

In 1820, the islands were named *îles Gilbert* (in French) by von Krusenstern, an Estonian admiral of the Czar after the British captain, Thomas Gilbert, together with the neighbouring *îles Marshall*. Two ships of the United States Exploring Expedition, USS *Peacock* (1828) and USS *Flying Fish* (1838), under the command of Captain Hudson, visited many of the Gilbert Islands (then called the Kingsmill Islands or Kingsmill Group in English). While in the Gilberts, considerable time was devoted to mapping and charting reefs and anchorages.

#### *1.5.3 Colonial rule*

A British protectorate was first proclaimed over the Gilberts by Captain Davis of HMS *Royalist* (1883) on 27 May 1892. In 1915, the Gilbert and Ellice Islands were proclaimed a colony of the British Empire.

The residents of the Gilbert Islands are Micronesian, similar in many respects to the natives of the Marshalls, the Carolines, and the Marianas. At the time of the Japanese invasion in 1942, they were a self-governing people, with their tribal consciousness undisturbed by the British system of colony government and administration. Loyal to the British, I-Kiribati looked with dissatisfaction upon the prospects of coming under the rule of the Japanese. During their stay in the Gilberts, the Japanese did nothing to change the opinion of the I-Kiribati on this score.

At the outbreak of the war, about 78% of the local population were said to be Christians. This group was divided mainly into two denominations: Congregationalists (43%); and Roman Catholics (35%). The rest of the population was largely semi-pagan agnostics; they did not adhere to the Christian faith, nor did they retain much of their beliefs in their own traditional gods.

Local diet during this time consisted mainly of fish, coconuts, pandanus fruit, *babai* (swamp taro), chicken, and some pork. Housing for Europeans employed in the island was simple. Their houses were constructed of both European and local materials and were generally of the bungalow type.

#### *1.5.4 Self-determination*

The Gilbert and Ellice Islands became autonomous in 1971. From 1976 to 1978, the Ellice Islands were separated and called themselves Tuvalu. The Gilberts became the Gilbert Islands colony, which issued stamps under that name. In 1979, the Gilberts opted for independence, becoming the independent nation of Kiribati on July 12. Although the indigenous Gilbertese (now Kiribati) language name for the Gilbert Islands proper is "Tungaru", the new state chose the name "Kiribati", the Gilbertese rendition of "Gilberts", as an equivalent of the former colony to acknowledge the inclusion of Banaba, the Line Islands, and the Phoenix Islands, which were never considered part of the Gilberts chain. In the Treaty of Tarawa, signed shortly after independence and ratified in 1983, the United States relinquished all claims to the sparsely inhabited Phoenix Islands and those of the Line Islands that are part of Kiribati territory.

### **1.6 Geography**

Maiana is a medium sized atolls in the Gilberts chain of Kiribati (Fig. 1a), located north of the Equator. It has a landmass of roughly 15.9 km<sup>2</sup> and the lagoon area of 98.4 km<sup>2</sup>. It is located 0°55'N and 173°00'E. Maiana has nine main villages that include Tebikerai on Tebikerai Islet (Fig. 1c). The western reef borders the shallow lagoon with the oceanic waters; is exposed from the end of Tebikerai Islet extending to about three quarters the length of the lagoon in a south-west direction and offers some fairly deep channels between patch reefs. A boat channel blasted through the reef in late 1980s offers a passageway to medium sized vessels.

The main vegetation is coconut, pandanus and shrubs occupying most of the arable land area. The landmass is wide in some areas exceeding 500 meters while quite narrow in others including the Island Council headquarter. The climate is typically tropical and humid with less than 20 meters rainfall during rainy seasons. Droughts are becoming more frequent and the latest one had much impact on fruit trees and all forms of terrestrial life.

Maiana population is predominantly I-Kiribati comprising about 99.5% of the island's total population of about 2,000 individuals with over 100 persons per km<sup>2</sup> and making up 2.1% of Kiribati total population of around 90,000 (2005 Census).

Small islets at both ends of the island are luxuriant with mangrove and ironwood (*Pemphis acidula*) bushes, avifauna, shellfish and mud crab. The main activities are copra cutting, fishing and *babai* cultivation. Shark fin and bech-der-mer (boiled and sun-dried sea cucumber) are traded. Handicrafts are also made on a small scale and sent to outlets at Tarawa.

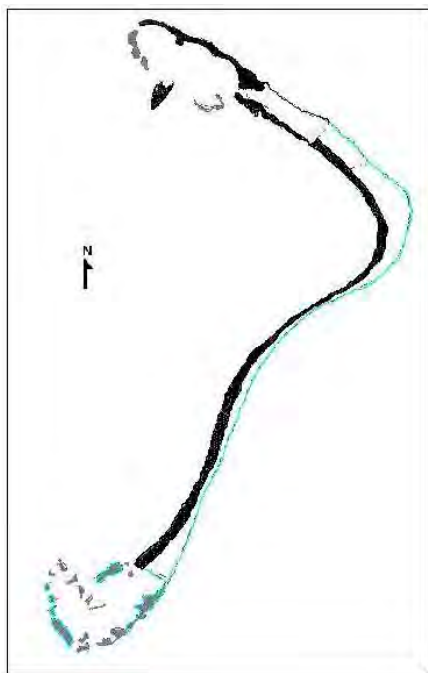


Fig.

1b: Map of Maiana Island

### 1.7 Myths and Legends of Maiana Island

Details of the myths and legends related to Maiana can be cited from the writings of Sir Arthur Grimble (*Legends from the Gilbert Islands*) and Sir Harry Maude.

This is one of the versions on how Kiribati came into being. “Nareau the Wise was in Samoa, procreating with the spirits there. One day, he decided to trace the whereabouts of his two children who left Te Kaintikuaba. He left Samoa, heading north, and on his way he created a resting place by trampling the sea and uttering powerful magic. Behold, land was formed with

spirits inhabitants on it. This land is now called South Tabiteuea. Feeling satisfied with his marvellous work, he left and went further north. At last, he sighted Tarawa. He stayed on Tarawa and started his work of creating new lands. He used his power to create Makin, Butaritari, Marakei, Abaiang, Maiana, Kuria, Abemama and Aranuka. These are now referred to as the islands of North Kiribati”. Geographically these islands lie north of the Equator and according to Kiribati Government’s district allocation Maiana belongs to Central Gilbert.

Maiana people believe that the northern and central islands were created at the time when the earth and the sky were separated. They also say that Samoa, Tabiteuea, Tarawa and later the rest of the Gilbert Islands, were originally clouds transformed into islands when they came into contact with the plant called Terenga, which spouted from Awaiki the core of the earth. This tree became Te Kaintikuaba which the spirits of Te Bomatemaki saw emerging in Samoan soil. They were said to have rushed to it and remained there. The inhabitants of the islands were those spirits who dispersed from Te Kaintikuaba when it was destroyed by Teuribaba, another inhabitant. The dispersals were believed to have been to the north of the Gilberts. Their descendants later returned to the Gilberts and travelled throughout the group.

Maiana is known for the arts in song composition, singing, dancing and magic. Ancestral gods such as Tabuariki and others are still revered and trusted for their helping hands in times of needs. Although the majority of the Maiana population belongs to Christian beliefs the old and ‘pagan’ ways are still practised from time to time.

### **1.8 Information Collection Templates**

The templates below reflect on the approaches described above as a result of consulting with appropriate ministries, and the advice of international and regional advisors, a list of problems and vulnerabilities provided by island representatives of the first National Consultation of 2007, ranking and prioritizing them by seriousness by participants. Some modifications were made as appropriate to suit the current consultation and risk assessment on the outer islands. Risk assessment focuses on water, coastal erosion and marine resources. Physical environment and structures, and human resources are added for additional information on island profiling.

Below are the form templates (see Appendix i) to guide the recording of information in a systematic and uniform manner for all islands visited. They contain information collected from Maiana Island in the areas of risks (brackish water, coastal erosion, declining food resources, the physical environment and infrastructure, and human resources. Similar information for other islands will also be recorded.

#### *Risk Assessment*

- Island Risk Assessment (*form 1.1*)
- Ranking Risks - Island Level (*form 1.2*)
- Ranking islands for risk response – National Level (*form 1.3*)

#### *Island profiling*

- Island Profiling - Natural Resources (*form 2a*)
- Island Profiling – Physical Environment and Infrastructure (*form 2b*)
- Island Profiling – Human Resources (*form 2c*)
- Ranking Resources, Environment and Infrastructure –Island Level (*form 2d*)
- Ranking Resources, Environment and Infrastructure – National Level (*form 2e*)

## Island Risk Assessment (form 1.1)

Island [Makin]	Vulnerability/ Risk	Hazard/ danger	Nature of disaster	Location/Site	Ranking [1=not serious; 2=serious; 3=very serious]	Proposed Adaptation measures [reactive/ preventive]	Responsible agency/ministry
Refers to islands in the Gilbert Group [reef/raised or atoll – needs to be specified]. Number of villages to be visited, number of participants, sex, age and occupation.	Island residents identify the vulnerabilities and risks they are experiencing in light of climate change and sea level rise. A list given during the 2007 consultation is checked against this new listing.	Causative hazard type identified	Extent and impact of disaster, who are affected, how are they affected	Identify area(s) on the island where the problem occurs – name of district or village is recorded and marked on a map. Pictures of these sites are videotaped or shot with digital camera.	Implication on urgency of response	Measures and strategies must be proposed by the communities themselves with the assistance of a consultant or members of the visiting team; reactive implies immediate practical actions to mitigate impacts (e.g. planting mangrove, seawall construction, construction of wooden embankments). These strategies are <i>reactive</i> in that they are actions taken to mitigate the effects of erosion for example; Preventive – includes warning systems, planning and regulatory measures.	Government ministries or other agencies that are involved or have similar interest in the programs/issues are identified, results of similar activities from other ministries are put together with the recent findings of KAP II outer islands reports.
<i>Maiana Atoll, northern Gilbert; 9 main villages 6workshop participants from each village representing all village sectors..</i>	<i>Coastal erosion</i>	<i>King tides, storm surge and sea level rise. [aggregate mining on the rise for more permanent structures]</i>	<i>Coastline at Bubutei, Tebiauea, Tekaranga and Tebikerai. houses and properties, rows of coconut trees and coastal vegetation are sitting on the eroded beaches</i>	<i>Tebikerai, Tekaranga, Tebiauea and Bubutei</i>	<i>3 very serious</i>	<i>Law to regulate aggregate mining on the island; properly designed seawall along currently affected areas- reactive.</i>	<i>Ministry of Works and Public Utilities; MELAD, MISA.</i>
<i>Maiana Atoll</i>	<i>Fresh water becoming brackish day by day. during drought period</i>	<i>Drought</i>	<i>Prolonged drought with no rain for more than ten months, people are fetching water from wells further inland, fruit trees within village compound (breadfruit, fig tree, etc) are turning yellow and dying.</i>	<i>Most villages along the western coastline</i>	<i>2 serious</i>	<i>More water catchments such as plastic tanks, cisterns should be encouraged. Ground water must be enhanced, wells must be well looked after, covered with board and properly secured with concrete around it.</i>	<i>Ministry of Works and Public Utilities – Public Utilities Board’ Ministry of Internal and Social Affairs; Ministry of Health and Medical Services.</i>

<i>Maiana Atoll</i>	<i>Terrestrial resources</i>	<i>Drought</i>	<i>Fruit trees (main in particular for fruit disease); general vegetation affected.</i>	<i>All villages</i>	<i>1 not very serious</i>	<i>Replanting and research into cause of breadfruit problem.</i>	<i>MELAD, MISA</i>
---------------------	------------------------------	----------------	---	---------------------	---------------------------	--	--------------------

### Ranking Risks for Action – Island Level (*form 1.2*)

<b>Island</b>	<b>Risk</b>	<b>Ranking score as in form 1.1; 3 highest, 1 lowest</b>	<b>Responsible ministry/agency</b>	<b>Current status of activities</b>	<b>Timing and estimated duration of response (months)</b>
<b>Name of village and area be stated, map of site provided</b>	<b>List of risks.</b>	<b>Risk with highest score appears first, those with lowest score come last</b>	<b>Name of agency or government ministry specifies</b>	<b>Describes whether there had been similar activities carried out before or a new issues; if risk has been responded to describe status of the activities and future direction</b>  <b>(contact MISA and other relevant ministries)</b>	<b>This needs to be factored in with the budget or obtained from relevant agency/ministry.</b>
<b>Teakaranga</b>	<i>Coastal erosion, public road</i>	3	<i>MELAD, MISA, MWPU</i>	<i>Concrete walls and relocation to mainland.</i>	
<b>Tebikerai</b>	<i>Coastal erosion</i>	3	<i>MISA, MWPU/PWD</i>	<i>None</i>	
<b>(Maiana)</b>	<i>Water</i>	2	<i>MWPU/PUB, MISA</i>	<i>None</i>	

**Ranking islands for responses to risks – National Level (form 1.3)**

<b>Island</b>	<b>Type of risk</b>	<b>Ranking score (forms 1 and 2)</b>	<b>Implementing agency/ministry</b>	<b>Partners</b>	<b>Start-up date</b>
<b>Provide island name  (and district – Gilbert northern, central, southern)</b>	<b>List of risks identified for island</b>	<b>Provide corresponding ranking score</b>	<b>Provide name of agency tasked to carry out the required job</b>	<b>Provide names of agencies and funding donors in the project</b>	<b>Supply exact date of the start-up date for implementation</b>

**Island Profiling – Natural Resources (form 2a)**

<b>Terrestrial/Marine Resource</b>	<b>Current Status</b>	<b>Potential cause(s) of problem</b>	<b>Action needed [low/high priority]</b>	<b>Partners</b>	<b>Cost of activity [AU\$]</b>	<b>Source of funding identified</b>
Specifies type of resource – terrestrial or marine; specifies whether fauna or flora; name resource	Refers to observed status by residents whether dying, declining, extinct, etc. Verification needed if can be done during a visit – photos and site visits	Residents’ list of causes, verification needed – survey or research may be required; examine existing reports and relevant information.	Consultation, cooperation, team work, regulation, etc. Specify urgency for action	Identify partners who can assist or who are responsible [government or private]	To be determined by agency	To be identified by agency
<i>Water</i>	<i>Becoming brackish and contaminated with sea water – in particular in villages close to the shoreline.</i>	<i>Drought for many months, closeness of villages to coast, increasing population.</i>	<i>Inspection and island visit; low priority</i>	<i>Government, PUB</i>		
<i>Finfish and non-finfish resources</i>	<i>All finfish are declining.</i>	<i>Overfishing, unregulated fishing</i>	<i>Byelaws to be set up to regulate fishing activities and protect spawning seasons; quota limits and off-seasons – high priority</i>	<i>MFMRD, MISA, OAG</i>		
<i>Fruit trees (terrestrial)</i>	<i>Just recovering after the latest drought</i>	<i>No replanting scheme, drought</i>	<i>Replanting scheme encouraged, home gardening encouraged- high priority.</i>	<i>MELAD, MISA</i>		

**Island Profiling – Physical Environment and Infrastructures** (*form 2b*)

<b>Terrestrial/Marine Environment or infrastructures; public or private</b>	<b>Current Status and site/location</b>	<b>Potential cause(s) of problem</b>	<b>Response type required [urgent or not urgent]</b>	<b>Partners</b>	<b>Costs</b>	<b>Source of funding</b>
Specifies type of environment or structure in question – eg. Reef, lagoon, coastline, mudflat, marshland, buildings, causeways, seawalls, land reclamation, etc.	Refers to observed status by residents – damaged, dead, lost, wave over wash, etc. Verification needed if can be done during a visit – photos and site visits	Residents’ list of causes, verification needed – survey or research may be required; examine existing reports and relevant information.	Consultation, Cooperation, team work, etc. Specify urgency for action	Identify partners who can assist or who are responsible [government or private]	To be determined by agency	To be identified by
<i>Eroded coastline between Tekaranga and Tematantong, main road inundated and flooded during extreme tides.</i>	<i>Storm search and king high tide over-wash</i>	<i>Unpredicted impact of CC and SLR on coastline;</i>	<i>Very urgent response to areas mostly affected by man-made structure and natural events.</i>	<i>MISA, MWPU, Makin Island Council</i>	Approx. \$200,000 (material, labour and administration)	tbi
<i>Eroded coastlines where land reclamations exist</i>	<i>Storm search and king high tide over-wash</i>	<i>Unpredicted impact of CC and SLR on coastline</i>	<i>Very urgent</i>	<i>MELAD, MISA, MWPU, Makin Island Council</i>	na	tbi

### Island Profiling – Human Resources (form 2c)

Population by sex	Age groups	Schools/Public utilities	Government/non-government paid workers	Major occupation	Production/export	Imports
Number of males and females (2005 Census)	Schooling, non schooling, over 50 years old	Name of school (primary, secondary, jss) and number of children; name of public utilities. Types of buildings (concrete or local) within each establishment	Number belonging to each group, level of education	Apart from paid jobs	List	List
<i>see MISA report and Kiribati Census 2005</i>	<i>see 2005 Census</i>	<i>refer to Education Digest 2005</i>	<i>refer to Education Digest 2005</i>	<i>refer to Education Digest 2005</i>	<i>refer to Kiribati Balance of Trade, 2005 (MFED)</i>	<i>refer to Kiribati Balance of Trade 2005 (MFED)</i>

### Ranking Resources, Environment and Infrastructure for Action – Island Level (form 2d)

Island	Type of resource, environment and infrastructure	Ranking score (Forms 2a and 2b)	Agency/ministry for further observation and research	Partners	Start-up date
Provide island name (and district – Gilbert northern, central, southern)	List of resources identified for island	Provide corresponding ranking score	Provide name of agency tasked to carry out the required job	Provide names of agencies or ministries who may be involved in the process	Supply exact date of the start-up date for the task
<i>Maiana</i>	<i>Coastal erosion(main road between Tekaranga and Tematantongo)</i>	<i>3</i>	<i>MISA, MWPU, MELAD</i>	<i>MWPU</i>	<i>na</i>
<i>Maiana</i>	<i>water</i>	<i>1</i>	<i>MWPU, MISA</i>	<i>MWPU</i>	<i>na</i>
<i>Maiana</i>	<i>Marine</i>	<i>1</i>	<i>Fisheries</i>	<i>MFMRD</i>	<i>Not available</i>
<i>Maiana</i>	<i>Terrestrial</i>	<i>1</i>	<i>MELAD</i>	<i>MELAD</i>	<i>NA</i>

**Ranking for Action and Implementation – National Level** *(form 2e)*

<b>Island</b>	<b>Type of resource, environment and infrastructure</b>	<b>Ranking score</b> <i>(Forms 2a and 2b)</i>	<b>Implementing agency/ministry</b>	<b>Partners</b>	<b>Start-up date</b>
Provide island name (and district – Gilbert northern, central, southern)	List of risks identified for island	Provide corresponding ranking score	Provide name of agency tasked to carry out the required job	Provide names of agencies and funding donors in the project	Supply exact date of the start-up date for implementation
Na	na	na	Na	Na	Na

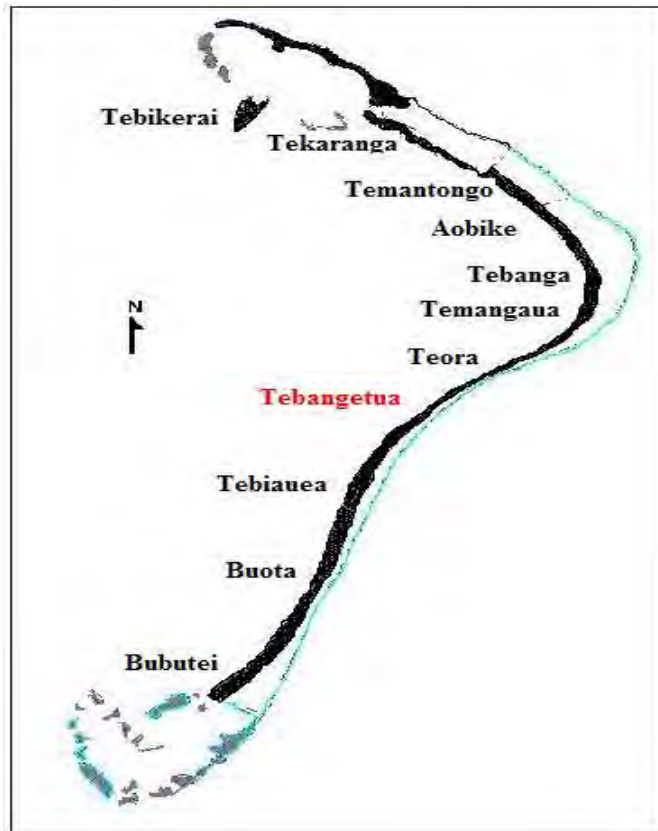
## **1.9 Topography**

Maiana Island is a lagoon island. Its fringing barrier reef lies at the windward side and bends at both ends forming partly submerged underwater barrier at the southern arm of the lagoon western rim, and exposed barrier at low tide toward the north-western end of lagoon outer edge. The shoreline slightly rises from sea level to over two meters at the highest points. Ruderal vegetation is common along the coastal area with more defined vegetation into the bushland (Thaman and Tebano, 1995). The midland may be slightly higher than the coastal areas by a few centimeters while the ocean beach front is even higher as the waves keep building up the shoreline with more sand and coral debris.

The windward shoreline is protected with rocky shores while the leeward western portion is mainly made up of sandy beach that gently slopes down to a reef flat that in turn connects to a lagoon, a back reef and open sea. The beach front drops to the beach zone or rocky foreshore and onto the reef platform and out onto a reef crest, reef buttress and a drop-off into a deep ocean. There are *babai* pits along the main road running through main villages and close to the lagoon or ocean side, more pits can be found further inland only accessible by bush tracks.

## **1.10 Main Settlements**

Figure 1c below shows the approximate location of the main villages. The isolated far north-western village is on Tebikerai Islet, very northern village on the mainland is Tekaranga; going in a southward direction are Tematantongo, Tebanga, Aobike, Temangaua, Teora, Tebangetua (IC headquarter), Tebiauea, Buota and the southern, largest village of Bubutei.



*Fig. 1c: Map of Maiana showing main villages.*

## **Chapter 2: CONSULTATION FINDINGS**

The findings of the Maiana consultation on the status of natural resources, coastal erosion, water resources and the marine and physical environments is a combination of data and information gathered during the five days of consultation, field observations and interviews with people of different backgrounds. Interviews were kept as informal as possible.

### **2.1 Status of Natural Resources**

#### *2.1.1 Marine Living Resources*

Participants claimed that the marine resources, fin-fish in particular, is not as used to be. The bonefish - *ikarii* (*Albula glossodonta*) is declining after the approval of the destructive splash method two years back by *te unimwane* as a response to the great demand for fish during the visit of Tabiteuea people. The method plus gill-netting beyond the intertidal flat separating mudflat with the lagoon (*matanikabi*) were banned in the late 1990s at the advice of the Fisheries Division (MFMRD) and the University of the South Pacific's Atoll Research Program, with subsequent bylaw set up to protect the resource (Tebano, 2004). The relaxing of the bylaw remains and juvenile fish are being exploited with small mesh size nets and the widespread use a splash method.

*Te bun* (*Anadara holoserica*) was once abundant at the intertidal flat at the southern portion of the island, and at a sand bank adjacent to Tebiauea village. Its heavy harvest by greedy crews of inter-island vessels drove it to almost extinction leaving no breed stocks to replenish the populations (Tebano, 2004). There was no bylaw to protect the resources then and it remains so. The opening of a boat passage through the western reefs must have also affected the current patterns within the lagoon hence the normal life cycle of the resource must have been ecologically affected (Tebano, 2004). The consultation was informed that the Fisheries Division of MFMRD is embarking on transplanting seedlings from Tarawa lagoon.

Participants from Bubutei and Buota villages expressed their concerns over the construction of a causeway to replace a seawall at the southern end of Bubutei village (Fig. 2a).



*Fig. 2a: From top left to bottom right – coral boulder seawall; a closer look at the Tekarina seawall; a Taborara seawall almost turned into a causeway; the original strategy to reduce flooding and seawater intrusion (photos by Tion K.Uriam)*

The purpose of the initial seawall was to reduce flooding and sea water intrusion to the southern portion of the village (Fig. 2a; Table 1). Some small islets and shoals at the southern end of the atoll provide habitats for a variety of shellfish such as *nikatona* (*Acropagia* sp.), *koikoi* (*Barbatia* sp.) and *koumwara* (*Gafrarium pectinatum*); also a rich mangrove forest in terms of mud crab and finfish. The adverse impact of such activity on all resources in the area will be dramatic hence a review on its status is critical.

The use of traditional canoes is gradually overtaken by motorized canoes and skiff boats. The use of monofilament gill nets of small mesh size is on the rise. Over two hundred fishing nets were recorded in 2005 with some households owning 5-10 units; and it is assumed this number has increased since. Shark is rarely landed, could be associated with a decline in their population due to overfishing for shark fin trade. Other reef resources such as octopus - *te kiika* or *kao* (*Octopus* sp.) and lobsters – *te nnewe* (*Panulirus* sp.) are rarely caught, the latter is sometimes caught during night fishing with a torch or pressure lamp.

Moray eel traps are few (Fig. 2a) as there are also insignificant trappers. Stone fish traps are a thing of the past as most existing ones are no longer maintained and have become public domains instead of family owned. Maiana had about twenty skiff and motorized boats and less than forty traditional canoes (Census, 2005), the numbers are unlikely to change much as the number of people living on Maiana is stable.

An ice plant provides ice cubes for the fishermen and some reef fish goes to the plant itself, most of the fish is sold at fishermen's residents. There are no obvious fishery activities enhancing the fishermen's skills or conservation strategies for resource management purposes.

Ciguateric moray eels and other carnivorous fish such as *te ingo* (*Lutjanus bohar*) are rarely caught as fishermen know where not to fish. The consultation participants raised concerns over the issue with a response from the team advising that ciguatera is not a problem but a 'blessing in disguise' in that the toxic areas and fishes therein are the conservation areas and breeding stocks, respectively, for the sustainable fish stocks on Maiana reefs and lagoon.



Fig.2b: Moray eel traps (photo by Bwe Temakei)

Fish species brought to land by fishermen during the one week stay on the island comprised the bonefish (*Albula glossodonta*), goatfish and snappers. Skip jack – *te ati* (*Katsuwonus pelamis*) and yellow-fin tuna – *te baibo* (*Thunnus albacore*) are fished in villages close to the open sea such as Bubutei and Tebikerai. Giant clams such as *te were* (*Tridacna maxima*) and *te werematai* (*T. squamosa*) are not part of the main source of sea protein on the island. *Te kima* (*Tridacna gigas*) is rare in the lagoon and reefs of Maiana. *Anadara* was once abundant but had

disappeared about ten years ago. Sea cucumber is abundant on the western reef; is currently exploited for foreign markets through agents in Kiribati. The unregulated exploitation will leave the lagoon and surrounding waters polluted and dirty; marine organisms will be affected.

The most common preservation method practised on Maiana is salting and sun drying; very few or none have dip-freezers. Fish baking in dug-out earthen ovens are unheard of. Overall, marine resources on Maiana are being heavily exploited to feed the population but there is no protein shortage as far as the island people are concerned. *Cardissoma* crab is consumed but not on a daily basis as in Butaritari or Marakei. Higher water temperatures associated with climate variability and climate change may seriously impact the living corals important for reef fish sustainability. Warmer water and a change in current patterns may prevent pelagic fish species such as tunas from coming closer to land hence forcing fishermen to go out to sea farther. The combined effect of all these factors may have a detrimental impact on marine living resources and food security at large. Adaptive measures in terms of the latter must be seriously considered at a village and island level.

### *2.1.2 Terrestrial Living Resources*

Like most other islands in Kiribati, Maiana has few terrestrial living resources but much higher rainfall than the rest of the islands. These include fruit trees, fruit plants and garden plants. Of particular importance for the sustenance of the island's population coconut (*Cocos nucifera*), a giant taro – *babai* (*Cyrtosperma chamissionis*), breadfruit and pandanus, like fish, are the main starch staples. The most recent drought had a drastic impact not only on plants and trees but on other terrestrial animal resources as well.

On Maiana *babai* is currently cultivated and utilized almost on a daily basis now as the price of rice and flour is spiraling. *Te mai* (breadfruit – *Artocarpus*) varieties and pandanus - *te tou* (*Pandanus tectorius*) compliment the main staples when in season. Banana varieties (*Musa*) grow on the island and papaya (*Carica papaya*) varieties and citrus fruits such as lemon and lime are also grown but in limited numbers. *Te karewe* – fresh toddy is popularly drunk but the impact of drought on coconut trees is significant. Toddy provides a daily intake of Vitamin C.

The cultivation of *babai* by gang workers known as *te karoronga* or *kawawa* is no longer practised as used to be properly family or *kaainga* members are getting larger and would not

require extra hands. The burning of coconut leaf compost and dead shrubs is practiced but to a very small extent. Bush fires deliberately set or by careless deeds are dealt with by *kaainga* members as most land plots are shared amongst related *kaainga* members. Certain pandanus varieties are more common in villages and appeared not to be doing well away from dwellings. Replanting activities are unheard of perhaps only on small scales at family land level.

The storage of coconut for future needs is not heard of, nor the harvest of pandanus to make *tuae* or *kabubu*, pandanus cake and powder, respectively. The making of *bwiro* from breadfruit for long storage purpose, traditional for the northerners and centralists is rarely if not practised these days. These all mean that none of the plant or tree fruits are processed for safe keeping for future use and food security. The imminent impact of prolonged droughts could be serious enough if adaptation measures such as mentioned here are not adopted soon. *Te non* (*Morinda citrifolia*) juice processing for local and overseas market is popular on Tarawa; given the landmass and excellent climate for this plant Maiana could benefit from planting and processing the fruit of *te non*.

Land-based reared protein sources such as pigs and chickens (Figs. 2b, 2c) are abundant and made available for special occasions. While the local pig breed is fed mainly on coconut and fish, shortage of these may seriously affect the number of animals available on the island. Complimentary grass feed of *mtea* (*Portulaca samoensis*), *wao* (*Boerhavia repens*) and *booi* (*Portulaca lutea*) may not be available in times of drought. While pigs are commonly roped on one of the hind legs or forearms (appearing to be the practice in central and northern groups) chickens are domesticated and roam around in villages. Penning and fencing using local material was the usual practice but the declining availability of them offers no choice but letting chickens roam freely and pigs tied to a bush that provides shade during most of the day. The status of the population of a crab - *te mwanai* (*Cardissoma* sp.) on the island has not been assessed; the residents claim they are not plentiful as used to be years ago and mangrove deforestation on the island, particularly at the southern end, will seriously impact the crab's population and affect other resources and organisms as well.



Fig. 2c-1: Roaming chicken (photo by Erimeta Barako); Fig. 2c-2: Pig feeding (photo by Erimeta Barako)

The avifauna resource of Maiana exists on the uninhabited islets but is insignificant in numbers as compared with those in the Phoenix Islands. There are nesting black noddies and white terns around the island. The birds, although small in size, may provide some protein source when marine and terrestrial sources are scarce. Their habitats must be protected by law.

It appears from information collected that the marine living resources of Maiana are heavily exploited but can sustain the current pressure. However, there is a need to enhance finfish species popularly fished by reinstating and enforcing an Island Council's bylaw on gillnetting with a splash method suspended by *te unimwaane* group (Te Wii-ni-Maiana) two years back. More importantly is that there is a need to re-look at best options that may bring back the *Anadara* resource and reconsidering the causeway option implemented to replace the stone seawall at the southern end of Bubutei village. The mangrove bushes, mud crab and other sessile shellfish will be affected hence many food sources. Milkfish farming in the area may help sustain the level of protein availability provided there is a forward plan for development.

### 2.1.3 Non-living resources

Ground well water is the main source of water for many purposes on the island. Community rainwater tanks and reservoirs are few and not adequate to cater for the need of large numbers of people during prolonged drought periods. There are also few concrete private homes with aluminum roofing, the Maiana Island Council owns about a dozen office buildings and classrooms built of more long term imported material. Properly constructed water cisterns will last a long time and must be encouraged. Plastic water tanks have a short life span given the hot humid environmental condition that degrades the material in a very short time.

Most wells, if not all, seen are not covered. The concrete blocks or coral boulders surrounding the outer rim are either too low or broken to effectively stop seepage of dirty water from the

surrounding during heavy rains in most cases. The 2005 Census showed only about forty households are dependent on rainwater and the remaining population relies on ground well water.

There is a need to improve a water system throughout the island with particular note on schools such Tebangetua and Tebikerai Primary Schools. A concrete cistern or tank is most ideal for schools and Island Council housing as they last longer and easier to maintain. Solar operated water systems need to be encouraged and the existing defunct village water systems requiring spare parts and proper maintenance work need to be re-looked at.



*Fig.d: Tebikerai Primary School defunct concrete water tanks*

For all villages on Maiana alternative well sites must be identified and reserved for future needs. The construction of concrete water catchments at public places such as schools, church compounds that have huge chapels and meeting houses, *maneaba*, with aluminum roofing must be encouraged. Wells need to be properly secured from surface water flooding and potential pollutants.

Sanitation cannot be separated from a water system as it is one of the main causes of ground water pollution and contamination. While there is a substantial number of land-based toilets recorded on Maiana how well are they functioning and managed is any body's guess. There is a need to properly determine the current status of the system(s) to ensure the safety of ground water and the quality of lagoon water are not compromised.

Aggregate mining for construction work is the major contributing factor to coastal erosion. Much of construction work requiring sand and gravel is apparently done by the Maiana Island

Council for office, classroom and clinic construction. Construction works at a household and church community levels in terms of land reclamation and more permanent buildings also add to the negative impacts on the coastal environment. Reducing or controlling aggregate mining remains with the Island Council and its peoples. A bylaw, specific for Maiana, that regulates these activities and complimenting the 2007 Revised Environment Act needs to be put in place soonest. Alternative sources need to be identified to ensure Maiana coastline is protected from unprecedented surge and bad storms.

## **2.2 Status of the Physical Environment**

### *2.2.1 The Marine Environment*

In this report the marine environment will include the sea surrounding Maiana Island, a reef and intertidal reef zone, marine fauna and flora, traditional navigation skills in relation to weather forecasting and current patterns. Other relevant issues are also discussed.

Maiana by definition is an atoll with a lagoon like most islands in the Group. The physical status of the marine environment can be described in terms of a well developed and open lagoon with flushing from the leeward oceanic waters, hence supporting healthy patch reefs with a variety of branching, massive and calcareous coral species. The lagoon is more than 5 meters deep. The submerged western reef, with a blasted channel, allows small and medium sized vessels enter and leave at any time of tide. The remaining leeward reef is exposed during low tide and only allows canoes and outboard skiffs enter and leave the lagoon during high tide.

The consultation participants claimed that the lagoon water closer to land is dirty and not as used to be years ago. This is due to the dumping of degradable and non-degradable rubbish in the lagoon, the harvest of sea cucumbers in great numbers and gutting them in the sea, and the use of the beach and sea for toileting purposes. The key factor is a large number of people living on the island which nears 3,000 according to 2005 Census. The increasing number of outboard motors and the more frequent visits of marine vessels contribute to water pollution in many ways. The west-oceanic water is undoubtedly healthy and clean and provides good flushing to the lagoon.

Finfish are abundant among corals and in the open sea beyond the reefs. Micro-organisms, although not significant in terms of food source, occupy a range of ecological micro habitats within the entire reef system.

There are navigational experts on Maiana who notice the changes in weather patterns confirmed over the lessening usefulness of traditional navigation skills in terms of travelling and fishing seasons. The weather pattern has changed, participants claimed, the southerlies come at the time of the northerlies and vice versa. The current directions also change, meaning that the timing of the eastward or landward bound current bringing pelagic fish close to the fringing reefs has also changed. This creates confusion among the fishing communities on Maiana. Adjusting and re-inventing fishing seasons is a challenge to the fishermen of today.

### *2.2.2 The Coastal Environment*

This section covers the coastal environment discussing erosion, the beach, the rocky shores, aggregates and mining, the coastal strands, bushes and shrubs, and coral boulder removal.

Observations and assessments from this visit consider coastal erosion on Maiana as a serious problem in some areas, a threat to properties and people's welfare. The seriousness is measured in terms of rows of coconut trees and vegetation disappearing or standing on the beach, and the flooding of lowlands during extreme high tides. All claimed eroded sites were visited, estimated costs to protect them were determined. Pictures were also taken as proof of their current status (Fig. 2e), their locations were recorded with a GPS (Table 1).



*Fig. 2e: a traditional coconut leaf seawall to fend off extreme tides; a home partly standing on a beach (photos by Tion K. Uriam)*



*Fig. 2f: a reclaimed land using modern sandbag (cement and sand) causing much erosion on either sides (photo by Tion K. Uriam)*

**Table 1: Details of inspected seawalls on Maiana**

Location	ID	Bearing	Description
Tebiauaea	IKB1	N 00 55.718'	Tebiauaea RC Sea wall Length = 64.2.m
		E 173 01.680'	
	IKB2	N 00 55.687'	
		E 173 01.664'	
	Maneaba	IKM1	N 00 55.682'
IKBM		E 173 01.693'	Middle of Seawall
		N 00 55.712'	
	E 173 01.660'		
KPC Tebwanga	KPCN1	N 00 59.055'	Sand bag seawall
		E 170 03.209'	
	KPCN2	N 00 59.049'	
		E 173 03.200'	
	KPCN3	N 00 59.033'	
E 173 03.212'			
Teikanarina seawall	KA1	N 00 52.047'	seawaall length = 60.1m Width = 6.2m
		E 173 00.061'	
	KA2	N 00 52.047'	
		E 173 00.033'	
Taborara seawall	TA1	N 00 51.836'	TA1 to TA2 = 168m
		E 173 00.017'	
	TA2	N 00 51.775'	
		E 173 00.084'	
KPC Bubutei	KPCB	N 00 52.276'	Length of seawall = 24.2m
		E 173 00.151'	
	KPCB1	N 00 52.284'	
		E 173 00.161'	
Bubutei RC	RC0	N 00 52.390'	Length of seawall
	RC1	N 00 52.385'	
		E 173 00.242'	
Tebiauaea RC	IKB1	N 00 55.718'	IKB1 to IKB2 = 64.2 m
		E 173 01.680'	
	IKB2	N 00 55.687'	Height = 1m
E 173 01.693'			
(maneaba)	IKM1	N 00 55.682'	from middle of seawall to maneaba (IKM1 to IKBM)
(mid. Of bono)	IKBM	E 173 01.693'	
		N 00 55.712'	
		E 173 01.660'	
Bikerai	BIK 3	N 01 00.221'	heavily eroded area
		E 173 00.098'	
		N 01 00.409'	
(seawall)	BIKB	E 173 00.322'	good mangrove cover
		N 01 00.506'	
	BIKB1	E 173 00.288'	
		N 01 00.528'	
		E 173 00.259'	

The most affected area that requires urgent attention is between Tekaranga and Tematantongo villages (Fig. g) with the road only 10 meters from the beach front. Information gathered about the area claimed that the same area measuring about 40 meters in length had previously been protected with a coral boulder seawall. Mangroves appeared to have been removed and a new generation is coming up with few big trees in the vicinity. The approximate cost of protecting the shoreline with concrete seawall is around \$200,000. Other areas affected by land reclamation and aggregate mining are yet to be determined.





*Fig g: A close look at the badly eroded area between Tekaranga and Tematantongo, Maiana (photo by Tion K. Uriam)*

The impact of sea level rise is obscured by human destructive activities such as aggregate mining and land reclamation, to name a few. On the other hand, the 2007 revised Environment Act has not made any impact on coastal protection on the outer islands but is making progress on South Tarawa and Betio (Tebano-Farren pers. comm., 2008).

Natural causes include extreme high tides, surge storms, natural shifting of aggregates underpinned by seasonal trade winds, ElNino and LaNina which now control global weather patterns, and to some extent a refutable increase in sea level. Human induced causes of coastal roision on Maiana include aggregate mining, land reclamation by churches by the most part.

There are not many seawalls or land reclamations on Maiana. Those recorded in the 2005 Census were less than fifty in total and observation on the island has not come across any newly constructed ones.



*Fig. h: A reclaimed land concrete side boundary extending to below beach mark.*

A complete review of the policy and design of seawall construction needs to be undertaken, which currently is the case as far as civil engineering is concerned. The reinforcement of the revised 2007 Environment Law to penalize land reclamation done outside law needs to be put in place.

Recommendations regarding causeways are similar to those made by SOPAC. That these structures must be discouraged and bridges are recommended. A properly designed walkway like the one that is currently being constructed between Tanaea and Buota must be encouraged.

### *2.2.3 The Land Environment*

This section discusses the locations or sites of villages in relation to storm surges and overtopping events, water issues, house gardening, land clearing practices, replanting and location of cemeteries.

Before the British colonial era individual *kaainga* (family and immediate members) lived in hamlets built on their own plot of land. When the British Crown learnt of tribal warfare between *kaingas*, mainly for the purpose of grabbing land from others as was the main wealth in those days, all isolated hamlets were moved and erected in a chosen area which is called *te kaawa* or village. The move was to foster harmony between and among warring tribes hence creating a long and ever lasting peace among all island populations. The preferred village locations were close to the sea at the lagoon side where most fishing activities are carried out; canoes had to be put in and out of the water almost on a daily basis.

Villages were rarely located at the windward side, except in a few cases like Makin where overcrowding is becoming a problem. Maiana is a medium sized island by Kiribati standard and supports over 2,000 people in 9 main villages. All the villages at Maiana Island are situated at the lagoon side. This is where most of the fruit trees and decorating plants are found.

Coconut plantations occupy most of the arable land area. Any increases in population on Maiana will no doubt exacerbate the potential risks and vulnerabilities in terms of portable water, declining terrestrial and marine food sources, sanitation systems affecting sea water and ground water sources, and other related over-population problems. The initial choice of village locations was most appropriate then but in light of the current climate change, climate variability and sea

level rise homes and other physical structures are at risk and vulnerable to any unprecedented storm and bad weather events.

Increase in human population requires more dwellings and homes, hence the expansion of villages is imminent. Development projects, communal or private, in the form of construction work that requires aggregate mining and timber material, certainly contribute to the destruction of the environment and the land plant resources at large. Productive land shrinks as villages expand and marine and terrestrial resources are constantly and increasingly being tapped. Water consumption increases and the drawing of more and more water to meet daily requirements will affect the drinkability of ground water. Compounding these problems is drought that can seriously impact all forms of life. The relocation of many dwellings in the existing villages must be seriously considered at a home, village and Island Council level as an adaptation measure in light of the impending impact of climate change scenarios.

The current water status on Maiana is not as serious as compared to several months ago. However, more frequent and prolonged droughts will mostly affect Tebikerai Islet as it has limited ground water reserve and prone to storm surges, extreme tides and bad weather. The storage of rainwater with tanks and concrete cisterns must be encouraged at Tebikerai and mainland Maiana. The current capacity to hold rainwater is insignificant. Concrete water cisterns last longer and require little maintenance, this must be encouraged. During the Christian Missionaries and European traders' era concrete water cisterns made of local lime cement obtained from burned coral were popular. They have been abandoned and corrugated iron tanks replaced them. Today plastic tanks are most popular but have limited and short life span.

While the Maiana Island Council owns a number of semi-concrete buildings with aluminum roofing a large number of catchments will suffice to provide government and island council workers with rain water for a long period if the thinking is made a reality. Private and communal water catchments must be encouraged to ensure adequate drinking water is available when required.

Equally important is the improvement of the existing wells to protect them from contamination of all forms. The use of hand and solar pumps to provide village households with portable well water can further improve the standard and quality of water as it will no longer require bailing.

Potential ground water sites must be identified and protected from activities such as animal husbandry and gardening, erection of toilet blocks, the digging of *babai* pits and cemeteries.

House gardening on Maiana is insignificant in that only less than a dozen households at Maiana villages are engaged in the activity. Although home gardening can produce a variety of vegetables there is no ready market for it except a home and local consumption. This weakens the desire of many families to produce such items.

The planting of a variety of breadfruit trees from around the Pacific will ensure the longer fruiting season hence reducing the consumption of imported rice and flour. Similarly, the planting of pandanus varieties that are good for making *tuae* and *kabubu* must be encouraged. The storing of coconut for future needy times must also be encouraged. These lifestyles do not exist on the island and experts from AMAK or other women groups must be involved.

Animal husbandry, in terms of swine and poultry, must form the basis of land protein availability when other sources are at stake. The agricultural activities must be strengthened to ensure all local produce can sustain the livelihood of Maiana population in times of food shortage. It is imperative that a bylaw is strengthened to ensure potential ground water sources are not unnecessarily contaminated or polluted with activities discussed above.

Similarly, the dumping of rubbish (compost and plastic) on the beach or the coastal areas is detrimental to the marine and coastal environments. Proper disposal sites must be identified by the Maiana Island Council to ensure waste disposal sites are properly utilized and co-managed.

#### *2.2.4 The Physical Structures*

This section looks at public and private structures in the context of their vulnerabilities to climate change and sea rise and how the situations can be improved through the design of appropriate adaptation strategies that can be self-contained or assisted by government.

##### *Public Structures*

There are no public structures vulnerable to coastal erosion or other natural/human induced causes except those created by humans. Settlements close to reclaimed lands experience coastal

erosion and accretion in most instances. Land reclamation interferes with natural beach movement thus causing accretion on one side and erosion on the other.

### *Private Structures*

Seawalls and land reclamations are being mixed up in most considerations. The distinction between them is that seawalls are constructed at the highest tide mark while land reclamation extends to below highest tide mark; in some cases reclaimed lands are sitting on a reef or mudflat as in Figure 2h above.

## **Chapter 3: COMMUNICATION AND TRANSPORT**

### **3.1 Voice Communication, the Media**

It is only in recent months that satellite telephones were installed on Maiana as part of improving voice communication on the outer islands. Telephone links with Tarawa and other islands were installed on the island in late 2007. There are more than 10 telephone links including those at the Island Council. About twenty CB radios were reported operational on Maiana company or privately owned by churches or individuals. There are over 200 transistor radios reported in 2005 (Census, 2005). Radio Kiribati and FM98 provide daily local, regional and world news. Weather forecasts are also broadcasted by Radio Kiribati when made available from the Meteorological Office in Betio. Local newspapers like Uekera, TeMauri, Tarakai, Newstar and Kiribati Times rarely make any impact on the outer islands. Their major markets are Betio and South Tarawa. Daily communication with Maiana via telephone or CB radio can be handy in case of unprecedented disasters caused by storm surges and seawater inundation, as well as other similar events linked to climate change and sea level rise.

### **2.3 Road, Sea and Air Transportation**

Bicycles or push bikes are the most common form of road transportation that serves many purposes including coconut and firewood collection. There were over 200 units recorded in Census 2005. The next most popular are motorcycles nearing 140 in all and are increasing with a most popular made of Honda trailers. Several trucks are owned by individual businessmen, churches, two belong to Maiana Island Council. The later provide daily transportation for school children but are also made available on a hire basis.

Traditional canoes on Maiana appear to be on a decline. There were approximately 50 recorded in the 2005 Census and this number is likely to decline as motorized crafts are becoming more popular. A demand for faster island sea transportation means and shorter fishing times spent in the open lagoon or ocean is evident. Motorised skiffs and boats skim in and out of the wide lagoon day and night despite of the unparalleled increase in fuel cost. More than sixty motorized

boats and skiffs are operational on Maiana. There are also huge double hulled canoes that provide frequent transportation between Maiana and Tarawa.

Inter island sea travel is provided by several private and government vessels serving Maiana on a weekly basis. Food and other required supplies are brought in from Tarawa, local produce in terms of shark fins, bananas, pumpkins, copra and handicrafts are shipped to Tarawa. Regional and privately owned container vessels bring in much needed supplies from outside the South Pacific in terms of fuel, food, machinery, construction material and others.

Air link is provided by Air Kiribati between Maiana, Tarawa and the neighboring central islands. Air Pacific and Our Airline (formerly Air Nauru) and Air Marshall (currently suspended) provide international links between Tarawa and the world. Maiana has both means of evacuation in case of emergency, sea and air. The airstrip on Maiana, like other islands, needs to be upgraded.

#### **Chapter 4: GENERAL DISCUSSION AND RECOMMENDATIONS**

Certain areas on Maiana need urgent attention in light of their vulnerability to flooding and erosion. Of particular attention are i. a low lying area between Tekaranga and Tematantongo villages, ii. The coastlines of the islet of Tebikerai. A public road in the former will soon be inundated if urgent action is not taken. A recommended protection is in the form of seawall constructed with sand bags filled with sand and cement. The planting of the foreshore with mangrove will subsequently provide extra protection in 3 – years time.

Other vulnerable areas caused by human destructive activities need to be examined with caution as the culprits are the major church communities and the Island Council itself. It appears now that seawalls are requested for to protect vulnerable coastlines but in fact damaged reclaimed lands are those requested for. Requests such as these must be clearly checked to ensure that financial and material assistance provided by government or other donors are not used to set up structures that will cause more long term problems affecting properties, people and the coastlines.

A seawall and reclaimed land must be distinguished. The former is built at the highest tide mark while the latter extends beyond the highest tide mark toward a mud- or reef flat. There is an Environment Act that clarifies these concepts and if applied heavy penalties may be imposed on those who construct land reclamation without proper licensing. In many or almost all cases reported by participants of the consultations held on each island visited showed where land reclamation exist the neighboring coastlines are eroded, properties are vulnerable, ground water is affected and land is lost. These local impacts induced by human activities exacerbate the effect of sea level rise, storm surges and flooding. The Island council and government must be stringent on such activities and discourage them at any cost. Politics must stay clear on this issue as it does not help protect an island but exposes it to disasters related to climate change and sea level rise. Tebikerai and the area mentioned earlier need special and urgent attention.

Maiana is known for healthy mangrove forests along the lagoon coastline but particularly at the southern and northern portions of the island. Hence, the planting of mangroves may help provide natural coastal defense, however this may take around five years before its impact can be felt.

Coupled with this is the planting of vegetation along the coastlines to stabilize eroded beach areas. The clearing of coastal vegetation as a form of tidying and clean up practised in Kiribati should be discouraged. Public campaigns run by KAP II, MELAD and other appropriate bodies need to cooperate on this important issue.

A final reactive resort, if everything else failed, is a seawall using proper designs provided by the Civil Engineering Unit, Ministry of Works and Public Utilities. Rules and guidelines pertaining to the construction of such structures must be strictly followed. Of critical importance is the environmental impact assessment (EIA) that should offer advance warnings on any issue to be seriously considered before further steps are taken. There are reported instances where structures are constructed ignoring designs provided resulting in poor resilience and ineffectiveness, meaning the structures do not help solve problems, public money has effectively been wasted on unworthy undertakings. Responsible ministries must check the quality of workmanship, identify irresponsible personnel and deal with them accordingly.

The 2007 revised Environmental Act needs to be applied on the outer islands soonest if the coastal areas are to be protected. In the same light, an Island Council bylaw specific for Maina's current problems needs to be devised and acted on. More awareness programs on protecting the land must be encouraged and embarked on by respective government ministries and non-governmental organization partners.

Marine and terrestrial resources of Maiana Island are just adequate to support the current population density despite of loss of resources via human destructive activities to include mangrove clearing, aggregate mining, land reclamation, waste dumping, habitat destruction, to name a few. There is a need to devise management plans to ensure the resources are unnecessarily over-exploited or locked away via destructive 'development?' projects. The enhancement of marine protein via milkfish farming or other mari-culture activities must be looked into. Equally important is the encouragement of local farmers to plant more local fruit trees such as pandanus, *te bero*, *babai*, bananas, pumpkins and others to ensure local foods are consumed and stored for future use in times of prolonged droughts and bad weather conditions. Traditional preservation methods must also be encouraged and demonstrated to ensure the local populace is familiar with them.

Water and sanitation improvement must be looked into seriously to ensure the health of the people of Maiana. Water catchment must be enhanced, encouraged and potential water reservoirs are identified for future use. Tebikerai Village needs substantial help to enhance its rain water catchment systems as ground water turns brackish during prolonged droughts. A concrete water cistern must be encouraged. To ensure ground water system is properly maintained and managed residents of Tebikerai must be involved in all steps of planning, procurement of material and other equipment required. They must be involved in its implementation and management to give them a feeling of ownership and responsibility. The Maiana Island Council, in consultation with communities, must give full support to such a vital undertaking.

Overcrowding, if not yet felt, must be thought of as an inherent problem that compounds potential risks and vulnerabilities related to climate change and sea level rise. Maiana is ranked ninth in population density after South and North Tarawa, Abaiang and Kiribati. The impact of overcrowding on all resources must be taken seriously. Relocating families to safer grounds within the island now will help reduce the impacts of predicted ground water and storm surge problems.

It is with great care that both communal and private structures are discussed in a manner that does not discourage those concerned to ensure cooperation and realization of the realities of their impact on the environment and the rest of the communities. Structures such as reclaimed land and aggregate mining causing the loss of properties, resources and coastlines must also be re-considered in light of long term benefits by all. Areas suitable for aggregate mining must be identified and controlled by laws and regulations. Public money must not be committed in unsustainable projects that are undermined by continued human destructive activities. Proper assessment of potential risks and vulnerabilities involving experts in required and related fields must be the first stepping stone before other related processes are carried out.

To ensure Maiana is linked to the rest of the world voice and text communications need to be enhanced and improved further. Break downs in telephone communication causes a lot of problems particularly when it comes to urgent matters such as serious health cases, disaster caused by extreme tides and surge storms, to mention a few. Sea and air transport are vital for emergency purposes in a case of evacuation and emergency services. The current airstrip may need to be extended and properly sealed; similarly the existing boat channel may require

widening and dredging depending on environmental impact assessment findings. Cheap sources of energy such as solar and wind must be enhanced to cut down costs on fossil fuel.

The relocation issue, seen as sensitive and complex, must be carefully discussed at household, village and island levels. Should a household be relocated full consultation with the Island Council is necessary to ensure all parties that may be affected in one way or another are aware and supportive to such a move. The reality is that households within a village compound are locked away in their current locations. Relocating to further inland outside a village designated compound will require land owners' consent, the Island Council and the whole village must be involved in a full consultation.

Beyond an island level when most of the land is under water relocating to other islands within the Republic may not be a clear option. A more sustainable option is resettlement on high volcanic islands within the Pacific region, an option supported by the Pacific Council of Churches (PCC). However, doors by Australian and New Zealand governments are open; this option will be left to each individual family and *kaainga* to decide on. When will this scenario become a reality instead of a myth, in 30 or 50 years time, no one knows. What is important now is to plan and act at a local level to reduce potential risks and vulnerabilities related to climate change and sea level rise.

For future direction community consultation on CCA and SLR must continue and development projects in light of these must be considered as part of Phase 3 of KAP to focus on the practicalities of mitigation and adaptation strategies. Risk identification and management must be handled through cooperative approach by respective ministries and non-governmental organizations. The Maiana Island Council must strive to continue the consultation process that KAP II is currently embarking on.

## **ACKNOWLEDGEMENTS**

The following are thanked for their various assistance and support throughout the outer islands consultation visits, with which this report would not have been possible.

Mr. Kautuna Kaitara (KAP II Coordinator)

Mr. Kaiarake Taburuea (KAP II Manager)

Mrs. Atu Moanibaa (KAP II Project Accountant)

Mr. Tekoreaua Kairoro (KAP II Procurement Officer)

Ms. Ruti Kautebiri (KAP II Office Assistant)

Acting Clerk – Tiirenga

ICW Tabwebwe Kokoria

IPO Maria Kaoma

Mr. Tion K. Uriam (MFMRD)

Mr. Onikannara Arika (Civil, MWPU)

Ms. Rosalind Kiata (National Consultant, Media)

## REFERENCES

Britanica Concise Encyclopedia: Kiribati

Gillie, R.D., 1993. Coastal erosion problems in the Gilbert Islands Group, Republic of Kiribati. SOPAC Technical Report 167. Kiribati Project:KIA

([http://www.fj.emb-japan.go.jp/eco\\_corporation/eco\\_kiribati.html](http://www.fj.emb-japan.go.jp/eco_corporation/eco_kiribati.html)).

Moul, E.T., 1959. The Halimeda and Caulerpa of Onotoa, Gilbert Islands. *Bulletin of the Torrey Botanical Club*, Vol. 86, No. 3 (May - Jun., 1959), pp. 159-165

National Statistics Office Ministry of Finance. Volume 1: Basic Information and tables (revised edition).

Republic of Kiribati Ministry of Education, Youth and Sports. Digest of Education Statistics 2005.

Republic of Kiribati and European Commission Joint Annual Report 2004. Final Report, 30 April 2005.

Talu, A., *et al.*, 1984. Aspects of Kiribati. University of the South Pacific, Suva, Fiji.

Tebano-Farran pers. comm., 2008.

Wikipedia

Reilly Ridgell. *Pacific Nations and Territories: The Islands of Micronesia, Melanesia, and Polynesia*. 3rd. Ed. Honolulu: Bess Press, 1995. p. 95.

*Merriam-Webster's Geographical Dictionary*. Springfield, Massachusetts: Merriam Webster, 1997. p. 594.

Tebano, T., 2004. The Biology and Harvesting of *Anadara holoserica* (Reeve, 1843) in Kiribati. Dissertation submitted in fulfillment of the requirement for the research degree of Doctor of Philosophy in Marine Science. University of the South Pacific, Suva, Fiji. 220 pp.